

# APPROACH TO THE GERIATRIC PATIENTS

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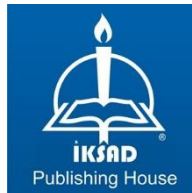
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## **PREFACE**

Today, thanks to the positive developments in the field of health and technology, human life spans have extended. The World Health Organization (WHO) has stated that the elderly population will increase even more in the coming years. Increasing elderly population; increased the frequency of admission to hospitals and even the need for inpatient treatment in hospitals. This situation has led to an increase in the current burden on the health system. In the presented work, it is aimed to contribute to the geriatric patient issue, which should be considered in our country as well as in the world. In this direction, a multidisciplinary perspective has been approached in the light of current information and the presented work has emerged.

We would like to express our gratitude to all the authors who contributed to the emergence of this work, to all the families who supported the authors and to all the families who made sacrifices in the background, to the publishing house and to our family elders SAVRUN AND TAŞDAN, who supported them from the first day we were born...

**Assoc. Prof. Dr. Atakan SAVRUN**

**Assist. Prof. Dr. Şeyda Tuba SAVRUN**



## **CHAPTER 1**

### **AGING OF THE HUMAN PHYSIOLOGICAL SYSTEMS**

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## INTRODUCTION

Aging is the progressive impairment in physiological processes in the organ systems. Weakness of compensatory mechanisms to maintain homeostasis leads to presence a higher risk of a range of diseases and disorders during the adult period of life, underlies an increasing susceptibility to challenges and thereby decrease the ability of the organism to survive. The existence of aging is a well-known condition around the world because all living beings experience it throughout their lives. Therefore to understand well of this process and its results is essential for clinicians during examine senescent patients and evaluate the possible reasons of their impair physiological mechanisms. A lot of both morphological and functional changes of the body's systems, that occur with time in the adult organism, are required special care and management (Hill et. al, 2020). Almost all tissues in the body are involved in physiologic changes related with aging. Ageing is a crucial risk factor for different age-associated diseases (Flint et. al. 2022).

A lot of mechanisms about the reasons of aging process have been suggested in the literature. Some of these mechanisms are involved in a review article performed by Lopez et. al, kind of they are related to especially cellular senescence including telomere fraying, mitochondrial dysfunction, stem cell failure, genomic instability, impaired intercellular communication, epigenetic alterations, and deregulated nutrient sensing. (Lopez-Otin et. al, 2013). The loss of cell turnover, decreased function of mucous membranes, increased atherosclerotic decrease in vascular compliance, cachexia and loss of skeletal muscle mass, and cerebral atrophy finally cause to the variety of changes we observe in aging. Distinguish the normal physiological processes of aging from pathologic changes occur in the case of disease is important. These processes may be linked to each other and moreover some interaction may exist (Koshla et, al. 2020).

The importance of cellular senescence is noticed in recent years as potential treatments of some diseases may be improved after clarifying the detailed mechanisms associated with pathogenesis of various diseases during aging. In this section, we will emphasize about the changes seen in all systems with aging.

## **1. Skin**

Skin aging process includes an increasingly weakness of performing its tasks similar to other organs. The skin is a barrier organ thanks to its flexible and mechanically protective features. The reasons of aging process of skin can be divorced in two main parts; as intrinsic factors the innate features such as our genomic structures, hormones and extrinsic environmental factors we are exposed to such as air pollution, feeding behaviour. Intrinsic factors cannot change or correct. The main indicators of innate factors lead to skin aging are thin lines, xerosis (loss of water) and looseness. But, extrinsic aging is limited usually exposing to sun shine, where the exposure duration is higher than the other sides such as the hands, neck and face. Exposure of excess sunshine/UV is the main reason of pigmentation and wrinkles in skin. Skin aging leads to significant visible indicators, such as hanging, the loss of water or age spots. (Csekes et. al, 2021).

## **2. Skeletal Muscle**

The most common age-related chronic disease about skeletal muscle is sarcopenia. Leading factors to sarcopenia are not only related to inactive life style or lack of some nutrients but also there are a variety of impaired pathways in the cells. Sarcopenia is a progressive permanent skeletal muscle atrophy related to aging. The patient suffered from sarcopenia have a decreased life quality because of the restriction of all movements. When the respiratory muscles are effected the death is unavoidable (Dao et. al, 2020).

Another age-associated problem is swallowing problems are also seen especially over 60 ages. Noticing a swallowing change in a senescent patient may be essential for appropriately manage swallowing problems. They may originate from increased esophageal sphincter pressure or late beginning of this sphincter or bolus transit duration. In some patients, all these may even cause residual food to remain in the esophagus and thus cause pneumonia or even death due to aspiration (Jardine et. al, 2020).

## **3. Bone and Synovial Joints**

Bone is a dynamic tissue, due to modifying by the balancing activity of osteoblast-related bone formation and osteoclast-related bone resorption. This balance between bone formation and resorption protects the skeletal stability until pathological processes, commonly age-associated. Impairing of this

balance may lead to bone fragility and increased risk for fracture (Nehlin et. al. 2019).

Osteoarthritis (OA) is mostly seen in senescent people, characterized with impairment of articular cartilage, and articular chondrocytes (Loeser, 2009). Aging and its effects on cell senescence have crucial importance in OA pathogenesis. Senescent chondrocytes can stimulate or aggravate to this disease (Zhang et al., 2019).

Extracellular matrix (ECM) responsible for maintaining of the stability and protect of articular cartilage, is produced by chondrocytes. Osteoarthritic chondrocytes stay in an irreversible differentiated stage caused due to changes in cellular physiological pathways. Factors related with age, such as secreted factors released by senescent cells, may lead to the induction of immature phenotypes in subsequent stages of wound healing (Price et al., 2002).

#### **4. Renal**

Aging causes to decrease of numbers of functional nephrons about 10 percent every 10 years after age 40. So, after at age 80, people have usually 40 percent less functioning nephrons. Thanks to the compensatory mechanisms in the remaining nephrons, decrease of nephrons number is not life threatening. These nephrons can remove the appropriate amounts of water, electrolytes, and waste products. But they have much higher risk for complications if a kidney failure develops (Darmady et. al, 1973).

Aging effects the glomeruli, tubulous systems, circulation and interstitial tissues of a kidney. The main age-related macroscopic changes recognized using the imaging methods additional to a tumor or cystic lesion is decreasing of kidney volume (Denic et. al, 2016). In a study included more than 600 adult volunteers performed by Emamian et. al using ultrasound suggested that kidney volumes are decreases with age. (Emamian et. al, 1993).

#### **5. Urinary Function**

Senescent are vulnerable to infectious diseases, especially to the most common seen urinary tract infections (UTI). Although postmenopausal women have high risk of recurrent UTIs; the reason cannot understood totally. This increased vulnerability and intensity in senescent people may include functional changes to the immune system with age. It also may related with the effect of aging on the epithelium that led to weakened protection against pathogens.

The prostate is a gland including in urogenital system in men. With aging dimension of prostate increases called benign prostate hyperplasia. The excess enlargement of the prostate gland may cause to obstruction in urethra. The most common symptoms are dysuria, urgency, frequency, and nocturia. Because of the remain residue urine may lead to urinary infections. These symptoms effect the patients' quality of life. Another important disease of prostate gland is prostate cancer. Prostate cancer usually does not sign in early stage, but when cancer grows over time it may lead to obstructive symptoms or pain associated with a metastatic spreading (Ligon et. al, 2023).

In addition to prostatic disorders in men, the presence of bladder dysfunction increases with age and extremely affects the quality of life of both men and women. Bladder capacity decrease with age and uncontrolled contractions increases. While urethral pressure declines particularly in women, urinary flow rate decreases particularly in men (Siroky M. B. 2004). The reason of voiding dysfunction in senescent people is suggested to deterioration of bladder muscle function and increased wall fibrosis, but unfortunately there is not a certain knowledge yet.

## **6. Gastrointestinal Functions**

Changes with aging of gastrointestinal system organs functions should evaluate all in itself. Because every organs involved in gastrointestinal system has different functions. But we can only make a general summary here. A decrease in appetite is observed as a result of changes in taste and smell in old age. Constipation is common challenge in senescent people due to changes in intestinal microbiota and motility. There are also absorption problems in many segments. With the contribution of all these factors, feeding problems, cachexia, vitamin and mineral deficiencies and the disorders caused by these are seen. For example the decreased absorption of vitamin D leads to weakness and bone fractures. Metabolic activity decreases in every organs both especially in the liver and so it can lead to alterations in drug metabolism (Bhutto et. al. 2008).

## **7. Pulmonary Function**

Normal pulmonary function is necessary for all tissues to provide them oxygen and removed carbon dioxide. The differences observed in respiratory system functions associated with aging leads to impair of disfunction in all tissues of the body. We can divide the age-related differences in to three groups

to understand them easily. Compliance is a vital property of the lung tissue, which provides expand the lung during inspiration. As expand the lung tissue atmospheric air enters to the alveoli until the pressures between the alveoli and atmosphere become equal thanks to the compliance ability. The other important feature of the lung is elasticity which provides return to its initial shape during expiration. Some diseases related to parenchyma destruction in lungs cause to stay expansion of alveoli even after expiration. And the last group is associated with the chest wall including respiratory muscles, rib cage and its joints with vertebra and sternum. A defect in a part of chest wall causes to impair of compliance capacity of the lungs. As a result of expanding of chest wall become more difficult, oxygenation of tissues in the body. Over time these changes may cause to impairment of compensating capacity for an acute illness or respiratory failure (Janssens et. al, 1999).

## **8- Nervous System**

In the aging brain are seen some changes in structure, function, and metabolism. When the brain is older than 70 the ratio of reduction of volume rises. The differences in neurological disorders in men and women such as the beginning age or the intensity of a disease suggest that gender plays a role. For example; Although brain volume reduction starts in early ages in men, the progression rate of neurological disorders are faster in women. And the effected places of central nervous system may vary in different gender. The most common problem about nervous system of senescent people is cognitive changes, caused to loss of memory especially episodic memory being most common (Alvis et. al, 2015).

Vascular circulation of the central nervous system impairs progressively per ten years of life. The circulation of a brain place feeds correlated with the metabolic rate of that place. Thicker and rigid vessels leads to micro-vascular damages in senescent people. (Trollor et. al, 2001).

## **CONCLUSION**

The presence of aging is a well-known situation that leads to impair of maintaining physiologic homeostasis in our systems. Therefore, the susceptibility to diseases increases in senescent people. As the elderly population increases, the importance of this issue will continue to increase.

## REFERENCES

- Alvis, B. D., & Hughes, C. G. (2015). Physiology Considerations in Geriatric Patients. *Anesthesiology clinics*, 33(3), 447–456. <https://doi.org/10.1016/j.anclin.2015.05.003>
- Bhutto, A., & Morley, J. E. (2008). The clinical significance of gastrointestinal changes with aging. *Current opinion in clinical nutrition and metabolic care*, 11(5), 651–660. <https://doi.org/10.1097/MCO.0b013e32830b5d37>
- Csekes, E., & Račková, L. (2021). Skin Aging, Cellular Senescence and Natural Polyphenols. *International journal of molecular sciences*, 22(23), 12641. <https://doi.org/10.3390/ijms222312641>
- Dao, T., Green, A. E., Kim, Y. A., Bae, S. J., Ha, K. T., Gariani, K., Lee, M. R., Menzies, K. J., & Ryu, D. (2020). Sarcopenia and Muscle Aging: A Brief Overview. *Endocrinology and metabolism (Seoul, Korea)*, 35(4), 716–732. <https://doi.org/10.3803/EnM.2020.405>
- Darmady, E. M., Offer, J., & Woodhouse, M. A. (1973). The parameters of the ageing kidney. *The Journal of pathology*, 109(3), 195–207. <https://doi.org/10.1002/path.1711090304>
- Denic, A., Glasscock, R. J., & Rule, A. D. (2016). Structural and Functional Changes With the Aging Kidney. *Advances in chronic kidney disease*, 23(1), 19–28. <https://doi.org/10.1053/j.ackd.2015.08.004>
- Emamian, S. A., Nielsen, M. B., Pedersen, J. F., & Ytte, L. (1993). Kidney dimensions at sonography: correlation with age, sex, and habitus in 665 adult volunteers. *AJR. American journal of roentgenology*, 160(1), 83–86. <https://doi.org/10.2214/ajr.160.1.8416654>
- Flint, B., & Tadi, P. (2022). Physiology, Aging. In *StatPearls*. StatPearls Publishing.
- Hill, M., Třískala, Z., Honců, P., Krejčí, M., Kajzar, J., Bičíková, M., Ondřejíková, L., Jandová, D., & Sterzl, I. (2020). Aging, hormones and receptors. *Physiological research*, 69(Suppl 2), S255–S272. <https://doi.org/10.33549/physiolres.934523>
- Janssens, J. P., Pache, J. C., & Nicod, L. P. (1999). Physiological changes in respiratory function associated with ageing. *The European respiratory journal*, 13(1), 197–205. <https://doi.org/10.1034/j.1399-3003.1999.13a36.x>

- Jardine, M., Miles, A., & Allen, J. (2020). A Systematic Review of Physiological Changes in Swallowing in the Oldest Old. *Dysphagia*, 35(3), 509–532. <https://doi.org/10.1007/s00455-019-10056-3>
- Khosla, S., Farr, J. N., Tchkonina, T., & Kirkland, J. L. (2020). The role of cellular senescence in ageing and endocrine disease. *Nature reviews. Endocrinology*, 16(5), 263–275. <https://doi.org/10.1038/s41574-020-0335-y>
- Ligon, M. M., Joshi, C. S., Fashemi, B. E., Salazar, A. M., & Mysorekar, I. U. (2023). Effects of aging on urinary tract epithelial homeostasis and immunity. *Developmental biology*, 493, 29–39. <https://doi.org/10.1016/j.ydbio.2022.11.003>
- López-Otín, C., Blasco, M. A., Partridge, L., Serrano, M., and Kroemer, G. (2013). *The Hallmarks of Aging*. *Cell* 153 (6), 1194–1217. <http://doi:10.1016/j.cell.2013.05.039>
- Loeser, R. F. (2009). Aging and Osteoarthritis: the Role of Chondrocyte Senescence and Aging Changes in the Cartilage Matrix. *Osteoarthritis Cartilage* 17 (8), 971–979. doi:10.1016/j.joca.2009.03.002
- Nehlin, J. O., Jafari, A., Tencerova, M., & Kassem, M. (2019). Aging and lineage allocation changes of bone marrow skeletal (stromal) stemcells. *Bone*, 123, 265–273. <https://doi.org/10.1016/j.bone.2019.03.041>
- Pignolo, R. J., Law, S. F., & Chandra, A. (2021). Bone Aging, Cellular Senescence, and Osteoporosis. *JBMR plus*, 5(4), e10488. <https://doi.org/10.1002/jbm4.10488>
- Price, J. S., Waters, J. G., Darrah, C., Pennington, C., Edwards, D. R., Donell, S. T., et al. (2002). The Role of Chondrocyte Senescence in Osteoarthritis. *Aging cell* 1 (1), 57–65. doi:10.1046/j.1474-9728.2002.00008.x
- Sato, K., & Iemitsu, M. (2018). The Role of Dehydroepiandrosterone (DHEA) in Skeletal Muscle. *Vitamins and hormones*, 108, 205–221. <https://doi.org/10.1016/bs.vh.2018.03.002>
- Siroky M. B. (2004). The aging bladder. *Reviews in urology*, 6 Suppl 1(Suppl 1), S3–S7.
- Trollor, J. N., & Valenzuela, M. J. (2001). Brain ageing in the new millennium. *The Australian and New Zealand journal of*



*psychiatry*, 35(6), 788–805. <https://doi.org/10.1046/j.1440-1614.2001.00969.x>

Zhang, M., Theleman, J. L., Lygrisse, K. A., and Wang, J. (2019). Epigenetic Mechanisms Underlying the Aging of Articular Cartilage and Osteoarthritis. *Gerontology* 65 (4), 387–396. doi:10.1159/000496688

**CHAPTER 2**  
**NUTRITION IN GERIATRIC PATIENTS**

MD. Muhammed Ali AYVAZ

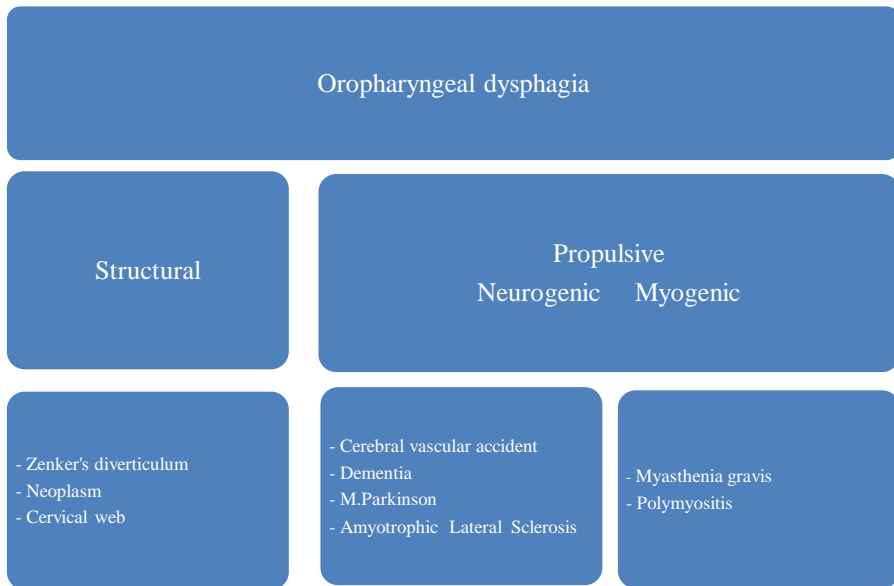


## INTRODUCTION

Malnutrition of the elder people is a common disorder, which is aggravated by dementia, in particular, when nursing personel is not available. This leads to a lowered nutritional status. Dementia patients are exposed to malnutrition, involving low dietary nourishment, leading to an alteration of the nutritional condition, which has consequences for nutritional status, life activities and worsening of malnutrition (Tangvik et al., 2020).

### 1. Oropharyngeal and Esophageal Dysphagia

Dysphagia is an important symptom and reason of malnutrition in elderly patients, whereas it has to be distinguished in an esophageal and oropharyngeal dysphagia. Structural and propulsive disorders are the most important reasons for oropharyngeal dysphagia, as shown in Figure 1 (modified Kasper DL, 2017, *Harrisons’s Gastroenterology and Hepatology*, 3rd edition).

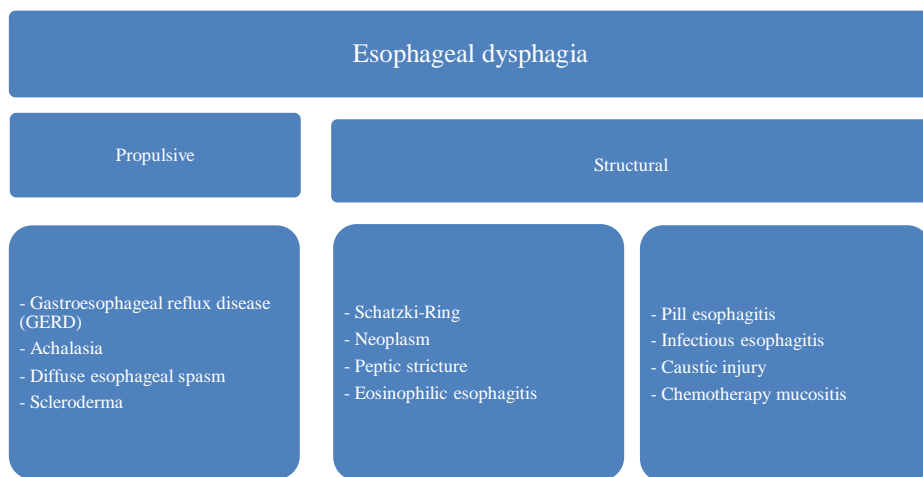


**Figure 1:** Approach to patients with oropharyngeal dysphagia

About 15 % of stroke patients have remaining dysphagia, which leads to malnutrition, aspiration and death. In a study with 158 stroke patients (53,2 % male, median age 75 years) the survival after insertion of Percutaneous

Endoscopic Gastrostomy (PEG) was analyzed (Patita et al., 2021). The median time between cerebrovascular accident and placing of PEG was 2 months, median survival after placing of PEG was 16 month. 41,6 % of the patients had reduced levels of BMI, transferrin and cholesterol at the time being admitted into hospital. A significant increase in albumin, transferrin and cholesterol levels was observed after 3 months of PEG-feeding. Mortality was 12.9 %, 27.7 % and 40 % at 1, 3 and 12 months, respectively. There could also be shown that the survival of patients with decreased levels of albumin, transferrin or total cholesterol at the time of entering hospital was lower. So the authors concluded that the prevalence of nutritional deficiency would be high among patients after cerebrovascular accident related dysphagia and PEG-feeding would improve albumin, transferrin and cholesterol levels and mortality after placing of PEG would be high (Kesari & Noel, 2022).

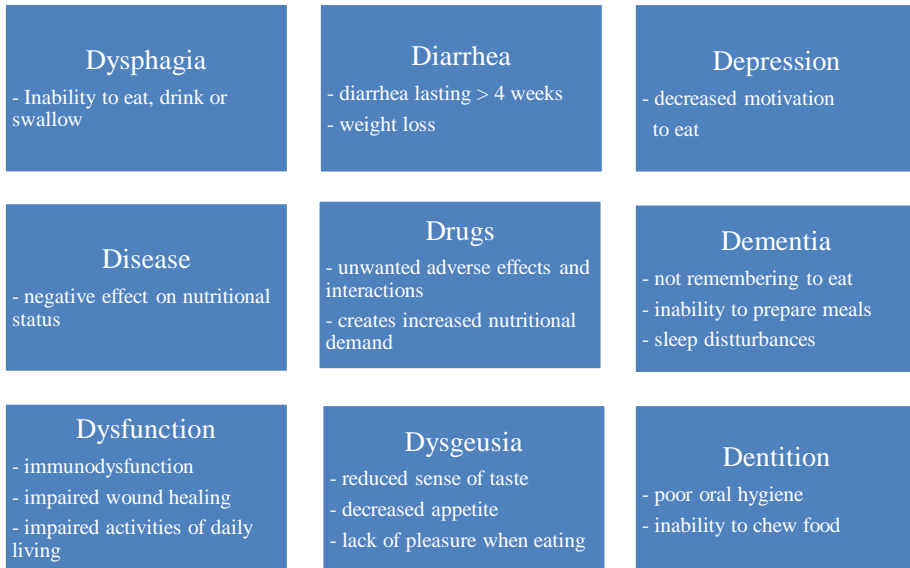
Esophageal dysphagia can be divided in propulsive and structural disorders, which lead to a propulsive impairment of the esophagus (Figure 2), (Kasper DL, 2017, Harrison's Gastroenterology and Hepatology, 3rd edition).



**Figure 2:** Approach to patients with esophageal dysphagia (modified Harrison's Gastroenterology and Hepatology, 3rd edition 2017).

## 2. Clinical and physical findings of nutritional deficiencies

Apart from the differentiation of esophageal and oropharyngeal disorders leading to nutrition the general reasons of malnutrition and secondary nutritional deficiencies are listed in Figure 3 (James Haines et al., 2020).



**Figure 3:** The 9 D's of malnutrition in the elderly illustrating the reasons of malnutrition

Other age-related determinants influencing nutritional requirement are hormones, e.g. leptin, glucagon-like peptide-1 (GLP-1), cholecystokinin (CCK), ghrelin, insulin and peptide YY (PYY), leading to reduced food consumption. With proceeding age, plasma concentration of CCK rises, which causes earlier satiety. GLP-1 and PYY are reducing appetite, lead to a decrease of insulin and to elevated circulating leptin levels which are linked with nutritional deficiency (Choubisa, 2022).

### **3. Assessment tools for nutritional status in elderly patients**

Early diagnosis of malnourished patients is important and there should be screened for malnutrition ideally within 24-48 h of admission, in particular in clinically undernourished patients.

The European Society of Parenteral and Enteral Nutrition (ESPEN) recommends the use of the Nutritional Risk Screening-2002 (NRS-2002) method for inhouse patients, the Malnutrition Universal Screening Tool (MUST) in the community health care setting, and the Mini-Nutritional Assessment (MNA) for elderly patients. The Subjective Global Assessment (SGA) and MNA tests are advisable in the nutritional validation, but they are not generally estimated as the gold standard (del Portillo et al., 2015).

Bouillanne et al. introduced another Index, which correlated patients with risk of malnutrition, morbidity and mortality, called Geriatric Nutritional Risk Index (GNRI). So it is important to recognize hospitalized malnourished elders by nutritional assessment tools (11). SGA, MNA and GNRI are the nutritional classification tools mainly used (Bouillanne et al., 2005).

Percutaneous endoscopic gastrostomy (PEG) is a way for long-time feeding, in particular in patients with dysphagia because of neurological reasons. In a study of Lima et al. 277 patients with PEG were evaluated in relation to survival. 247 patients (89.5 %) had neurological dysphagia and 29 patients (10.5 %) had tumors or other diseases. The 30-day proportional mortality probability rate was 13 %, whereas anemia and previous Intensive Care Unit (ICU) admission were predictors of mortality at four weeks (Lima et al., 2021). Nutritional deficiency has to be screened actively. There is the Mini Nutritional Assessment (MNA) which comprises a questionnaire which can be finished in 20 minutes. According to the American Society for Parenteral and Enteral Nutrition (ASPEN) guidelines, a complete nutritional assessment should include a detailed clinical inspection (patient's history and physical examination), anthropometric measurements, diagnostic tests and dietary assessments (Abd Aziz et al., 2017). In a systematic review Toniazzi et al. compared the nutritional condition and oral health in elderly. The studies performed the Subjective Global Assessment (SGA) or the Mini Nutritional Assessment (MNA) and an oral examination performed by a dental professional. The Mini Nutritional Assessment (MNA) classifies patients as

malnourished (MNA  $\leq$  17), at risk of malnutrition (MNA 18-23), or well nourished (MNA  $\geq$  24). Three oral health parameters (edentulism, use of prosthesis and number of present teeth) were evaluated. It was shown that well fed subjects had a significantly higher number of teeth/Functional Teeth Units (FTU) in comparison to individuals with malnutrition. The meta-analyses showed no statistically significant association between toothlessness and use of prosthesis. FTU and mean number of teeth were significantly related with nutritional condition (Toniazzi et al., 2017). It is also known that people over the age of 65 are partially or completely edentulous, which results in loss of masticatory strength, which further leads to a change of their usual nutrition (Toniazzi et al., 2018). Society is ageing and it is well known that health problems related to nutritional intake may present. Both mental and physical disabilities in the elderly may need specific changes of dietary assessment methods. As a result of nutritional deficiency the basal metabolic rate is decreased by 15-20 %; this decline is caused by a reduced lean body tissue (body weight minus body fat) which is linked to an atrophy of muscle (Choubisa, 2022). Laboratory tests for nutritional assessment are the serum albumin, serum total iron binding capacity, prothrombin time, serum creatinine, 24-h urinary creatinine, 24-h urinary ureanitrogen and blood ureanitrogen (Kasper DL, 2017, *Harrisons's Gastroenterology and Hepatology*, 3rd edition 2017).

The nutritional deficiencies and their physical findings are shown in table 1 (mod. *Harrisons's Internal Medicine*, 19th Edition 2015).

**Table 1:** Physical findings of nutritional deficiencies and their possible deficiencies

Clinical finding	Nutritional deficiency
Hair, nails (corkscrew hairs, transverse ridging of nails)	Vitamin C, Biotin, zinc
Skin (cellophane and cracking appearance)	Vitamin A, C, K, Niacin
Eyes (night blindness)	Vitamin A
Perioral (angular stomatitis, cheilosis)	Riboflavin, Pyridoxine, niacin
Oral (atrophic lingual papillae, glossitis)	Riboflavin, niacin, folate, Vitamin B12/C, iron, pyridoxine, zinc



Bones, joints (Beading of ribs, epiphyseal swelling)	Vitamin C and D
Neurologic(confabulation,dysorientation, lethargy, vomiting, dementia, peripheral neuropathy, ataxia, tetany)	Thiamine, Niacin, Vitamin B12, Folate, pyridoxine, Ca, Mg
Edema	Albumin

Drugs taken by elderly patients may be linked with nutritional risk. This can lead to an de- or increased appetite and secondary nutritional deficiencies or toxic interactions. To avoid these interactions patients should take their medications at the prescribed time and they should be advised to take medication which interact at separate times (Roe, 1994).

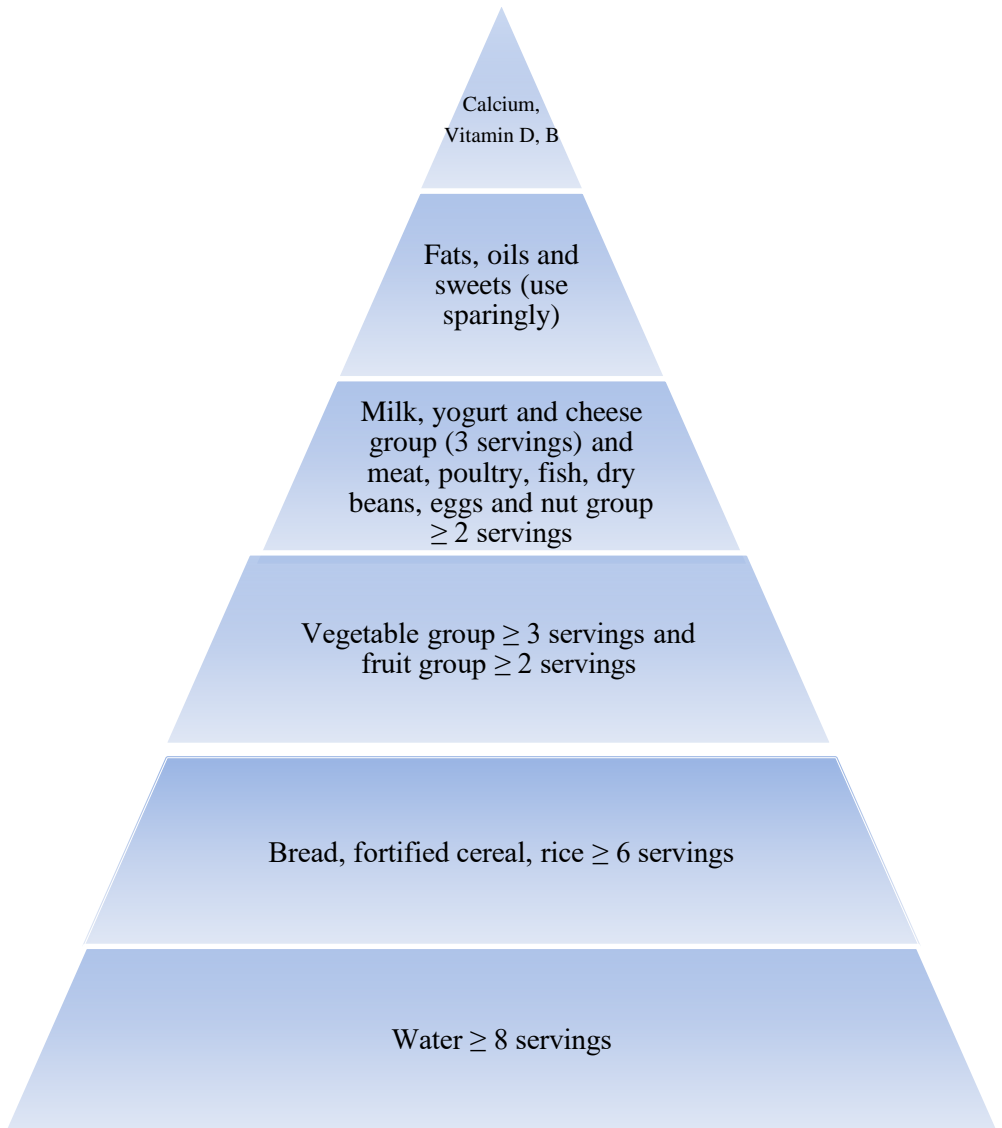
#### **4. Factors influencing nutritional status in elderly patients in literature**

In a study including 1367 elders in 26 nursing homes the relationship of the awareness of nutrition in elderly patients, eating habits and BMI with their education status was assessed with questionnaires. The conclusion was that education level of older patients was crucial for their nutrition knowledge and eating habits ( $P=0.00$ ). With regard to the education level, age and BMI, the effect of age on BMI was stronger than the education level. When elders get beyond 75 years, they tend to weight loss and they need more nutritional advice (Liu et al., 2013). The association between nutritional condition and life circumstances was investigated among 703 community-dwelling persons (268 men and 435 women) aged 65 years and older. In this cross-sectional survey study, living circumstantial factors, health-related criteria, and nourishment (the Nutrition Quotient for the Elderly scores; NQ-E) were evaluated. NQ-E scores were significantly higher in men than women. Humans living with a partner and attending in regular sports activities had significantly higher NQ-E scores than those living without any activities or hobbies. It was shown that women's nutritional status was better when adequate nutrition education was given and when food safety was warranted. For all persons, social activities and habits were essential for upholding good nutritional condition and a healthy life (Kim et al., 2020). In elderly patients unable for oral feeding, Percutaneous Endoscopic Gastrostomy (PEG) is an

important ethical and medical topic in literature, in particular regarding the indication of this procedure. The decision of placing a PEG should be discussed thoroughly with the patients' relatives (Sivero et al., 2018). The long-term results of PEG-tubes being placed in 305 patients and the benefit of this method was determined retrospectively in patients with pre-existing dementia (Rakici & Ayvaz, 2019). Therefore, three groups of patients were compared: advanced dementia patients fed via PEG, stroke patients fed via PEG and advanced dementia patients not fed via PEG. The median length of PEG stay was 9 months. In total, 49 (17.5%) patients developed complications. Mortality ( $p=0.0002$ ) and CRP levels ( $p=0.01$ ) were statistically significantly higher in the advanced dementia group not fed via PEG. The duration of PEG stay, risk of complications and mortality in the stroke group were not found to be statistically significant in relation to the dementia group. The mortality and rate of complications in the dementia group were similar to those in the stroke group. Nutrition through the PEG is an adequate and preferred way for advanced dementia patients (Rakici & Ayvaz, 2019).

## **5. Nutritional recommendations in elderly population**

In order to maintain a nutritional balance geriatric patients have to drink enough water, take proteins, carbohydrates and fat. The intake of the Vitamins A, B complex (Vitamin B1, B2, B6, B12 and Folate), Vitamin C, D, E and K is as important as the supplementation of Minerals as Calcium, Iron, Zinc, Chromium, Copper, Iodine, Magnesium, Manganese, Phosphorus, Potassium, Sodium. The revised food guide pyramid is illustrated in figure 4 (Choubisa, 2022).



**Figure 4:** Revised food guide pyramid for people aged 70 and older

**REFERENCES**

- Bouillanne, O., Morineau, G., Dupont, C., Coulombel, I., Vincent, J. P., Nicolis, I., Benazeth, S., Cynober, L., Aussel, C. (2015). Geriatric Nutritional Risk Index: a new index for evaluating at-risk elderly medical patients. *Am J Clin Nutr.* Oct;82(4):777-83. doi: 10.1093/ajcn/82.4.777. PMID: 16210706.
- Campos, del Portillo, R., Palma Milla, S., García Vázquez, N., Plaza López, B., Bermejo López, L., Riobó Serván, P., García-Luna, P. P., Gómez-Candela, C. (2015). Assessment of nutritional status in the healthcare setting in Spain. *Nutr Hosp.* Feb 26;31 Suppl 3:196-208. doi: 10.3305/nh.2015.31.sup3.8767. PMID: 25719787.
- Choubisa, D. (2022). Nutrition and Geriatric: An Overview. *Dental Journal of Advanced Studies*, Thieme Medical and Scientific Publishers. Oct.12th, DOI <https://doi.org/10.1055/s-0042-1757548>. ISSN 2321-1482.
- Harrison's Gastroenterology and Hepatology. 2017, 3rd Edition, Kasper, D. L., Fauci, A. S., Hauser, S. L., Longo, D. L., Jameson, J. L., Loscalzo, J.
- James-Haines, M., David, L. V., Michele, R. K. (2020). Malnutrition in the Elderly: Underrecognized and Increasing in Prevalence. *Clinical Advisor*, February 7.
- Kesari, A., Noel, J. Y.(2022). Nutritional Assessment. *StatPearls*. <https://www.ncbi.nlm.nih.gov/books/NBK430685/>
- Kim, D. E., Lim, H. S., Ahn, H., Kim, Y. S., Park, Y. K. (2020). Sex Differences in the Association between Living Environmental Factors and Nutritional Status in Community-Dwelling Elderly Koreans. *Int J Environ Res Public Health.* Aug 19;17(17):6034. doi: 10.3390/ijerph17176034. PMID: 32825086; PMCID: PMC7504555.
- Lima, D. L., Miranda, L. E., da Penha, M. R., Lima, R. N., dos Santos, D. C., Eufanio, M. S., Miranda, A. C., Pereira, L. M. (2021). Factors associated with 30-day mortality in patients after Percutaneous Endoscopic Gastrostomy. *JSL: Journal of the Society of Laparoscopic and Robotic Surgeons*, 25. *JSL*. 2021 Jul-Sep; 25(3): e2021.00040. doi: 10.4293/JSL.2021.00040.

- Liu, C., Su, Y., Jin, B. Relationship of the elderly nutrition knowledge and their education level in Nanjing. *Wei Sheng yan jiu = Journal of Hygiene Research*. 2013 Jul;42(4):605-609. PMID: 24024373.
- Patita, M., Nunes, G., Grunho, M., Santos, C. A., Fonseca, J. (2021). Endoscopic gastrostomy for nutritional support in post-stroke dysphagia. *Scientific Electronic Library Online, Nutricion Hospitalaria*, vol.38, n.6, pp.1126-1131.
- Rakici, H., Ayvaz, M. A. (2019). Percutaneous endoscopic gastrostomy feeding is beneficial in patients with advanced dementia. *Asia Pac J Clin Nutr*.;28(4):695-700. doi: 10.6133/apjcn.201912\_28(4).0004. PMID: 31826365.
- Riobó Serván, P., Sierra Poyatos, R., Soldo Rodríguez, J., Gómez-Candela, C., García Luna, P. P., Serra-Majem, L. (2015). Special considerations for nutritional studies in elderly. *Nutr Hosp*. Feb 26;31 Suppl 3:84-90. doi: 10.3305/nh.2015.31.sup3.8756. PMID: 25719776.
- Roe, D. A. (1994). Medications and nutrition in the elderly. *Prim Care*. Mar;21(1):135-47. PMID: 8197251.
- Sivero, L., Telesca, D. A., Gentile, M., Aprea, G., Massa, G., Cestaro, G., Danzi, M., Sivero, S., Formisano, C. (2018). Percutaneous endoscopic gastrostomy (PEG), in elderly patients with dementia and anorexia. Medical and ethical issues regarding placement. *Ann Ital Chir*.;89:305-308. PMID: 30337506.
- Tangvik, R. J., Bruvik, F. K., Drageset, J., Kyte, K., Hunskaar, I.(2021). Effects of oral nutrition supplements in persons with dementia: A systematic review. *Geriatr Nurs*. Jan-Feb;42(1):117-123. doi: 10.1016/j.gerinurse.2020.12.005. Epub 2020 Dec 28. PMID: 33383439.
- Toniazzo, M. P., Amorim, P. S., Muniz, F. W. M. G., Weidlich, P. (2018). Relationship of nutritional status and oral health in elderly: Systematic review with meta-analysis. *Clin Nutr*. Jun;37(3):824-830. doi: 10.1016/j.clnu.2017.03.014. Epub 2017 Mar 28. PMID: 28392164.
- Tramontano, A., Veronese, N., Giantin, V., Manzato, E., Rodriguez-Hurtado, D., Trevisan, C., De Zaiacomo, F., Sergi, G. (2016). Nutritional status, physical performance and disability in the elderly of the Peruvian

Andes. *Aging Clin Exp Res.* Dec;28(6):1195-1201. doi: 10.1007/s40520-016-0591-9. Epub 2016 Jun 4. PMID: 27262950.

Vellas, B., Guigoz, Y., Nourhashemi, F., Bennahum, D., Lauque, S., Albarede, J.L. (1999). The Mini Nutritional Assessment (MNA) and its use in grading the nutritional state of elderly patients. *Nutrition.* Feb;15(2):116-22. doi: 10.1016/s0899-9007(98)00171-3. PMID: 9990575.



## **CHAPTER 3**

### **PREHOSPITAL CARE IN GERIATRIC PATIENTS**

MD. Ismail Eren AKCAY





## **1.Introduction**

Aging is a physiological but inevitable process. It is irreversible and affects all systems. As a result of these systems being affected, some problems specific to the elderly arise. In our country, the population aged 65 and over constitutes 5-6% of our total population. With the prolongation of the average life expectancy in our country, it is estimated that the elderly population will reach 9-10.0% in 2025. While these developments prolong the average life expectancy, they also bring along many problems that need to be solved in health, social, cultural and economic fields, especially for the elderly (Anon. n.d.-a., 2022)

In the researches, it was determined that 65.0% of the elderly over 65 years old had at least 3 diseases and 75.0% of the elderly over 79 years old had at least 4 diseases. The elderly have a 3 times higher risk of falls and other accidents compared to the general population. They are also more prone to fractures due to changes in bone structure such as osteoporosis and osteoarthritis (Anon. n.d.-b., 2022)

### **1.1 Pre-hospital emergency care**

Prehospital emergency care is a vital component of the health service, responding to the most critical acute illness and injury episodes affecting both older people and other population groups. Pre-hospital emergency health services include providing emergency care before the hospital and safely transporting individuals who need emergency help as a result of a disaster, accident or illness. The main purpose of these services, which constitute one of the basic building blocks of modern health systems, is to reduce morbidity and mortality, especially due to major trauma, chronic diseases and sudden health problems. In this model, emergency treatment and care is initiated by health personnel other than physicians in the field. The life-saving medical treatment and care started in the field is continued during the transport, and the patient is transported to the hospital emergency services for advanced emergency care. Hospital emergency services operate under the control of emergency medicine specialists. For this reason, the Department of Emergency Medicine has made significant progress as a separate specialty in countries using the British-American model. This model is also used in our country (Kaldirim, 2013, Paksoy , 2016).

In order for the pre-hospital care system to be successful, all the wheels of the system must work very well. Each step of the system should be in communication with each other and should be ready in case of an emergency and do its own duty (Şimsek et. Al., 2019)

### **1.1.2.Pre-hospital emergency care in Turkey**

In Turkey, pre-hospital emergency health services are provided by land, air and sea ambulances. There are types of land ambulances that are designed according to the needs of the patients to be transported and that can serve different purposes. In Turkey, all ambulance equipment is inside the ambulances and in case of emergency, the equipment needed at the scene can be accessed from within the ambulance. The number of ambulances used in 112 emergency health services in Turkey is 4750 for 2017, and all ambulances are equipped in accordance with the standards of European Union countries. In addition, motorcycle emergency medical teams in the country are in charge of reaching the case and providing the first evaluation and care until the ambulance teams arrive at the scene (Erbay, 2017).

### **1.2. Prehospital care for the elderly**

Population aging, which started at the beginning of the 20th century and became more visible in the 21st century, brings with it many problems that need to be resolved. With the aging process, biological, psychological and physiological regressions occur in the elderly, difficulties are experienced in daily living activities and visible deficiencies in functions occur. These changes in the elderly affect the quality of life of individuals negatively by limiting their daily living activities. However, as health problems increase in the elderly, their self-sufficiency status gradually decreases and there is an increase in accident and fall rates (Keskinoglu and Sofuoglu, 2009).

Health problems in old age are shaped by the interaction of factors such as genetics, lifestyle, social and physical environment. Many, if not all, of these factors can be prevented or changed in a healthier way, either by direct interventions or by the indirect effects of these interventions. The emergence of vital problems related to falls in the elderly can be prevented by emergency interventions (WHO, 2007). The aim of elderly care is to keep the physical,

mental and spiritual functional capacity of the elderly at the highest level and to increase the quality of life, as well as the treatment of diseases. Health professionals have an important role in increasing the quality of life of the elderly, in the implementation of preventive services for the elderly, in prolonging the healthy life span and in emergency interventions. The role of paramedics, who are among the health professionals, in falls requiring emergency intervention in the elderly is important in terms of prolonging the life expectancy of the elderly, reducing the dependency situation that may occur due to falls, early intervention for health problems that may occur due to falls, and increasing the quality of life (Canli and Bingol , 2018).

Pre-hospital emergency health services include the evaluation, first treatment and safe transfer of geriatric patients who need emergency help as a result of a disaster, accident or illness by pre-hospital health professionals. The main purpose of these services, which constitute one of the basic building blocks of modern health systems, is to reduce the morbidity and mortality rates of patients (Şimsek, 2019, Force, 2014)

In time-sensitive diseases such as acute coronary syndrome, prehospital cardiac arrest and stroke, which are common in geriatric patients, every second is important for patient survival. Good pre-hospital care, excellent emergency response, complete angiography or a quality intensive care process alone are not enough for these patients to survive. A complete organization is required for these patients (Keskinogu and Sofuoglu, 2009).

It is observed that there is a gradual increase in the rate of geriatric patients admitted to the emergency department in our country (Varisli , 2018)

### **1.2.1. Geriatric prehospital care in Turkey**

The most common reasons for geriatric patients to apply to the emergency department are chest pain, abdominal pain and shortness of breath, respectively. In another study, respiratory system problems (21.3%) were found to be the most common reason for admission. Hypertension is the most common disease in patients using ambulance services (Bedel and Tomruk, 2018)

3.8% of the patients who applied to the emergency department due to trauma are over the age of 65. Falls are the most common with 60.7% in the trauma-related admissions of the geriatric age group. In all cases, emergency

admissions are more common in men, while women aged 65 and over are more common in the geriatric patient population. The important reasons for this are the low life expectancy in men as well as the changing disease profile in advanced age groups. There is an increase in hospital admissions in geriatric patients during the winter months. In addition, the mortality rate of emergency admissions at advanced ages is quite high. It seems beneficial for emergency room workers to receive special training in geriatric diseases (Ercal, 2017 , Roudsari et al. 2007 ).

Today, it is known that 15% of patients who apply to hospital emergency services are geriatric patients (65 years and older) (Oktem et al 22022). It is estimated that this situation will increase in the coming years and one out of every four patients who apply to the emergency department will be a geriatric patient. Among the reasons for geriatric patients to use the emergency service, besides the existing medical reasons, the physical facilities provided by the emergency services, the ease and speed of the medical procedures to be performed have an important place. In addition to the admission of geriatric patients to the emergency services, the way they apply is also gaining importance. Especially as patient transport services, which are a part of pre-hospital emergency health services, develop, it is evaluated that there is an increase in emergency service applications made by ambulance (Şimsek et. Al.,2009, Bedel and Tomruk, 2018 ,, Kocar 2002).

## REFERENCES

- Anon. n.d.-a. 'Ageing and Health'. Retrieved 8 December 2022 (<https://www.who.int/news-room/fact-sheets/detail/ageing-and-health>).
- Anon. n.d.-b. 'Turkish Statistical Institute. Seniors with Statistics,... - Google Akademik'. Retrieved 8 December 2022 ([https://scholar.google.com.tr/scholar?hl=tr&as\\_sdt=0%2C5&q=Turkish+Statistical+Institute.+Seniors+with+Statistics%2C+2022.+Access+Link%3A+https%3A%2F%2Fwww.tuik.gov.tr%2FHome%2FIndex+%5BAccess+Date%3A08.12.2022%5D&btnG=](https://scholar.google.com.tr/scholar?hl=tr&as_sdt=0%2C5&q=Turkish+Statistical+Institute.+Seniors+with+Statistics%2C+2022.+Access+Link%3A+https%3A%2F%2Fwww.tuik.gov.tr%2FHome%2FIndex+%5BAccess+Date%3A08.12.2022%5D&btnG=)).
- Kaldirim, Ü., Tuncer, S. K., Ardic, S., Tezel, O., Eyi, Y. E., Arziman, İ., ... & Eroğlu, M. (2013). Analysis Of Geriatric Cases Admitted To The Emergency Department By Ambulance. *Turkish Journal Of Emergency Medicine*, 13(4).
- Paksoy, V. M. (2016). Comparison Of International Application Models In Emergency Health Services: Anglo-American And Franco-German Model. *Journal Of İnönü University Vocational School Of Health Services*, 4(1), 6-24.
- Erbay, H. (2017). Why the number of pre-hospital emergency health services in Turkey is 112 A recent study in the context of ambulance services. *Mersin University Faculty of Medicine Lokman Hekim Journal of Medical History and Folkloric Medicine*, 7(1), 28-32.
- Canlı, S., & Bingöl, N. (2018). Falls and Emergency Management in the Elderly Population. *Prehospital journal*, 3(2), 63-73.
- Keskinoğlu P., Sofuğlu T., Older people's use of pre-hospital emergency medical services in Izmir, Turkey July 2009 *Archives of Gerontology and Geriatrics* 50(3):356-60 DOI:10.1016/j.archger.2009.05.019
- Şimsek, p., Günaydın, m., & Gündüz, a. (2019). Pre-hospital emergency health care: the case of turkey. *Gumushane University Journal of Health Sciences*, 8(1), 120-127.
- Varışlı, B. (2018). Clinical, Demographic and Cost Evaluation of Geriatric Age Group Patients Presenting to the Emergency Department. *Anatolian Journal of Emergency Medicine*, 1(2), 18-24.

- Bedel, C., & Tomruk, Ö. (2018). Characteristics of Geriatric Patients Presenting to a University Emergency Department. *Journal of SDU Faculty of Medicine*, 25(4), 393-399.
- Erçal, T. (2017) Review Of Pre-Hospital Approach To Geriatric Trauma Cases. *Pre-Hospital Journal*, 2(2), 105-118.
- Oktem, B., & Fatih, Ü. Z. E. R.(2022) General Characteristics Of The Population Of Geriatric Patients Applying To The Emergency Department. *Kocatepe Medical Journal*, 23(3), 283-287.
- Roudsari, B. S., Nathens, A. B., Arreola-Risa, C., Cameron, P., Civil, I., Grigoriou, G., ... & Rivara, F. P. (2007). Emergency Medical Service (EMS) systems in developed and developing countries. *Injury*, 38(9), 1001-1013.
- Eksi, A. (2015). Pre-Hospital Emergency Health Services in Mass Incidents. Kitapana Publications, Izmir, 312pp.
- Force, G. E. D. G. T., American College of Emergency Physicians, American Geriatrics Society, & Emergency Nurses Association. (2014). Geriatric emergency department guidelines. *Annals of emergency medicine*, 63(5), e7-e25.
- Kocar, IH. (2002). Aging and Geriatric Medicine in the Elderly World. I. National Geriatrics Congress. 25-29 May 2011. Antalya.

## **CHAPTER 4**

### **HOME CARE SERVICES FOR GERIATRIC PATIENTS**

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## INTRODUCTION

Aging is a normal and inevitable physiological process. According to 2019 data, there are 703 million people older than 65 years worldwide, and this number is expected to reach 1.5 billion in 2050 (World Population Ageing, 2019). Biological aging varies from person to person and depends on genetic factors and lifestyle. Lifestyle creates a significant difference between people in terms of health and functioning at each stage of life. It is very important both for the quality of life of the individual and for the organization of elderly care services that the years spent living a long life are healthy (Ozmete&Hussein, 2017). The average life expectancy in the world is increasing and on the other hand, this situation brings some problems in health, sociocultural and economic fields (Turaman, 2001).

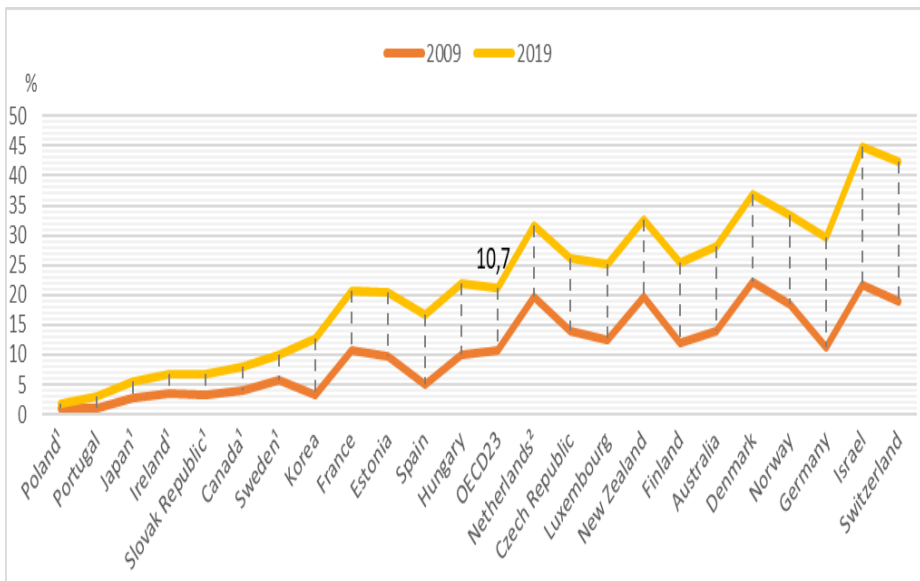
The social, economics and political consequences of the increase in the elderly population have been discussed in all countries. The increasing demand for post-hospital healthcare leads to a significant increase in healthcare expenditures. With the increase in chronic diseases such as diabetes, hypertension, and chronic obstructive pulmonary disease, the number of dependent patients has also increased. In particular, the unnecessary use of hospital beds by elderly and chronic patients has increased the burden on hospitals. Because of all these factors, the elderly have become more and more in need of protection and care (Karahana&Güven, 2002; Cayir 2020; Cayir et al., 2013). This situation makes it imperative for the state and society to take care of services for the elderly. The increase in the proportion of older people in most countries of the world and the setting of priorities to improve the welfare of this population group are among the most important issues (Ozmete et al.,2017; Karakus, 2018)

In developed countries, older people are healthier and better educated, and more than half of them can manage their daily activities. In developing countries, on the other hand, the elderly are unable to adequately provide their care due to reasons such as socioeconomic inadequacies, low literacy rates, poverty, and rapid aging of the population (Gutiérrez-Robledo et al., 2022). This situation is also observed in the admission of geriatric patients to emergency departments in studies conducted in developing countries.

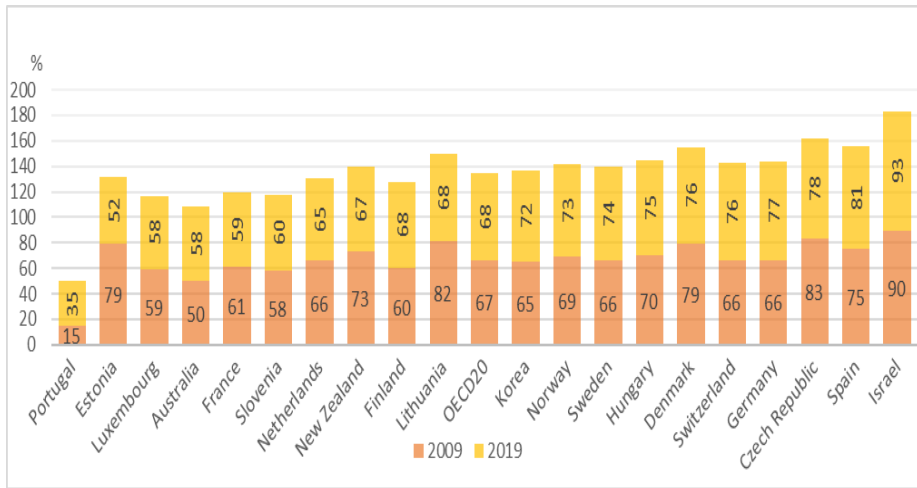
Notably, the majority of trauma patients live with and are cared for by their geriatric spouses (Çağlayan et al., 2019). These and similar indicators in developing countries show that care for the elderly population is more challenging (Gutiérrez-Robledo et al., 2022).

### 1.Home care services in the world

Today, home care takes precedence, but institutional care services continue to evolve (Karakus, 2018). Home care for the elderly is a key area for improving health care quality. Over the past two decades, a major goal has been to ensure that older people can be cared for in their own homes for as long as possible. Remaining in familiar surroundings increases independence, is cost-effective, and helps older people maintain their health (Glomsås et al., 2020). According to 2019 data, in Organisation for Economic Co-operation and Development (OECD) countries, an average of 10.7% of people aged 65 years and older received long-term care at home or in long-term care facilities, and 68% of them could receive care at home (Figure 1,2) ( OECD Health Statistics 2021).



**Figure 1:** Share of adults aged 65 and over receiving long-term care, 2009 and 2019 (or the nearest year)



**Figure 2:** Long-term care recipients aged 65 and over receiving care at home, 2009 and 2019 (or the nearest year)

The World Health Organization has defined home care services as services provided to individuals who cannot provide their own personal care and need assistance in maintaining their lives. This includes examination, treatment, and rehabilitation services provided to bedridden or homebound individuals in their living environment for reasons such as various chronic diseases or malignancies (Cayir, 2020).

## 2.Components of home care services

Home care distinguishes between services provided by family members (informal) or by professionals (formal). Informal caregivers are usually family members or other unpaid relatives. Formal caregivers are professionals who provide home care services (Karahan&Güven, 2002). Although informal care is preferred by the elderly, it has positive and negative aspects. Elderly people who are cared for by their children report being less restless, lonely, bored, and unhappy than other elderly people. On the other hand, the loss of personal control over their lives and the tension between needing care and not wanting to be a burden negatively affect the relationship between the elderly and their caregivers. In addition, it is observed that home caregivers' freedom is restricted, their mental state is negatively affected, and they often experience burnout (Barnay&Juin, 2016; Navaie-Waliser et al., 2002). Therefore, it is crucial to assess the needs of caregivers and the risk of burnout.

Home care services require teamwork because they must consider the individual and his/ her family in all physical, emotional, social, economic, and environmental aspects. Members of the home care team may include:

Physician, a nurse, a medical social worker, a psychologist, a dentist, rehabilitation staff, dietician, optometrist, paid caregivers, friends, and family members. Factors such as the patient's needs, pre-existing conditions, and life circumstances determine the degree and necessity of each specialist's involvement in home care (Alkurashi, 2006). Conditions requiring home care services include hemiplegia, Alzheimer's disease/dementia, end-stage malignancies, chronic obstructive pulmonary disease, and other chronic diseases. Many patients are bedridden, and pressure ulcers are common in these patients. Urinary and fecal incontinence is also seen in most patients (Cayir et al., 2013; Uzan et al. 2017). The home care specialist, usually a physician, provides care planning and team coordination. During the visit, the patient's social support system (people who can be reached in an emergency, etc.) should be assessed. The patient and his or her caregivers should be instructed in the proper use of equipment for home use, such as ventilators and pulse oximetry. Home safety must be assessed to prevent accidents (tables and chairs, stairs, bathrooms, loose carpets, lighting, and night lamps, etc.) (Green, 1998).

The services provided in home care can be summarized as follows (Ministry of Family and Social Services of Turkey, 2020):

- Examination, workup, and treatment services,
- Prescription of medications deemed appropriate,
- Dressings, wound care, various invasive procedures (urinary catheter, nasogastric catheter, etc.)
- Rehabilitation, education and support services,
- Oral and dental health services
- Transportation services for patients,
- Identifying social service needs and ensuring necessary coordination with relevant institutions,
- Ensuring the integration of home care services and palliative care services.

## **CONCLUSION**

The primary goal of home care is to ensure that older people can live in their own family and home environment and meet their needs as needed without becoming detached from their social environment. With qualified home care services, it is possible to provide many treatments for the elderly in the environment in which they live. It is important to use a well-trained, professional team for the proper implementation of the service. The physical and psychological well-being of informal caregivers should also be considered. In cases where the person's needs cannot be met at home, inpatient care services should be activated. Therefore, proper coordination of home care and inpatient care services is of utmost importance.

## REFERENCES

- Alkurashi, N. Y. (2006). Home health care team members. *Middle East Journal of Family Medicine*, 148, 4196.
- Barnay, T., & Juin, S. (2016). Does home care for dependent elderly people improve their mental health?. *Journal of Health Economics*, 45, 149-160. doi: 10.1016/j.jhealeco.2015.10.008
- Çayır, Y. (2020). Home Health Care. *Turkish Journal of Family Medicine and Primary Care*, 14(1), 147-152. doi: 10.21763/tjfmpe.693164
- Çayır, Y. (2013). Characteristics of patients receiving home health services and expectations of caregivers. *Konuralp Medical Journal*, 5(3), 9-12.
- Çağlayan, S., Çelik, B., Çağlayan, E., Çelik, N., Öztürk, D., Altınbilek, E., & Kavalci, C. (2019). Evaluation of geriatric patients presenting to emergency department with trauma. *Наука и здравоохранение*, (3), 77-83.
- Glomsås, H. S., Knutsen, I. R., Fossum, M., & Halvorsen, K. (2021). ‘They just came with the medication dispenser’-a qualitative study of elderly service users’ involvement and welfare technology in public home care services. *BMC health services research*, 21(1), 1-11. doi: 10.1186/s12913-021-06243-4
- Gutiérrez-Robledo, L. M. (2002). Looking at the future of geriatric care in developing countries. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences*, 57(3), M162-M167. doi: 10.1093/gerona/57.3.M162
- Karahan, A., & Güven, S. (2002). Home care in old age. *Turkish Journal of Geriatrics*, 5(4), 155-159.
- Karakuş, B. (2018). Services for the elderly, institutional elderly care and the situation of the provinces in institutional elderly care in Turkey. Ankara: Ministry of Family and Social Policies Publications.
- Kay Green. (1998). Home care survival guide. Lippincott Williams & Wilkins.
- Ministry of Family and Social Services of Turkey. (2020) Yaşlılar için bilgilendirme rehberi-III [Information guide for elderly people]. URL: <https://www.aile.gov.tr/media/45960/yasli-lar-icin-bilgilendirme-rehberi-3.pdf>

- Navaie-Waliser, M., Feldman, P. H., Gould, D. A., Levine, C., Kuerbis, A. N., & Donelan, K. (2002). When the caregiver needs care: The plight of vulnerable caregivers. *American journal of public health*, 92(3), 409-413.
- Özmete, E., & Hussein, S. (2017). Elderly care services report in Turkey: best practice examples from Europe and a model design for Turkey. Ministry of Family and Social Policies.
- Turaman, C. (2001). Planning of elderly health services in primary care. *Turkish Journal of Geriatrics*, 4(1), 22-27.
- Uzan, M. M., Eğici, M. T., & Toprak, D. (2017). Sociodemographic Characteristics and Medical Conditions of Patients under Homecare Service. *JAREM. Journal of Academic Research in Medicine*, 7(3), 117. doi: 10.5152/jarem.2017.1286
- World Population Ageing (2019) United Nations, Department of Economic and Social Affairs, Population Division





## **CHAPTER 5**

### **PREVENTIVE MEDICINE IN GERIATRIC POPULATION**

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## INTRODUCTION

Preventive health services are the general name of health services where early diagnosis and treatment planning are made, supported by specific screening tests, if necessary, before the symptomatic diagnosis of diseases. These cost-effective health services that increase survival are increasingly being adopted in all countries of the world in all age groups. Preventive medicine practices have been revised and updated over time, but still, the main goals are to prevent the emergence of the disease, to prevent the progression of the disease and the development of complications by early diagnosis. (Öztürk et al.,2015, Akdeniz et al.,2017) The World Health Organization (WHO) categorized the 65-74 years old into three subgroups as “young old”, 75-84 years old “middle-aged”,and those 85 and over are “advanced old”. (Soyuer et al.,2008) In the geriatric period, which is a special population, the expected life expectancy during preventive medicine practices is shaped according to the preferences and values of the person. The management of modifiable risk factors for many chronic diseases, screening for malignancies with a high incidence, regular physical activity, healthy diet, not smoking and alcohol use, ensuring that social situations should be together contribute to the remaining life span by protecting physical and cognitive functions, and even lowers the mortality rate. (Naharcı et al., 2018)

Preventive measures are grouped as primordial, primary, secondary, tertiary and quaternary prevention. These stages are shown in Table 1 together with their examples. (Jamuel,2014) These stages, which are basically related to each other, can start in any period of life or directly in old age. It can be revised according to the person, his/her background and the possibilities of the health facility, provided that they do not deviate from the main idea. It is aimed to reduce the number of new cases with primary prevention, and to prevent the number of serious cases and possible complications in secondary prevention. In tertiary prevention, it is aimed to reduce mortality by managing the complication process, and in quaternary prevention, it is aimed to prevent unnecessary use of drugs and medical interventions to be used for therapeutic purposes.

**Table 1:** Preventive Measures

Preventive Measures	Scope	Example
Primordial Preventive	To prevent the occurrence of risk factors	-To determine the person with risk factors for obesity in childhood - Measures to prevent epidemics
Primary Preventive	Pre-illness management	-Vaccine - Lifestyle changes
Secondary Preventive	Asymptomatic disease period	-Cancer, hearing, vision screenings etc.
Tertiary Preventive	Symptomatic disease period Complication follow-up - rehabilitation	-Diabetic Foot -Hypertensive Nephropathy
Quaternary Preventive	Avoiding unnecessary drugs and medical interventions	-Avoiding polypharmacy, -Preventing infections with invasive examination management

Reference: Jamouille M. The four duties of family doctors: quaternary prevention – first, do no harm. Extracted from HK Pract 2014;36:1-6.

### 1. Primary Prevention Services for the Elderly

In a cohort study evaluating people over the age of 65 who do not have a known dependency for care, 1236 people became moderately and severely dependent in the process as a result of 12 years of follow-up. According to this, severe addiction in active smokers and those who recently quit, moderate and severe addiction in those consuming less than 1 serving of fruit and vegetables per day was found. (Artaud et al., 2013) The titles of primary prevention methods in geriatric individuals and the things to be considered can be summarized as follows;

#### 1.1 Nutrition:

Evaluation of nutrition starts with inspection at the first time the individual is encountered in the outpatient clinic. However, during the evaluation, appetite status, involuntary weight loss status should be questioned, anthropometric measurements such as weight, height, waist

circumference, upper leg and upper middle arm circumference, and information on which foods were consumed should be recorded. Even if there is no known or detected nutrient restriction, the elderly should be encouraged to consume all kinds of natural food sources. Nutrition is indispensable for the biopsychosocial state of full health of the body. With the mini nutritional test (MNT), the nutritional status of elderly individuals can be evaluated easily and it can be determined whether there is a malnutrition status. After the preliminary evaluation with the six-question scanning part, it is determined whether there is a normal or risky situation and the evaluation is completed with the long form of the test. A score of 0-7 in the screening test indicates that the person is malnourished, and a score of 8-11 indicates that she is at risk for malnutrition. If the long form is completed and a score of 24 or higher is obtained, it is possible to talk about a healthy eating elderly individual. Screening evaluation for MNT is given in Table 2. (Vellas et al., 2006, Rubenstein et al., 2001)

**Table 2:** Mini Nutritional Test (MNT) Evaluation Scale

<p>A. Has there been a decrease in food intake in the last three months due to loss of appetite, digestive problems, difficulties in chewing or swallowing?</p> <p>0: Severe decrease in food intake                  1: Mild decrease in food intake                  2: No decrease in nutrient intake</p>
<p>B. Weight loss status in the last three months</p> <p>0: Weight loss of more than 3 kg                  1: No information                  2: Weight loss between 1 - 3 kg                  3: No weight loss</p>
<p>C. Mobility</p> <p>0: Bed or chair bound                  1: Able to get out of bed or chair but cannot leave the house                  2: Can go out of the house</p>

<p>D. Have you complained of psychological stress or acute illness in the last three months?</p> <p>0: Yes    2: No</p>
<p>E. Neuropsychological problems</p> <p>0: Severe dementia or depression</p> <p>1: Mild dementia</p> <p>2: No psychological problems</p>
<p>F. Body Mass Index (BMI) = (Body weight-kg) / (Height in meters) <sup>2</sup></p> <p>0: BMI less than 19 (not inclusive)</p> <p>1: BMI 19 to 21 (not including 21)</p> <p>2: BMI 21 to 23 (not including 23)</p> <p>3: BMI over 23</p>
<p>Screening score (total maximum 14 points)</p> <p>12-14 point: Normal nutritional status</p> <p>8-11 point: Under malnutrition risk</p> <p>0-7 point: Malnutrition</p>

Referrance:Rubenstein LZ, Harker JO, Salva A, Guigoz Y, Vellas B. Screening for Undernutrition in Geriatric Practice: Developing the Short-Form Mini Nutritional Assessment (MNA-SF). *J. Geront* 2001;56A: M366-377

The incidence of malnutrition in elderly individuals varies between 5 and 85%. Physical problems that are inevitable with advancing age can make it difficult for the elderly to prepare and consume their food. Elderly individuals may reduce their fluid intake due to urinary incontinence. For all these reasons, the individual's eating habits, how many meals he consumes, what kind of food he consumes and the amount of water consumption should be evaluated at each visit. (Erdinçler DS. 2012) In this way, the growth of many health problems can be prevented and the management of existing problems will be much more effective. Involuntary weight loss of 10% or more in the last 6 months has been associated with increased mortality and morbidity. (Johnston, 2004)

### **1.2 Exercise:**

Since physical activity increases the quality of life and reduces morbidity, it should be actively and/or passively planned and recommended for all individuals over the age of 65 within the framework of special exercise programs. Physiotherapists should play an active role in these programs. In the guidelines published by the American College of Sport Medicine (ACSM) and the American Heart Association (AHA), exercises are grouped under four headings: aerobics, muscle strengthening, flexibility, and balance. Aerobic and muscle strengthening exercises are also important for cardiac and pulmonary rehabilitation in elderly individuals who benefit from balance exercises to prevent falls and to have a proper posture. (Öztürk et al.,2015, King et al.,2010, Nelson et al.,2007.) In order to benefit from the exercise, the exercise intensity must be above a certain level. Increasing exercise intensity will lead to an increase in cardiac output and heart rate. The recommended maximum heart rate is calculated using the formula;  $220 - \text{age} \pm 10$ . For individuals over 50 years of age, the  $180 - \text{age}$  formula is used for the intensity of exercise. It is stated that the target heart rate should be taken as 60% to 90% of the maximum heart rate. (Bölükbaşı,2020)

### **1.3 Smoking – Alcohol use:**

Smoking harms every organ of the body and is among the primary causes of many diseases. While quitting smoking does not completely eliminate the possibility of developing these diseases, it can reduce the incidence. According to the Center for Disease Control and Prevention (CDC), it is responsible for 90% of all lung cancer deaths and 80% of chronic obstructive pulmonary disease (COPD) deaths. In addition, while it increases the risk of coronary heart diseases and stroke by 2 to 4 times, it increases the risk of developing lung cancer 25 times in men and 25.7 times in women. Therefore, while it causes an increase in health services and costs, the loss of workforce is another social loss that comes with it. (CDC,2022) Although the age of onset of cigarette consumption varies, the rate of smoking in people aged 65 and over was found to be lower than in young people. Alcohol use may also affect general health conditions, similar to smoking, and may also play a role in further deterioration of cognitive functions, which change somewhat with age. (Öztürk et al., 2015)



### **1.4 Aspirin Useage:**

According to the 2019 data of the Turkish Statistical Institute (TUIK), when the causes of death are examined, circulatory system diseases take the first place with 36.8%, this rate is followed by benign and malignant tumors with 18.4% and respiratory system diseases with 12.9%. (TUIK, 2022). While the use of aspirin is effective in the treatment of myocardial infarction in both genders and as a secondary prevention measure in the cardiovascular disease group, its use in primary prevention is controversial. Although it reduced the risk of myocardial infarction by 32% in comparison with placebo, the risk of death from cardiovascular disease and stroke was not defined. (Ridker et al., 2005) Within the scope of Periodic Health Examinations Recommended in Family Medicine Practice in our country, Turkish Republic. In the guide published by the General Directorate of Public Health, taking into account risk factors such as bleeding disorder, renal failure, concomitant anticoagulant therapy and gastrointestinal side effects in adults aged 65-80 in elderly individuals, daily use of 81 mg of aspirin is used for both sexes to prevent cardiovascular diseases and to prevent ischemic stroke. It is recommended for women for prevention. (The Guide of Periodic Health Examinations and Screening Tests Recommended in Family Medicine Practice , 2015) In the literature available, it has been observed that the benefits of aspirin therapy may differ based on gender, that its prevention in ischemic stroke is more prominent in women, and that the level of evidence is low for both sexes after the age of 80. (Öztürk et al.,2015) According to the consensus in the guidelines of the American cardiology and gastroenterology societies, the use of proton pump inhibitors is also recommended in all individuals using chronic aspirin. (Nelson et al., 2005)

### **1.5 Vaccination:**

Immunization services, which are perhaps the most well-known examples of primary preventive medicine, are applied to our elderly by evaluating them according to their conditions and previous vaccination schedules. Vaccines recommended for individuals aged 65 and over are listed in Table 3. (CDC,2022)

**Table 3:** >65 ages vaccines

Tetanus & Diphtheria (Td)	Booster with Td 1 every 10 years
Herpes Zoster	2 doses
Conjugated Pneumococcus	1 dose
Inactive/ Recombinant Influenza	Single dose before each influenza season
Hepatitis A	2 doses in risky patient group
Hepatitis B	2 doses in risky patient group
Hemophilus Influenza Type B	1 or 3 doses in risky patient group
Meningococcus	1 or more doses in risky patient group
Varicella	2 doses

Reference: CDC,2022

## 2. Secondary Prevention Services for the Elderly:

Evaluations on cancer, vision and hearing screenings, as well as all chronic diseases, the prevalence of which increases with age, are gathered under this heading. Diseases that cannot be prevented from being diagnosed with primordial or primary preventive services are followed up with screening and, if necessary, diagnostic evaluations. While this process can be managed by the Family Medicine Specialist, it mostly requires multidisciplinary management processes in the coordination of Family Medicine. (Savaş et al.,2010)

### 2.1 Vision Examination:

In old age, vision loss problems are encountered due to cataract, glaucoma, macular degeneration and diabetic / hypertensive retinopathy. Even though the Snellen visual card is a globally accepted evaluation method, the evaluation of elderly individuals at high risk by an ophthalmologist once a year is necessary not only in terms of visual health but also in preventing all kinds of home accidents that may occur. (Savaş et al.,2010)

### 2.2 Hearing Examination:

In our country, the population over the age of 65 has increased by 24% in the last 5 years and it is predicted that this process will continue to increase proportionally in the following years. Age-related hearing loss (presbycusis); It has a multifactorial etiology and is encountered in up to 70% of individuals over the age of 75. (Karakuş, 2022) Hearing loss is an important health

problem to be diagnosed and followed up because it has a negative impact on the quality of life, will be reflected as a regression in functional processes, and may trigger depressive states with all kinds of accidents. (Savaş et al.,2010)

### **2.3 Cardiovascular Diseases:**

Due to the structural changes in the body, other possible accompanying diseases, the presence and duration of risk factors for the development of the disease, this group of diseases varies in the elderly. The most preventable cardiovascular diseases (CVD) with preventive health medicine; hypertension, dyslipidemia, diabetes mellitus, obesity. (Öztürk et al.,2016)

#### **2.3.1 Hypertension:**

Blood pressure, which must be evaluated by providing appropriate measurement conditions at each visit, is one of the most important health problems in individuals aged 65 and over. According to the Turkish Hypertension Prevalence study (Patent2) (2016), the prevalence of hypertension is 67.9% in the 60-69 age group, while it increases to 85.2% in the 70-79 age group, and up to 76.3% in the 80-year and older age group. According to the regions, hypertension is mostly encountered in the Eastern Black Sea Region and its incidence increases according to the increase in body mass index. (Turkish Association of Hypertension and Kidney Diseases,2012) If hypertension is not taken under control, cerebrovascular accident, cardiological and vascular problems lead to conditions such as heart failure and chronic kidney failure, resulting in complex pictures in elderly individuals. Hypertension is diagnosed by combining history, physical examination, repeated blood pressure measurements, and laboratory examinations. If the target blood pressure value cannot be reached in the treatment process, which starts non-pharmacologically with lifestyle changes at the beginning, it is tried to be controlled with mono or combined drug therapies. Hypertension is a very important disease to follow in terms of complications that may occur in the follow-up of patients. (Kolcu et al.,2017) The target blood pressure value is 130–140/70–80 mmHg in patients older than sixtyfive years. (Turkish endocrine and metabolism society,2022)

### 2.3.2 Dyslipidemia:

Due to the high incidence of cardiovascular disease, which is one of the leading causes of morbidity and mortality in individuals over the age of sixty five, it is one of the clinical conditions in which laboratory screenings and follow-up and treatment are required. Laboratory evaluation is recommended once a year in the advanced age group without a known disease. Lipid profiles vary with age and gender. The most important factor affecting cholesterol levels in both sexes is changes in body weight. In the dyslipidemia guide published by the European Society of Cardiology (ESC) 2019, statin use in high-risk individuals under the age of 75 is among the primary prevention methods. (Class I, Level of Evidence A). However, it should not be forgotten that the use of statins may impair blood sugar regulation, and necessary blood parameters should be followed routinely. Clinical decision is at the forefront of the necessity of treatment in individuals over eighty years of age, the evidence for this age group is not sufficient. According to the ESC 2019 dyslipidemia guideline, treatment recommendations for individuals over the age of 65 age given in Table 4 along with the levels of evidence. (Yıldırım et al.,2017, Mach F et al.,2020)

**Table 4:** ESC 2019 Dyslipidemia Guideline Treatment Recommendations

Recommendations	Class	Level of evidence
It is recommended in older individuals with atherosclerotic cardiovascular disease in the same way as in younger patients.	I	A
Treatment with statins for primary prevention is recommended for individuals under 75 years of age, based on risk level.	I	A
In individuals over 75 years of age, initiation of statin therapy may be considered for primary prevention if there is a high risk or more.	Iib	B
In cases such as renal failure and/or drug interactions, statin therapy should be started with a low dose and then dose titrated to achieve treatment goals.	I	C

Referrance: Yıldırım et al.,2017, Mach F et al.,2020

### 2.3.3 Diabetes Mellitus:

It is one of the diseases that need to remain dynamic in the treatment and follow-up process as a result of the prolongation of the expected life span. The Turkish Endocrine Metabolism Society (TEMED) recommends classifying individuals according to their health status in the follow-up of elderly individuals for diabetes. According to this;

*1. Healthy elderly - individuals with a long life expectancy with normal functional and cognitive functions;*

Target A1C: <7-7.5%, pre-meal plasma glucose 80-130 mg/dl, post-meal plasma glucose 80-180 mg/dl, and blood pressure <140/90 mmHg

*2. Moderately healthy elderly – individuals with multiple chronic diseases, accompanied by mild to moderate cognitive and functional impairment;*

Target A1C: <7.5-8%, pre-meal plasma glucose 90-150 mg/dl, post-meal plasma glucose 100-180 mg/dl, and blood pressure <140/90 mmHg

*3. The elderly in poor health - individuals with short life expectancy, concomitant multiple complications;*

Both glycemic and metabolic targets fall within wide ranges. The most important goal is not to disrupt the current quality of life, but to try to increase it. While providing this, protecting from hypoglycemia and making arrangements with simple treatments are the basic principles. Target A1C: <8-8.5%, pre-meal plasma glucose 100-180 mg/dl, post-meal plasma glucose 110-200 mg/dl, and blood pressure <150/90 mmHg.

The management of complications, which are inevitable to occur slowly in all the processes of the long years left behind in the development of diabetes, is at least as important as the target blood values and the treatments to be applied. Conditions that may adversely affect the treatment, such as retinal examination of the elderly individual, cognitive functions, presence of sarcopenia, and development of malnutrition, should be evaluated annually by a preventive physician. In addition, it is recommended to perform a foot examination at each visit to eliminate the risk of developing diabetic foot due to peripheral neuropathic conditions and peripheral vascular disease. Another

point to be considered is that antidiabetics that cause orthostatic hypotension and hypoglycemia are not in the treatment while the treatments are being arranged. Multidisciplinary assessments should be organized if needed. At the very beginning of these services, the main goal is to prevent the development of diabetes by means of lifestyle changes, age-appropriate physical activities and mild weight loss in cases diagnosed with impaired glucose tolerance before diabetes develops, thanks to periodic examinations. (Turkish endocrine and metabolism society,2022)

### **2.3.4 Obesity:**

Obesity, which is a health problem with an increasing frequency in all age groups all over the world, is a process that increases mortality and disability in elderly individuals. According to the report published by the WHO in 2022, it is the 4th most common problem after high blood pressure, nutritional problems and tobacco use among non-communicable causes. Although these reasons cause a vicious circle by triggering obesity like intertwined rings, they are easily manageable processes with self-sacrificing preventive medicine recommendations.

The main recommendations for obesity management are listed as follows;

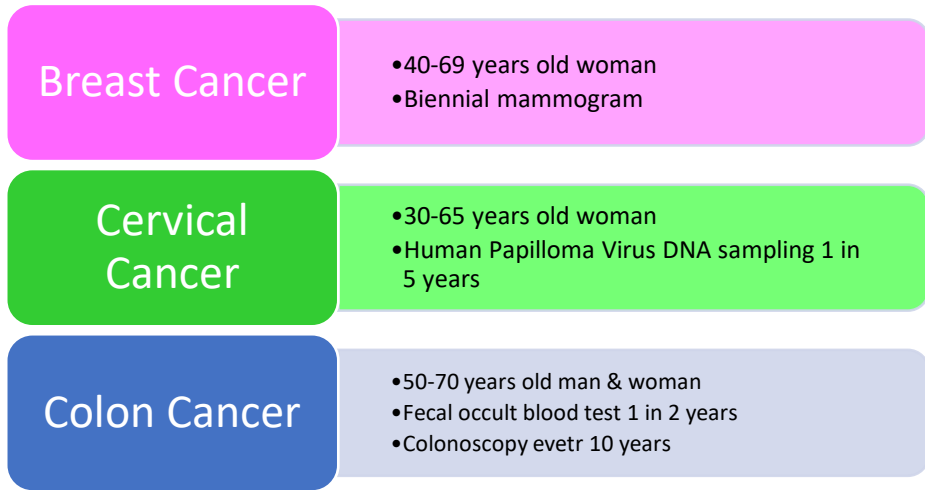
- Ensuring motivation by improving communication
- Avoiding labeling the individual
- To measure waist circumference at regular intervals
- Regulation of treatment of accompanying comorbid conditions
- Working with a multidisciplinary team
- Periodic evaluation of weight lost
- Arranging the deficiencies and mistakes detected in the lifestyle
- Regular physical activity

Decreased basal metabolic rate and physical activity in the elderly is the leading cause of obesity. Obesity; It can be a chronic disease that causes deterioration in the quality of life with its complications such as hypertension, hyperlipidemia and diabetes, and it is a complication that alone manages to complicate the management of cardiovascular diseases that have already developed unrelated to obesity. Physical disability, which will develop along with it in the process, can also trigger social isolation and depression in

elderly individuals. It is thought that individuals can mostly prevent the vicious circle that will develop if it is not managed well over time with regular physical activity. Primary and secondary gains in obesity are inevitable with physical activity that will be provided in safe environments that support muscle strength, coordination, endurance and flexibility, and where the possibility of injury is kept to a minimum. (Bölükbaşı, S. 2020)

#### **2.4 Cancer Screenings:**

Another disease group that is increasingly encountered with the increase in life expectancy is malignancies. While 30% of breast cancer patients are over the age of 70, more than half of them are over the age of 65, and 48% of these patients were found to be metastatic at the time of diagnosis. (İlhan et al., 2019) The integration of compliance with cancer screening programs implemented in our country by the Ministry of Health at an early age continues with increasing awareness day by day. The goal is not to make a diagnosis, but to recognize a positive finding (if any) of cancer at an early stage, in apparently healthy people, to be confirmed by further methods, and to use cost-effective treatment options that do not affect the quality of life. However, the desired levels have not yet been reached. According to TUIK 2018 data, cancers are the second leading cause of death in our country. (Statistics, T. T. H. (2019).) The cancer types included in the cancer screening program in our country are shown in Figure 1. (Ridker, P. M, et al.2005)



**Figure 1:** National Cancer Screening Programs

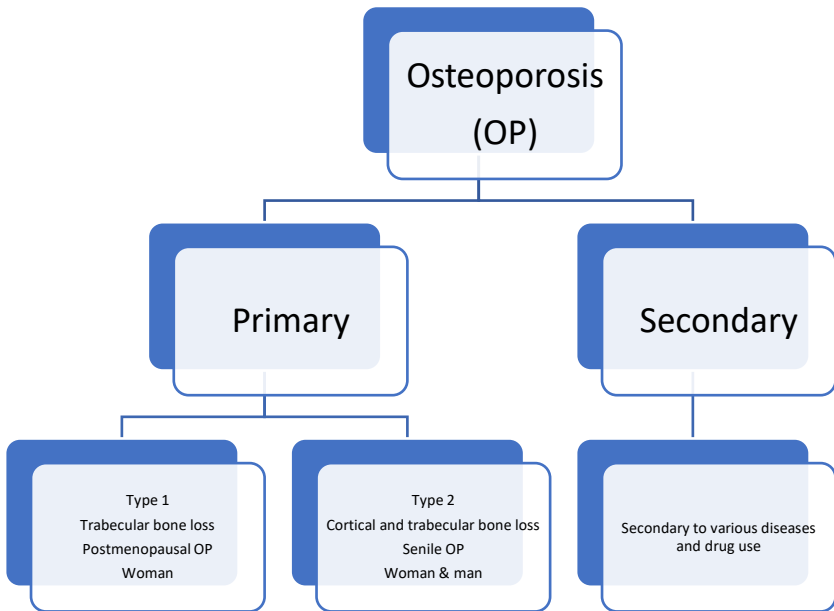
**Refferance:** Ridker, P. M, et al.2005

The Cancer Society of America recommends that screening for breast cancer should not be discontinued as long as a person has a life expectancy of more than 10 years. (Oeffinger et al., 2015) In our country, if there is no pathology requiring follow-up in women aged seventy and over, the screening program is continued by calculating the profit-loss ratio at the request of the person. The American Center for Disease Prevention and Control (USPSTF) recommends bi-annual mammography screening for women aged 50 to 74 years, with evidence level B. (İlhan et al., 2019)

### 2.5 Osteoporosis:

Osteoporosis is a metabolic bone disease with a multifactorial mechanism that results in an increase in bone fracture tendency as a result of deterioration in bone structure. (Turkish endocrine and metabolism society, 2022) In a study conducted in our country in 2010, osteoporosis was detected in 1 out of 4 people aged 50 and over. (Tuzun et al.,2012) It is predicted that this rate will increase exponentially in direct proportion to the increasing population. The classification of osteoporosis is summarized in Figure 2. ([https://file.temd.org.tr/Uploads/publications/guides/documents/OSTEOPOR\\_OZ\\_MKH2022.pdf?a=1](https://file.temd.org.tr/Uploads/publications/guides/documents/OSTEOPOR_OZ_MKH2022.pdf?a=1) Accessed: 17/12/2022)





**Figure 2:** Osteoporosis Classification

([https://file.temd.org.tr/Uploads/publications/guides/documents/Osteopor Oz\\_Mkh2022.Pdf?A=1](https://file.temd.org.tr/Uploads/publications/guides/documents/Osteopor Oz_Mkh2022.Pdf?A=1) Accessed: 17/12/2022)

In the basic pathophysiological process of life, the aspect of destruction comes to the fore as of the 4th and 5th decades and continues throughout life. In their eighties, 40% of women and 25% of men have suffered bone loss. Osteoporosis brings with it physical disability, costly treatments, decreased quality of life, and increased risk of new fractures and mortality. (Turhanoglu et al.,2008)

Osteoporosis is asymptomatic until a fracture occurs. There is no trauma condition for the formation of fractures, it is especially common in the elderly. The treatment and rehabilitation process is very laborious and costly for the individual or the person or persons who will care for him. The recommended method for the diagnosis of osteoporosis is the measurement of bone mineral density by dual X-ray absorptiometry (DXA). Women over the age of sixty five and men over the age of seventy should be evaluated for osteoporosis regardless of all risk factors. It is done according to T and Z scoring during interpretation. The T-score expresses how many standard deviations the patient's measurements are above or below the mean of the

same-sex young adults' measurements. It is used for the interpretation of postmenopausal women and men over 50 years old. The Z score, on the other hand, shows how many standard deviations above or below the mean of the same sex and same age measurements. It is used to evaluate premenopausal women and men under 50 years of age. (Turkish endocrine and metabolism society,2022) It is possible to diagnose these processes, which become more negative in old age compared to other periods of life, with the screening methods provided by preventive medicine, even before fractures occur, and to manage the necessary precautions and treatments with the most cost-effective methods. First of all, lifestyle evaluations and nutritional and physical activity status of the elderly individual should be evaluated. Contribution to this process management is provided by the analysis of laboratory samples and bone densitometry measurement at appropriate periods. The elderly person and her relatives, if any, should be informed about the measures to be taken to follow up the drugs (eg: Corticosteroids) used by the individual and to prevent all kinds of home accidents, especially falling. Although there is a special area of expertise for the use of agents used in the treatment of osteoporosis in our country, preventive health physicians play a key role in the right time to apply to the relevant physician and to follow up the continuation of the treatment.

### **2.6 Neuro-psychiatric Evaluation:**

Not only physical health, but also cognitive and social health areas are areas that are evaluated by us, preventive health physicians. According to the available sources, the most prominent clinical processes in the global data of mental problems in the elderly have been interpreted as dementia and depression. (Zubaroglu Yanardağ,et al.,2018) Since basically both diseases progress with regression in cognitive functions and this regression process can only be an age-related normal picture, great care should be taken while making the differential diagnosis. It can be quite challenging for the clinician to clarify whether the process is normal developments due to age, a reversible clinic due to depression, or a permanent and progressive picture due to dementia. In both diseases, we can suspect, screen, and even diagnose and initiate treatment under outpatient conditions. Again, if necessary, they should be directed to the neurology and/or phsyciatry specialist.

### 2.6.1 Dementia:

It is one of the public health problems whose importance continues to increase day by day. It is a progressive process in which people approach the flow of life much more emotionally than normal time. In cognitive functions, impairments in more than one area are together. Its incidence increases with advancing age. While the risk is 5% in “young old” individuals, this rate reaches 50% in “advanced old” individuals. (Ağar, 2020)

Memory changes that begin with simple forgetfulness progress to mild memory impairment and end with dementia. Dementia classifications are primarily made as primary and secondary dementia, and subgroups are shaped according to these two main headings. Classifications of dementia based on its pathological features and mechanism have also been found in accessible sources. The most common dementia type is Alzheimer's dementia. (Marziali et al., 2010). While the causes of secondary dementia can be prevented and treated by managing the process, this is not possible for primary dementias. The problems faced by dementia patients according to their stages can be summarized under the following headings; (Akyar, 2011)

#### Early Stage

- Forgetfulness, difficulty finding words
- Personality changes
- Difficulties in math calculations (Getting money, giving change)
- Lose things, mess around
- Need to repeat questions or sentences
- Person, time and space confusion

#### Middle Stage

- Increased memory loss
- Using inappropriate words
- Basic care skills are lost (Changing clothes, oral care, personal hygiene)

- Character change, loss of day-night distinction
- Distant relatives, inability to remember friends
- Difficulty in communication
- Excessive irritability, aimless wandering, daydreaming

#### Advanced Stage

- Malnutrition – insufficient calorie intake
- Urinary and stool incontinence
- Loss of mobility-bed addiction
- Becoming dependent on all movement, speech and eating functions in the last period.

It is important to manage cognitive, communicative and physical impairments together in dementia management. Because even if the person has a single problem, this may not be enough for the clinician to manage the process. For example, a normal individual suffering from osteoarthritis pain can be evaluated by expressing himself easily, while a dementia patient will have difficulty remembering his complaint, interpreting the senses, and verbally expressing it. For this reason, preventive health services for both the dementia patient and the caregiver are very important in order to delay these processes and to slow down the progression under the leadership of current treatments. These services include providing support for the maintenance of mental and physical activities after the diagnosis of dementia. For example, putting simple reminder notes while maintaining the patient's life in the current order in the environment he is used to, calling him by his name when communicating, introducing himself by name, ensuring that he sits close to the window to keep in touch. On the other hand supporting him to walking, making exercise, watching television, listening to music, chatting are recommending. Again, for malnutrition, which is not expected at the beginning but is inevitable to develop in the process, it is important to monitor the

nutritional status of the patient according to the anthropometric measurements and the amount of calories obtained from the foods consumed at each visit, and to support the individual with enteral nutrition products when necessary, in order to ensure that the metabolic processes are maintained for a longer period of time. (Akyar et al.,2009 , Uçkaç et al.,2020)

In order to exclude dementia, the "Mini Mental State Assessment (MMSE)" test given in Table 5 is applied. Scoring from this test is compatible with normal between 24-30 points, mild dementia between 18-23 points, and severe dementia at 17 points and below. (Sertel et al.,2016)

**Table5:** Mini Mental Status

**Orientation (1 point for each correct answer, 10 points in total)**

	POINT		POINT
Which year are we in?		Which country are we live?	
Which season are we in?		In which city are you currently located?	
Which month are we in?		What neighborhood are you currently in?	
What date is today?		What building are you currently in?	
What day is today?		What floor are you on in this building right now?	
Orientation Section Total (0-10):			

**Memory (Total 3 points)**

Listen carefully to the 3 names that I will tell you in a moment and repeat them after I have finished.(Table, flag, dress) (20 seconds allowed).(Each correct name is 1 point)	POINT
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**Attention and Calculation (Total 5 points)**

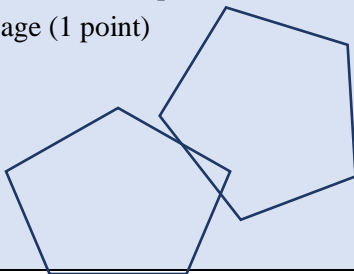
Go from 100 by subtracting 7 backwards. Continue until you say stop. (1 point for each correct action)	POINT
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**Recall** (Total 3 points)

Repeat the words you repeated above (table, flag, dress) (1 point per word)	POINT
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**Language** (Total 9 points)

a. What are the names of the objects you see? (clock, pen)(one point for a total of 2 points)(Give 20 seconds.)	POINT
b. Listen carefully to the sentence I am going to tell you now and repeat it after I have finished. "I don't want if and but" (give 10 seconds) (1 point)	
c. Now I will ask you to do something, listen carefully and do as I say "Take the paper on the table in your hand, fold it in half with both hands and put it down please" (total score 3) (time 30 seconds, each correct action 1 point)	
d. Now I will give you a sentence. Read and do what is said in the article. (1 point) - "Close your eyes" on a piece of paper. Write it down and show it to the patient.	
e. Write a meaningful sentence that comes to your mind on the paper I will give you now. (1 point)	
f. Draw the same shape as I will show you; draw it on the back page (1 point)	



Refferance: Sertel M, Şimşek Tarsuslu T, Tütün Yümin E. Yaşlılarda kognitif durum, depresyon düzeyi ve denge arasındaki ilişkinin incelenmesi. Journal of Exercise Therapy and Rehabilitation. 2016;3(3):90-95

**2.6.2 Depression:**

Depression, which has a multifactorial etiology, can be encountered in any period of life. In depression in the elderly, the diagnosis may be delayed

because the individual knows the possibility of not seeing his old physical and cognitive functions as a normal process of life. For this reason, mood affect status of our patients should be questioned at each visit, albeit for a very short time, and the anamnesis for diagnosis should be deepened in suspicious individuals.

According to studies, depression in elderly individuals is seen in 1 out of every 4 elderly individuals in the community sample. It is known that this rate is higher in individuals staying in elderly care centers. Clinically, the prevalence of depression varies between 5-9% in women and 2-3% in men. (Ağar, 2020)

Depression is diagnosed with "The Diagnostic and Statistical Manual of Mental Disorders" Turkey (DSM-V) TR criteria. (Yalçın et al., 2016) According to this;

A. General Diagnostic Criteria

1. Depressed mood
2. Anhedonia, decreased interest and desire
3. Decreased or increased appetite
4. Decrease or increase in sleep
5. Psychomotor slowing or agitation
6. Decreased energy, fatigue
7. Feelings of guilt, worthlessness
8. Difficulty concentrating
9. Suicidal tendencies

B. There is transaction loss.

C. The symptomatology is not due to a substance use or general medical condition.

D. It cannot be explained by another mental illness.

E. There is never a manic or hypomanic episode.

According to these criteria, there should be at least 5 symptoms in a 2-week period, and at least one of the symptoms should be depressive mood or decreased interest-desire. Cognitive impairments in depression are reversible impairments that do not cause damage to the functional basis. Although it differs from dementia at this point, 20% of individuals with dementia have major depression and more than 20% have depressive symptoms. If there is an elderly person who is thought to be in the picture of depression, depression anamnesis, family history, and other accompanying disease histories belonging to the youth years are key points that will help the clinician during differential diagnosis. Another difference is that while the cognitive functions of the depressed person are affected, this situation is not encountered in the dementia picture. (Erden Aki,2010.)

### **3. Tertiary Prevention Prevention in the Elderly:**

The philosophy of preventive health medicine approaches the individual in a holistic way, starting from the fetal period until the moment of death. Family Medicine Specialization and its practices in our country are historically more recent than other countries in the world. For this reason, we can still encounter some of our patients at a much later stage of life. In tertiary prevention, where possible complications of diseases are managed, hypertension and diabetes mellitus are the most common causes in elderly individuals.

#### **3.1 Tertiary Prevention Prevention in Hypertension:**

It is recommended to avoid aggressive blood pressure treatments. Because the process may progress to undesirable consequences such as orthostotic hypotension, fainting, falling, injury, electrolyte imbalance and death. Of course, we need to be careful in terms of clinics where uncontrolled blood pressure measurements also impair the quality of life such as cerebral hemorrhage, stroke, myocardial infarction, hypertensive nephropathy, and hypertensive retinopathy, which will create a need for continuous care, and which are likely to be mortal.

018 European Society of Cardiology/European Heart Association recommended the blood pressure threshold for initiation of antihypertensive



therapy as  $\geq 140/90$  mmHg in elderly individuals and  $\geq 160/90$  mmHg in very elderly individuals. In the 2019 Turkish Consensus Report on Hypertension, the criteria for initiation of treatment were recommended as  $\geq 140/90$  mmHg for 65-79 years of age, and systolic blood pressure  $\geq 150$  mmHg for those aged 80 and above. (Turkish endocrine and metabolism society, 2022)

### 3.2 Tertiary Prevention Prevention in Diyabetes Mellitus:

In case of incomplete Diabetes Mellitus treatment and follow-up; It brings together complications such as dehydration, poor wound healing-non-healing, ketoacidosis coma, hyperglycemic hyperosmolar coma, diabetic foot, neuropathy, retinopathy and nephropathy. In order to encounter all these complications in diabetes patients at no or less rate, it is necessary not to encounter problems in blood sugar follow-ups, to implement lifestyle changes, to apply the treatments given regularly, and not to interrupt the follow-ups.

The routine laboratory tests and follow-up frequencies required from diabetic patients are shown in Table 5. (Turkish endocrine and metabolism society, 2022)

**Table 5:** Routine laboratory tests and monitoring frequencies required from diabetic patients

HbA1c	Once in 3-6 months
Fasting lipid profile (Total cholesterol, HDL-cholesterol, LDL-cholesterol, triglyceride)	Once in a year
Microalbuminuria	At diagnosis and then once a year
Serum creatinine	Once in a year
Urine analysis (Ketone, protein, sediment)	At each visit
Electrocardiography	Once in a year

**Referrance:** [https://file.temd.org.tr/Uploads/publications/guides/documents/diabetes-mellitus\\_2022.pdf](https://file.temd.org.tr/Uploads/publications/guides/documents/diabetes-mellitus_2022.pdf) Accessed: 14/12/2022

### 4. Quaternary Prevention Prevention in the Elderly:

Family medicine specialists are specialist physicians who provide treatment and preventive health services together in line with the requirements

of their discipline. The concept of quaternary prevention was first used by Family Physician Marc Jamouille. The idea of not harming people while providing medical care services that are ethically and scientifically acceptable for the needs of the patient and that are of high quality, but achieved with the least number of interventions, formed the idea of quaternary prevention. In the ongoing processes, the idea presented at the European Family Medicine (WONCA) congress was accepted and finally published in the dictionary of WONCA in 2003. (Pandve, 2014, Jamuel 2014, Akdeniz M et al., 2017).

Quaternary prevention is also adopted by other specialties today. Examples starting with issues such as screening test without clinical evidence, vaccination without indication, unnecessary drug use are increasing day by day. (Akdeniz M et al., 2017)

According to available sources, multivitamin supplementation does not reduce the risk of cancer or cardiovascular disease. In a cohort study, it was determined that long-term multivitamin supplementation negatively affects mortality in elderly individuals. (Mursu et al.,2011) One of the examples to be given for quaternary prevention in elderly individuals is to control the status of polypharmacy. Maybe it will be a basic example to be presented in the name of quaternary prevention as a common view among disciplines with the coming time.

### **CONCLUSION:**

Preventive medicine practices in our country are followed periodically by Family Medicine Specialists under the leadership of the guide published by the Turkish Republic General Directorate of Public Health of the Ministry of Health. According to this guideline, individuals aged 65 and over at least once in their lives with the "Multidimensional Geriatric Evaluation" mini mental state assessment test, Yesavage Geriatric Depression Scale, mini nutritional test, "get up and walk" test, daily living activities test (Lawton Brody Instrumental Daily Living Activity Scale Tests) are recommended periodically. Apart from these periodic applications, the continuous application of preventive health medicine by making evaluations according to the acute dynamic changes detected in the other applications of our patients compared to their previous applications is perhaps the point that gives the most support to the increase in life expectancy after the advancing technology.

**REFERENCES:**

- Öztürk, A., Özenç, S., Canmemiş, S., & Bozoğlu, E. (2016). Preventive health care in old age. *Turkish Journal of Family Medicine and Primary Care*, 10(1).
- Akdeniz, M., & Kavukçu, E. (2017). Quaternary prevention: Do no harm first. *Turkish Journal of Family Practice*, 21(2).
- Soyuer, F., & Soyuer, A. (2008). Aging and physical activity. *Journal of Turgut Ozal Medical Center*, 15(3), 219-224.
- Naharcı Mİ., (2018). *Comprehensive geriatric evaluation*. Ankara. Turkey Clinics.
- Jamouille, M. (2014). The four duties of family doctors. Quaternary prevention: first, do no harm. *Hong Kong Practitioner*, 36.
- Artaud, F., Dugravot, A., Sabia, S., Singh-Manoux, A., Tzourio, C., & Elbaz, A. (2013). Unhealthy behaviours and disability in older adults: Three-City Dijon cohort study. *Bmj*, 347.
- Vellas, B., Villars, H., Abellan, G., Soto, M. E., Rolland, Y., Guigoz, Y., ... & Garry, P. (2006). Overview of the MNA®-Its history and challenges. *Journal of Nutrition Health and Aging*, 10(6), 456.
- Rubenstein, L. Z., Harker, J. O., Salvà, A., Guigoz, Y., & Vellas, B. (2001). Screening for undernutrition in geriatric practice: developing the short-form mini-nutritional assessment (MNA-SF). *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences*, 56(6), M366-M372.
- Erdinçler, D. S. History and Physical Examination in the Elderly. *Clinical development*, 4.
- Palmer, R., Johnston, C., Johnson, M. A., & Lyons, W. (2004). *Current geriatric diagnosis and treatment*. McGraw Hill Professional.
- King, A. C., & Guralnik, J. M. (2010). Maximizing the potential of an aging population. *JAMA*, 304(17), 1944-1945.
- Nelson, M. E., Rejeski, W. J., Blair, S. N., Duncan, P. W., Judge, J. O., King, A. C., ... & Castaneda-Sceppa, C. (2007). Physical activity and public health in older adults: recommendation from the American College of Sports Medicine and the American Heart Association. *Circulation*, 116(9), 1094.

- Bölükbaşı, S. (2020). Exercise Approach and Effects in Elderly Obese. *Turkish Journal of Diabetes and Obesity*, 4(1), 54-59.
- Centers for Disease Control and Prevention. (2017). Health effects of cigarette smoking. *Smoking & Tobacco Use*. Available at: [https://www.cdc.gov/tobacco/data\\_statistics/fact\\_sheets/health\\_effects/effects\\_cig\\_smoking/index.htm](https://www.cdc.gov/tobacco/data_statistics/fact_sheets/health_effects/effects_cig_smoking/index.htm). Accessed: 10/12/2022
- Statistics, T. T. H. (2019). Available at: <http://www.tuik.gov.tr/PreTablo.do>. Accessed: 11/12/2022
- Ridker, P. M., Cook, N. R., Lee, I. M., Gordon, D., Gaziano, J. M., Manson, J. E., ... & Buring, J. E. (2005). A randomized trial of low-dose aspirin in the primary prevention of cardiovascular disease in women. *New England Journal of Medicine*, 352(13), 1293-1304.
- Özkan, S., (2015). *Periodic Health Examinations and Screening Tests Recommended in Family Medicine Practice*. Ankara: Ministry Of Health. Available at: [https://hsgm.saglik.gov.tr/depo/birimler/Toplum\\_Sagligi\\_Hizmetleri\\_ve\\_Egitim\\_Db/Dokumanlar/rehberler/psm\\_2019.pdf](https://hsgm.saglik.gov.tr/depo/birimler/Toplum_Sagligi_Hizmetleri_ve_Egitim_Db/Dokumanlar/rehberler/psm_2019.pdf) Accessed: 16/12/2022
- Nelson, M. R., Liew, D., Bertram, M., & Vos, T. (2005). Epidemiological modelling of routine use of low dose aspirin for the primary prevention of coronary heart disease and stroke in those aged > or =70. *BMJ (Clinical research ed.)*, 330(7503), 1306. <https://doi.org/10.1136/bmj.38456.676806.8F>
- Weinstein, J. (2017). 2017 Update on Adult Vaccinations. *Primary Care Reports*, 23(4). Available at: <https://www.cdc.gov/vaccines/schedules/downloads/adult/adult-combined-schedule.pdf> Accessed: 08/12/2022
- Savaş, S., & Akçiçek, F. (2010). Comprehensive geriatric assessment. *Ege Journal of Medicine*, 49(3), 19-30.
- Karakuş MF. (2022). *End of Life Hopes in Family Medicine*. Ankara. Turkey Clinics.
- Turkish Association of Hypertension and Kidney Diseases (2012) Available at: <https://www.turkhipertansiyon.org/ppt/PatenT2.ppt> (Accessed: 12/12/2022)

- Kolcu, M., & Ergün, A. (2017). Hypeertension in elderly. *Marmara Health Services Journal*, 1(1), 17-23.
- Turkish Endocrine and Metabolism Society (TEMMD), H.T.,(2022). Treatment and Follow-up Guide. *Turkish Society of Endocrinology and Metabolism*. Available at: <https://file.temd.org.tr/Uploads/publications/guides/documents/Hipertansiyon-Kilavuzu-2022.pdf> Accessed: 15/12/2022
- Yıldırım, A. B., & Kılınç, A. Y. (2017). Dyslipidemia in elderly. *Turk Kardiyol Dern Ars*, 45(5), 25-28.
- Mach, F., Baigent, C., Catapano, A. L., Koskinas, K. C., Casula, M., Badimon, L., ... & Wiklund, O. (2020). 2019 ESC/EAS Guidelines for the management of dyslipidaemias: lipid modification to reduce cardiovascular risk: the Task Force for the management of dyslipidaemias of the European Society of Cardiology (ESC) and European Atherosclerosis Society (EAS). *European heart journal*, 41(1), 111-188.
- Turkish Endocrine and Metabolism Society (TEMMD), D. M., (2022). Treatment and Follow-up Guide. *Turkish Society of Endocrinology and Metabolism*. Available at: [https://file.temd.org.tr/Uploads/publications/guides/documents/diabetes-mellitus\\_2022.pdf](https://file.temd.org.tr/Uploads/publications/guides/documents/diabetes-mellitus_2022.pdf) Accessed: 14/12/2022
- World Health Organization (2022) Obesity Report, Accessed: 14/12/2022 <https://apps.who.int/iris/bitstream/handle/10665/353747/9789289057738-eng.pdf>
- İlhan, B., & Bakkaloğlu, O. K. (2019). Vulnerability and cancer screening rates in the elderly. *Journal of Istanbul Faculty of Medicine*, 82(1), 24-28.
- Turkish Statistical Institute (2022). <https://data.tuik.gov.tr/Bulten/Index?p=Olum-Nedeni-Istatistikleri-2018-30626> Accessed 10/12/2022
- General, T. S. B. H. S., & Presidency, M. K. D. (2022). Cancer Screenings. Access: <https://hsgm.health.gov.tr/tr/cancer-scans> Access Date, 11/12/2022.
- Oeffinger, K. C., Fontham, E. T., Etzioni, R., Herzig, A., Michaelson, J. S., Shih, Y. C., Walter, L. C., Church, T. R., Flowers, C. R., LaMonte, S.

- J., Wolf, A. M., DeSantis, C., Lortet-Tieulent, J., Andrews, K., Manassaram-Baptiste, D., Saslow, D., Smith, R. A., Brawley, O. W., Wender, R., & American Cancer Society (2015). Breast Cancer Screening for Women at Average Risk: 2015 Guideline Update From the American Cancer Society. *JAMA*, *314*(15), 1599–1614. <https://doi.org/10.1001/jama.2015.12783>
- Turkish endocrine and metabolism society (TEMMD), Osteoporosis., (2022). Treatment and Follow-up Guide. *Turkish Society of Endocrinology and Metabolism*. Available at [https://file.temd.org.tr/Uploads/publications/guides/documents/OSTEOPOROZ\\_MKH2022.pdf?a=1](https://file.temd.org.tr/Uploads/publications/guides/documents/OSTEOPOROZ_MKH2022.pdf?a=1) Accessed: 09/12/2022
- Tuzun, S., Eskiuyurt, N., Akarirmak, U., Saridogan, M., Senocak, M., Johansson, H., & Kanis, J. A. (2012). Incidence of hip fracture and prevalence of osteoporosis in Turkey: the FRACTURK study. *Osteoporosis international*, *23*(3), 949-955.
- Turhanoglu, A. D., Güler, H., & Özer, C. (2008). The Effect of Osteoporosis Treatment on Quality of Life in Elderly Women. *From the World of Osteoporosis*, *14*(1).
- Yanardağ, M. Z., & Şahin, D. S. (2019). A review on trait anxiety and trait depression in elderly individuals. *Community and Social Service*, *30*(1), 37-55.
- Ağar A. (2020). Psychological Changes in the Elderly. *Journal of Geriatric Sciences*, *3*(2), 75-80.
- Marzialli, E., McCleary, L., & Streiner, D. L. (2010). Evaluation of an assessment battery for estimating dementia caregiver needs for health and social care services. *American Journal of Alzheimer's Disease & Other Dementias®*, *25*(5), 446-454.
- Akyar, Ö. G. D. İ. (2011). Patient care and care models with dementia. *Journal of Hacettepe University Faculty of Nursing*, *18*(2), 79-88.
- Akyar, A. G. İ., & Akdemir, N. (2009). The difficulties experienced by caregivers of Alzheimer's patients. *Journal of Hacettepe University Faculty of Nursing*, *16*(3), 32-49.
- Uçkaç, K., & Bahar, L. Care of Elderly Patients with Dementia and Professional Competencies. *Journal of Education in Health Sciences*, *3*(1), 45-59.

- Sertel, M., Şimşek, T. T., & Yümin, E. T. (2016). Investigation of the relationship between cognitive status, depression level and balance in the elderly. *Journal of Exercise Therapy and Rehabilitation*, 3(3), 90-95.
- Yalçın, B. M. (2016). Öztürk O. Approach to major depressive disorder in primary care. *Turkish Journal of Family Medicine and Primary Care*, 10(4), 250-258.
- Erden-Aki, Ö. (2010). Differential diagnosis of dementia and depression in the elderly. *Turkish Journal of Geriatrics. Special Issue*, 3, 37-42.
- Pandve, H. T. (2014). Changing concept of disease prevention: From primordial to quaternary. *Archives of Medicine and Health Sciences*, 2(2), 254.
- Mursu, J., Robien, K., Harnack, L. J., Park, K., & Jacobs, D. R. (2011). Dietary supplements and mortality rate in older women: the Iowa Women's Health Study. *Archives of internal medicine*, 171(18), 1625-1633.

## **CHAPTER 6**

### **GERIATRY AND LUNG HEALTH**

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## **INTRODUCTION**

The ‘‘elderly medicine’’ known as geriatrics is mainly concerned with the medical aspect of old age. As the elderly population started to increase and the number of individuals living to advanced ages began to increase, it became necessary to divide the elderly group into some subgroups. Today, World Health Organization (WHO) has rearranged the age grouping in society. According to the new classification, the concept of "elderly" began to be used for older ages. By WHO between the ages of 0-17 are adolescent, between the ages of 18-65 are youth, between the ages of 66-79 are middle age, and between the ages of 80 and over are elderly.

### **1. Physiological and Anatomical Changes in the Lungs in the Elderly**

With the advancing age, some changes occur in the organism. These changes do not cause any problems to some extent and are considered ‘‘physiological changes’’, however, when these changes exceed a certain level, they become a health problem. For example, due to the decrease in lung elasticity over time, the respiratory capacity decreases to a certain extent, this is a physiological change and does not cause any problems or shortness of breath for a long time (Chan et al., 1998).

Due to smoking and various factors encountered in the workplace environment, the decrease in elasticity is faster and the respiratory capacity decreases more rapidly. Perhaps one of the most important changes in the lungs with age is the enlargement of the alveoli with the aging of the lungs, but this enlargement results in a decrease in the respiratory surface area.

The most obvious change in respiratory anatomy in advanced ages is the decrease in elastic fibers and increase in collagen fibers. As a result, there is an enlargement in the alveoli, and depending on this enlargement, degeneration occurs in the alveolar wall and destruction occurs in the supporting tissues adjacent to the alveoli. Overall lung volume increases with enlargement of the alveolar ducts and alveoli. This causes the physiological (senile) emphysema of old age.

The decrease in respiratory surface area is due to the decrease in the number of alveolar folds due to enlargement. Elastic recoil decreases with a decrease in elastic fibers and a decrease in supporting tissues. With aging,

small airways narrow in the lungs, collagen fibers increase, elastic fibers decrease. Therefore, alveolar patency cannot be achieved in expiration and the small airways are narrowed (Reiser et al., 1987).

Another change that affects physiology in the elderly is abdominal breathing. Although abdominal respiration occurs in respiratory system pathologies in adults, it occurs physiologically in the elderly. The reasons for this abdominal breathing; it is a decrease in chest wall compliance as a result of kyphoscoliosis, calcification of intercostal muscles, and intervertebral joint osteoarthritis. To tolerate this decrease, the abdominal muscles also come into play to maintain ventilation.

## **2. Changes in Respiratory Function in the Elderly**

Lung functions remain stable between the ages of 20-35, after which they begin to decline; there is a faster decline, especially after the age of 70. Since their physical activities are limited, they cannot perceive whether they have respiratory problems. Therefore, it is often not possible to distinguish symptomatic cases in the elderly. In addition, net values for the diagnosis of obstruction or restriction were not determined in the spirometric examination in the geriatric age group. This causes delays in diagnosis or unnecessary diagnoses (Ware et al., 1990). Numerous physiological changes occur in respiratory mechanics with increasing age. The decrease in elasticity and total compliance causes an increase in respiratory workload, and insufficient respiratory muscle function to meet this causes a decrease in exercise capacity.

Exercises to strengthen both respiratory and extremity muscles are extremely important in people with insufficient respiratory muscle strength (Tolep et al., 1993).

Appropriate nutritional support must be provided to maintain or increase muscle mass. In addition, the risk of pulmonary infection is high due to decreased cough reflex, impaired mucociliary clearance and decreased defense mechanism.

Especially in people with cognitive impairment, care should be taken in terms of aspiration. Therefore, nutrition in the elderly has a special importance.

### **3. Nutrition and Lung in the Elderly**

Many lung diseases such as Chronic Obstructive Pulmonary Disease (COPD), lung cancer, interstitial lung disease are seen in advanced age, and at the same time, the presence of malnutrition negatively affects the treatment and prognosis of this patient group. Malnutrition and cachexia are seen in 26-47% of patients with COPD (Erdoğan et al., 2010). Malnutrition also affects lung morphology. In experimental animal studies, it was found that alveolar spaces were enlarged, elastic fibers and surfactant production decreased, and emphysema-like morphological changes were observed in rat lung specimens examined after ten days of fasting (Sahebji, 2003). Programs that can be implemented to improve quality of life and lung health in the elderly. According to the definition of the WHO, quality of life is; it is how individuals perceive their situations in life in line with their goals, expectations, interests and standards within the culture and value system in which they live (Kaya et al., 2008). Chronic diseases are one of the most important factors affecting the quality of life in the elderly. Lung health also takes its place in determining the quality of life, especially chronic lung diseases. It should be ensured that the emergence of chronic diseases, including respiratory system diseases, which adversely affect the quality of life, is prevented, early recognition, appropriate treatment, monitoring at appropriate intervals and protective measures are applied at every stage (Cho et al., 2020).

### **4. Old Age and Smoking**

Smoking is an important cause of morbidity and mortality. Smoking increases mortality in old age, and mortality in the elderly who continue to smoke is about twice that of non-smokers (Smith et al., 1999). Many elderly people think that it is too late to quit smoking and there will be no gain, but studies in the elderly population show that this idea is not valid. It is seen that men who quit smoking after the age of 65 have a life expectancy of 1.4-2 years more than those who continue to smoke, and a gain of 2.7-3.7 years in women. Thus, it is important to quit smoking even in old age (Taylor et al., 2002).

## 5. Asthma in the Elderly

Although asthma is mostly known as a childhood and youth disease, new-onset asthma can also be seen in old age (Çelik et al., 2020). By 2050, the population aged >65 is projected to nearly triple to reach 1.5 billion, or 16% of the entire world population. The prevalence of asthma over 65 years of age has been reported as 1.8%-10.9% in different studies (Battaglia et al., 2016). In addition, the risk of morbidity and mortality is higher in older asthmatics than in young people. Early diagnosis of asthma, treatments to be arranged according to age and monitoring of whether the patient uses their medications regularly and with the right technique are important. In old age, alveolar enlargement and ductal ectasia develop without emphysematous destruction or fibrosis, this is called senile lung (Verbeken et al., 1992). Elderly asthmatic patients have different asthma phenotypes and these have not been adequately characterized. According to the age of onset of asthma and the duration of the disease, it may start in childhood and continue until advanced ages, it may start in childhood and disappear in adulthood and reappear at an advanced age, it may start in adolescence and continue until advanced ages, it may start in adulthood and continue to advanced ages, it may occur in geriatric ages, but the actual age of onset is doubtful, for the first time asthma can be seen after 65 (Nanda et al., 2020).

**Table 1-** Characteristics of Asthma Phenotypes in Advanced Age

	<b>Late-onset asthma</b>	<b>Long-term asthma</b>
<b>Age of onset</b>	Typically adult patient	Under 12 years old
<b>FEV1</b>	High	Low
<b>Seriousness</b>	Variable	Variable
<b>Th-2 mediated inflammation</b>	Variable	Yes
<b>Atopy</b>	No	Yes
<b>Family history</b>	No	Yes
<b>Obesity</b>	Yes	No
<b>Smoking status</b>	Yes	No

(Dunn et al., 2018)

Asthma diagnostic principles are as in the under 60 age group. The classic symptoms of asthma are wheezing, especially nocturnal cough,

episodic respiratory distress, and recurrent chest tightness. In some older asthmatics, it may present as just fatigue without typical asthma symptoms. Allergic diseases, which are generally known as childhood and youth diseases, may show their first symptoms in old age. Atopy, elevated IgE, and a history of allergic rhinitis are common, especially in elderly patients with long-standing asthma (Bom et al., 2009). While interpreting the pulmonary function test in the diagnosis of asthma, age-related changes should also be considered. Obstructive and mixed patterns emerge with an increase in residual volume (RV) and a decrease in FEV<sub>1</sub>, FVC, FEV<sub>1</sub> /FVC ratios with age. The linear decrease in FEV<sub>1</sub>, which usually starts at the age of 25-30, accelerates with increasing age, especially in asthmatic cases (Nanda et al., 2020). Spirometric values may be low even in healthy, asymptomatic non-smokers. Therefore, it is very important to use age-corrected values or the FEV<sub>1</sub>/FEV<sub>6</sub> ratio when interpreting spirometry in elderly patients. Diffusion test can be used in the differential diagnosis of asthma and COPD. Considering the changes in the basic immune response in advanced age, it should be kept in mind that weak responses can be obtained in allergy tests.

In addition to comorbid diseases and similar common symptoms in advanced age, many drugs used may also cause symptoms of asthma and similar clinical pictures. At this age, the symptoms of cardiovascular and respiratory diseases are often similar to asthma symptoms (Tinkelman et al., 2006). The most likely situations are; cardiovascular diseases such as heart failure, coronary artery disease and hypertension, emphysema, chronic bronchitis, COPD, gastroesophageal reflux disease, anemia and tumors. In addition, anti-hypertensives, nonsteroidal anti-inflammatory drugs and beta-blockers used by patients should be reviewed as they may worsen asthma symptoms (Sin et al., 2006).

Age alone is not a determining factor in the choice of treatment in advanced age asthma, but the presence of comorbidities is important in determining the treatment. Asthma treatment should be combined with the treatment of comorbidities. In the treatment of advanced age asthma, the risks of drugs should be determined well and the patients should be followed closely in terms of side effects (Çelik et al., 2020).

**Table 2.**Drugs risks and side effects of drugs in the treatment of advanced age asthma

Drugs	Risks and side effects
<b>Inhaled corticosteroids</b>	<ul style="list-style-type: none"> <li>-As age increases, response to treatment decreases, higher dose ICS may be required.</li> <li>-Dental prosthesis may increase risk of oral candidiasis cataracts, glaucoma, diabetes, bone fractures are more common</li> <li>-Very fine particle ICS may be appropriate as small airways are affected</li> </ul>
<b>Beta<sub>2</sub> agonists</b>	<ul style="list-style-type: none"> <li>-Potassium level should be monitored in patients using diuretics because of the risk of beta<sub>2</sub>-mediated hypokalemia.</li> <li>-Those with unstable cardiovascular disease may be more sensitive to the side effects of beta<sub>2</sub> agonists.</li> </ul>
<b>Leukotriene receptor antagonist</b>	Less effective in the elderly
<b>Long-acting muscarinic antagonists</b>	Caution should be exercised in narrow-angle glaucoma, prostatic hyperplasia and bladder neck obstruction.
<b>Biological agents</b>	No adequate studies in advanced age asthma

(Çelik et al., 2020)

## 6. COPD in the Elderly

Chronic Obstructive Pulmonary Disease (COPD) is a heterogeneous lung condition characterized by chronic respiratory symptoms (dyspnea, cough, sputum production) due to abnormalities of the airways (bronchitis, bronchiolitis) and/or alveoli (emphysema) that cause persistent, often progressive, airflow obstruction (Global Initiative for Chronic Obstructive

Lung Disease- GOLD, 2022). COPD is a particularly age-related disease because aging can be considered as an indicator of the cumulative effect of inhaled particles and gases. (Sorino et al., 2012). In elderly patients, existing complaints can be attributed to old age and the diagnosis of COPD may be delayed for this reason. Many structural and physiological changes that occur in the lung during the aging process show similarities with COPD, therefore, determining whether the existing pathology is age-related or the result of COPD and making its differential diagnosis constitute one of the most important problems today. The changes that aging creates on the respiratory system and the features of COPD are almost the same (Corsonello et al., 2015). With aging, pulmonary functions deteriorate due to changes such as decreased chest wall compliance, costal and chondrosternal calcifications, collapse of the vertebrae due to osteoporosis, increased dorsal kyphoscoliosis and anteroposterior distance, physiological aging in respiratory muscles, and approximately 25% decrease in diaphragmatic strength. Airway secretions become difficult to clear. Corresponding changes are also observed in COPD. Comorbidities are common in COPD, as in asthma (Gooneratne et al., 2010).

Spirometry is a very important test for the diagnosis of COPD. However, due to cooperation problems, orthopedic and neurological problems in old age, pulmonary function tests often do not give accurate results. It is not correct to diagnose COPD in the elderly by spirometry alone. Measurement of lung volumes, such as the ratio of inspiratory capacity (IC) to total lung capacity (TLC), has been found to be more useful than FEV1 in determining expected survival (Casanova et al., 2005). As a result, tests alone are not sufficient for the diagnosis of COPD. The importance of anamnesis and physical examination is indisputable. COPD is a disease with high mortality. According to the data of the WHO, it is in the 3rd place in the list of the deadliest diseases (World Health Organization, 2020). Comorbidities are one of the major prognostic factors in elderly patients with COPD. Especially the association of chronic renal failure and coronary artery disease is closely related with poor prognosis. Since there are no definitive treatment recommendations specific to old age in the treatment of COPD, treatment should be arranged according to the Global Initiative for Chronic Obstructive Lung Disease (GOLD) guideline. Pharmacological treatment mainly includes Long acting beta agonists (LABA), anticholinergics (LAMA) and



corticosteroids. However, the response to drugs used in the treatment of COPD in elderly patients may not always be the same as in the adult patient population. Side effects related to inhaled drugs may be seen more frequently in the elderly. Short-acting beta agonists (SABA) and short-acting antimuscarinic drugs (SAMA) may be preferred in home care patients and in elderly patients who cannot use inhalers due to loss of cognitive function (Zarowitz et al., 2012). Home long-term oxygen therapy (LTOT) may be prescribed in hypoxemic or hypercapnic respiratory failure. It provides a decrease in mortality, improvement in sleep quality, increase in exercise tolerance, improvement in polycythemia and pulmonary hypertension symptoms in elderly patients, improvement in cognitive functions, improvement in neurophysiological parameters such as memory, intelligence, motor skills. Pulmonary rehabilitation and psychotherapy also provide improvement in COPD and anxiety symptoms in the elderly. Malnutrition, weight loss and cachexia are another important health problems in elderly patients with COPD. Nutritional support should definitely be evaluated in the treatment program in these patients (Battaglia et al., 2011).

Finally, COPD is a disease with an increasing prevalence all over the world, with high morbidity and mortality. With the increase in the elderly population, the importance of palliative care in end-stage COPD patients is gradually increasing. This requires the cooperation of pulmonologists, geriatricians and palliative care specialists.

## **7. Pulmonary Embolism in the Elderly**

Pulmonary thromboembolism (PE) is an acute, life-threatening clinical picture that can occur in all veins, especially in the deep veins of the legs, and occurs when fragments of thrombi occlude the pulmonary arteries and/or their branches (Kearon 2003). The annual mean incidence of pulmonary embolism is about 75-269/100,000. The incidence of PE increases with age. While it is 3.5/1000 for individuals aged 60-74, this rate is three times higher for those aged 75 and over (Righini et al., 2005). More inactivity (immobility) in advanced age may be due to the presence of other diseases that increase susceptibility to thrombosis, and the combination of factors such as increased coagulation potential (Cushman, 2007). The most important problem in the diagnosis of PE in the elderly; clinical presentation similar to other cardio-

pulmonary diseases common in this age group and that this picture is atypical and/or nonspecific. Compared to younger patients, presentation with syncope is more common in the elderly. In a study involving elderly cases; it was found that the elderly often present with syncope rather than classical symptoms such as chest pain (syncope 33%, chest pain 7%) (Tisserand et al., 2014). The D-dimer test, which is used for exclusion rather than diagnosis, has low reliability in the elderly. The specificity of D-dimer is 49-67% in young (<50 years) patients, while it drops to 0-18% in elderly ( $\geq 80$  years) patients (Righini et al., 2000). The use of age-adapted thresholds may improve the performance of the D-dimer test, especially in the elderly. Therefore, it is recommended to use the age-adjusted threshold for age >50 years, using the “age x 10” formula (Konstantinides et al., 2020).

If warfarin is to be used when starting treatment in elderly patients, it is recommended to start 5 mg/day. Percutaneous catheter or surgical embolectomy can be applied as an alternative due to the risk of bleeding in the elderly with thrombolytic indication. In anticoagulant therapy, direct-acting oral anticoagulants may be preferred in the elderly ( $\geq 75$  years) since the risk of VTE and bleeding is low (Arseven et al., 2021).

## **8. Pulmonary Effects of Neurological Disorders in the Elderly**

With aging, there is a significant increase in the incidence of certain neurological diseases. Neurodegenerative diseases and stroke are among these diseases. Respiratory failure in neurological diseases may be due to a complication or may develop as a result of the actual pathology. Although the clinical course of these diseases is different, respiratory failure is the leading cause of morbidity and mortality (Aboussouan, 2005).

Especially neuromuscular diseases constitute the most important part of neurological diseases that cause alveolar hypoventilation. In such diseases, there is a limitation in ventilation due to the weakening of the respiratory muscles. The resulting rapid and superficial breathing impairs respiratory function by increasing the ratio of dead space to tidal volume. Weakness of the diaphragm and intercostal muscles interferes with ventilation, cough and secretion clearance, and atelectasis may develop. Despite the compensatory effort of the accessory respiratory muscles, hypercapnia may develop as a result of the progression of respiratory failure. Weakness in respiratory

muscles; can lead to acute (eg; Guillain-Barré syndrome), chronic (eg; multiple sclerosis) or progressive (eg; amyotrophic lateral sclerosis) respiratory failure. Early signs of respiratory failure in neurological patients are new sleep disorder, disappearance of snoring, morning headaches and waking up without resting and the development of shortness of breath (orthopnea) in the lying position. Orthopnea is the most common finding in neurological diseases. (Logemann, 1998). On the contrary, in tetraplegic patients with spinal cord lesion, platypnea and orthodeoxy occur when standing upright (Borel et al., 1995). Clinical suspicion and special tests are needed to detect signs of respiratory failure in neurological diseases. Pulmonary function tests (PFT) are as follows in neurological diseases; decreased vital capacity (VC), MIP and MEP, and restrictive changes are observed. Functional residual capacity (FRC) and total lung capacity (TLC) are preserved until advanced stages (Braun, 1987).

In neurological patients, inspiratory and expiratory muscle functions need to be supported for adequate respiration. For this purpose, mechanical ventilation support can be applied to suitable patients in addition to medical treatment. Indications and contraindications should be carefully questioned.

It is recommended to use devices that support Continuous Positive Airway Pressure (CPAP) via nasal mask and/or face mask in patients with hypoventilation Bilevel Positive Airway Pressure (BIPAP) or patients with only upper airway obstruction due to bulbar muscle weakness (Kleopa, 1999).

## **9. Swallowing Disorder and Aspiration Pneumonia in the Elderly**

Old age, frailty, neurological diseases, changes in consciousness are the main risk factors for aspiration. A history of coughing while eating or drinking supports the risk of aspiration. In aspiration pneumonia, pharmacological measures such as influenza and pneumococcal vaccines will regulate the patient's immune response, while non-pharmacological approaches that will strengthen the swallowing and cough reflex will reduce the risk of recurrence of aspiration. Oral hygiene was found to be the most effective method at Evidence A level in preventing the risk of aspiration. It is recommended to feed the patient in an upright or semi-lateral position to reduce and prevent the risk of aspiration. In the elderly population, symptoms

of pneumonia may not be as pronounced as in the younger population. This may cause delays in diagnosis. When pneumonia is detected in the elderly, the risk of aspiration and the environment in which the patient lives (home/nursing home/hospital) should be questioned and antibiotic treatment should be arranged according to these situations (Marik et al., 2003).

### **10. Prevention of Lung Infections in the Elderly**

With aging, the immune system weakens. Concomitant Diabetes mellitus, dementia, chronic lung and heart diseases facilitate disease formation. It is important for the elderly to be vaccinated to protect them from infections.

Vaccines do not prevent the disease, but make the disease milder. There is no vaccination program for the elderly, it is optional. It is important for the person to have knowledge about vaccination and its benefits, and the attitudes and behaviors of the physician in this regard in promoting vaccination.

Three vaccines especially recommended for the elderly are pneumococcal, influenza and herpes zoster vaccines. Influenza vaccination is recommended for individuals aged 65 and over once a year, starting from the beginning of October (Köksal et al., 2019).

Individuals who have not been vaccinated against pneumococcal previously (unless there are concomitant conditions that weaken the immune system) should be given Pneumococcal Cojugated vaccine (PCV 13) first and 23-Valent Pneumococcal Polysaccharide Vaccine (PPSV 23) 1 year later. Individuals who have previously been vaccinated against pneumococcus (unless there are concomitant conditions that weaken the immune system) should be given PPSV 23 at least 1 year later if the first vaccine is PCV 13, if the first vaccine is PPSV 23, PCV 13 should be applied at least 1 year later. If the individual has had both vaccines (PCV 13 and PPSV 23) before the age of 65, it is recommended to administer 1 dose of PPSV 23, provided that at least 5 years have passed from the last PPSV 23 dose. Herpes zoster vaccine, a new vaccine, is recommended as a single dose to immunocompetent adults over 60 years of age to protect against herpes zoster and post-herpetic neuralgia, regardless of their history of herpes. Contraindicated in those with severe immunodeficiency (Köksal et al., 2019).

## REFERENCES

- Chan, E. D., & Welsh, C. H. (1998). Geriatric respiratory medicine. *Chest*, 114(6), 1704–1733. <https://doi.org/10.1378/chest.114.6.1704>
- Reiser, K. M., Hennessy, S. M., & Last, J. A. (1987). Analysis of age-associated changes in collagen crosslinking in the skin and lung in monkeys and rats. *Biochimica et biophysica acta*, 926(3), 339–348. [https://doi.org/10.1016/0304-4165\(87\)90220-0](https://doi.org/10.1016/0304-4165(87)90220-0)
- Ware, J. H., Dockery, D. W., Louis, T. A., Xu, X. P., Ferris, B. G., Jr, & Speizer, F. E. (1990). Longitudinal and cross-sectional estimates of pulmonary function decline in never-smoking adults. *American journal of epidemiology*, 132(4), 685–700. <https://doi.org/10.1093/oxfordjournals.aje.a115710>
- Tolep, K., & Kelsen, S. G. (1993). Effect of aging on respiratory skeletal muscles. *Clinics in chest medicine*, 14(3), 363–378.
- Erdinc, E., Polatli, M., Kocabas, A., Yıldırım, N., Gurgun, A., & Saryal, S. (2010). Turkish Thoracic Society Chronic Obstructive Pulmonary Disease Diagnosis and Treatment Consensus Guidelines. *Türk Toraks Dergisi 2010; 11: 1, 64*.
- Sahebjami, H. (2003). Effects of nutritional depletion on lung parenchyma. *EUROPEAN RESPIRATORY MONOGRAPH*, 8, 113-122.
- Kaya, M., Aslan, D., VAİZOĞLU, S. A., Doruk, C., Dokur, U., Biçici, V. & Ertekin, Ö. (2008). Ankara Keçiören ilçesine bağlı bir mahallede yaşayan 65 yaş ve üzeri bireylerin yaşam kalitesi özellikleri ve etkileyen faktörler. *Türk Geriatri Dergisi*, 11(1), 12-17.
- Cho, S. J., & Stout-Delgado, H. W. (2020). Aging and Lung Disease. *Annual review of physiology*, 82, 433–459. <https://doi.org/10.1146/annurev-physiol-021119-034610>
- Smith, S. S., & Fiore, M. C. (1999). The epidemiology of tobacco use, dependence, and cessation in the United States. *Primary care*, 26(3), 433–461. [https://doi.org/10.1016/s0095-4543\(05\)70112-3](https://doi.org/10.1016/s0095-4543(05)70112-3)
- Taylor, D. H., Jr, Hasselblad, V., Henley, S. J., Thun, M. J., & Sloan, F. A. (2002). Benefits of smoking cessation for longevity. *American journal of public health*, 92(6), 990–996. <https://doi.org/10.2105/ajph.92.6.990>

- Çelik G. et al., (2020). *Astım tanı ve tedavi rehberi 2020 güncellemesi*. Türk toraks derneği. <https://www.toraks.org.tr/site/community/library/OYHYXiC8BxpNVuUb>
- Battaglia, S., Benfante, A., Spatafora, M., & Scichilone, N. (2016). Asthma in the elderly: a different disease?. *Breathe (Sheffield, England)*, 12(1), 18–28. <https://doi.org/10.1183/20734735.002816>
- Verbeken, E. K., Cauberghe, M., Mertens, I., Clement, J., Lauweryns, J. M., & Van de Woestijne, K. P. (1992). The senile lung. Comparison with normal and emphysematous lungs. 2. Functional aspects. *Chest*, 101(3), 800–809. <https://doi.org/10.1378/chest.101.3.800>
- Nanda, A., Baptist, A. P., Divekar, R., Parikh, N., Seggev, J. S., Yusin, J. S., & Nyenhuis, S. M. (2020). Asthma in the older adult. *The Journal of asthma : official journal of the Association for the Care of Asthma*, 57(3), 241–252. <https://doi.org/10.1080/02770903.2019.1565828>
- Dunn, R. M., Busse, P. J., & Wechsler, M. E. (2018). Asthma in the elderly and late-onset adult asthma. *Allergy*, 73(2), 284–294. <https://doi.org/10.1111/all.13258>
- Bom, A. T., & Pinto, A. M. (2009). Allergic respiratory diseases in the elderly. *Respiratory medicine*, 103(11), 1614–1622. <https://doi.org/10.1016/j.rmed.2009.06.003>
- Tinkelman, D. G., Price, D. B., Nordyke, R. J., & Halbert, R. J. (2006). Misdiagnosis of COPD and asthma in primary care patients 40 years of age and over. *The Journal of asthma : official journal of the Association for the Care of Asthma*, 43(1), 75–80. <https://doi.org/10.1080/02770900500448738>
- Sin, B. A., Akkoca, O., Saryal, S., Oner, F., & Misirligil, Z. (2006). Differences between asthma and COPD in the elderly. *Journal of investigational allergology & clinical immunology*, 16(1), 44–50.
- Global Initiative for Chronic Obstructive Lung Disease- GOLD, 2022, *Global strategy for prevention, diagnosis and management of copd: 2023 report*. <https://goldcopd.org/2023-gold-report-2/>
- Venkatesan, P. (2022). GOLD COPD report: 2023 update. *The Lancet Respiratory Medicine*.

- Sorino, C., Battaglia, S., Scichilone, N., Pedone, C., Antonelli-Incalzi, R., Sherrill, D., & Bellia, V. (2012). Diagnosis of airway obstruction in the elderly: contribution of the SARA study. *International journal of chronic obstructive pulmonary disease*, 7, 389–395. <https://doi.org/10.2147/COPD.S31630>
- Corsonello, A., Scarlata, S., Pedone, C., Bustacchini, S., Fusco, S., Zito, A., & Incalzi, R. A. (2015). Treating COPD in Older and Oldest Old Patients. *Current pharmaceutical design*, 21(13), 1672–1689. <https://doi.org/10.2174/1381612821666150130121229>
- Gooneratne, N. S., Patel, N. P., & Corcoran, A. (2010). Chronic obstructive pulmonary disease diagnosis and management in older adults. *Journal of the American Geriatrics Society*, 58(6), 1153–1162. <https://doi.org/10.1111/j.1532-5415.2010.02875.x>
- Casanova, C., Cote, C., de Torres, J. P., Aguirre-Jaime, A., Marin, J. M., Pinto-Plata, V., & Celli, B. R. (2005). Inspiratory-to-total lung capacity ratio predicts mortality in patients with chronic obstructive pulmonary disease. *American journal of respiratory and critical care medicine*, 171(6), 591–597. <https://doi.org/10.1164/rccm.200407-867OC>
- World Health Organization (2020, December 9). *The top 10 causes of death*. <https://www.who.int/news-room/fact-sheets/detail/the-top-10-causes-of-death>
- Zarowitz, B. J., & O'Shea, T. (2012). Chronic obstructive pulmonary disease: prevalence, characteristics, and pharmacologic treatment in nursing home residents with cognitive impairment. *Journal of managed care pharmacy: JMCP*, 18(8), 598–606. <https://doi.org/10.18553/jmcp.2012.18.8.598>
- Battaglia, S., Spatafora, M., Paglino, G., Pedone, C., Corsonello, A., Scichilone, N., Antonelli-Incalzi, R., & Bellia, V. (2011). Ageing and COPD affect different domains of nutritional status: the ECCE study. *The European respiratory journal*, 37(6), 1340–1345. <https://doi.org/10.1183/09031936.00032310>
- Kearon C. (2003). Natural history of venous thromboembolism. *Circulation*, 107(23 Suppl 1), I22–I30. <https://doi.org/10.1161/01.CIR.0000078464.82671.78>

- Righini, M., Le Gal, G., Perrier, A., & Bounameaux, H. (2005). The challenge of diagnosing pulmonary embolism in elderly patients: influence of age on commonly used diagnostic tests and strategies. *Journal of the American Geriatrics Society*, 53(6), 1039–1045. <https://doi.org/10.1111/j.1532-5415.2005.53309.x>
- Cushman M. (2007). Epidemiology and risk factors for venous thrombosis. *Seminars in hematology*, 44(2), 62–69. <https://doi.org/10.1053/j.seminhematol.2007.02.004>
- Tisserand, G., Gil, H., Méaux-Ruault, N., & Magy-Bertrand, N. (2014). Particularités cliniques de l'embolie pulmonaire chez la personne âgée : étude comparative de 64 patients [Clinical features of pulmonary embolism in elderly: a comparative study of 64 patients]. *La Revue de médecine interne*, 35(6), 353–356. <https://doi.org/10.1016/j.revmed.2013.07.004>
- Righini, M., Goehring, C., Bounameaux, H., & Perrier, A. (2000). Effects of age on the performance of common diagnostic tests for pulmonary embolism. *The American journal of medicine*, 109(5), 357–361. [https://doi.org/10.1016/s0002-9343\(00\)00493-9](https://doi.org/10.1016/s0002-9343(00)00493-9)
- Konstantinides, S. V., Meyer, G., Becattini, C., Bueno, H., Geersing, G. J., Harjola, V. P., Huisman, M. V., Humbert, M., Jennings, C. S., Jiménez, D., Kucher, N., Lang, I. M., Lankeit, M., Lorusso, R., Mazzolai, L., Meneveau, N., Ní Áinle, F., Prandoni, P., Pruszczyk, P., Righini, M., ... ESC Scientific Document Group (2020). 2019 ESC Guidelines for the diagnosis and management of acute pulmonary embolism developed in collaboration with the European Respiratory Society (ERS). *European heart journal*, 41(4), 543–603. <https://doi.org/10.1093/eurheartj/ehz405>
- Arseven O. et al., (2021). Türk toraks derneği pulmoner tromboembolizm tani ve tedavi uzlaşi raporu. Türk toraks derneği. <https://www.toraks.org.tr/site/sf/books/2021/06/c0eefce4d5d10929930f7f1abd7b2e48055dac42e01827898a08ec0ee4e961e7.pdf>
- Aboussouan L. S. (2005). Respiratory disorders in neurologic diseases. *Cleveland Clinic journal of medicine*, 72(6), 511–520. <https://doi.org/10.3949/ccjm.72.6.511>



- Logemann, J. A. (1998). The evaluation and treatment of swallowing disorders. *Current Opinion in Otolaryngology & Head and Neck Surgery*, 6(6), 395-400.
- Borel, C. O., & Guy, J. (1995). Ventilatory management in critical neurologic illness. *Neurologic clinics*, 13(3), 627-644.
- Braun S. R. (1987). Respiratory system in amyotrophic lateral sclerosis. *Neurologic clinics*, 5(1), 9-31.
- Kleopa, K. A., Sherman, M., Neal, B., Romano, G. J., & Heiman-Patterson, T. (1999). Bipap improves survival and rate of pulmonary function decline in patients with ALS. *Journal of the neurological sciences*, 164(1), 82-88. [https://doi.org/10.1016/s0022-510x\(99\)00045-3](https://doi.org/10.1016/s0022-510x(99)00045-3)
- Marik, P. E., & Kaplan, D. (2003). Aspiration pneumonia and dysphagia in the elderly. *Chest*, 124(1), 328-336. <https://doi.org/10.1378/chest.124.1.328>
- Köksal İ. et al., (2019). *Erişkin bağışıklama rehberi*. EKMUD. [file:///C:/Users/selen/Downloads/eriskin-bagisiklama-rehberi-v-2-2019%20\(1\).pdf](file:///C:/Users/selen/Downloads/eriskin-bagisiklama-rehberi-v-2-2019%20(1).pdf)

**CHAPTER 7**  
**DELIRIUM IN GERIATRIC PATIENT GROUP**  
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## INTRODUCTION

It is one of the most frequently missed geriatric emergency diagnoses characterized by acute onset, cognitive function changes and thought to be related to old age. The most important parameter in the diagnosis is to come to mind. If the diagnosis is missed, it is a geriatric emergency with high mortality and morbidity. Improvements in preventive medicine, diagnosis and treatment with developing technology have led to an increase in average life expectancy. According to World Health Organization projections, 1 out of every 5 people is expected to be 60 years of age or older in 2050 (WHO, 2015). Therefore, emergency department visits of geriatric patients are increasing day by day. In a study, the rate of emergency department visits of geriatric patients was found to be 21.8% per year (Lesley P et al, 2014). Delirium, which has an incidence rate of 25% in patients aged 70 and over, is unfortunately undiagnosed in 30-60% of patients (Tintinalli JE et al, 2013). As a result of studies, it has been revealed that approximately 10-25% of hospitalized patients actually present in the delirium clinic at the time of first presentation to the emergency department. In patients with delayed diagnosis, there is an increase in secondary infection, length of hospitalization and cost. Mortality is 25-33% on average in the first month (Turkcan A, 2001).

The onset of delirium occurs within days and cognitive functions fluctuate. Intracranial diseases, drugs, secondary to systemic diseases and toxins may be implicated in the pathophysiology. Since the disease may show a fluctuating course, the examination performed at the time of initial presentation may differ from the follow-up examination. Clinical deterioration is more prominent especially in the early morning and late at night. The first step should be to obtain a detailed anamnesis from the patient's relatives. Factors that may cause delirium include drugs such as antiparkinsonian drugs, diuretics, neuroleptics, infections, alcohol, cerebrovascular diseases, acute and chronic cardiovascular diseases, head trauma and surgical interventions. Apart from these, no cause can be found in approximately 5-20% of patients (Kaya et al, 2013). The risk is higher in men, those with dementia, those with multiple chronic diseases, alcohol users and elderly people with hip fractures (Holt et al, 2013).

Delirium is divided into 3 types: hyperactive, hypoactive and mixed type.

In hyperactive type delirium, patients are brought to the emergency room agitated. Hallucinations may accompany. Aggression and restlessness

are present. Hyperactive delirium is the easiest type to diagnose. In hypoactive delirium, patients come with a picture that can be missed more often. In one study hypoactive delirium covers approximately 90% of cases (Han et al, 2009).. Patients may present with symptoms such as slowed speech, reluctance, drowsiness and even lethargy. Although it is the most common type of delirium, it is the most frequently missed type. It is also the type of delirium with the highest mortality rate. In mixed type delirium, features of both types may be seen at varying time intervals.

The most important condition in diagnosis is to take a detailed anamnesis from the patient and relatives. In addition to his/her condition at the time of presentation to the emergency department, his/her condition in the morning and night hours and fluctuations during the day should be asked in detail. On physical examination, all systems should be evaluated for the underlying pathology that may cause delirium. Although the Mini Mental State Examination Test (MMSE) is recommended to evaluate the cognitive status of the patient, it is very difficult to perform this test under emergency room conditions. For this reason, the Confusion Assessment Scale (CAM), which allows short and rapid assessment, is used in the emergency department. With this method, which evaluates patients according to 4 parameters, patients can be differentiated quickly and simply:

- Acute onset and a fluctuating course
- Attention deficit
- Disorganized thought form
- Altered state of consciousness

The Confusion Assessment Method – CAM

1. According to whether there is an acute change in mental state or fluctuations during the day
2. According to difficulty in attention and focus
3. According to whether there is inconsistency in thinking

4. The level of consciousness is evaluated according to normal/alert/lethargic/stupo/coma states.

\*Criteria 1 and 2 are mandatory for diagnosis. It must be accompanied by one of the criteria 3 or 4.

The priority in treatment is to treat the condition that causes delirium. Attempts are made to prevent the patient from harming himself and his environment and the symptoms of delirium are treated. Although it is an acute onset geriatric emergency, treatment may take weeks or months.

A patient diagnosed with delirium must be in a quiet, well-lit room. For these patients, relatives should be taken with the patient, never left alone. Their needs such as hearing aids and glasses should be met, if they use them. Since sedation or physical restraint may increase the risk of injury in these patients, it can only be considered in patients with severe hyperactive delirium.

First choice in treatment Haloperidol can be started as a low dose. It can be administered 0.25-0.5 mg orally every 2 or 4 hours or intramuscular every 30-60 minutes. The maximum dose should not exceed 25 mg per day. Benzodiazepines such as lorazepam are given as 0.5-2 mg dose together with haloperidol. Atypical antipsychotics such as olanzapine, risperidone and quetiapine may also be tried in treatment. Risperidone 0.5 mg 2\*1, olanzapine 2.5-5 mg/day, quetiapine 25 mg 2\*1 can be started.

### **CONCLUSION**

Delirium is a geriatric emergency that can be easily missed in the majority of geriatric patients, is difficult to think of, but can lead to poor outcomes in terms of both morbidity and mortality. In cases where there is an underlying cause, it should be treated, but it should be kept in mind that delirium treatment may take weeks or months.

**REFERENCES**

- Bucht G, Gustafson Y, Sandberg O. Epidemiology of delirium. *Dement Geriatr Cogn Disord* 1999; 0: 315-318. <http://dx.doi.org/10.1159/000017161>
- Diagnostic and Statistical Manual of Mental Disorders, 4th Edition, Text Revision. Washington, DC: American Psychiatric Association; 2000
- Kaya E, Sönmez S, Barlas F-Delirium. *S.B, Okmeydani medical journal* 29(2):70-74, 2013.
- Gleason OC. Delirium. *Am Fam Physician*. 2003;67:1027-34.
- Han JH, Zimmerman EE, Cutler N, et al. Delirium in older emergency department patients: recognition, risk factors, and psychomotor subtypes. *Acad Emerg Med*. 2009;16:193–200
- Holt R, Young J, Heseltine D. Effectiveness of a multi-component intervention to reduce delirium incidence in elderly care wards. *Age Ageing*. 2013 Nov;42(6):721-7. doi: 10.1093/ageing/aft120. Epub 2013 Aug 26. PMID: 23978407.
- Inouye SK, Westendorp RG, Saczynski JS. Delirium in elderly people. *Lancet*. 2014;383:911-22.
- Lesley P. Latham, MSc and Stacy Ackroyd-Stolarz, BSc(OT), PhD. Emergency Department Utilization by Older Adults: a Descriptive Study. *Can Geriatr J*. 2014 Dec; 17(4): 118-125.
- Myers S. Patient Care. Eldery Emergency. *Hosp Health Netw* 2005; 79; 24-6.
- Ozcan Keskin, M. Kalemoglu, T. Deniz. The Analyzes of Delirium Cases Presenting to the Emergency Department Turkish Journal of Emergency Medicine. 2004, volume 4, Issue 3.
- Shenvi C, Kennedy M, Austin C, Wilson M, Gerardi M, Schneider S. Managing Delirium and Agitation in the Older Emergency Department Patient: The ADEPT Tool. *Ann Emerg Med*. September 2019. <https://www.ncbi.nlm.nih.gov/pubmed/31563402>.
- Setters B, Solberg LM. Delirium. *Prim Care*. 2017;44:541-59.
- Schubert M, Schürch R, Boettger S, Garcia Nuñez D, Schwarz U, Bettex D et al. A hospital-wide evaluation of delirium prevalence and outcomes in acute care patients - a cohort study. *BMC Health Serv Res*. 2018;18:550.

Tintinalli JE, Stapczynski JS, Ma OJ et al. Tintinallis  
emergency medicine A comprehensive study guide.  
2013.

Turkcan A. Delirium: World of Psychiatry 2001; 5: 15-23

WHO. (2015a), World Health Organization, World Report on Ageing and  
Health, 01Şubat 2016,  
[http://apps.who.int/iris/bitstream/10665/186463/1/9789240694811\\_en  
g.pdf](http://apps.who.int/iris/bitstream/10665/186463/1/9789240694811_eng.pdf).





## **CHAPTER 8**

### **APPROACH TO HEADACHE IN GERIATRIC POPULATION**

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## INTRODUCTION

Headache constitutes approximately 4% (0.5-4.5%) of admissions to the emergency department. Differential diagnosis of headache includes pathologies ranging from benign pathologies such as migraine, cluster-type or tension-type headache to pathologies with high mortality such as brain tumor, encephalitis, meningitis and intracranial hemorrhage. The presence of a large number of pathologies in the differential diagnosis causes difficulties in diagnosis(Munoz-Ceron J et al, 2019)..

The geriatric population is a patient group of high importance in terms of headache. Because the underlying causes of headache are pathologies that require early intervention and have high mortality. The approach to headache is similar in all patient populations. The feature that distinguishes the approach to headache in the geriatric population from the others is the high risk of developing headaches in the geriatric population due to secondary pathologies, unlike young adults (Figure 1) (Starling AJ., 2018). The necessity of modifying the treatment is another challenge.

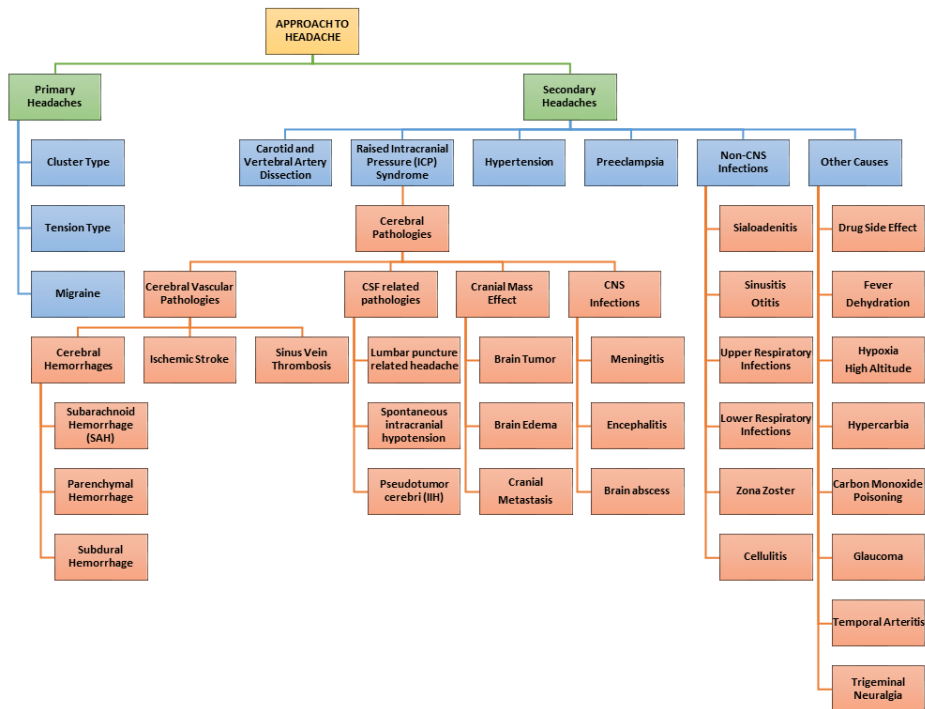


Figure 1. Approach to Headache: Primary and secondary causes of headache

## TYPES OF HEADACHE

Headaches are divided into two main groups by The International Headache Society (Diener, H. C. et al, 2019):

- **Primary Headaches:** The type of headache that does not have a structural change, systemic disease or trauma to explain the headache, and no pathology is detected by physical examination and imaging methods is called primary headache. It constitutes 90% of headache causes. In order to make the diagnosis of primary headache, the following criteria must be met:
  - Absence of trauma
  - Absence of abnormality in physical examination
  - Absence of pathology on imaging
  - No associated acute pathology

Primary headache types include migraine, cluster headache, and tension-type headache. Although migraine is the most common type of primary headache diagnosed in the emergency department, the most common primary headaches are tension-type headache, followed by migraine and cluster headache. So why do migraine patients apply to the emergency department most frequently? Because migraine is the most common type of primary headache. Therefore, patients are aware of the existence of migraine diagnoses. Apart from the three main headache syndromes, there are many different types of primary headaches that are less common.

- **Secondary Headaches:** The type of headache that occurs secondary to pathologies such as trauma, infection, tumor, cerebral hemorrhage and is diagnosed as a result of pathology detected by physical examination or imaging is called secondary headache. It accounts for only 10% of headache causes.

The underlying cause should be treated in secondary headaches. However, the fact that the headache is caused by a secondary headache does not mean that urgent treatment is required.

Secondary headaches are also divided into two groups as truly urgent and non-urgent. Our main goal in the approach to headache in the emergency department is to distinguish the causes of headache that require emergency intervention or treatment from non-emergency causes (Robbins MS, 2021)

## PATHOPHYSIOLOGY:

Before the pathophysiology of headache, it should be known that the brain parenchyma does not have pain-sensing receptors (nociceptors). Headaches are the result of pain typically originating from surrounding structures such as blood vessels, meninges, muscle fibers, facial structures, and cranial or spinal nerves rather than the brain parenchyma. Stretching, vasodilation, or any nociceptor stimulation within structures with pain receptors can cause headaches (Gaul C. et al, 2017). Although theories about secondary headaches have been put forward, the pathophysiology of primary headache has not been fully elucidated. Although many studies have tried to associate certain anatomical and physiological disorders with primary headache types, it is a known fact that not all primary headaches can be explained by a single common mechanism. The pathophysiology of secondary headaches depends on the underlying process.

### The Monro Kelly Doctrine

When talking about intracranial pressure, it is impossible not to mention basic physics knowledge: '

*'With the amount of liquid substance in a fixed volume (non-expandable) container is increased, the pressure of the container increases.'*

The brain, cerebrospinal fluid (CSF), and blood vessels are externally bounded by a rigid sheath such as the skull. This feature of the head inspired the emergence of the Monro-Kellie Doctrine. According to the Monro-Kellie doctrine, the sum of the brain, CSF and blood volumes creates a constant total volume within the skull. The increase in volume in one due to constant pressure must be balanced by the decrease in volume of the other.

$$V_{\text{BRAIN}} + V_{\text{CSF}} + V_{\text{BLOOD}} = \text{CONSTANT}$$

With the volume of a component in rigid-constant-volume structures increases, the volumes of other component begin to decrease and the constant volume value is tried to be maintained. Finally, at a point where the volumes of the other components cannot decrease, the pressure increases due to continued volume expansion. The same feature; for the head; CSF + Brain + Blood Volume is fixed within the rigid skull.

While the increase in volume in any of these three structures was initially tried to be compensated by the decrease in volume in other structures; In cases where the compensation is insufficient, it will cause an increase in pressure. For example, in the presence of a mass in the brain, the CSF and blood volumes are reduced and the volume is kept constant. The increase in

pressure at a constant volume within the skull is called the raised intracranial pressure (rICP) syndrome, which is characterized by several different symptoms:

- Nausea-vomiting
- Photophobia
- Decreased level of consciousness
- Papilledema

In rICP syndrome characteristic findings called Cushing's triad can be seen. Cushing's triad consists of hypertension, bradycardia, and respiratory irregularity.

### **RED FLAGS OF HEADACHE**

Headaches that alarm the clinician and require detailed examination are called 'red flags'. In addition to the red flag, there are also alarm signs called orange flags. Orange flags are called alarming information only when occur together with other orange or red flags (Do TP, 2019). According to the degree of alarm, it can be said that the orange flag has relatively lower alarm importance than the red flag. The main red flag is the newly onset of headache in people older than 50 years. Headaches start under the age of 10 are also considered a red flag in some sources. **The other red flags of headache:**

- Headache that progresses over days and is resistant to analgesic treatment
- Headache that started within the last 6 months
- Changes in severity, frequency and character
- History of head trauma
- Severe pain that worsens in a short time
- Headache that occurs during or after pregnancy
- Headache aggravated by physical activity, valsalva or cough
- Persistent, treatment-resistant vomiting
- Systemic findings such as fever
- Presence of focal neurological deficit
- Unconsciousness or syncope
- Epileptic seizures
- Acquired immune deficiency such as malignancy and HIV
- Papilledema in fundus examination
- Position-induced headache
- Weakness, weight loss or presence of systemic disease

## MANAGEMENT OF HEADACHE AND DIFFERENTIAL DIAGNOSIS

The first aim in the approach to headache should be 'differentiation of primary and secondary headache types'. Secondary headaches are also divided into two groups as emergency and non-emergency headaches. Our main goal in the approach to headache in the emergency department is to distinguish the causes of headache that require immediate intervention or treatment from non-urgent causes.

Demanding central imaging and laboratory tests in every headache patient admitted to the emergency department leads to serious costs and undesirable serious consequences due to high radiation. This situation reveals the importance of differential diagnosis in patients with headache and the importance of anamnesis and physical examination in the approach to headache.

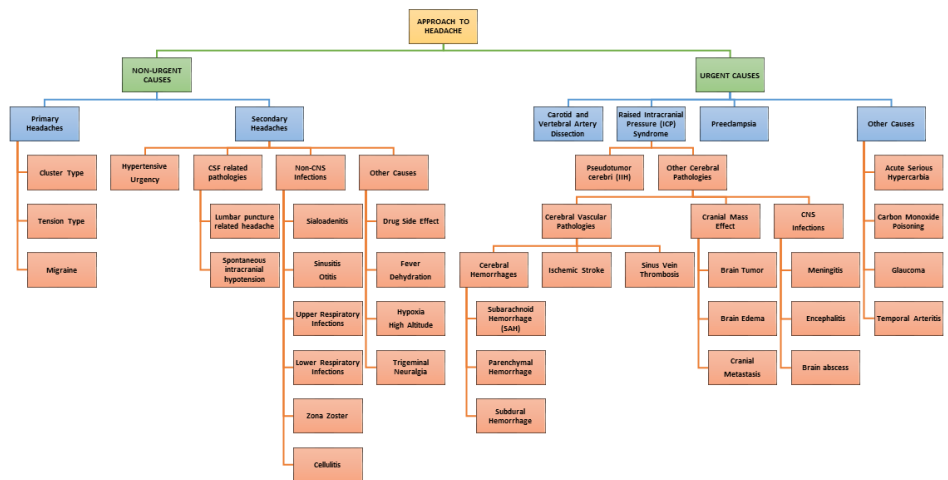


Figure 2. Approach to Headache: Differential diagnosis of headache

### a. ANAMNESIS AND PHYSICAL EXAMINATION

In primary headache syndromes, anamnesis and physical examination are sufficient for diagnosis. Although anamnesis and physical examination can be used in the suspicion of secondary headaches, laboratory tests and imaging are examined to confirm the diagnosis.

#### 1. Distinctive features of primary headache types:

- **Migraine** is a cause of moderate-to-very severe headache, usually unilateral, located on the right/left half of the head, with a throbbing



character. It is usually seen in women between the ages of 15-55. Symptoms accompanying headache include nausea-vomiting, photophobia-phonophobia. Its triggers are usually physical activity. Headache in migraine patients can last 4-72 hours.

- **Tension-type headache** is a bilateral headache that encircles the forehead region and has a constricting character, causing mild to moderate intensity headache. It is commonly seen in people aged 25-30 and equally in both male and female gender. Photophobia and phonophobia are usually among the accompanying symptoms of the headache. Stress is usually one of the triggers. Tension-type headache patients can last for 30 minutes to 7 days.
- **Cluster-type headache** is typically a unilateral headache that is located around the eyes and has a sharp, stabbing character, causing very severe headache. It is commonly seen in people aged 25-30 and especially in the male gender. Accompanying symptoms of the headache usually include redness in the eyes, nasal congestion, myosis, ptosis, and sweating, characterized by autonomic dysfunction. Triggers include generally stretching/sleeping. Cluster headache patients can have headache for 15-180 minutes. While cluster headache has sudden onset, tension-type headache has a slow onset.

## 2. Distinctive features of secondary headache types:

Although secondary headache types are generally detected using physical examination, laboratory and imaging methods, it should not be forgotten that the information obtained from the anamnesis can significantly help in suspecting the diagnosis. Differential diagnosis can be made by evaluating the character of the headache, the way it appears, the triggers, accompanying diseases, and accompanying symptoms.

- **Age:**
  - New-onset headache in the geriatric population raises the possibility of secondary headache causes. In populations outside the geriatric population, headaches that start below the age of 10 and above the age of 50 should be considered secondary headache causes until proven otherwise.
- **Character of pain:**
  - Lightning-like, history of ‘the most severe headache in the patient's life’ raises the possibility of subarachnoid hemorrhage (SAH).

- Headache that appears when lying down in bed at night or upon waking up in the morning raises the possibility of raised intracranial pressure (rICP).
- The rapid progression of the headache to its most severe state within a very short period of time (seconds-minutes) raises the possibility of SAH.
- **Triggers of pain:**
  - Pains associated with body and head position suggest rICP.
  - Pain caused by physical activity, coughing, or valsalva suggests SAH. Exacerbation of existing pain by physical activity, coughing or valsalva suggests rICP. In addition, it should not be forgotten that there may be causes of upper respiratory tract infections such as sinusitis.
- **Comorbid diseases:**
  - Hemorrhagic diathesis raises the possibility of hemorrhagic stroke types, including SAH.
  - The presence of inherited or acquired immune deficiency raises the possibility of CNS infections such as cerebral abscess, encephalitis, and meningitis.
  - A history of cerebrovascular disease raises the possibility of a new, developing hemorrhagic or ischemic stroke.
  - Malignancy raises the possibility of cranial metastasis and sinus vein thrombosis.
- **Accompanying symptoms:**
  - Fatigue, weight loss, fever and other systemic disease findings suggest malignancy.
  - Syncope and altered consciousness after headache suggest stroke and CNS infections.
  - Neck pain-stiffness suggests SAH and CNS infections.
  - Any focal neurological deficit suggests types of stroke, especially hemorrhagic stroke.
  - Presence of claudication in the chin suggests temporal arteritis.
  - Visual disturbances suggest rICP, ophthalmic pathologies and temporal arteritis. In the presence of photophobia, rICP, and ophthalmic pathologies are considered more. It should be noted that photophobia can be seen together with migraine and tension-type headache, which are types of primary headaches.
  - Pain and red eye in the eyes suggest ophthalmic pathologies.

- Pain and fullness in the maxillofacial region suggest sinusitis and other respiratory tract infections.

### **b. LABORATORY TESTS**

There is no laboratory parameter that can directly diagnose secondary headache with its presence in the emergency department. In secondary headaches, changes in laboratory parameters related to the underlying pathology can be seen:

- The presence of elevated infectious parameters raises the possibility of infectious pathologies, including CNS infections, and malignancy. While CNS infections are the most important cause of headache leading to elevated infectious parameters, the most common cause is respiratory tract infections.
- The presence of respiratory acidosis in blood gas raises the possibility of type 2 respiratory failure (exacerbation of COPD, asthma attack) or the presence of hypoxia characterizes respiratory pathologies with type 1 respiratory failure. In addition, a high level of carboxyhemoglobin suggests carbon monoxide poisoning.
- A high erythrocyte sedimentation rate (ESR) raises the possibility of temporal arteritis.
- A high D-dimer level can confirm the diagnosis of sinus vein thrombosis. A high D-dimer level supports sinus vein thrombosis, but a negative result does not exclude it.

### **c. IMAGING**

In patients with suspected secondary headache, especially those suspected of CNS pathologies, the first imaging method to be selected should be brain tomography without contrast. Instead of specifying the indications for imaging individually, some sources mention the types of headache that do not require routine imaging. Accordingly, it is thought that routine imaging methods are unnecessary for patients who meet the following criteria:

- Isolated headache (without seizures, loss of consciousness, neck stiffness/pain, fever, etc.)
- The patient is awake, cooperative, and oriented
- No newly developed neurological symptoms
- The systemic physical examination is normal (including eyes, skin, and all other extracranial systems)
- Similar character and severity to previous pain

The best diagnostic methods for some headaches requiring emergency intervention in patients presenting with headache is as follows:

- Cranial CT(computer tomography) angiography and diffusion MR for the diagnosis of ischemic stroke
- Cranial CT angiography and lumbar puncture for the diagnosis of CT negative subarachnoid hemorrhage
- MR(magnetic resonance) venography for the diagnosis of sinus vein thrombosis
- Cranial and cervical CT angiography for the diagnosis of carotid and vertebral artery dissection
- Temporal artery biopsy for the diagnosis of temporal arteritis
- Contrasted cranial MR for the diagnosis of brain tumor, cranial metastasis
- Lumbar puncture for the diagnosis of encephalitis, meningitis
- Eye tonometry and ocular examination (optic nerve cupping) for the diagnosis of glaucoma

The rate of diagnosis of subarachnoid hemorrhage with CT within the first 6 hours reaches 100%, with sensitivity ranging from 97-100% and specificity ranging from 99.5-100%, and a negative predictive value of 99.5-100% (Perry, J. J. et al, 2011). The sensitivity of detecting SAH on unenhanced CT decreases over time. In cases where the diagnosis is suspected, CT angio and lumbar puncture should always be preferred. In addition, the presence of papilledema shown by ocular examination is important in the diagnosis of ICH in patients with suspected ICH in the absence of pathology on brain tomography. Ocular examination should always be performed after brain tomography in patients with persistent, analgesic-resistant headache.

#### **d. TREATMENT**

The use of analgesic drugs for pain reduction is the cornerstone of treatment for patients with headache. However, in these patients, the focus should be on identifying secondary headaches that require urgent treatment, rather than just reducing headache. In patients with a definite cause of headache, it is possible to consider complete elimination of pain with analgesic treatment.

**1. Analgesic Treatment:** The use of analgesics for the pain reduction in patients who present with headache is the foundation of treatment. However, in these patients, more focus should be placed on

identifying secondary headaches that require urgent treatment rather than just reducing the headache. The response to analgesic treatment, the relief of headache with analgesic treatment, does not show that the cause of the headache is not secondary pathology. Both primary and secondary causes of headache can show a decrease in headache severity with analgesic treatment.

**2. Other Treatments:** Depending on the underlying cause of the headache, non-analgesic treatment methods can be used in some patient groups:

- It is necessary to avoid triggering factors, especially in primary headaches.
- Methylprednisolone treatment is given in temporal arteritis.
- Hyperbaric oxygen therapy should be applied in carbon monoxide poisoning.
- Carbamazepine treatment is given in trigeminal neuralgia.
- High volume oxygen therapy is applied in cluster headache.
- In addition to analgesic treatment, metoclopramide treatment is given in patients diagnosed with migraines.
- Appropriate antihypertensive medication should be given according to end-organ damage in patients with high blood pressure. Nitrates should be avoided in headache patients as they cause cerebral vasodilation.

## REFERENCES

- Munoz-Ceron, J., Marin-Careaga, V., Peña, L., Mutis, J., & Ortiz, G. (2019). Headache at the emergency room: Etiologies, diagnostic usefulness of the ICHD 3 criteria, red and green flags. *PloS one*, 14(1), e0208728. <https://doi.org/10.1371/journal.pone.0208728>
- Starling A. J. (2018). Diagnosis and Management of Headache in Older Adults. *Mayo Clinic proceedings*, 93(2), 252–262. <https://doi.org/10.1016/j.mayocp.2017.12.002>
- Diener, H. C., Tassorelli, C., Dodick, D. W., Silberstein, S. D., Lipton, R. B., Ashina, M., Becker, W. J., Ferrari, M. D., Goadsby, P. J., Pozo-Rosich, P., Wang, S. J., Mandrekar, J., & International Headache Society Clinical Trials Standing Committee (2019). Guidelines of the International Headache Society for controlled trials of acute treatment of migraine attacks in adults: Fourth edition. *Cephalalgia : an international journal of headache*, 39(6), 687–710. <https://doi.org/10.1177/0333102419828967>
- Robbins M. S. (2021). Diagnosis and Management of Headache: A Review. *JAMA*, 325(18), 1874–1885. <https://doi.org/10.1001/jama.2021.1640>
- Gaul, C., Meßlinger, K., Holle-Lee, D., & Neeb, L. (2017). Pathophysiologie von Kopfschmerzkrankungen [Pathophysiology of Headaches]. *Deutsche medizinische Wochenschrift* (1946), 142(6), 402–408. <https://doi.org/10.1055/s-0042-111694>
- Do, T. P., Remmers, A., Schytz, H. W., Schankin, C., Nelson, S. E., Obermann, M., Hansen, J. M., Sinclair, A. J., Gantenbein, A. R., & Schoonman, G. G. (2019). Red and orange flags for secondary headaches in clinical practice: SNNOOP10 list. *Neurology*, 92(3), 134–144. <https://doi.org/10.1212/WNL.0000000000006697>
- Perry, J. J., Stiell, I. G., Sivilotti, M. L., Bullard, M. J., Emond, M., Symington, C., Sutherland, J., Worster, A., Hohl, C., Lee, J. S., Eisenhauer, M. A., Mortensen, M., Mackey, D., Pauls, M., Lesiuk, H., & Wells, G. A. (2011). Sensitivity of computed tomography performed within six hours of onset of headache for diagnosis of subarachnoid haemorrhage: prospective cohort study. *BMJ (Clinical research ed.)*, 343, d4277. <https://doi.org/10.1136/bmj.d4277>



**CHAPTER 9**  
**HYPERTENSION IN ELDERLY**  
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## INTRODUCTION

Hypertension (HT) is characterized by persistent high blood pressure. It is a systemic disease that causes serious complications and is an important health problem because it is common in the community. Untreated hypertension has been shown to increase the rate of heart failure, coronary heart disease, hemorrhagic and thrombotic stroke, renal failure, peripheral artery disease, aortic dissection, and death (Turkish Society of Endocrinology and Metabolism 2022). Worldwide, high blood pressure is estimated to cause 7.5 million deaths, about 12.8% of all deaths (World Health Organization, 2021). According to the latest data published by World Health Organization (WHO), while 27.7% of young adults in Turkey have hypertension, this rate reaches 75% over the age of 70 (WHO, 2017).

In the Turkish Hypertension Prevalence Study, the prevalence of hypertension has been reported that 75.1% in the population aged  $\geq 65$  years, 67.9% in the 60-69 age group in the Patent-2 study, 85.2% in the 70-79 age group, and 76.3% in the 80-year-old and older population. In the HT study of the Turkish Endocrine and Metabolism Association conducted in seven different geographical regions of Turkey, it was found that the frequency of HT increases with age, compared to the 20-29 age group, the HT risk increase 6.8 times between the ages of 60-69, 9.7 times between the ages of 70-79, and 6.4 times over 80 years of age (Turkish Society of Endocrinology and Metabolism, 2022).

The number of individuals aged 65 and over is predicted to reach approximately 1.5 billion by 2050, with the hypertension prevalence expected to rise to 29% by 2025 (Chen et al., 2020).

With the aging of the population, determining the treatment target for systolic blood pressure in elderly patients with hypertension has become the focus of research (Zhang W. et al., 2021).

### **1. Pathophysiology And Complications of Hypertension In The Elderly**

Both systolic and diastolic blood pressure increase gradually until the age of 50-60 years. After age 60, however, systolic blood pressure continues

to rise, while diastolic blood pressure remains constant and then begins to fall (Turkish Society of Endocrinology and Metabolism, 2022).

It would not be correct to consider hypertension as a normal physiological process in the elderly. This is the result of the development of age-related arterial stiffness and changes in arterial compliance due to our environment and lifestyle. Because this age-related relationship was not observed in primitive societies (Burnier M. et al. 2020).

This increase is due to the decrease in elasticity of large vessels as a result of atherosclerosis. Degeneration of the media layer of the great arteries is the biggest cause of atherosclerosis. The increase in systolic blood pressure contributes to the pathophysiological process by causing endothelial dysfunction. Diastolic blood pressure remains the same or decreases in elderly patients. Decreased diastolic blood pressure is a factor that impairs coronary blood supply. The reason why diastolic blood pressure does not increase is the decrease in stroke volume with age. Isolated systolic hypertension is present in 75% of patients over 75 years of age (Alp C. et al., 2018)

The increase in systolic blood pressure and pulse pressure that occurs with aging is a more important cardiovascular risk factor than elevation in diastolic blood pressure (Turkish Society of Endocrinology and Metabolism, 2022).

Age-related decrease in arterial baroreceptor sensitivity negatively affects the expected compensatory responses in heart rate, facilitating postprandial and orthostatic hypotension. It also causes higher sympathetic nervous system activation at certain blood pressure levels, leading to higher blood pressure levels. Hypertension increases the risk of hypotension more in the elderly because of impaired baroreflex sensitivity and decreased ventricular complement. Sudden drops in blood pressure are a very important factor that increases the risk of cerebral ischemia. Hypertensive elderly may show cerebral ischemic manifestations even in mild and short-term hypertension, because long-term hypertension impairs cerebral autoregulation. In addition, antihypertensive drugs may impair cardiovascular reflexes and lead to orthostatic hypotension (Turkish Society of Cardiology, 2018).

Age-related decreases in renal blood flow and glomerulofiltration rate also impair the kidney's sodium excretion ability. Thus, a tendency to sodium

retention is observed. This means salt sensitivity; It is present in two-thirds of elderly hypertensives, and with a low-sodium diet, their blood pressure can drop  $>5$  mmHg (Turkish Society of Cardiology, 2018).

Hypertension is recognized as the main risk factor for many cardiovascular diseases. The coexistence of these diseases with hypertension can lead to deterioration of health status and/or worsening of vulnerability (Guasti et al. 2022).

In elderly the frailty describes a condition or syndrome in which physical, physiological and cognitive abilities are reduced. Frail individuals; It is defined as a condition in which decrease in movement, weakness, decrease in muscle mass, malnutrition and decrease in cognitive functions occur together. The presence of all these conditions makes older individuals more susceptible to stressors (Düzgün et al. 2021). Frail older people are at both a higher risk of cardiovascular outcomes and a higher risk of adverse outcomes. A more personalized understanding of the balance of risk for older people is key to improving safe clinical care (Masoli et al. 2021).

Recent findings suggest that hypertension may also play a role in the pathogenesis of vascular dementia and Alzheimer's disease. It has been reported that increased blood pressure variability may cause white matter hyperintensity and brain atrophy (Lee et al. 2019). High blood pressure is not only a known risk factor for cardiovascular events, but also increases the risk of depression in the elderly (Burnier M. et al. 2020).

## **2.Target Blood Pressure Available In Available Guidelines For The Elderly**

The hypertension treatment target has been recommended by the 2017 American Society of Cardiology/American Heart Association as  $<130/80$ mmHg for 65 years and older, by 2018 European Society of Cardiology/European Heart Association as  $<130-139/70-79$  mmHg for 65 years and older, by 2017 American Association of Physicians /American Academy of Family Physicians as  $<150/90$  mmHg. In the 2019 Turkish Consensus Report on Hypertension, the threshold blood pressure value is  $\geq 140/90$  mmHg, the blood pressure target is 130-140 mmHg systolic, 70-80

mmHg diastolic for the patient group aged 65-79 years. Also threshold blood pressure value is  $\geq 150$  mmHg and target blood pressure value is systolic 130-140 mmHg, diastolic 70-80 mmHg are recommended for patients 80 years and older (Turkish Society of Endocrinology and Metabolism, 2022).

The age limit was determined as 60 in the Eighth Joint National Committee guideline, and 150/90 mmHg was recommended as the treatment initiation limit and treatment target value for those older than 60 years of age (Goldstein et al. 2017).

Thresholds and targets blood pressure for initiation of antihypertensive treatment in elderly individuals are shown in Table 1 in the guidelines (Turkish Society of Endocrinology and Metabolism, 2022, Goldstein et al. 2017).

**Table 1.** Blood pressure threshold for initiation of antihypertensive therapy and target blood pressure in guidelines

	ACC/AH A2017	ACP/AAF P2017	ESC/ESH 2018	TCRH 2019	JNC-8
Definition of elderly person	$\geq 65$ years	$\geq 60$ years	65-79 years $\geq 80$ years	65-79 years $\geq 80$ years	$\geq 60$ years
Blood pressure threshold for initiation of antihypertensive therapy	$\geq 130/80$ mm Hg	SBP $\geq 150$ mm Hg	65-79 years $\geq 140/90$ mm Hg $\geq 80$ years $\geq 160/90$ mm Hg	65-79 years $\geq 140/90$ mm Hg $\geq 80$ years $\geq 150$ mm Hg	SBP $< 150$ mm Hg DBP $< 90$
Target blood pressure	$< 130/80$ mm Hg	SBP $< 150$ mm Hg	SBP 130-139 mm Hg DBP 70-79 mm Hg	SBP 130-140 mm Hg DBP 70-80 mm Hg	SBP $< 150$ mm Hg DBP $< 90$
ACC/AHA 2017: American Society of Cardiology/American Heart Association 2017 guideline ACP/AAFP 2017: American Association of Physicians /American Academy of Family Physicians 2017 guideline ESC/ESH 2018: European Society of Cardiology/European Heart Association 2018 guideline TCRH 2019: Turkish Consensus Report on Hypertension 2019 JNC 8: Eighth Joint National Committee SBP: Systolic blood pressure; DBP: Diastolic blood pressure					

In patients with transient ischemic attack or stroke, target blood pressure differs between guidelines because the benefits of a lower target are not supported by clinical trial evidence. However, newer guidelines accept the overall target blood pressure of 130 mmHg, previously accepted for lacunar infarction. A general target of 140 mmHg is recommended in patients with diabetes mellitus, although the target blood pressure may vary depending on the underlying risk profile; For example, a target blood pressure of 130/80 mmHg is recommended for the presence of a high risk of atherosclerotic cardiovascular disease, cardiovascular disease, or chronic kidney disease. In chronic kidney disease, the 2021 Kidney Disease: Improving Global Outcomes guidelines and the Systolic Blood Pressure Intervention Trial (SPRINT) recommend <120 mmHg in SBP as a target in chronic kidney disease (Shin et al. 2022).

### **3. Diagnosis Of Hypertension In The Elderly**

Because of arterial stiffness in the elderly, if the cuff pressure is not raised above the systolic pressure, it is mistakenly assumed to be low. The pulse should be palpated as the cuff is inflated to confirm that the pressure is elevated above the systolic pressure. Blood pressure should be measured in both arms, in the follow-ups, the measurements are made on the arm with higher elevation. The blood pressure while standing should also be measured within a few minutes with the patient standing up; A drop in systolic pressure greater than 20 mmHg is defined as orthostatic hypotension. Orthostatic hypotension should be checked at each follow-up visit of patients receiving treatment for hypertension, because almost all drugs facilitate this. Orthostatic hypotension is one of the most important causes of falls in the elderly (Turkish Society of Cardiology, 2018).

Elderly hypertensive patients have a number of diagnostic difficulties. A significant discrepancy between intra-arterial blood pressure and cuff blood pressure is defined as pseudohypertension and is common in the elderly (Lee et al. 2019). Due to calcification and atherosclerosis in the arteries with aging, the cuff may stop the brachial artery flow at high pressures. Therefore, the blood pressure may be found to be higher. This is called pseudohypertension. In case of doubt, an osler maneuver (palpable radial artery when the cuff is inflated enough to prevent the brachial artery sound from being heard) is

performed. In addition, it is necessary to be careful in terms of masked hypertension with high out-of-office measurements, white coat hypertension, and postprandial hypotension that develops after meals with high carbohydrate content (Sözen Gencer&Akciçek 2022).

#### **4.Special Considerations In Elderly Hypertensive Patients**

In elderly individuals, it is not only age that determines blood pressure targets, but also general condition, concomitant diseases, medications, orthostatic hypotension, cognitive dysfunction and frailty. The frailty has been defined as a medical syndrome of multiple causes and contributing factors, characterized by reduced strength, endurance, and decreased physiological function, increasing the individual's vulnerability to development of addiction and/or death. Comprehensive geriatric evaluation is required to determine frailty and functional status, especially when planning antihypertensive treatment in people over 80 years of age (Turkish Society of Endocrinology and Metabolism, 2022).

According to the FRAIL scale, a person is defined as frail if they have 3 criteria for fatigue, endurance, ambulation, multimorbidity, and weight loss. Odden et al. They took slow walking as a criterion for frailty. When they examined 2340 patients aged >65, they could not find a relationship between blood pressure and mortality in the frail elderly, whereas they found that the most frail patients had "lower mortality" if "blood pressure was high". In elderly patients, it is necessary to individualize the treatment of hypertension and to evaluate the functionality when determining the targets (Turkish Society of Cardiology, 2018).

The Canadian Study of Health and Aging (CSHA) score is a practical decision-making tool for determining antihypertensive treatment strategies. Groups 6 to 9 in particular need daily assistance with basic activities of daily living. Figure 1 is an example of classification by frailty status based on CSHA score (Benetos et al. 2019).



**Figure 1.** CSHA score

When treating hypertension in the elderly, not only should chronological age be considered, but also an overall risk assessment for individual patients, including comorbidities, frailty status, functional status, and risk of orthostatic hypotension (Lee et al. 2019).

## 5. Hypertension Treatment In Elderly

In the treatment of hypertension in the elderly population, chronological age rather than biological age should generally be considered. Due to functional heterogeneity in geriatric individuals, a different therapeutic strategy should be applied for each patient (Chen et al. 2020).

When prescribing antihypertensive treatment, it is not enough to simply look at the age of 60 or 80. The systolic blood pressure treatment target should be 130 mmHg and above in individuals aged >65 years who live in the community and do not stay in institutions such as nursing homes. In the treatment of hypertension in the elderly, frailty, functional status, cognition, survival expectancy, multiple drug use should be considered, orthostatic hypotension, malnutrition, dehydration and drug-induced hypotension should be carefully monitored. In frail elderly patients with high comorbidity, limited life expectancy, and controversial risk-benefit ratio, rational treatment should be used in the selection of antihypertensive drugs and in determining the



treatment target, and higher targets should be chosen. Hypertension treatment in patients with functional limitations may adversely affect life expectancy and quality of life. SBP <150 mm Hg is appropriate as a systolic blood pressure target in frail elderly, this target can be kept higher depending on cerebral hypoperfusion symptoms, orthostatism, and functional status. The recommended minimum diastolic blood pressure is 65 mmHg if coronary artery disease is present, 60 mmHg if coronary artery disease is not (Turkish Society of Cardiology, 2018).

One of the most important side effects of antihypertensive treatment is postural hypotension. Atypical symptoms, such as general malaise and weakness, rather than dizziness and feeling ill when standing up, may be due to postural hypotension (Turkish Society of Cardiology, 2018).

Therefore, it is critical to routinely screen for orthostotic hypotension by measuring blood pressure in the standing position and according to its symptom. Typical orthostatic symptoms include dizziness, blurred vision, weakness, nausea, and palpitations within minutes of standing up. Orthostotic hypotension may be transient during postprandial or exacerbated by dehydration, smoking, chronic kidney disease, or medications (Shin et al. 2022).

Despite measuring a markedly elevated blood pressure in an elderly patient, a rapid reduction of blood pressure to normal values will be harmful, if there is not evidence which indicates a true hypertensive emergency for example; end-organ damage, hypertensive encephalopathy, intracranial hemorrhage, pulmonary edema, aortic dissection, unstable angina (Turkish Society of Cardiology, 2018).

Regarding non-pharmacological interventions to lower blood pressure, there is little evidence from controlled trials in hypertensive patients over 80 years of age, although benefits have been demonstrated in younger populations (Benetos et al. 2019).

A typical elderly hypertension patient is overweight, sedentary, and salt-sensitive, and lifestyle modification is beneficial in these patients. Stopping smoking tobacco, weight reduction in the obese, reducing excessive alcohol consumption, physical exercise, reducing salt consumption, Dietary Approaches to Stop Hypertension (DASH) diet, low-carb, vegetarian, a heart-

healthy diet such as plant-based and Mediterranean diet can be recommended as a lifestyle modification. In addition, potassium supplements (1500 to >3000 mg), calcium or magnesium supplements, probiotic, fiber, flaxseed consumption, garlic and fish oil consumption are recommended. Patients' medications should be reviewed to ensure they are not taking any medications, such as nonsteroidal anti-inflammatory drugs, steroids, angiogenesis inhibitors, tyrosine kinase inhibitors, atypical antipsychotics, antidepressants, amphetamines, hormone replacement therapy, immunosuppressants, and decongestants that can cause hypertension. The use of recreational drugs, caffeine, tea and herbal supplements should also be questioned (Turkish Society of Cardiology, 2018, Oliveros et al. 2019).

If there is hyperlipidemia, it should be treated. However, weight loss in frail elderly increases functional impairment; Unconscious and unnecessary weight loss approach should be avoided. Body mass index (BMI) in the elderly should be over 23 kg/m<sup>2</sup>; Normal or higher BMI correlates with better functional status. Low BMI is associated with increased mortality in all diseases, including cardiovascular causes (Turkish Society of Cardiology, 2018).

We should be very careful when recommending a diet, especially for those aged 80 and over. Because weight loss diets can cause sarcopenia, low salt diet can cause malnutrition, hyponatremia, orthostatic hypotension and falls (Turkish Society of Endocrinology and Metabolism, 2022).

In the management of hypertension in the elderly, outpatient blood pressure monitoring should be performed instead of relying on single office measurements. The prevalence of isolated systolic hypertension, white coat effect, masked hypertension, orthostatic hypotension, and drug interactions can thus be easily detected (Masoli et al. 2021).

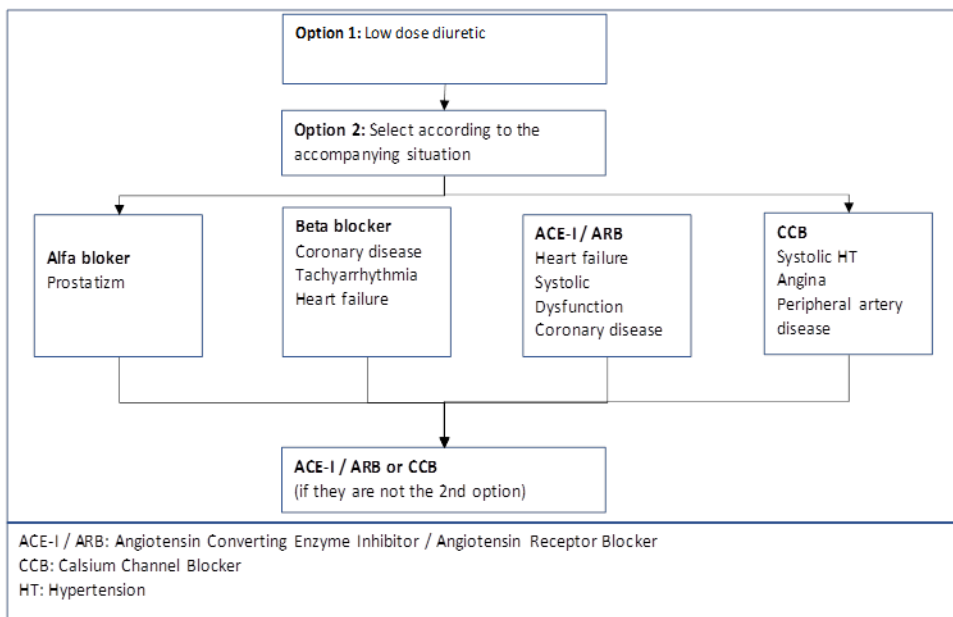
In the pharmacological treatment of hypertension, primarily agents such as diuretics (thiazide and thiazide-like diuretics), angiotensin converting enzyme inhibitors (ACEs) or angiotensin II receptor blockers (ARBs) and dihydropyridine calcium channel blockers (CCBs) alone or in combination are used.  $\beta$ -blockers should be considered in the presence of cardiac conditions such as ischemic heart disease, atrial fibrillation or heart failure (Guasti et al. 2022).

It should be known that reaching the blood pressure target is more important than the drug group in the selection of antihypertensive drugs in the elderly. However, in some cases, some group drugs should be preferred; : such as giving an ACE inhibitor in case of type 2 diabetes or congestive heart failure. Centrally acting antihypertensive drugs and direct vasodilator drugs should be avoided because of their sedative effects and significant postural hypotension. ACE inhibitors, angiotensin receptor blockers, calcium channel blockers or thiazide diuretics can be chosen as the first choice in JNC8 guidelines. Beta receptor blockers are not recommended as first choice in the elderly. Diuretics may be preferred in the elderly as they significantly reduce systolic pressure. It is an advantage that they are cheap, their side effects are known, and they are mild at low doses and included in combinations. The fact that hyponatremia is easier to develop in the elderly requires careful follow-up, especially in patients using thiazide diuretics (Turkish Society of Cardiology, 2018).

It is important to note that each class of antihypertensive drugs provides additional benefit in the presence of different comorbidities; such as ACE inhibitors in diabetes mellitus and beta-blockers in coronary disease. In the selection of antihypertensive drugs, efficacy, tolerability, cost-effectiveness, drug interactions and the presence of the patient's specific comorbidities should be considered. Beta-blockers should be used with caution in elderly patients as they are particularly susceptible to bradycardic effects. Nightmares, sleep disturbances, depression, and confusion may be present especially for the  $\beta$ -blockers crossing the blood brain barrier. The main side effects of calcium channel blockers are related to lower limb edema and orthostatic hypotension. Lower limb edema can decrease in social and physical activities for practical reasons (difficulties in walking with shoes). Also, diltiazem and verapamil can cause constipation. Nitrates are useful during hypertensive emergencies and angina; however, they are not preferred for long-term blood pressure control in elderly. Peripheral agents are not first-line agents because of their side-effect profile such as; bradycardia and sedation. Risk of aggravation of urine incontinence; diuretics may have an impact on the social life of the patient and can contribute to his/her isolation (Masoli et al. 2021, Benetos et al. 2019).

For elderly patients with primary hypertension, the initial antihypertensive drug should be a thiazide diuretic or a calcium channel blocker. If necessary, the second antihypertensive drug should be a calcium channel blocker in addition to a thiazide diuretic. If a third antihypertensive drug is required, the patient should be treated with a thiazide diuretic plus a calcium channel blocker plus an angiotensin converting enzyme inhibitor or angiotensin receptor blocker. If blood pressure is still not controlled and a fourth antihypertensive drug is needed, it should be a mineralocorticoid antagonist (Aronow 2020). Especially in the very elderly, the use of triple medication should be avoided unless it is necessary (Turkish Society of Endocrinology and Metabolism, 2022).

If there are selective conditions for the antihypertensive drugs, drug selection should be appropriate for these situations (Figure 2).



**Figure 2.** Hypertension treatment algorithm in elderly (Cakan 2017)

In the very elderly and frail, it is always recommended to start with a single drug and at a low dose, to titrate slowly (start low, increase slowly) and to be careful in terms of orthostatic hypotension (Turkish Society of Endocrinology and Metabolism, 2022).

Although SBP <150 mm Hg is recommended as an evidence-based target, antihypertensive drugs should be reduced or even stopped for safety reasons in the elderly who is in groups 6-9 on the frailty scale and SBP <130 mm Hg or orthostatic hypotension. Other factors that can potentially lower blood pressure and cause orthostatic hypotension should be identified and corrected, including malnutrition, dehydration, and other medications (Benetos et al. 2019).

Antihypertensive therapy may pose a risk factor for the development of frailty, especially when dual or triple drug combinations are used. On the other hand, frailty can increase the risk of treatment failure and drug-related side effects, resulting in increased patient frailty in a negative cycle. Also, certain side effects requiring special precautions may be associated with antihypertensive drugs in individuals aged 80+. Therefore, an individualized approach to the management of hypertension in frail patients is the best choice (Guasti et al. 2022).

## **CONCLUSION**

When determining blood pressure targets in elderly individuals, not only age, but also general condition, comorbidities, medications, orthostatic hypotension, cognitive dysfunction and fragility should be taken into consideration. The choice of medication is similar to that of teenagers. Because of the risk of falls and fractures, loop diuretics and alpha blockers should not be preferred unless necessary. Beta-blockers should not be the primary choice because of the risks of heart block, stroke, depression, and cognitive deterioration unless there is a specific indication. Hypertension treatment should be started with a single drug and at a low dose in the very elderly and frail, and it should be titrated slowly (start low, increase slowly), and care should be taken in terms of orthostatic hypotension.

## REFERENCES

- Alp Ç., Sarak T., Çifçi A., Kabalcı M. (2018). Approach to hypertension in the elderly. *Turkish Journal of Clinics and Laboratory* 9(3): 233-236. <https://doi.org/10.18663/tjcl.30349>.
- Aronow, W. S. (2020). Managing Hypertension in the elderly: What's new?. *American Journal of Preventive Cardiology*, 1, 100001. <https://doi.org/10.1016/j.ajpc.2020.100001>.
- Benetos A., Petrovic M., Strandberg T. (2019) Management of Hypertension in the Elderly and Frail Patient. *Circulation Research*; 124:1045–1060. <https://doi.org/10.1161/CIRCRESAHA.118.313236>.
- Burnier M., Polychronopoulou E. & Wuerzner G. (2020). Hypertension and Drug Adherence in the Elderly. *Frontiers in Cardiovascular Medicine*; 7:49. [10.3389/fcvm.2020.00049](https://doi.org/10.3389/fcvm.2020.00049).
- Cakan, F. (2017). 'Hypertension in the Elderly. *Turkish Society of Cardiology Studies*, 45(5), 29-31. <https://doi.org/10.5543/tkda.2017.95554>
- Chen, Y. J., Chiang, C. E., & Cheng, H. M. (2020). Rethinking of the hypertension management in the elderly with comorbidity: Should we forget the age in treating elderly hypertensives? *The Journal of Clinical Hypertension*, 22(6), 1080. <https://doi.org/10.1111/jch.13910>.
- Düzgün G., Üstündağ S., & Karadakovan A. (2021). Assessment of frailty in the elderly. *Florence Nightingale J Nurs*, 29(1), 2-8. <https://doi.org/10.5152/FNJJN.2021.41473>.
- Goldstein, F. C., Hajjar, I. M., Dunn, C. B., Levey, A. I., & Wharton, W. (2017). The relationship between cognitive functioning and the JNC-8 guidelines for hypertension in older adults. *Journals of Gerontology Series A: Biomedical Sciences and Medical Sciences*, 72(1), 121-126. <https://doi.org/10.1093/gerona/glw181>
- Guasti, L., Ambrosetti, M., Ferrari, M., Marino, F., Ferrini, M., Sudano, I., Sudano I., Tanda ML., Parrini I., Asteggiano R., Cosentino, M. (2022). Management of hypertension in the elderly and frail patient. *Drugs & Aging*, 39(10), 763-772. <https://doi.org/10.1007/s40266-022-00966-7>.
- Lee, J. H., Kim, K. I., & Cho, M. C. (2019). Current status and therapeutic considerations of hypertension in the elderly. *The Korean journal of internal medicine*, 34(4), 687.

- Masoli J.A.H., Sheppard J.P., Rajkumar C. (2021). Hypertension management in older patients—Are the guideline blood pressure targets appropriate? *Age and Ageing*; 51:1–3. <https://doi.org/10.1093/ageing/afab226>.
- Oliveros, E., Patel, H., Kyung, S., Fugar, S., Goldberg, A., Madan, N., & Williams, K. A. (2020). Hypertension in older adults: Assessment, management, and challenges. *Clinical cardiology*, 43(2), 99-107. <https://doi.org/10.1002/clc.23303>.
- Shin, J., & Kim, K. I. (2022). A clinical algorithm to determine target blood pressure in the elderly: evidence and limitations from a clinical perspective. *Clinical Hypertension*, 28(1), 1-9. <https://doi.org/10.1186/s40885-022-00202-9>.
- Sozen Gencer N. & Akcicek SF. (2022) Hypertension in the elderly. *Turkiye Klinikleri Special Topics; Geriatric Endocrinology* 1:16-23 Available at:<https://dijitalakademi.turkiyeklinikleri.com/flippage/geriatri-ozel/8-3/tr-index.html>. Accessed 22 December.
- Turkish Society of Endocrinology and Metabolism (2022). Hypertension diagnosis and treatment guideline. Available at: [https://file.temd.org.tr/Uploads/publications/guides/documents/Hipertan\\_siyon-Kilavuzu-2022.pdf](https://file.temd.org.tr/Uploads/publications/guides/documents/Hipertan_siyon-Kilavuzu-2022.pdf) Accessed 16 December.
- Turkish Society of Cardiology Hypertension Study Group Hypertension Bulletin (2018). Hypertension in the Geriatric Patient Group. Available at: <https://tkd.org.tr/HTBulteni/?makale=2>. Accessed 15 December, 2022.
- World Health Organization (2021). Blood Pressure/Hypertension. Available at: <https://www.who.int/data/gho/indicator-metadata-registry/imr-details/3155>. Accessed 15 December, 2022.
- World Health Organization (2017). Turkey hypertension fact sheets. Available at: <https://www.who.int/publications/m/item/hypertension-tur-country-profile-turkey-2020>. Accessed 16 December, 2022
- Zhang W., Zhang S., Deng Y., Wu S., Ren J., Sun G., Yang J., Jiang Y., Xu X., Wang T., Chen Y., Li Y., et al. (2021). Trial of Intensive Blood-Pressure Control in Older Patients with Hypertension. *The New England Journal of Medicine*; 385:1268-79. <https://doi.org/10.1056/NEJMoa2111437>.

**CHAPTER 10**

**HEAD TRAUMA IN GERIATRIC PATIENT**

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## INTRODUCTION

Today, approximately 8 billion people live worldwide, and 10% constitute the population over 65 (geriatric population). The general population is estimated to be 9.7 billion in 2050, and this geriatric population will double (United Nations Department, 2022). In recent years, there has been a noticeable increase in the geriatric patient population admitted to the emergency department (ED) in the world and our country, and therefore in geriatric trauma patients. More than 1 million geriatric patients are exposed to trauma annually, which will increase yearly (Zafar et al., 2015). 30.75% of trauma patients admitted to the ED are geriatric patients (Chang et al., 2016). Trauma is the leading cause of mortality and morbidity in elderly patients. Head traumas account for approximately 20% of elderly trauma patients admitted to the ED (Baykan et al., 2022). Compared to young age, the elderly exposed to head trauma are three times more likely to die and need more care. Even if there is no death in the acute period in patients exposed to trauma, it was reported that the incidence of death in these patients increases within 12 months (Zafar et al., 2015). The elderly differ from the young and adults because of their comorbidities, physical and physiological changes, and the drugs they use. Geriatric patients with head trauma should be evaluated differently, and their diagnosis and treatment should be regulated in the early period. They must be evaluated by physicians experienced in trauma centers and the elderly. However, considering the increased geriatric patient population, it is understood that this is unlikely to be possible. Therefore, in this section, we summarized the approach to geriatric patients admitted to the ED with head trauma and aimed to present a way for physicians who encounter this patient group.

### 1. Etiology

Geriatric age is generally used as >65 years. However, the patients' chronological and biological ages are generally different. While chronological age is the actual number of years a person has lived, physiological age defines the physiological functional capacity of the patient's organ systems. Frailty, defined as age-related decline in physiological function in multiple organ systems, increases the likelihood that patients will experience both traumas (especially falls) and have poor outcomes after trauma (Joseph et al., 2014).

These comorbidities in elderly patients, such as unilateral weakness secondary to stroke, make them more susceptible to falls. Moreover, older patients often take more medication, which can cause confusion, accelerate falls, or worsen bleeding. For example, using anticoagulants or antiaggregants may increase traumatic intracranial hemorrhagic complications by up to 15.9% and worsen the prognosis by causing increased bleeding (Alrajhi et al., 2015). These chronic conditions, combined with the effects of polypharmacy, result in a reduced capacity of elderly patients to compensate for traumatic injuries.

## **2. Epidemiology**

The most common cause of trauma in the elderly is falls (83%) (Williams et al., 2015). The probability of falling within one year has been calculated as 27% (Ganz et al., 2007). These falls are most often on flat ground – from the same level. Usually, while these falls are mild in young people, they may have more severe consequences in the elderly. The causes of falls are weakness due to chronic diseases, balance and gait disorders, polypharmacy, general condition loss, poor reaction times, cognitive disorders, alcohol consumption, syncope, and vision loss. Patients who have fallen within the past year are more likely to have recurrent falls (Bonne & Schuerer, 2013). The second most common cause of trauma is motor vehicle accidents. Elderly people exposed to high-energy trauma are three times more likely to die than younger people. Other causes of trauma are non-vehicle traffic accidents, accidents related to other modes of transportation, firearm injuries, and sharp/stab wounds (Sandstrom & Nunez, 2018).

## **3. Pathophysiology**

With aging, a series of anatomical and physiological changes occur in the body, making elderly patients prone to bleeding after head trauma.

### **3.1. Cerebral Atrophy**

The space between the arachnoid and dura mater increases due to decreased brain parenchyma volume. This condition leads to the stretching of the bridging veins and their vulnerability to rupture. Contrary to young people, subdural hemorrhages are more common in the elderly with bleeding from these vascular structures. Besides, since the space between is large, the bleeding must be more severe than usual for symptoms to occur. This situation causes

the neurological symptoms to appear later and the diagnosis to be delayed (Adhiyaman et al., 2002).

### **3.2. Hypertension**

It causes an increase in wall tension in the veins. It is a risk factor that increases the likelihood of an aneurysm and rupture and increases the probability of subarachnoid hemorrhage by up to 180% (Teunissen et al., 1996).

### **3.3. Decreased Cerebral Autoregulation**

Cerebral blood flow is reduced after the head injury, resulting in hypoxic brain injury (Beedham et al., 2019)

### **3.4. Cerebrovascular Atherosclerosis**

It contributes to the reduction of cerebrovascular autoregulation and is associated with an increased risk of spontaneous intracerebral hemorrhage (Qureshi., 2009).

## **4. Outcomes of Head Trauma**

The most common traumatic lesions in geriatric patients with head trauma are cerebral contusions and subdural hemorrhages (Beedham et al., 2019).

### **4.1. Skull Fracture**

The condition is classified by location, appearance, and degree of depression (Vieira et al., 2016). It may cause damage to the brain parenchyma, veins, and cranial nerves. CSF leakage can result in intracranial hypotension and secondary subdural hemorrhage. Skull fractures occur less frequently compared to young people. This is because they are exposed to lower-energy traumas, and their skull bones thicken with age.

### **4.2. Subdural Hemorrhage**

It is the most common bleeding in geriatric head traumas, characterized by bleeding into the space between the dura and the arachnoid matter following acute arterial or parenchymal injury. The most common etiology of chronic subdural hemorrhage is the rupture of bridging veins crossing the arachnoid and dura in cerebral atrophy and/or intracranial hypotension (Zare., 2012).

### **4.3. Cerebral Contusion**

It is defined as small-volume focal micro hemorrhage areas that occur due to damage to the small veins of the brain parenchyma. The contusion may be close to the side of the impact, but it is often located on the opposite side of the impact (contrecoup). It causes a focal neurological deficit. Although not specific to the elderly, temporal and frontal region contusions are more common in this age group (Modi, et al., 2016).

### **4.4. Traumatic Subarachnoid Hemorrhage**

This usually occurs due to direct injury to a vein or injury secondary to a sudden increase in intravascular pressure. It is characterized by bleeding into the subarachnoid space filled with CSF (Jauch & Elias., 1999).

### **4.5. Intracerebral Hemorrhage**

It is the collection of blood within the brain parenchyma. The hemorrhage is classified according to etiology and occurs most frequently due to causes such as hypertension and less frequently due to trauma. It results in focal damage due to direct local pressure or more extensive damage due to increased intracranial pressure (Kurland, et al., 2012).

### **4.6. Epidural Hemorrhage**

It is the least common bleeding after trauma in the elderly. Skull fractures occur in 75-90% of patients. The most common mechanism of injury is the rupture of the middle meningeal artery as it passes through the foramen spinosum (Demetriades & Kobayashi., 2017).

### **4.7. Diffuse axonal injury**

This syndrome represents microscopic damage to the neural pathway, brain stem, and corpus callosum axons. It is defined as a coma lasting longer than 6 hours following traumatic brain injury without underlying ischemic lesion or edema (Bullock et al., 2006).

## **5. History**

Obtaining complete and accurate information about the history of elderly patients who have had head injuries is vital. Detailed information should be

acquired about the mechanisms of the trauma, the drugs used, and the known diseases. For example, dysrhythmias may predispose to falls by causing balance disturbance, dizziness, or syncope; beta-blockers may cause confusion in the interpretation of vital signs; anticoagulants such as warfarin increase the risk of intracranial hemorrhage after minor head injuries. Anticoagulants are used in at least 10% of patients who present with trauma. These drugs increase the rate and amount of bleeding, thus increasing the likelihood of morbidity and mortality (Donze et al., 2012).

The high rate of dementia in elderly patients causes them to be unable to recognize their symptoms or express themselves, and diagnosis is delayed. It is difficult and unreliable to obtain anamnesis from unconscious patients with dementia or mental disorders. Information about these patients should be obtained from themselves, as well as from their caregivers, relatives, or witnesses to the event (Rathlev et al., 2006). A history of syncope increases the possibility of a head injury. Geriatric patients with head trauma usually admit to the ED with complaints of headache (not always in the trauma area), scalp injury, dizziness, nausea, vomiting, blurred vision, temporary loss of consciousness, weakness, and rarely seizures. Associating the current hemodynamics and conscious state in these patients with the underlying disease may lead to an incomplete diagnosis and approach. Therefore, taking a detailed anamnesis is crucial for accurate and effective diagnosis.

## **6. Physical Examination**

The geriatric trauma patient should be examined as both a trauma patient and a medical patient. Vital signs and state of consciousness, which could be normal at the time of admission, should not be misleading. As people age, the myocardium stiffens, its pumping efficiency decreases, and it becomes less sensitive to catecholamines. Furthermore, if these patients also use the beta-blocker group and/or antihypertensive drugs, tachycardia may be masked, and the blood pressure value found may not be accurate. For all these reasons, we should not rely too much on the vital values of elderly trauma patients at the time of admission (Baykan et al., 2022).

### **6.1. Primary Survey**

Primary survey should be initiated quickly and carefully, as with all trauma patients. The primary assessment of geriatric trauma patients is not different from other patients (airway, breathing, circulation, disability, exposure). When examining the airway, the presence of dentures (which may obstruct the airway), arthritis in the neck (which may complicate the stabilization of the neck), or arthritis of the temporomandibular joint (which may prevent mouth opening) should be considered. It should be kept in mind that respiratory muscles may be weakened, and degenerative changes in the chest wall may reduce respiratory capacity (Salottolo et al., 2014).

### **6.2. Secondary Survey**

A thorough secondary survey is required to detect severe damage. Elderly patients may have difficulty localizing the examination findings, which may obscure the findings of the patients. Especially in patients with poor mental functions, bruises on inspection may be evidence of trauma. In the head examination, bleeding focus, presence of neural tissue outside, hemotympanum, otorrhea, rhinorrhea, raccoon eyes, and battle's sign findings should be determined. The presence of a collapse fracture in the head should be investigated by palpation. The presence of bilateral light reflex, decorticated or decerebrate posture, seizure, and Cushing's triad (hypertension, bradycardia, and irregular breathing) should also be evaluated. It should be kept in mind that patients with no apparent life-threatening damage may deteriorate rapidly without warning if the physiological reserve is limited (Ferraris et al., 2010).

## **7. Evaluation**

Although frequently used to evaluate trauma patients, Glasgow Coma Scale (GCS) may not be reliable in elderly trauma patients. Due to the reasons mentioned above, the elderly may have higher GCS compared to young people with the same degree of head trauma at the time of admission to the emergency department since symptoms appear later. This condition may be misleading and cause delays in diagnosis and treatment (Kehoe et al., 2014). Cranial computed tomography (CT) is the imaging modality of choice for evaluating elderly patients with significant head injuries. Considering their comorbidities, inability to express themselves adequately, inadequate history, and unreliable physical examination, cranial CT should be performed in all elderly patients

with head trauma. The Canada and Nexus II criteria were developed for patients with head trauma, recommending that a cranial CT scan be performed on each patient with a head injury over age 65. The American College of Emergency Physicians (ACEP) also recommends a cranial CT scan for all elderly patients with head trauma (Jagoda et al., 2009).

## **8. Management**

Subdural, epidural hematoma, and intraparenchymal hemorrhage require surgical treatment if they meet certain criteria. The neurosurgery department should be consulted immediately. Usually, a burr hole or craniectomy is required. If there is bleeding that requires surgical treatment, it should be intervened within 4 hours. Patients who do not require surgical treatment but have GCS <8 should be followed up in intensive care units. Non-surgical treatment includes head elevation, sedation, analgesia, mechanical hyperventilation to maintain normal pCO<sub>2</sub>, euthermia, antiepileptics, mannitol (or hypertonic saline) infusion, and intracranial pressure monitoring (NICE, 2014).

## **9. Patients Using Anticoagulant or Antiaggregant Drugs**

NICE recommends that treatment with prothrombin complex concentrate (PCC) should be initiated immediately for patients using warfarin if they have suspected or confirmed intracranial hemorrhage. Recombinant factor VIIa or fresh frozen plasma is not a preferred treatment in these patients. Other measures include 5-10 mg intravenous vitamin K, immediate discontinuation of anticoagulant therapy, and follow-up with serial international normalised ratio (INR) measurement (Beedham et al., 2019). For patients using Dabigatran, a factor II inhibitor, treatment should be administered with Idarucizumab. PCC or Andexanant is recommended for those using factor X inhibitor new generation oral anticoagulants. Tranexamic acid can also be used. Tranexamic acid, platelet replacement, and recombinant-activated factor VIIa are recommended for those using antiplatelet drugs. The most critical problem is when the patient who has had bleeding can start these drugs again. The risk of thrombosis and recurrent intracranial bleeding should be compared, and the decision should be made accordingly. Guidelines report



that anticoagulant and antiaggregant treatments can be started 7-10 days later in patients with hemorrhage due to head trauma (Beedham et al., 2019).

### **10. Seizures**

Seizures may develop in approximately 30% of patients with hemorrhage due to head trauma. Most seizures occur within the first 24 hours after injury (Beedham et al., 2019). About 8-16% will suffer from post-traumatic epilepsy within two years. Levetiracetam is recommended as a prophylactic antiepileptic medication (Xu et al., 2016).

### **11. Prognosis**

Elderly patients with head trauma have high mortality and low recovery rates. In a cohort study performed in the United Kingdom, the inpatient mortality rate was 22.9%, the long-term moderate disability rate was 10.8%, and the rate of severe disability requiring permanent assistance in activities of daily living was 5.3% (Hawley et al., 2017).

### **12. Discharge**

Patients using oral anticoagulants with INR within the therapeutic range and normal cranial CT findings can be discharged with recommendations. Those with high INR values should be followed up for 6-8 hours. Anticoagulant treatment does not need to be discontinued in patients with head trauma who have a normal physical examination and cranial CT and use anticoagulant drugs (Clare & Zink., 2021). Prevention of falls through patient education is essential to reduce injuries. Canes, walkers, and eventually wheelchairs can help prevent injuries. Carpets and rugs can be removed to prevent tripping and falling in homes.

## **CONCLUSION**

In conclusion, anamnesis and physical examination are unreliable in evaluating geriatric head trauma patients, and their vital signs and GCS may also be misleading. Hence, cranial CT should be performed in all patients with head trauma, even if it is mild. Measures should be developed to prevent high mortality and morbidity falls due to elder age.

**REFERENCES**

- Adhiyaman, V., Asghar, M., Ganeshram, K. N., & Bhowmick, B. K. (2002). Chronic subdural haematoma in the elderly. *Postgraduate medical journal*, 78(916), 71-75. doi: 10.1136/pmj.78.916.71.
- Alrajhi, K. N., Perry, J. J., & Forster, A. J. (2015). Intracranial bleeds after minor and minimal head injury in patients on warfarin. *The Journal of emergency medicine*, 48(2), 137-142. doi: 10.1016/j.jemermed.2014.08.016.
- Baykan, N., Durukan, P., Ömer, S. A. L. T., Yakar, Ş., Kantar, Y., Kaymaz, N., & Özkan, S. (2022). Examination of Geriatric Trauma Patients Presenting to the Emergency Department. *Phoenix Medical Journal*, 4(1), 22-26.
- Beedham, W., Peck, G., Richardson, S. E., Tsang, K., Fertleman, M., & Shipway, D. J. (2019). Head injury in the elderly—an overview for the physician. *Clinical Medicine*, 19(2), 177-84. doi: 10.7861/clinmedicine.19-2-177.
- Bonne, S., & Schuerer, D. J. (2013). Trauma in the older adult: epidemiology and evolving geriatric trauma principles. *Clinics in geriatric medicine*, 29(1), 137-150. doi: 10.1016/j.cger.2012.10.008.
- Bullock, M. R., Chesnut, R., Ghajar, J., Gordon, D., Hartl, R., Newell, D. W., ... & Wilberger, J. E. (2006). Surgical Management of Acute Epidural Hematomas. *Neurosurgery*, 58, S7-15; Discussion Si-iv.
- Chang, M. C., Stewart, R. M., & Rotondo, M. F. (2016). National trauma data bank 2016 annual report. *Chicago, IL: American College of Surgeons*, 4-5.
- Clare, D., & Zink, K. L. (2021). Geriatric trauma. *Emergency Medicine Clinics*, 39(2), 257-271. doi: 10.1016/j.emc.2021.01.002.
- Demetriades D , Kobayashi L .(2017) Skullfractures. *BMJ*,<http://bestpractice.bmj.com/topics/en-gb/398>.
- Donzé, J., Clair, C., Hug, B., Rodondi, N., Waeber, G., Cornuz, J., & Aujesky, D. (2012). Risk of falls and major bleeds in patients on oral anticoagulation therapy. *The American journal of medicine*, 125(8), 773-778. doi: 10.1016/j.amjmed.2012.01.033.

- Ferraris, V. A., Ferraris, S. P., & Saha, S. P. (2010). The relationship between mortality and preexisting cardiac disease in 5,971 trauma patients. *Journal of Trauma and Acute Care Surgery*, 69(3), 645-652.
- Ganz, D. A., Bao, Y., Shekelle, P. G., & Rubenstein, L. Z. (2007). Will my patient fall?. *Jama*, 297(1), 77-86. doi: 10.1001/jama.297.1.77.
- Hawley, C., Sakr, M., Scapinello, S., Salvo, J., & Wrenn, P. (2017). Traumatic brain injuries in older adults—6 years of data for one UK trauma centre: retrospective analysis of prospectively collected data. *Emergency medicine journal*, 34(8), 509-516. oi: 10.1136/emered-2016-206506.
- Jagoda, A. S., Bazarian, J. J., Bruns Jr, J. J., Cantrill, S. V., Gean, A. D., Howard, P. K., ... & Whitson, R. R. (2009). Clinical policy: neuroimaging and decision making in adult mild traumatic brain injury in the acute setting. *Journal of Emergency Nursing*, 35(2), e5-e40.
- Jauch, E. C., & Elias, B. (1999). Intracerebral hemorrhage pathophysiology and management. *Air Medical Journal*, 18(2), 62-67.
- Joseph, B., Pandit, V., Rhee, P., Aziz, H., Sadoun, M., Wynne, J., ... & Friese, R. S. (2014). Predicting hospital discharge disposition in geriatric trauma patients: is frailty the answer?. *Journal of Trauma and Acute Care Surgery*, 76(1), 196-200. doi: 10.1097/TA.0b013e3182a833ac.
- Kehoe, A., Rennie, S., & Smith, J. E. (2015). Glasgow Coma Scale is unreliable for the prediction of severe head injury in elderly trauma patients. *Emergency medicine journal*, 32(8), 613-615. doi:10.1136/emered-2013-203488).
- Kurland, D., Hong, C., Aarabi, B., Gerzanich, V., & Simard, J. M. (2012). Hemorrhagic progression of a contusion after traumatic brain injury: a review. *Journal of neurotrauma*, 29(1), 19-31. doi: 10.1089/neu.2011.2122.
- Modi, N. J., Agrawal, M., & Sinha, V. D. (2016). Post-traumatic subarachnoid hemorrhage: A review. *Neurology India*, 64(7), 8. doi: 10.4103/0028-3886.178030.
- National Institute for Health and Care Excellence (2014). Head injury: Assessment and early management. Clinical guideline. *NICE* .

- Qureshi, A. I., Mendelow, A. D., & Hanley, D. F. (2009). Intracerebral haemorrhage. *The Lancet*, 373(9675), 1632-1644. doi: 10.1016/S0140-6736(09)60371-8.
- Rathlev, N. K., Medzon, R., Lowery, D., Pollack, C., Bracken, M., Barest, G., ... & Mower, W. R. (2006). Intracranial pathology in elders with blunt head trauma. *Academic Emergency Medicine*, 13(3), 302-307. doi: 10.1197/j.aem.2005.10.015.
- Salottolo, K., Levy, A. S., Slone, D. S., Mains, C. W., & Bar-Or, D. (2014). The effect of age on Glasgow Coma Scale score in patients with traumatic brain injury. *JAMA surgery*, 149(7), 727-734.
- Sandstrom, C. K., & Nunez, D. B. (2018). Head and neck injuries: special considerations in the elderly patient. *Neuroimaging Clinics*, 28(3), 471-481. doi: 10.1016/j.nic.2018.03.008.
- Teunissen, L. L., Rinkel, G. J., Algra, A., & Van Gijn, J. (1996). Risk factors for subarachnoid hemorrhage: a systematic review. *Stroke*, 27(3), 544-549. doi: 10.1161/01.str.27.3.544.
- United Nations Department of Economic and Social Affairs, Population Division. World Population Prospects (2022): Summary of Results (UNDESA/POP/2021/TR/NO.3).<https://www.un.org/development/desa/pd/content/World-Population-Prospects-2022>.
- Vieira, R. D. C. A., Paiva, W. S., De Oliveira, D. V., Teixeira, M. J., De Andrade, A. F., & Sousa, R. M. C. D. (2016). Diffuse axonal injury: epidemiology, outcome and associated risk factors. *Frontiers in neurology*, 7, 178. doi: 10.3389/fneur.2016.00178.
- Williams, H., Caplan, B., Bogner, J., Brenner, L., Cuthbert, J. P., Harrison-Felix, C., & Whiteneck, G. G. (2015). Epidemiology of adults receiving acute inpatient rehabilitation for a primary diagnosis of traumatic brain injury in the United States. *Journal of head trauma rehabilitation*, 30(2), 122-135. doi: 10.1097/HTR.0000000000000012.
- Xu, J. C., Shen, J., Shao, W. Z., Tang, L. J., Sun, Y. Z., Zhai, X. F., ... & Zheng, J. Y. (2016). The safety and efficacy of levetiracetam versus phenytoin for seizure prophylaxis after traumatic brain injury: A systematic review and meta-analysis. *Brain injury*, 30(9), 1054-1061.

- Zafar, S. N., Obirieze, A., Schneider, E. B., Hashmi, Z. G., Scott, V. K., Greene, W. R., ... & Haider, A. H. (2015). Outcomes of trauma care at centers treating a higher proportion of older patients: the case for geriatric trauma centers. *Journal of trauma and acute care surgery*, 78(4), 852-859. doi: 10.1097/TA.0000000000000557.
- Zare, M. A., Ahmadi, K., Zadegan, S. A., Farsi, D., & Rahimi-Movaghar, V. (2012). Effects of brain contusion on mild traumatic brain-injured patients. *International journal of neuroscience*, 123(1), 65-69. doi: 10.3109/00207454.2012.728653.

## **CHAPTER 11**

### **APPROACH TO ABDOMINAL TRAUMA IN GERIATRIC PATIENT GROUP**

MD. Alper GOK<sup>1</sup>

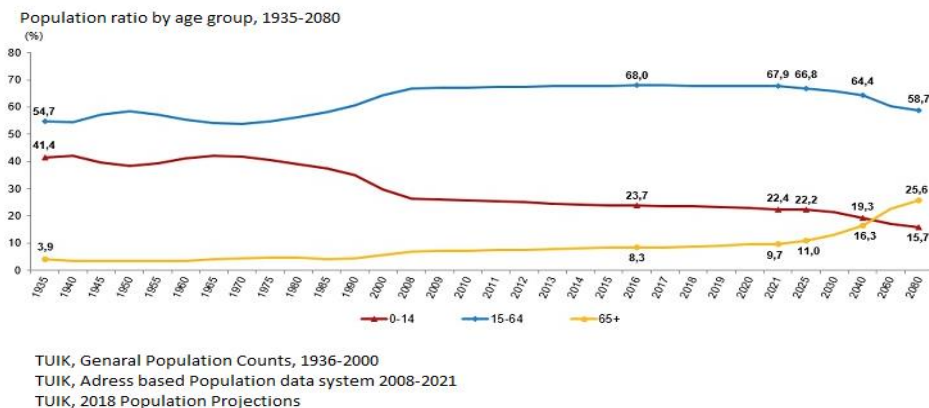
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## INTRODUCTION

The elderly population is used to describe people aged 65 and over. The population over the age of 65 has increased by 24.0% in the last five years, in line with the 2021 data of the Turkish Statistical Institute. While the proportion of the elderly population in the total population was 8.3% in 2016, it increased to 9.7% in 2021. The increase in the elderly population in the general population also indicates that the health problems of the elderly population will become more important day by day; shows that the average age of the patient population encountered in the provision of health services will increase day by day.



**Figure 1.** The elder population ratio is increasing by years and it's estimated to reach %25.6 of population by 2080

The geriatric patient population in emergency service admissions has been evaluated in studies; In a study 19% of the total patients admitted to emergency department in a year were geriatric patients, the proportion of elderly patients admitted by ambulance was 37.4%, and 16.1% of geriatric patients admitted by ambulance and 11.8% of outpatients were due to trauma (Kaldirim U. et al., 2013)

The approach to geriatric abdominal traumas is discussed in this section. Although the approach to trauma is similar to the younger population in general, the issues that should be considered in the management of elderly patients are the age-related decrease in organ functions; concomitant comorbid diseases; drugs currently used by the patient and their interactions with each other; Depending on the decreased cognitive and physical capacity of the patient, there is difficulty in the anamnesis due to hearing and speech problems, and



indistinct or absent examination findings. The underlying congestive heart failure and respiratory problems mislead the clinician in the evaluation of the patient and the response to treatment (ATLS; 2018, chapter 11, 214-223)

### **1. Anatomically Abdomen**

Abdomen can be defined from the costal margins to the inguinal folds anteriorly, and from the lower border of the scapula to the upper border of the gluteal region posteriorly. Topographically, it can be evaluated in 9 areas anteriorly (Picture 1) (Flynn W, Vickerton P. 2022).

Region 1: Liver, Gallbladder, Right Kidney, Small Intestine

Region 2: Stomach, Liver, Pancreas, Duodenum, Spleen, Adrenal Glands

Region 3: Spleen, Colon, Left Kidney, Pancreas

Region 4: Gallbladder, Liver, Right Colon

Region 5: Umbilicus, Jejunum, Ileum, Duodenum

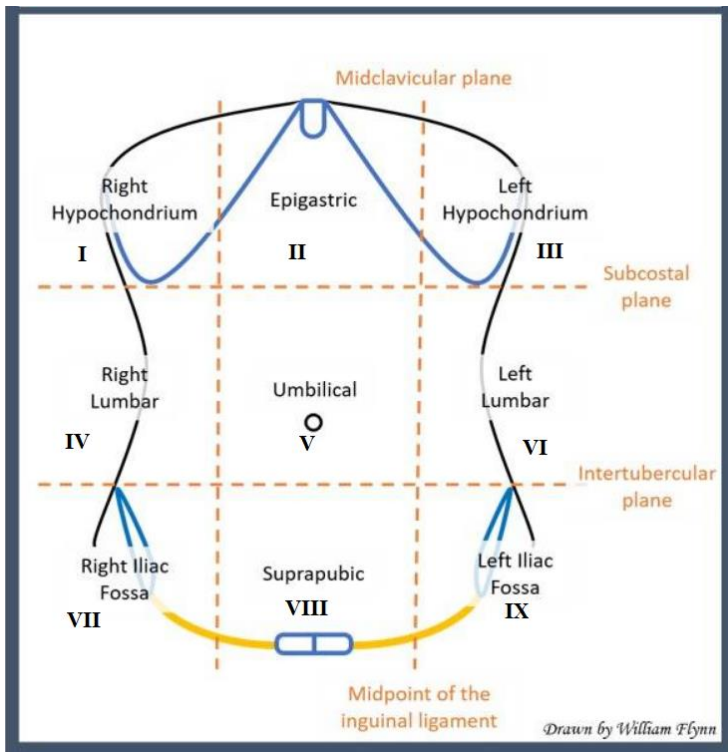
Region 6: Descending Colon, Left Kidney

Region 7: Appendix, Cecum

Region 8: Urinary Bladder, Sigmoid Colon, Female Reproductive Organs

Region 9: Descending Colon, Sigmoid Colon

(Flynn W, Vickerton P. 2022)



Pic 1. Regions of abdomen

## 2. Abdominal traumas according to their mechanisms:

- Blunt Traumas,
- Penetratingtraumas
- Blast-like injuries with blunt and penetrating trauma together.

(ATLS;2018, chapter 5, 82-99)

### 2.1.Blunt Traumas

These are traumas on a large surface that can collectively affect interrelated structures within the abdomen. Includes compression, tensioner, acceleration, deceleration injuries. The most common cause is traffic accidents and secondly mechanical falls (Demetriades D. Et al. 2003, Intravia JM. et al., 2013)

The traumas force causes deformation and rupture of organs which leads to hemorrhage and intraabdominal contaminations

A deceleration injury which is caused by a traffic accident or falling from too high can cause lacerations of liver and spleen by sudden changes of momentum (PHTLS 8<sup>th</sup> edition ; 362-373)

## **2.2. Penetrating Traumas**

The common causes of penetrating traumas are caused by stabbing or gunshot; but in elder patients impalement from falling onto an object is another common cause. These traumas damages by tearing and lacerating. Most commonly the damage involves the liver (40%), small bowel (30%), diaphragm (20%), and colon (15%). All penetrating traumas on the chest pelvis or back of the torso should be assumed penetrating the abdomen until abdominal penetration is excluded (PHTLS 8<sup>th</sup> edition; 362-373)

## **2.3. Blast Traumas**

Blast traumas combines penetrating and blunt traumas by explosive pressure and projectile damage or environmental objects the distance from blast radius is the main cause of the damage but secondary injuries can present later; systemic approach should be used to treat the victims.

The abdominal traumas are resulted in death %15 to %20 in all of the trauma deaths, that ratio should be decreased by diagnosing and treating the patient soon after admission to the hospital (Tintinalli's 9<sup>th</sup> edition; 1751-1755)

## **3. Assessment and Management**

### **3.1. Primary Assessment**

While performing the primary evaluation, the trauma patient should be evaluated with the following systematic:

- Brief consciousness check
- A (Airway – C-spine) : Provide airway safety/cervical immobilization
- B (Breathing / Ventilation)
- C (Circulation/Hemorrhage Control):
- D (Disability): Brief neurological assessment
- E (Exposure):Removal of clothing, protection from hypothermia

First of all elder trauma patients who have altered circulation should be considered as bleeding caused by intraabdominal organ laceration.

Primary assessment can help us to recognize patients in shock but the patients chronic diseases or medication can mask the symptoms or physiologic responses of trauma (PHTLS 8<sup>th</sup> edition ; 362-373).

## **3.2. Secondary Assessment**

### **3.2.1. History**

In geriatric traumas we should question the following:

- The mechanism of the trauma (eg, time passed, trauma energy, vehicles speed, airbag status, height of fall)
- Other situations that leads to trauma (eg, Chest pain, vertigo )
- Patients comorbidities and chronic diseases (eg, cerebrovascular disease history, hypertension )
- Patient's prescribed medications and using habits (eg, betablockers, anticoagulants)
- The patients consciousness level before the trauma (to evaluate the central nervous system pathology) (ATLS;2018, chapter 5, 82-99)

### **3.2.2. Physical Examination**

Signs and symptoms in abdominal trauma may occur immediately or may occur later. For this reason, abdominal evaluation should be done in detail during the secondary evaluation. All quadrants must be evaluated carefully and repeatedly, penetrating or major wounds like gunshots can be observed in primary assessment but altering conditions can hide secondary injuries.(PHTLS 8<sup>th</sup> edition; 362-373)

As usual inspection, palpation, auscultation and percussion are the main parts of physical examination; but we should consider that palpation findings of patients with altered mental status is not reliable at all.

As many as 45% of blunt trauma patients thought to have a benign abdomen on initial physical exam are later found to have a significant intra-abdominal injury (Tintinalli's 9<sup>th</sup> edition; 1751-1755)

### **3.2.3 Additional diagnostic tools**

- Diagnostic peritoneal lavage (DPL)
- Focused assessment with sonography for trauma (FAST)
- X-ray
- Computed tomography (CT)

DPL can be performed rapidly in resuscitation area, to hemodynamic unstable patients to detect bleeding and bowel injury but it is invasive, not repeatable and has risk of procedural complications.

On the other hand FAST is also can be performed rapidly in the resuscitation area and it is noninvasive and can be performed repeatedly but it is operator dependent to visualize pathologic findings and retroperitoneal injuries can not be seen.

CT scans are also repeatable; noninvasive , visualizes bone, soft tissue, intraabdominal extraluminal air and retroperitoneal structures but the patients are exposed to radiation and IV contrast and it requires transport of the patients. (PHTLS; chapter 13, 362-373)

#### **4. Management**

Early evaluation and consultation for surgery is important for hemodynamically unstable patients. For patients with suspected intraabdominal hemorrhage, the systolic blood pressure should be maintained at a minimum of level of 90 mm Hg.

Hemodynamic instability, intra-abdominal, or retroperitoneal air on X-ray or CT, persistent hypotension, evisceration of bowel or peritonitis are indications for emergency laparotomy. (ACS; 2008:111-126.)

scan, DPL and FAST can be used in stable patients with recurring physical examinations through the observation period. Nonoperative management can be chosen in hemodynamically stable blunt hepatic and splenic injured patients. (Cannon JW et al, 2017)

Patients on anticoagulants should be treated with appropriate antidotes. Tranexamic acid should be considered in traumatic abdominal hemorrhage. It is proven that administration within 1 hour reduces the risk of death; if the treatment of the patient with severe hemorrhage lasts more than 3 hours it implicates an increased risk in death. (Napolitano LM, et al. 2013) If a patient's discharge is considered from emergency department suggestion of follow ups is needed. Patient should be aware of red flags like fever, vomiting, dizziness, loss of consciousness, new onset pain to admit to emergency department again (Tintinalli's 9<sup>th</sup> edition; 1751-1755).

## 5. References

1. American College of Surgeons (ACS) Committee on Trauma. (2008). Advanced Trauma Life Support for Doctors, Student Course Manual. 8th ed. Chicago, IL: ACS; 111-126.
2. ATLS Subcommittee, American College of Surgeons' Committee on Trauma, & International ATLS working group (2018). Advanced trauma life support (ATLS®): the tenth edition. Chapter 11, 214-223
3. Cannon, J. W., Khan, M. A., Raja, A. S., Cohen, M. J., Como, J. J., Cotton, B. A., Dubose, J. J., Fox, E. E., Inaba, K., Rodriguez, C. J., Holcomb, J. B., & Duchesne, J. C. (2017). Damage control resuscitation in patients with severe traumatic hemorrhage: A practice management guideline from the Eastern Association for the Surgery of Trauma. *The journal of trauma and acute care surgery*, 82(3), 605–617.
4. Demetriades, D., Murray, J., Charalambides, K., Alo, K., Velmahos, G., Rhee, P., & Chan, L. (2004). Trauma fatalities: time and location of hospital deaths. *Journal of the American College of Surgeons*, 198(1), 20–26.
5. Flynn W, Vickerton P. (2022). Anatomy, Abdomen and Pelvis, Abdominal Wall. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing
6. Intravia, J. M., & DeBerardino, T. M. (2013). Evaluation of blunt abdominal trauma. *Clinics in sports medicine*, 32(2), 211–218.
7. Kaldirim, U., Tuncer, S. K., Ardic, S., Tezel, O., Eyi, Y. E., Arziman, I., ... & Eroglu, M. (2013). Analysis of elderly patients presenting to the emergency department via Ambulance *Turkish Journal of Emergency Medicine*, 13(4), 161-166.
8. Napolitano, L. M., Cohen, M. J., Cotton, B. A., Schreiber, M. A., & Moore, E. E. (2013). Tranexamic acid in trauma: how should we use it?. *The journal of trauma and acute care surgery*, 74(6), 1575–1586.
9. Prehospital Trauma Life Support Committee of The National Association of Emergency Medical Technicians in cooperation with the Committee on Trauma of the American College of Surgeons.(2016) PHTLS : prehospital trauma life support- Eighth edition. Chapter 13; 362-373

10. Rozycki, G. S., & Root, H. D. (2010). The diagnosis of intraabdominal visceral injury. *The Journal of trauma*, 68(5), 1019–1023.
11. Tintinalli J.E., & Ma O, & Yealy D.M., & Meckler G.D., & Stapczynski J, & Cline D.M., & Thomas S.H.(Eds.), (2020). *Tintinalli's Emergency Medicine: A Comprehensive Study Guide 9e*. McGraw Hill. C Chapter 263 1751-1755
12. Turkish statistical institution, TUIK; seniors with statistics. (2022, March 18) Access address (2022, December 20): <https://data.tuik.gov.tr/Bulten/Index?p=Istatistiklerle-Yaslilar-2021-45636>

## **CHAPTER 12**

### **EXTREMITY TRAUMAS IN GERIATRIC PATIENTS**

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## **INTRODUCTION**

Undesirable outcomes in the elderly population after physical traumas are higher than in other age groups due to the physiological changes that occur with advanced age. The elderly are more susceptible to severe injuries even after traumas, categorised as low-energy traumas. They also have a lower ability to withstand the stress of injury. They may suffer more from undesirable situations during the treatment or healing process. The primary reason for this situation is the physiological decrease in the functional capacities of the organ systems of the geriatric population. Concomitant diseases such as Diabetes Mellitus (DM), Coronary Artery Disease, Arthritis, kidney dysfunctions, and pulmonary diseases can reduce the physiological reserve of this population and complicate the healing process as a result of injuries (Morris et al., 1990) (Camilloni et al., 2008).

The injuries of the geriatric population are similar to the young-adult population. Nonetheless, this similarity does not hide the fact that the occurrence of trauma is often different.

The orthopaedic traumas of geriatric patients are usually caused secondary to low energy traumas, which differs from young-adult trauma admissions. These traumas can be caused by ground-level falls due to tangling to a small ledge or the corner of a carpet, as well as during simple physical therapy movements. Abilities that change and regress with advancing age, such as stance stability, balance, motor power coordination, and motor power response time, can cause staggering, tripping, and eventual fall in the geriatric population. The agitating fact is that skeletal conditions such as sarcopenia (loss of muscle density), osteoporosis and osteopenia (loss of bone density), usually seen in the geriatric population, increase the possibility of bone damage even though the trauma is a low-energy one. Furthermore, sarcopenia and osteopenia causes an increased possibility of a requirement for the rehabilitation of geriatric patients and the possibility of long-term hospitalisation secondary to post-traumatic injuries (Teng et al., 2021).

### **1.Pre-Hospitalisation**

Before transferring the patient to the Hospital/ A&E (Accident and Emergency, emergency room), healthcare personnel should be aware that minor trauma, such as falling from a low level or being hit by a low-speed motor

vehicle, can cause substantial injuries to elderly patients. Due to these reasons, the threshold point for the decision to transfer the patient to a trauma centre should be lower in elderly patients compared to younger patients (Fidan et al., 2020), (Cox et al., 2014)

## **2.Admission To The A&E Department**

When geriatric patients are admitted secondary to trauma, the evaluation should be not only for trauma but for both a trauma evaluation and a general medical examination should be performed. For example, cardiac dysrhythmia can be the reason for a ground-level fall. Cardiac-acting agents, such as beta-blockers, may mislead the patient's vital data interpretation. In another example, or, patients using medication that affects coagulation mechanisms, such as warfarin, are at risk of severe haemorrhage after pelvic fractures caused by very mild trauma. In patients with chronic diseases such as congestive heart failure, responses to resuscitation treatments may differ significantly (Clare et al., 2021)

In geriatric trauma patients, the time to obtain sufficient information about the trauma experienced by the patient and the patient's medical and medication history is limited. In this regard, reviewing the patient's medical records may be helpful. Relatives of the patient can also provide information about the trauma and the patient's medical history. The medicine utilisation of these patients should be carefully evaluated, as many may be on cardiac, diuretic, psychotropic and anti-coagulant medication.

## **3.Physical Examination**

The A&E physician should not fall into a false sense of confidence because of the vital signs of the patient that are within normal limits.

As age progresses, especially in the geriatric population, the cardiac muscles gradually become more rigid, and the efficiency of the pumping mechanism of the heart gradually weakens (Osler et al., 1988).

A geriatric patient without evidence of atherosclerotic coronary artery disease had shown a half-decreased cardiac output compared to a 20-year-old young adult. Moreover, the myocardium becomes less sensitive to endogenous and exogenous catecholamines. Conduction defects may not develop a tachycardic response to hypovolemia or may be suppressed. Likewise,

medication such as beta-blockers may shadow tachycardia and prevent a correct evaluation of the geriatric patient. The blood pressure levels can also be deceptive as the mentioned population might also have precedent hypertension. (Heffernan et al., 2010)

As a result, the A&E physician should carefully evaluate all the abovementioned factors and decide accordingly.

### **3.1.Primary Examination**

Once admitted to the A&E, the patient should be immediately and carefully examined as any other trauma patient. Any anatomic changes might cause difficulty in any intervention to check the airway, such as the presence of any denture which might cause airway obstruction or arthritis, which would increase the risk while positioning the neck, or arthritis at the temporomandibular joint to restrain the mouth opening should be taken into consideration.

In the geriatric population, the maximum inspiratory and expiratory power and capacity will be reduced by half compared to the patients in the young-adult population due to relatively weakened respiratory muscles and possible degenerative differences in the thoracic wall. The response of the geriatric population to conditions such as hypoxia and hypercarbia may also be suppressed. The response to acidosis, which delays the onset of clinical signs of the traumatic event, may also be suppressed.

The chronotropic response of geriatric trauma patients, especially to hypovolemia, is generally impaired. A baseline elevation of arterial pressure is expected in the geriatric population and may relatively hide hypotension. Haemorrhage might worsen secondary to the usage of anti-coagulant or anti-platelet medication (Aneesh et al., 2006).

### **3.2.Secondary Examination**

A thorough secondary examination following the primary is crucial and required to notice significant post-traumatic problems in the body. Many orthopaedic problems may not be severe enough to be noticed during the primary examination. (Fitschen-Oestern et al., 2020) (Fitschen-Oestern et al., 2019). It should be noted that such problems that are not considered severe can collectively cause significant morbidity and mortality. Patients who do not have a life-threatening injury at first glance can be potentially fatal if physiological

reserves are of limited value. Seemingly stable geriatric trauma patients can suddenly deteriorate without warning (Heffernan et al., 2010).

## **4. Orthopedic Injuries**

### **4.1. Pelvic Fractures**

The fact that geriatric trauma patients are predisposed to pelvic fractures after low-energy traumas, which we can count as simple, is unique compared to other age groups. In addition, the amount of haemorrhage seen in the geriatric population for a similar fracture is much higher than in other age groups. (Krappinger et al., 2012)

The shape of the fractures does not show a significant difference between young adult or geriatric patients when all patients are considered. The most common are pubic rami fractures. When compared, lateral compression fractures are more common than anteroposterior fractures. Although mortality and morbidity rates in fractures caused by lateral compression mechanisms in young adults seem to be decreased compared to fractures formed by anteroposterior mechanisms, it is the exact opposite in the geriatric population. Haemorrhage and the resulting need for transfusion are much higher in the geriatric population. As mentioned above, the risk of haemorrhage is much higher in patients using anti-coagulant drugs, and pelvic fractures that occur with low-energy mechanisms, which seem simple, can cause haemorrhage that can cause harmful and undesirable results. Therefore, a high level of suspicion for pelvic fractures is crucial. (Krappinger et al., 2012) (Dechert et al., 2009)

If X-Ray imaging does not provide sufficient information or has doubts during pelvic or hip fractures, further imaging methods such as Computerised Tomography (CT) or Magnetic Resonance Imaging (MRI) should be carried out. Even though MRI provides better results than CT for pelvic and proximal femoral fractures, CT evaluation is faster and more common (Haj-mirzaian et al., 2020).

### **4.2. Hip Fractures**

The individuals of this population are inevitably susceptible to hip fractures. In a geriatric patient, a hip fracture should be considered if there is a pain in the hip region, limitation of joint movements, external rotation and shortness of the leg, even after a low-energy trauma (Aksu et al., 2008).

We can mention hip fractures in three primary locations:

- Intertrochanteric Fractures
- Femoral Neck Fractures
- Subtrochanteric Fractures

#### **4.2.1.Femoral Neck Fractures**

A pain radiating to the inner part of the hip is present in non-displaced fractures. The pain can be noticed when the heel is hit upwards. Hip movements will be painful. The patient may walk painfully, albeit with a limp. If the diagnosis is delayed or missed, the fracture may become displaced. In displaced femoral neck fractures, the leg will have an outer rotation. The leg will be shorter than the other side, severe pain will be present, and the patient will not be able to walk. (Aksu et al., 2008)

#### **4.2.2.Intertrochanteric Fractures**

These fractures are four times more common than femoral neck fractures. Another remarkable fact is that three out of four intertrochanteric fractures occur in the geriatric population due to falling from ground level. Furthermore, a significant part of low-energy trauma occurs in the home environment. The patient will mention a direct trauma to the trochanter major or a sudden hip rotation during the fall. (Aksu et al., 2008)

Intertrochanteric Fractures occur between the major and minor trochanters, typically observed in the older age group, such as femoral neck fractures. Knowing the pre-trauma leg functions of the patient is crucial to determine the target level to be obtained following the initial treatment.

Intertrochanteric fracture regions will have severe haemorrhage (up to three units), and this high volume haemorrhage causes severe hypovolemia in the geriatric population. In this type of fracture, the injured leg will be shorter than the other side, and it can show an outer rotation of up to 90 degrees. Localised ecchymosis will be present in the hip area. The thigh will have an enlarged appearance secondary to oedema and haemorrhage. Joint movements will be painful, and the patient will not be able to weigh on the injured leg. (Aksu et al., 2008)

#### **4.2.3. Subtrochanteric femoral fractures:**

They form 7% to 20% of all femoral fractures (Aksu et al., 2008)

Similar to other fractures, it may result from high-energy trauma in young adults but may occur in the geriatric population after low-energy trauma (such as a simple fall). It occurs at approximately 5 cm between the distal region of the minor trochanter. The injured extremity will be shorter and rotated outwards, and the knee will be flexed.

Fractures caused by lateral compression are common in elderly patients. This condition can result in vascular damage, which necessitates an invasive procedure. Geriatric patients with hip fractures, such as pelvic fractures, are more likely to develop complications in operative interventions. Therefore, higher mortality rates are observed in geriatric patients compared to young adult patients. For example, late-recognised pelvic or hip fractures can cause avascular necrosis and morbidity. (Swiontkowski et al., 1993)

Despite the frequency of hip fractures encountered in geriatric patients, insufficient attention is paid to hip fractures encountered in geriatric patients (although they are actual emergency patients by nature).

Surgery for hip fractures is recommended in most patients and situations, except when the patient is immobile or has comorbidities that prevent surgery. Pulmonary complications are reduced if surgery for the operational repair of hip fractures can be performed within the first 24 hours (Kenzora et al., 1984) (Eiskjaer et al., 1991)

There is a significant improvement in both avascular necrosis development rates and 30-day mortality rates compared to repairs performed more than 12 hours after the repair is performed within the first 12 hours. In general, delays in operative interventions are more frequent in those with overnight or weekend hospital admissions (Massie, 1973) .

#### **4.3. Long Bone Fractures**

Long bone fractures seen in the femur, tibia and humerus cause loss of mobility and thus lead to a deterioration in the independent lifestyle of geriatric patients.

For patients with long bone fractures to become mobile earlier, orthopaedic consultation should be performed early to ensure early evaluation of surgery. (Tintinalli, J., E. 2013)

#### **4.4.Upper Extremity Fractures**

Upper extremity injury mechanisms usually occur after falling on an open hand. Diagnosis is usually made by X-Ray imaging.

In geriatric patients, humeral head and surgical neck fractures also increase due to falling on an open hand or the elbow. Sensitivity, oedema and ecchymosis proximal to the humerus are characteristic findings of these injuries. Early treatment with shoulder-arm fixation or surgical fixation should be performed (Tintinalli, J., E. 2013)

#### **RESULT**

As a result, pathological fractures should be considered in geriatric patients who present even with low-energy mechanisms and should be approached with suspicion. If X-Ray imaging does not provide sufficient information or has doubts, further imaging methods such as Computerised Tomography (CT) or Magnetic Resonance Imaging (MRI) should be carried out. Haemodynamic follow-up of geriatric patients should be done by considering the pre-traumatic medical condition of the patient (such as regular medication and chronic diseases). Early orthopaedic consultation and, if necessary, early orthopaedic surgical treatment methods help maintain the patient's quality of life.



## REFERENCES

- Aksu., N., Işıklar., Z., U. (2008) Hip fractures. TOTBID Turkish Orthopedics and Traumatology Association Journal, 7 (1-2), 8-19  
[https://dergi.totbid.org.tr/uploads/pdf\\_432.pdf](https://dergi.totbid.org.tr/uploads/pdf_432.pdf)
- Aneesh T., N., Rishi S. (2006). Resuscitation of the Elderly. *Emergency Medicine Clinics of North America*, 24(2), 261-272  
<https://doi.org/10.1016/j.emc.2006.01.001>.
- Camilloni, L., Farchi, S., Rossi, P., G., Chini, F., Borgia, P. (2007). Mortality in elderly injured patients: the role of comorbidities. *International journal of injury control and safety promotion*, 15(1), 25-31  
 doi: 10.1080/17457300701800118
- Clare, D., Zink, K., L. (2021). Geriatric trauma. *Emergency medicine clinics of north america*, 39(1), 257-271  
<https://doi.org/10.1016/j.emc.2021.01.002>.
- Cox, S., Morrison, C., Cameron, P., Smith, K. (2014). Advancing age and trauma: triage destination compliance and mortality in victoria, australia. *Injury international journal of the care of the injured*, 45(19), 1312-1319. <https://doi.org/10.1016/j.injury.2014.02.028>
- Dechert, T., A., Duane, T., M., Frykberg, B., P., Aboutanos, M., B., Malhotra, A., K., Ivatury, R., R. (2009) Elderly patients with pelvic fracture: interventions and outcomes. *The american surgeon*. 75(4), 291-295. doi:10.1177/000313480907500405
- Eiskjaer, S., Ostgård, S., E. (1991) Risk factors influencing mortality after bipolar hemiarthroplasty in the treatment of fracture of the femoral neck. *Clin orthop relat res*. 270, 295-300.
- Fidan, S., Kurtoğlu Çelik, G., Özhasenekler, A., Şener, A., Tanrıverdi, F., Pamukçu Günaydın, G., Yıldırım, Ç., Gökhan, S. (2020). Evaluation of revised trauma score in geriatric trauma patients. *Ankara med j* 2020(3), 578-587. doi:10.5505/amj.2020.24993
- Fitschen-Oestern, S., Lippross, S., Lefering, R., Klüter, T., Behrendt, P., Weuster, M., Seekamp, A., Dgu, T. (2020). Missed hand and forearm injuries in multiple trauma patients: an analysis from the traumaregister dgu®. *Injury*. 51(7), 1608-1617. doi: 10.1016/j.injury.2020.04.022.

- Fitschen-Oestern, S., Lippross, S., Lefering, R., Besch, L., Klüter, T., Schenzer-Hoffmann, E., Seekamp, A. (2019). *Missed foot fractures in multiple trauma patients. BMC Musculoskelet Disord* 20, 121 <https://doi.org/10.1186/s12891-019-2501-8>
- Haj-Mirzaian., A., Eng., J., Khorasani., R., Raja., A.,S., Levin., A.,S., Smith, S.,E., Johnson, P.,T., Demehri., S. (2020) Use of advanced imaging for radiographically occult hip fracture in elderly patients: a systematic review and meta-analysis. *Radiology*, 296(3), 521-531. doi: 10.1148/radiol.2020192167.
- Heffernan, D., S., Thakkar, R., K., Monaghan, S., F., Ravindran, R., Adams, C., A., Kozloff, M., S., Gregg, S., C., Connolly, M., D., Machan, J., T., Cioffi, W., G. (2010). Normal presenting vital signs are unreliable in geriatric blunt trauma victims. *The journal of trauma: injury, infection, and critical care* 69(4), 813-820 doi: 10.1097/TA.0b013e3181f41af8
- Kenzora, J.,E., McCarthy, R.,E., Lowell, J.,D., Sledge, C.,B. (1984) Hip fracture mortality. Relation to age, treatment, preoperative illness, time of surgery, and complications. *Clin orthop relat res.* 186, 45-56.
- Krappinger, Dietmar., Zegg, M., Jeske, C., El Attal, R., Blauth, M., Rieger, M. (2012) Hemorrhage after low-energy pelvic trauma. *The journal of trauma and acute care surgery* 72(2), 437-442 doi: 10.1097/TA.0b013e31822ad41f
- Massie, W.,K. (1973) Treatment of femoral neck fractures emphasizing long term follow-up observations on aseptic necrosis. *Clin orthop relat res.* 92, 16-62. doi: 10.1097/00003086-197305000-00004.
- Morris, J. A., MacKenzie, E. J., Edelstein, S. L. (1990). The effect of preexisting conditions on mortality in trauma patients. *JAMA*, 263(14), 1942–1946. doi:10.1001/jama.1990.03440140068033
- Osler, T., Hales, K., Baack, B. (1988). Trauma in the elderly. *Am j surg*, 156,537
- Swiontkowski, M.,F., Tepic, S, Rahn, B.,A., Cordey, J., Perren, S.,M. (1993). The effect of fracture on femoral head blood flow. Osteonecrosis and revascularization studied in miniature swine. *Acta Orthop Scand.* 64(2), 196-202. doi:10.3109/17453679308994570
- Teng, Z., Zhu, Y., Teng, Y., Long, Q., Hao, Q., Yu, X., Yang, L., Lv, Y., Liu, J., Zeng, Y., Lu, S. (2021). The analysis of osteosarcopenia as a risk

factor for fractures, mortality, and falls. *Osteoporosis international*, 32, 2173-2183 doi:10.1007/s00198-021-05963-x

Tintinalli., J., E. (2013) Geriyatrik travma. *Tintinalli acil tıp, kapsamlı bir çalışma klavuzu*. 1683-1687 ISBN: 978-975-420-944-0

## **CHAPTER 13**

### **APPROACH TO ABDOMINAL PAIN IN GERIATRIC PATIENTS**

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## **INTRODUCTION**

As a result of the increase in the elderly population all over the world, the rates of elderly patients are increasing in hospital applications and especially emergency service applications. Abdominal pain is one of the most common complaints of these patients. Although the causes of abdominal pain in elderly patients are similar to the general population, it is possible to encounter difficulties in diagnosing due to excessive drug use, changes in physiology, difficulties in taking anamnesis , and additional diseases. ( Chanana et al., 2015)

Abdominal pain in elderly patients progresses more quietly compared to other age groups. Some of the reasons are increased endogenous opiate secretion, decrease in nerve conduction and mental illness.Prolonged diagnosis in elderly patients presenting with abdominal pain causes increased mortality and morbidity rates. For this reason, there is great importance to reach the diagnosis faster in specific patient populations. (Fillit et al., 2016)

### **1. Anamnesis-Diagnosis**

The use of a large number and variety of drugs causes delays in diagnosis in geriatric patient population. For example, non-steroidal anti-inflammatory drugs (NSAID) and steroid -containing drugs used by patients cause peritonitis findings to become indistinct, and beta- blockers cause tachycardia response to decrease.Leukocytosis and fever response due to changing physiology also manifests later and more indistinctly compared to other age groups. The decreased number of T cells also makes it difficult for elderly patients to cope with infectious diseases. (Ersel, 2014)

Problems may also occur in communicating with patients due to reasons such as previous cerebrovascular diseases, dementia, hearing problems, and depression. For all these reasons, it should be kept in mind to approach the geriatric patient population more carefully and to keep in mind the difficulties in reaching the diagnosis. (Lyon et al., 2006)

## **2. Causes of Abdominal Pain**

### **2.1. Gallbladder Diseases**

The most common cause of abdominal pain in the geriatric population is diseases associated with the gallbladder and biliary tract. The most common need for surgical intervention in patients who apply to the hospital with abdominal pain is also in biliary tract diseases. Among these diseases are cholecystitis and cholangitis . Unlike younger patients, cholecystitis presents with a more subtle clinic in elderly patients. Even in cases with empyema, abdominal pain may be less or even absent compared to young people (Martinez et al.,2006)

Elderly patients who need urgent cholecystectomy have a higher mortality than younger patients. However, the results are good in those who have elective surgery. Minimally invasive procedures such as endoscopic retrograde cholangiopancreatography and laparoscopic cholecystectomy should be used as often as possible. ( Polychronidis et al., 2008)

### **2.2. Acute Appendicitis**

Acute appendicitis is the third most common cause of abdominal pain in the elderly, after biliary tract diseases and nonspecific abdominal pain. The risk of perforation in elderly appendicitis cases is 60% higher than in the younger population. Fever, leukocytosis, right lower quadrant pain , which are typical findings, are less common in elderly patients. Since peritoneal irritation findings are more subtle, it is likely to be confused with other diseases. In the foreground it is confused with urinary tract infections. It should be kept in mind that the inflamed appendix may cause pyuria and hematuria by affecting the adjacent ureter . Crohn's disease, gastroenteritis , pelvic inflammatory disease , ovarian cysts and cecal diverticulitis are other diseases that should be considered in the differential diagnosis. (Omari et al.,2014)

In most cases, ultrasonography is sufficient to make the diagnosis. An uncompressed appendix of 6 mm or more seen on ultrasound is the diagnostic criteria. The diagnosis should be clarified by abdominal tomography in patients who cannot be diagnosed with other methods.For patients with a pre-diagnosis of acute appendicitis, general surgery consultation should be

promptly requested and prophylactic antibiotic therapy should be initiated. (Fu et al., 2014)

### **2.3. Small Bowel Obstruction**

In elderly patients, small bowel obstruction is mostly caused by adhesions and hernias due to previous surgery. Physical examination findings are similar to the younger population. Widespread and colic abdominal pain, nausea and vomiting are seen in the vast majority of patients. Peritoneal irritation findings occur in the presence of perforation. (Ozturk et al., 2018)

Diagnosis is usually made by direct abdominal X- ray. The radiograph shows enlarged small bowel loops (greater than 2.5 cm), air fluid levels, and pause of large bowel gas. In addition, direct radiograph findings may be normal in some of the patients. Gallstone ileus is a rare but important cause of small bowel obstruction. It should be kept in mind especially in patients with a history of biliary tract disease. (Pavlidis et al., 2003)

### **2.4. Large Intestine Obstruction**

The most common cause of large bowel obstruction in elderly patients is malignancies. Non-obstructive malignancies do not usually cause acute abdominal pain. The most common causes of large bowel obstruction in the elderly after carcinoma are diverticulitis and volvulus. Sigmoid volvulus is the most common volvulus. (Fillit et al., 2016).

In the anamnesis, patients most frequently complain of vomiting, constipation and bloating. Enlarged large bowel loops on direct X -ray are helpful in diagnosis. Expansions over 9 cm pose a risk for perforation . Contrast-enhanced tomography of the abdomen is the best method to confirm the diagnosis. (Sanson et al., 1996).

### **2.5. Pancreatitis**

Abdominal pain and vomiting are the most common complaints in patients with pancreatitis . The prognosis of the disease is poor compared to younger patients. Mortality rates are higher than the general population. (Lyon et al., 2006).



Among the most common causes of pancreatitis in elderly patients, we can list alcohol, gallbladder diseases, infections, and hypertriglyceridemia. The most common cause is gallstones. Patients present with nausea, vomiting, and epigastric abdominal pain. Amylase and lipase are used in the diagnosis. Lipase and amylase has similar sensitivities . The specificity of lipase is slightly higher. (Gloor et al., 2002).

## **2.6. Peptic Ulcer**

Helicobacter pylori infections and overuse of the drugs are the most common causes of peptic ulcer in elderly patients. The presence of peptic ulcer alone can progress without symptoms . In some cases , there is no abdominal pain before the perforation occurs . The symptoms present are less severe and are not easily localized. (Pilotto et al., 2010)

Elevated serum amylase level and leukocytosis can be helpful for the diagnosis of perforation . The presence of free air on the direct X -ray also strengthens the diagnosis. However, in most cases, free air is not seen on direct X -ray. Barium radiography and endoscopy are sufficient to diagnose peptic ulcer. However, it is contraindicated in suspected perforation . If the diagnosis is uncertain, ultrasound and tomography can be used to show free air and fluid in the abdomen. (Ersel, 2014)

## **2.7. Diverticular Disease**

Incidence of diverticular disease increases with age. It often occurs in the colon region. It develops into painful diverticular disease or diverticulitis in 10 to 30 percent of patients . Painful diverticular disease is characterized by attacks of localized pain without inflammation . It usually turns into diverticulitis after microperforations. The diagnosis is usually made clinically. Barium radiographs or colonoscopy should not be used as they will enlarge the perforation area (Rezapour et al., 2019)

## **2.8. Vascular Diseases**

### **2.8.1. Abdominal Aortic Aneurysm**

Abdominal aortic aneurysm (AAA) usually starts from the infrarenal level and extends to the iliac arteries. They are mostly detected during routine

controls or incidentally. Older men who smoke, have hypertension and family history are at risk. (Lyonet al., 2006)

The vast majority of patients are asymptomatic. If there are symptoms, these are nonspecific symptoms such as abdominal pain, back pain. Severe abdominal pain, back and flank pain, hypotension, and a pulsatile abdominal mass noticed during examination occur in the presence of perforation. The classic triad of AAA perforation (hypotension, back pain and pulsatile mass) is seen in 25-50% of patients. It can be confused with diseases such as cholecystitis, renal colic, diverticulitis . Therefore, there may be delays in diagnosis. Bedside ultrasound in diagnosis is very important in distinguishing it from other intra-abdominal events in the pre-diagnosis. Tomography can be performed to clarify the diagnosis of clinically stable patients (Lyon et al., 2006).

### **2.8.2. Mesenteric Ischemia**

Acute mesentery ischemia is an uncommon disease with a high mortality rate. It is one of the diseases that are difficult to diagnose because it appears with nonspecific symptoms. It can occur with 4 different pathologies. These are superior mesenteric artery (SMA) embolism, SMA thrombosis , mesentery vein embolism and non-occlusive mesentery ischemia (Fillit et al., 2016)

Among the complaints of the patients, there are nonspecific complaints such as abdominal pain, nausea and vomiting. This increases the probability of confusion with other diseases. With tomography, intestinal wall thickening, edema and hemorrhages and gas in the intestinal wall can be detected. It can be used to rule out other abdominal diseases. If the diagnosis of mesenteric ischemia is highly probable, angiography should be performed ( Kärkkäinen et al., 2016).

### **2.9. Other Reasons**

Abdominal pains originating from the genitourinary system are also encountered. Especially urinary tract infections and pyelonephritis are common diseases. Renal colic is another disease that should be kept in mind as the incidence of renal stones increases with age. Incidence of constipation

also increases with age. Both a low-fiber diet and reduced mobility increase constipation. Constipation is an important problem especially in bedridden patients and may progress to ileus. Intra-abdominal malignancies, myocardial infarction , lower lobe pneumonias , pneumothorax , pulmonary embolism may also present with abdominal pain (Fillit et al., 2016)

As a result, there are many diseases that should be kept in mind in patients presenting with abdominal pain in the elderly patient population. Considering the patient-related problems, more care should be taken in making the diagnosis in the geriatric patient population. The diagnosis process may be prolonged due to both the difficulty of communication with the patients and the indifference of the physiological findings. Considering all these, it would be appropriate to pay special attention to the geriatric patient population.

### 3. REFERENCES

- Chanana, L., Jegaraj, M. A., Kalyaniwala, K., Yadav, B., & Abilash, K. (2015). Clinical profile of non-traumatic acute abdominal pain presenting to an adult emergency department. *Journal of family medicine and primary care*, 4(3), 422–425.
- Ersel, M. (2014). Acute abdominal pain in geriatric patient. *Ege Journal of Medicine*, 53, 2637.
- Fillit, H. M., Rockwood, K., & Young, J. B. (2016). *Brocklehurst's textbook of geriatric medicine and gerontology*. Elsevier Health Sciences.
- Fu, J., Zhou, X., Chen, L., & Lu, S. (2021). Abdominal ultrasound and its diagnostic accuracy in diagnosing acute appendicitis: a meta-analysis. *Frontiers in Surgery*, 8, 707160.
- Gloor, B., Ahmed, Z., Uhl, W., & Büchler, M. W. (2002). Pancreatic disease in the elderly. *Best practice & research clinical Gastroenterology*, 16(1), 159-170
- Kärkkäinen, J. M. (2016). Acute mesenteric ischemia in elderly patients. *Expert Review of Gastroenterology & Hepatology*, 10(9), 985-988.
- Lyon, C., & Clark, D. C. (2006). Diagnosis of acute abdominal pain in older patients. *American family physician*, 74(9), 1537–1544.
- Omari, A. H., Khamash, M. R., Qasaimeh, G. R., Shammari, A. K., Yaseen, M. K. B., & Hammori, S. K. (2014). Acute appendicitis in the elderly: risk factors for perforation. *World Journal of Emergency Surgery*, 9(1), 1-6.
- Ozturk, E., van Iersel, M., Stommel, M. M., Schoon, Y., Ten Broek, R. R., & van Goor, H. (2018). Small bowel obstruction in the elderly: a plea for comprehensive acute geriatric care. *World Journal of Emergency Surgery*, 13(1), 1-8.
- Pavlidis, T. E., Atmatzidis, K. S., Papaziogas, B. T., & Papaziogas, T. B. (2003). Management of gallstone ileus. *Journal of hepato-biliary-pancreatic surgery*, 10(4), 299-302.
- Pilotto, A., Franceschi, M., Maggi, S., Addante, F., & Sancarlo, D. (2010). Optimal management of peptic ulcer disease in the elderly. *Drugs & aging*, 27(7), 545-558.

- Polychronidis, A., Botaitis, S., Tsaroucha, A., Tripsianis, G., Bounovas, A., Pitiakoudis, M., & Simopoulos, C. (2008). Laparoscopic cholecystectomy in elderly patients. *Journal of Gastrointestinal and Liver Diseases: JGLD*, *17*(3), 309-313.
- Rezapour, M., & Stollman, N. (2019). Diverticular disease in the elderly. *Current Gastroenterology Reports*, *21*(9), 1-10.
- Sanson, T. G., & O'Keefe, K. P. (1996). Evaluation of abdominal pain in the elderly. *Emergency Medicine Clinics*, *14*(3), 615-627.
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## **CHAPTER 14**

### **CHRONIC KIDNEY DISEASE IN THE ELDERLY**

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## INTRODUCTION

The kidneys are bean-shaped organs located on the right and left sides between vertebrae T12-13 on either side of the vertebral column in the posterior abdominal wall (Hansen, 2017). The main function of the kidney, which is so valuable to our body, is to remove and dispose of metabolic waste from the blood. It also regulates body fluids in terms of volume, content, and pH. Another function is the secretion of erythrocyte hormones and the regulation of blood pressure, which plays a role in calcium absorption through the activation of vitamin D (Coca, 2010; Floege et al., 2010). Older age affects many organs and causes both structural and functional changes in the kidneys. Functional and anatomical changes in the kidneys over the coming decades vary, as shown in **Table 1** (Dede, 2017).

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**Table 1** Functional and anatomical changes in the kidneys

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Decrease in renal growth factors

Decrease in the nitric oxide production

Decrease in maximal osmolality

Increased apoptosis

Thickening of the large vessel wall

Decrease in the number and size of tubules

Decrease in renal blood flow (10%/decade after the age of 40)

Decrease in glomerular filtration value (1 mL/min/year after the age of 45)

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Chronic kidney disease (CKD) is a progressive condition associated with loss of kidney function caused by irreversible damage to the nephron and is due to various etiological factors. Chronic kidney injury is typically associated with changes in the glomerular filtration rate (GFR). GFR decreases with increasing age, and CKD is more prevalent in the elderly (Coca, 2010; Munang & Starr, 2010). Chronic kidney injury is defined as abnormalities (structural/functional) of the kidney lasting 3 months or longer and a low glomerular filtration rate (GFR) of 60 ml/min/1.73 m<sup>2</sup>, whether



there is a decrease in glomerular filtration rate. Chronic kidney disease progresses in stages is shown in **Table 2**. Low GFR indicates decreased reserve and should be used as a guide for risk in elderly individuals. The decrease in GFR may be masked by the decrease in muscle mass in the elderly. Serum creatinine remains at normal levels despite the decrease in GFR). Therefore, small increases in serum creatinine in the elderly indicate a serious decline in renal function ("K/DOQI clinical practice guidelines for chronic kidney disease: evaluation, classification, and stratification," 2002; Levey et al., 2003).

<b>Table 2</b> Chronic Kidney Disease Stages				
Stage	GFR (mL/min/1.73m <sup>2</sup> )	Definition	Creatinine (mg/dl)	Clinic
1	>90	When renal function within normal limits presence of evidence of kidney damage	Normal	underlying disease
2	60-90	Mildly decreased renal function with evidence of renal injury	Normal	underlying disease
3	30-59	Moderately decreased renal function	2	+ hypertension, hyperparathyroidism
4	15-29	Severe decreased renal function	4	Anemia
5	<15 or dialysis	: N18.0- End-stage renal disease	8	+ Water and sodium retention, complaints of uremia, pulmonary edema, hyperkalemia, metabolic acidosis
GFR: Glomerular filtration rate				

## **1. CKD Etiology**

Factors affecting progression in chronic kidney disease (Munang & Starr, 2010);

- Advanced age, race, obesity, smoking.
- GFR level, presence, and severity of albuminuria
- Diabetic nephropathy
- Anemia, hypercalcemia, hyperphosphatemia
- Systemic hypertension
- Metabolic acidosis, inflammation
- Protein synthesis, dietary factors
- Exposure to nephrotoxic agents
- History of cardiovascular disease
- Urinary tract obstruction
- Hyperglycemia, dyslipidemia

Diabetes mellitus is the most common cause of CKD, and 32.7% of patients undergoing hemodialysis as their first renal replacement therapy (RRT) in our country have diabetes mellitus, compared with 26% in United Kingdom (UK) (Gilg et al., 2013). Also, in geriatric patients, renovascular disease and hypertension are caused CKD. Other etiologic causes include obstructive uropathy, myeloma, and systemic vasculitis in elderly patients. The factors that affect young patients more are glomerulonephritis, pyelonephritis, and polycystic kidney disease (EREK et al., 2010; Schiffrin et al., 2007).

## **2. CKD Clinical Symptoms and Findings**

In the advanced stages, CKD is usually asymptomatic. On examination of elderly patients hospitalized for various reasons, chronic kidney injury is found to be present. Clinical manifestations include symptoms such as loss of appetite, nausea, vomiting, fatigue, shortness of breath, peripheral edema, itching, cramps, and restless legs. There are no organs or systems that are not affected by chronic kidney injury (Bello et al., 2010; Munang & Starr, 2010;

Tomlinson & Wheeler, 2015). The effects of CKD on the systems are shown in **Table 3**. (Block et al., 2004; Go et al., 2004; Schiffrin et al., 2007).

<b>Table 3</b> Symptoms and findings in the process of chronic kidney disease and insufficiency	
<b>System</b>	<b>Findings</b>
Skin	Ischemic ulcers (calciphylaxis), hyperpigmentation, and itching marks as a result of calcium phosphate collapse on the vessel wall
Respiratory system	Kussmaul respiration, pulmonary edema after excessive fluid accumulation (uremic lung), pleural effusion, specific and nonspecific infections
Cardiovascular system CVS	Hypertension, cardiomyopathy, heart failure, ischemic heart disease, left ventricular hypertrophy, arrhythmias, uremic pericarditis
Gastroenterohepatic system	Stomatitis, nausea, vomiting, persistent hiccups, mucosal ulcerations, peptic ulcers, pancreatitis,
Metabolic findings	Diabetic curve in OGTT, hypoglycemia in diabetes, hypertriglyceridemia, hyperuricemia
Hemopoietic System:	Anemia, immunosuppression, bleeding diathesis
Endocrine system	Secondary hyperparathyroidism, impotence, sterility, hyperprolactinemia, menstrual irregularities, thyroid dysfunction
Locomotor System:	Renal osteodystrophy, adynamic bone disease, osteomalacia, spontaneous tendon rupture, carpal tunnel syndrome
Liquid Electrolyte Balance	Hypervolemia, hypovolemia, hyperpotassemia, hypopotassemia, hypernatremia, hypermagnesemia
Acid-base balance	Metabolic acidoses with increased anion opening and normal anion opening
Neuromuscular system	Autonomic neuropathy, involuntary movements, convulsions, restless leg syndrome, dialysis dementia
Psychiatric findings	Impairment of concentration, anxiety, agitation, depression, noncompliance with treatment

### **3. CKD Diagnosis Laboratory and Imaging**

Since chronic kidney disease usually does not show symptoms until the last period, the diagnosis of the disease is possible with urine and blood tests. For this purpose, diagnosis can be achieved by measuring creatinine in the blood, calculating the glomerular filtration rate (GFR), and determining protein/albumin in the urine (Levey & Stevens, 2010; Padhi et al., 2015; UK, 2014).

Structural abnormalities in the kidneys are visualized using ultrasound imaging. Renal ultrasonography is particularly important for ruling out a postrenal obstruction in the elderly. Renal artery doppler ultrasonography is required to detect renal artery stenosis in the presence of a rapid decline in glomerular filtration rate (GFR) and resistant hypertension (Munang & Starr, 2010).

Renal biopsy has no place in the investigation of the underlying disease in patients with advanced CKD (Munang & Starr, 2010).

### **4. Acute Kidney Failure in Chronic Kidney Disease**

It is a sudden decline in kidney function in patients with known CKD. The presence of acute kidney injury in CKD significantly increases morbidity and mortality. Acute renal failure may develop with some reversible factors accompanying CKD. These include medications, postrenal obstruction, dehydration, infection, hypertension, heart failure, metabolic causes, and interstitial nephritis (Mercado et al., 2019; Tomlinson & Wheeler, 2015).

### **5. Clinical Interventions and Treatment Methods in CKD**

When investigating comorbidities that accompany patients with CKD due to their advanced age, previous biochemical results related to kidney function levels should be reviewed, and serum creatine levels should be monitored and evaluated in terms of cardiovascular risk. Patients with end-stage renal failure should be trained on a healthy lifestyle (Munang & Starr, 2010; Tomlinson & Wheeler, 2015).

If we look at the parameters that vary in CKD patients;

### **5.1. Anemia (Rayner & Imai, 2010; Venkat et al., 2006)**

- It occurs when GFR is 60 ml/min/1.73 m<sup>2</sup>, and its incidence increases when GFR is below 30 ml/min/1.73 m<sup>2</sup>.
- Causes: EPO deficiency, nutritional disorders, iron deficiency
- The target hemoglobin level should be between 10.5-12 gr/dL.
- Erythropoietin (EPO) treatment is started when the hemoglobin level is below 10 gr/dL after 1-2 months of iron deficiency.

### **5.2. Mineral and Bone Disorders (Saner et al., 2005)**

*Stage 3 CKD characteristics;*

- Hyperphosphatemia
- Elevated PTH
- 1.25(OH)<sub>2</sub>D Intestinal Ca absorption is decreased.
- Phosphorus restriction in diet Phosphorus binding drugs (calcium acetate, sevelamer)
  - In treatment: Active vitamin D (calcitriol), vitamin D analogs (paricalcitol)
  - Calcium-sensitizing medications (cinacalcet), Parathyroidectomy

### **5.3. CVS diseases (Giachelli, 2004; Zucchelli & Zuccalà, 1993)**

Cardiovascular problems are 20 times more common in CKD than in the normal population.

- Addressing traditional risk factors in the prevention and treatment of CVS diseases should be the main goal.
- Salt-free diet, ACEi/ARB for ht,

### **5.4. Acute Neurological Problems (Mistry, 2019; Rayner & Imai, 2010)**

- Peripheral neuropathy, autonomic neuropathy
- Restless leg syndrome, sleep disorders

### **5.5. Nutrition (Rayner & Imai, 2010; Thomas & Bishop, 2013)**

For most patients with nondialysis eGFR <60 mL/min/1.73 m<sup>2</sup>;

- Daily protein intake 0.8 g/kg
- A vegetable-rich diet
- 5 g/day salt (5.75 g/day salt for nonhypertensive, overloaded, or proteinuric individuals)
- Potassium intake should be guided by serum potassium levels.
- Maximum phosphorus intake of 0.8 to 1 g/day even if serum phosphorus concentration is normal
- Maximum calorie intake 25 to 35 kcal/kg/day
- Maximum fat intake, < 30% of daily energy intake, saturated fat < 10%
- Daily fiber intake 25 to 34 g/day

### **5.6. Renal Replacement Therapy (RRT)**

The onset of uremic symptoms is seen earlier in older patients than in younger patients. It is recommended to start RRT without waiting until creatinine clearance has fallen below 10 ml/min, particularly in patients with heart failure. Patient selection is important in deciding on renal replacement therapy. Clinical factors are particularly important in the elderly population with chronic diseases (Munang & Starr, 2010).

In geriatric patients, hemodialysis frequently preferred as renal replacement therapy (RRT). It is recommended to initiate RRT when occurs symptomatic uremia, fluid balance difficulty, malnutrition, or cognitive impairment. These symptoms usually occur when the GFR drops to 5 to 10 mL/min/1.73 m<sup>2</sup> (Saner et al., 2005).

Patients usually receive dialysis treatment, three appointment session per week in hospital units, each 3 to 5 h. For appropriate patients are considered home hemodialysis but, it is limited. In elderly patients, arteriovenous vascular (AV) access fistulas, AV grafts, and catheters are preferred. (Collins et al., 1999).

Sometimes patients need to be taken urgently to HD, which are (Nee et al., 2016);

- Uremic signs and symptoms (such as encephalopathy, hemorrhage, pericarditis)
- Findings of hypervolemia (such as shortness of breath and distension)
- Uncontrolled hypertension
- Severe metabolic acidosis (pH<7.2)
- Hyperkalemia (K> 6.5 mEq/l)
- Calcium/phosphorus imbalance accompanying hypocalcemic tetany

The advantages and disadvantages of hemodialysis treatment for patients are shown in **Table 4.** (Collins et al., 1999).

<b>Table 4</b> Hemodialysis treatment advantages/disadvantages	
<b>Advantages</b>	<b>Disadvantages</b>
<ul style="list-style-type: none"> <li>- Taking care of the patient 2-3 times a week for 4-6 hours with dialysis treatment, free time at other times</li> <li>- Less obesity as it affects metabolic balance less</li> <li>- Less encounter with malnutrition</li> <li>- Less need for hospitalization</li> <li>-Rapid fluid, urea, and creatinine removal</li> <li>- Reduction in serum triglycerides</li> <li>-Effective potassium removal</li> </ul>	<ul style="list-style-type: none"> <li>-Elevated vascular access pathway problems</li> <li>- Excessive use of central catheters</li> <li>- High risk of septicemia</li> <li>-Diet and fluid restriction</li> <li>-Heparinization requirement</li> <li>- Development of complications, such as imbalance syndrome and hypotension during dialysis</li> <li>- There is a need for specially trained personnel</li> </ul>

Peritoneal dialysis (PD), another renal replacement therapy (RRT), has advantages in terms of patient comfort. It offers more spare time because the patient can adjust his dialysis at home according to his daily work (Dimkovic & Oreopoulos, 2002; Wang et al., 2002). However, peritoneal dialysis contraindicated that major abdominal surgery/ peritoneal adhesions, unrepaired hernias or respiratory dysfunction. Common problems of

peritoneal dialysis include infection and fluid overload. Because, hemodialysis may be required as inadequate ultrafiltration. For these reasons, PD cannot be used in most elderly patients (Collins et al., 1999). In our country, it was reported that 11.7% of the patients who started PD as their first RRT and were enrolled in the chronic PD program in 2010 were in the 65-to 74-year-old age group, and 5.1% were in the 75-year-old and older group (Collins et al., 1999; EREK et al., 2010).

At the end-stage renal failure, kidney transplantation is applied as a best treatment options. There are two options for kidney transplantation: living donor and cadaver. A kidney transplant can restore kidney function and is preferable over dialysis treatment. However, transplantation is not considered for many elderly patients because of the difficulty in finding donor organs. The comorbidities of elderly patients and their shorter life expectancy also play a role (Friedman, 2011; Karim et al., 2014).

## **CONCLUSION**

As the elderly population increases worldwide, the number of patients receiving dialysis and continuing dialysis increases. The increase in the diagnosis of diabetes recently has also increased the number of people with kidney disease. Early identification of risk factors helps in the diagnosis of asymptomatic diseases in elderly individuals. As patients age, their monitoring should intensify, and patients should be consulted to nephrologists. Also, patients should be informed about the prognosis of the disease and possible course of their treatment options.



## REFERENCES

- Bello, A., Kawar, B., El Kossi, M., & El Nahas, M. (2010). Epidemiology and pathophysiology of chronic kidney disease. In *Comprehensive clinical nephrology* (pp. 907-918). Elsevier.
- Block, G. A., Klassen, P. S., Lazarus, J. M., Ofsthun, N., Lowrie, E. G., & Chertow, G. M. (2004). Mineral metabolism, mortality, and morbidity in maintenance hemodialysis. *J Am Soc Nephrol*, *15*(8), 2208-2218. <https://doi.org/10.1097/01.Asn.0000133041.27682.A2>
- Coca, S. G. (2010). Acute kidney injury in elderly persons. *Am J Kidney Dis*, *56*(1), 122-131. <https://doi.org/10.1053/j.ajkd.2009.12.034>
- Collins, A. J., Hao, W., Xia, H., Ebben, J. P., Everson, S. E., Constantini, E. G., & Ma, J. Z. (1999). Mortality risks of peritoneal dialysis and hemodialysis. *Am J Kidney Dis*, *34*(6), 1065-1074. [https://doi.org/10.1016/s0272-6386\(99\)70012-0](https://doi.org/10.1016/s0272-6386(99)70012-0)
- Dede, F. (2017). Yaşlı Hasta ve Böbrek. *Istanbul Medical Journal*, *18*(2).
- Dimkovic, N., & Oreopoulos, D. G. (2002). Chronic peritoneal dialysis in the elderly. *Semin Dial*, *15*(2), 94-97. <https://doi.org/10.1046/j.1525-139x.2002.00038.x>
- EREK, E., SÜLEYMANLAR, G., & SERDENGEÇTİ, K. (2010). TÜRKİYE'DE NEFROLOJİ-DİALİZ VE TRANSPLANTASYON.
- Floege, J., Johnson, J., & Feehally, J. (2010). Renal anatomy in comprehensive clinical nephrology. In: Elsevier.
- Friedman, A. L. (2011). Cautious renal transplantation for the elderly is realistic. *Nephron Clin Pract*, *119 Suppl 1*, c14-18. <https://doi.org/10.1159/000328020>
- Giachelli, C. M. (2004). Vascular calcification mechanisms. *J Am Soc Nephrol*, *15*(12), 2959-2964. <https://doi.org/10.1097/01.Asn.0000145894.57533.C4>
- Gilg, J., Rao, A., & Fogarty, D. (2013). UK Renal Registry 16th annual report: chapter 1 UK renal replacement therapy incidence in 2012: national and centre-specific analyses. *Nephron Clin Pract*, *125*(1-4), 1-27. <https://doi.org/10.1159/000360020>
- Go, A. S., Chertow, G. M., Fan, D., McCulloch, C. E., & Hsu, C. Y. (2004). Chronic kidney disease and the risks of death, cardiovascular events,

- and hospitalization. *N Engl J Med*, 351(13), 1296-1305. <https://doi.org/10.1056/NEJMoa041031>
- Hansen, J. T. (2017). *Netter's Clinical Anatomy E-Book*. Elsevier Health Sciences.
- K/DOQI clinical practice guidelines for chronic kidney disease: evaluation, classification, and stratification. (2002). *Am J Kidney Dis*, 39(2 Suppl 1), S1-266.
- Karim, A., Farrugia, D., Cheshire, J., Mahboob, S., Begaj, I., Ray, D., & Sharif, A. (2014). Recipient age and risk for mortality after kidney transplantation in England. *Transplantation*, 97(8), 832-838. <https://doi.org/10.1097/01.TP.0000438026.03958.7b>
- Levey, A. S., Coresh, J., Balk, E., Kausz, A. T., Levin, A., Steffes, M. W., Hogg, R. J., Perrone, R. D., Lau, J., & Eknoyan, G. (2003). National Kidney Foundation practice guidelines for chronic kidney disease: evaluation, classification, and stratification. *Ann Intern Med*, 139(2), 137-147. <https://doi.org/10.7326/0003-4819-139-2-200307150-00013>
- Levey, A. S., & Stevens, L. A. (2010). Estimating GFR using the CKD epidemiology collaboration (CKD-EPI) creatinine equation: more accurate GFR estimates, lower CKD prevalence estimates, and better risk predictions. *American Journal of Kidney Diseases*, 55(4), 622-627.
- Mercado, M. G., Smith, D. K., & Guard, E. L. (2019). Acute Kidney Injury: Diagnosis and Management. *Am Fam Physician*, 100(11), 687-694.
- Mistry, K. (2019). Dialysis disequilibrium syndrome prevention and management. *Int J Nephrol Renovasc Dis*, 12, 69-77. <https://doi.org/10.2147/ijnrd.S165925>
- Munang, L. A., & Starr, J. M. (2010). Diseases of the Aging Kidney. In *Brocklehurst's Textbook of Geriatric Medicine and Gerontology* (pp. 690-696). Elsevier.
- Nee, P. A., Bailey, D. J., Todd, V., Lewington, A. J., Wootten, A. E., & Sim, K. J. (2016). Critical care in the emergency department: acute kidney injury. *Emerg Med J*, 33(5), 361-365. <https://doi.org/10.1136/emered-2015-204722>
- Padhi, S., Glen, J., Pordes, B. A., & Thomas, M. E. (2015). Management of anaemia in chronic kidney disease: summary of updated NICE guidance. *Bmj*, 350.

- Rayner, H. C., & Imai, E. (2010). Approach to renal replacement therapy. In *Comprehensive clinical nephrology* (pp. 1019-1030). Elsevier.
- Saner, E., Nitsch, D., Descoedres, C., Frey, F. J., & Uehlinger, D. E. (2005). Outcome of home haemodialysis patients: a case-cohort study. *Nephrology Dialysis Transplantation*, *20*(3), 604-610.
- Schiffrin, E. L., Lipman, M. L., & Mann, J. F. (2007). Chronic kidney disease: effects on the cardiovascular system. *Circulation*, *116*(1), 85-97. <https://doi.org/10.1161/circulationaha.106.678342>
- Thomas, B., & Bishop, J. (2013). *Manual of dietetic practice*. John Wiley & Sons.
- Tomlinson, L., & Wheeler, D. (2015). Clinical evaluation and management of chronic kidney disease. *Comprehensive clinical nephrology*, 945-946.
- UK, N. C. G. C. (2014). Chronic kidney disease (partial update): early identification and management of chronic kidney disease in adults in primary and secondary care.
- Venkat, A., Kaufmann, K. R., & Venkat, K. (2006). Care of the end-stage renal disease patient on dialysis in the ED. *Am J Emerg Med*, *24*(7), 847-858. <https://doi.org/10.1016/j.ajem.2006.05.011>
- Wang, T., Izatt, S., Dalglish, C., Jassal, S. V., Bargman, J., Vas, S., Tziviskou, E., & Oreopoulos, D. (2002). Peritoneal dialysis in the nursing home. *Int Urol Nephrol*, *34*(3), 405-408. <https://doi.org/10.1023/a:1024478523252>
- Zucchelli, P., & Zuccalà, A. (1993). Ischemic nephropathy in the elderly. *Contrib Nephrol*, *105*, 13-24. <https://doi.org/10.1159/000422465>

## **CHAPTER 15**

### **TREATMENT OPTIONS FOR BENIGN PROSTATIC OBSTRUCTION IN GERIATRIC PATIENT GROUP**

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## INTRODUCTION

Aging is a universal process that may result in a slowdown in all functional mechanisms and decrease or loss in functions. To sum it up in one sentence, it is a period that affects the human being in sociological, biological, and psychological dimensions as well as creating individual and social outcomes (Weber et al., 1995). Chronological limit for aging is accepted as 65 years by the World Health Organization (Sherrington et al., 2020). The elderly population is on the increase across the world, and accordingly, aging-related problems have become more important. The term geriatric syndrome is used to define clinical conditions and symptoms that develop in relation to aging by considering anatomical and physiological changes occurring as a result of aging. Geriatric syndrome is an extended definition in which atypical symptoms can be seen, complaints and clinical symptoms can develop due to numerous reasons, and the patterns or symptom classification routinely used cannot always be used (Ruiz et al., 2012). Geriatric patient group is a subject that occupies a significant place in our routine practice in which clinicians should be careful at every step of patient management and keep geriatric conditions in mind.

### **1. Aging and Benign Prostatic Obstruction**

Benign prostatic obstruction (BPO) is one of the most frequent proliferative conditions which coincides with aging period in males and is almost considered a natural part of this process with high incidence in men with advanced age (Yilmaz et al., 2022). Benign prostatic hyperplasia in advanced aged men is pathologically diagnosed with high proliferation of epithelial cells and fibroblast and myofibroblast cell types on the prostate tissue. The picture characterized by other changes seen along with aging, changes in smooth muscle contractility, increase in fibrosis, development of bladder outflow obstruction as a result of nodular formations developing in the prostatic tissue especially affecting urethra, and lower urinary tract system symptoms is termed benign prostatic obstruction (Pascal et al., 2022). BPO is closely associated with aging period in men, and it is even seen as a part of this period, which can be explained by the fact that its incidence in men over the age of 80 years is around 90% (Bellos et al., 2022). Among the reasons for this condition, changes associated with aging process, hormonal changes, and

microenvironmental changes of the prostate tissue are shown. It has long been known that androgens are highly effective on the prostate tissue; however, it has recently been observed that both androgens and estrogens play critical roles on the prostatic tissue. With aging, while an increase in testosterone levels in circulation is observed, it has been seen that estrogen levels remain constant or increase. This leads to a decrease in testosterone/estrogen ratio, and thus an increase is observed in especially prostate volume and collagen building (Liu et al., 2019). As a result of hormonal effects, an increase in collagen accumulation and remodeling is observed along with aging, as well as a significant increase in large collagen bundles. In examinations on the prostatic tissue, as a result of the aging process, an increase has been seen in inflammatory mediators secreted from the stroma, and consequently, a proliferation has been observed in epithelial and stromal fibroblast cell type (Sachdeva et al., 2022). As a result of nodular growths in the prostate tissue, stromal and epithelial proliferation, changes in smooth muscle structure, and anatomic and functional changes related to fibrosis increase, and BPO related lower urinary tract system complaints emerge. The incidence and severity of the symptoms that emerge as a result of this relationship has increased along with aging, and it has started to be seen as a part of aging process in men.

When BPO related symptoms are mentioned, the first thing that comes to mind is complaints about bladder emptying. These complaints can be defined as slowdown in urine flow, split or dispersed stream, intermittent stream, delay in starting urination, difficulty in urinating, and terminal dripping. Symptoms seen after urination are indicated as feeling of incomplete urine emptying and dribbling after urination. In BPO patients in advanced age, due to long-term follow up of bladder output obstruction and related response of detrusor muscle, storage symptoms are frequently seen. These are defined as increased daytime urination frequency, nocturia, feeling of stress, and urinary incontinence along with a feeling of stress (Shapiro & Brucker, 2022). In cases such as BPO related duration, prostate size, and exacerbation of symptoms, acute urinary retention risk increases in patients. However, only advanced age factor is a significant risk factor for the development of urinary retention and need for urinary catheterization in patients. In studies conducted, the risk of urinary retention development between the ages of 60 and 80 years has been reported to be 23%. It has also been stated that urinary retention was

observed in 12% of the patients who showed progressive symptoms along with advanced age, and that patients who postponed surgery for 1 year due to urinary retention carried high risks for surgery (Desgrandchamps et al., 2006).

In the evaluation of BPO and related complaints in aged patients, physical examination comes first and maintains its importance. Abdominal examination of geriatric patient group can provide additional information about evaluation of palpable bladder presence and retention, genital examination can give information about meatus evaluation and palpable masses, and digital rectal examination can yield extra information in terms of anal sphincter tonus, stoned feces, and rectal and intestinal malignancies that help us be informed about neurological examination. Digital prostate examination is important in terms of the prostate's average size, rigidity, nodular presence, and sensitivity (Naji et al., 2018). In laboratory examination, simple urine examination can provide information about both urine content and presence of infection and conditions that can be frequently seen in the elderly and affect lower urinary tract symptoms such as diabetes. As hydronephrosis, renal failure, and urinary retention risks are higher in geriatric patients with BPO, serum creatinine examination can prove useful for determining kidney functions (Oelke et al., 2012). Serum prostate specific antigen measurement is not desired in geriatric patients whose life expectancy is lower than 10 years and who are not expected to benefit from cancer therapy.

In BPO evaluation, uroflowmetry test is a non-invasive test which is routinely used in the diagnosis and follow-up of the disease and provides information about volume of urination, maximum flow rate, and average flow rate. It is a highly important test in terms of starting treatment, response to treatment, and deciding on surgery. Calculation of prostate volume with ultrasonography is generally used in planning the treatment, and postvoiding residue amount is employed both in deciding on the treatment and in the follow-up stage. In order to objectively determine and follow up patients' complaints, validated International Prostate Symptom Score is used as a standard form (Benli et al., 2020).



## **2.Treatment**

### **2.1. Medical Treatment**

The objective of the treatment in BPO related lower urinary tract system symptoms is to start treatment in line with the pathology causing the complaints, to increase patients' quality of life, and to take necessary precautions against potential complications.

#### **2.1.1.Alpha Blockers**

In the medical treatment of BPO patients, alpha blocker agents have long been used alone or in combined treatments. These agents aim to inhibit epinephrine and norepinephrine secretion from the prostate smooth muscle and decrease tonus through smooth muscle relaxation and to reduce bladder outflow obstruction (Shao & Kuo, 2019). Alpha1 adrenoceptors are found in the bladder, smooth muscles, blood veins, and central nervous system in addition to the prostate tissue, and it is thought that this distribution generally causes the development of side effects of alpha blockers, which is especially important in geriatric patient group. Alpha1A receptor is the dominant receptor in the lower urinary tract system, and Alpha1D receptor is found in the bladder smooth muscles. It is known that all currently used alpha blockers have similar effects, and that they do not have a distinct superiority over one another. In general, their effect becomes active 8-12 hours after their intake, and they lead to an improvement of 40% in symptom scores and an increase of 25% in maximum flow rate. In addition to their effects on urination complaints, they are also effective on storage symptoms. However, they display more symptomatic effects than recovery effects on BPO. There is a relationship between prostate size and their effects, and they have been determined to be more effective on prostates smaller than 40 ml. In current practice, in order to protect from side effects, alfuzosin, doxazosin, terazosin, tamsulosin, and silodosin among selective Alpha1 blockers are used. The most frequent side effects that should be considered in geriatric patients are orthostatic hypotension, dizziness, and syncope. Due to their uroselective effects, retrograde ejaculation is seen in patients who use tamsulosin and particularly silodosin. In patients who use alpha blockers and will undergo cataract surgery, floppy iris syndrome has been reported due to their causing problems during the surgery (Jan Teper et al., 2011). In geriatric patients,

especially in those over the age of 80 years, the risk of falling is a serious problem, which leads to vital complications such as femur fracture. Symptoms such as BPO related frequent urination, nocturnal urination, and urgency incontinence that may lead to falling can be seen in patients. Additionally, more increase in the risk of falling due to hypotension and syncope related to alpha blocker treatment is observed and the rate of complications increase. In fragile advanced aged patients, it is important to use especially more uroselective alpha blocker agents and to inform patients and relatives about hypotension and falling risk (Mari et al., 2021).

### **2.1.2.5-Alpha Reductase Inhibitors**

Androgenic effect in prostatic tissue is created by dihydrotestosterone. Dihydrotestosterone formation is achieved over testosterone thanks to 5-alpha reductase enzyme. When the distribution of this enzyme in the body is examined, it is seen that type 1 is found in the central and peripheral nervous system, type 2 is found in the prostate, genital organs, and the liver, and type 3 is found in many tissues. Today, dutasteride and finasteride are 5-alpha reductase inhibitors used in BPO treatment. Dutasteride inhibits type 1 and type 2, while finasteride inhibits only type 2. Their effects on BPO and related symptoms are seen in the 6th month, and they cause an improvement in IPSS score by 30% and an increase in maximum flow rate by 2mL/s on average. They also lead to a reduction in patients' prostate volume by 18-28% and a decrease in serum prostate specific antigen value by 50%. Differently from alpha blockers, it has been reported that they can decrease acute urinary retention risk by 57% and necessity of a surgical intervention by 55% (Roehrborn et al., 1999). Their most frequent side effects are sexual dysfunction, decrease in libido, and ejaculation disorders. Gynecomastia is frequent in geriatric patients, and it is recommended to consider their rare side effects related with depression and anxiety (Saengmearnuparp et al., 2021).

### **2.1.3. Phosphodiesterase 5 Inhibitors**

This group of drugs decrease bladder outflow stricture by increasing intracell cyclical guanosine monophosphate amount and decreasing smooth muscle tonus in the prostate, bladder, and urethra. They also lead to an improvement of 22-37% in symptom scores and an increase of 2.4 mL/s in maximum flow rate on average. The most frequent side effects related to these

drugs are dyspepsia, gastroesophageal reflux, headache, backache, flushing, and nasal congestion (Chapple et al., 2015).

#### **2.1.4. Antimuscarinic Drugs**

These drugs are used as combination therapy in cases where storage complaints accompany urination complaints in patients with advanced age. These agents have been reported to provide effective treatment for urge, urge incontinence, frequent urination, and nocturia complaints. It should be noted that they lead to an increase in postvoiding residue amount and increase in acute urinary retention risk in geriatric patients who have long-term obstructive complaints and severe urination and storage symptoms. In addition, it should be kept in mind that due to their distribution in the body, muscarinic receptors must be used with caution in advanced aged and fragile patients owing to their potential side effects on cardiovascular and central nervous system and psychological side effects (Kay & Granville, 2005).

### **2.2. Surgical Treatment**

In geriatric patients with BPO, exacerbation of symptoms, decrease in urine flow rate, development of acute urinary retention, need for urinary catheterization, repetitive urinary system infections or urosepsis development related to BPO lead to complications such as persistent urinary incontinence, chronic renal failure, and bladder stone, and thus, a need for surgical treatment may arise. In addition to an increase in BPO and related problems along with advanced age, the incidence of hypertension, diabetes, metabolic syndrome, pulmonary, cardiovascular, and cerebrovascular diseases, and organ failures increase in patients. Hence, patients' risks of both surgical procedures and anesthesia-related complications also increase. There exists a need for minimally invasive surgical procedures that will free geriatric and fragile patients from urinary catheter dependency and protect them against BPO related complications and complications such as surgery related hemorrhage, blood transfusion, infection, and need for intensive care.

#### **2.2.1. Transurethral Prostate Resection**

It is the resection procedure of the prostate endoscopically from the bladder neck to the level of verumontanum in order to protect especially continence in geriatric patients (TURP). In geriatric patients, especially those

receiving anticoagulant therapy, hematuria (15%), extended hospital stay durations, blood transfusion need (1.9%), thromboembolic events (2.4%), and long catheterization durations can be seen (Descazeaud et al., 2011). Besides, depending on the anesthesia method applied, postoperative respiration and hemodynamic problems can be observed. Generally, in order to avoid such complications, although local anesthesia methods are tried to be used, septic condition, coagulopathy, hypovolemia, severe hemorrhage, infectious problems in spinal region, and vertebral problems that do not allow procedure technique are frequently encountered in patients. In such cases, an increase in general anesthesia related risks as well as an increase in morbidity and mortality are seen in fragile patients. When urinary system complications are examined, urinary incontinence in patients has been reported to be 2.2%, urethral stricture as 3.8%, bladder neck stricture and urinary retention as 6.5%, BPO recurrence as 3-14%, and mortality rate as 0.25% (Madersbacher et al., 2005).

Use of monopolar devices during resection requires hypotonic irrigation liquid, and due to opening of venous sinuses and long operation durations, TUR syndrome can be encountered. TUR syndrome is a clinical picture which progresses with nausea, vomiting, bradycardia, hypertension, blurred vision, and mental confusion related to dilutional hyponatremia and can lead to serious complications such as cerebral edema, if not treated. It is a highly important condition in the geriatric patient group due to the use of monopolar devices (Rassweiler et al., 2006).

### **2.2.2. Transurethral Laser Resection**

It is a method which involves transurethral resection of prostatic tissue with laser energy and is shown to be an alternative in risky patient groups. One of the most frequently used methods in this regard is thulium laser prostate resection (ThuPR). Its important advantages over the classical method when used in continuous wave mode are creating maximum hemostasis and coagulation, and when used in central wavelength, providing more effective resection and vaporization. Therefore, less hemoglobin decrease, shorter catheterization durations, shorter hospital stay, and absence of TUR syndrome are shown among its advantages. It is a recommended

method in geriatric and fragile patient group due to low rate of perioperative mortality and low rate of long-term side effects (Cui et al., 2014).

### **2.2.3. Transurethral Laser Enucleation**

It is a procedure in which prostatic tissue is cut under the capsule in large lobes and is placed in the bladder and enucleated, and then the lobes deposited in the bladder are removed out with the help of a morcellator. It is shown as an alternative method to open prostatectomy method, especially for enlarged prostates. The most important drawback of this method is its slightly elongated learning curve. When Holmium Laser Enucleation of the Prostate is compared with TURP, it has been seen that it is statistically significantly advantageous in terms of postoperative hemoglobin decrease, catheterization duration, and hospital stay. Due to short duration of procedure, less hemorrhage, and shorter hospital stay, it is shown as an alternative to open prostatectomy and even as the primary method to be used especially in geriatric patient group who use anticoagulants (Schiavina et al., 2020). It has similar results to TURP in terms of urethral stricture, stress urinary incontinence, and re-operation rates.

### **2.2.4. Photoselective Vaporization**

Vaporization has frequently been used as an alternative treatment method in high-risk patients diagnosed with BPO who have comorbidities in recent years. Among the various vaporization practices, photoselective vaporization of the prostate is based on absorption of the laser by oxyhemoglobin in the tissue and vaporization of the tissue through this energy. In various studies conducted with photoselective vaporization, it has been shown to be an option that can be applied to geriatric patients group due to its advantages in terms of hospitalization, postoperative bleeding, catheterization duration, and morbidity. In studies conducted on high-risk patients who receive anticoagulant treatment, it has been reported that no blood transfusion was necessary, and that procedure duration was shorter than one hour. Many postoperative complications in high-risk patient group such as urethral stricture, TUR syndrome, hematuria related irrigation need, incontinence, and re-catheterization have been observed at rates lower than 10% (Tao et al., 2013).

### **2.2.5. Plasma Vaporization**

Plasma vaporization is based on the vaporization of the prostatic tissue through electric current by using electrocautery, and it is similar to TURP in this regard. Its biggest disadvantage in comparison to TURP is that no tissue sampling is performed. In a few studies conducted, it has been compared with TURP, and criteria such as transfusion need and hospitalization duration have been determined to be significantly lower. Yet, in the same study, it has been reported that retention and re-operation rates are higher than in TURP. In addition, in terms of efficiency, it has been determined to yield better results in symptom scores and maximum flow rate (Geavlete et al., 2010).

### **2.2.6. Radiofrequency Ablation**

Radiofrequency ablation is based on the technique of heating the prostatic tissue up to very high degrees through radiofrequency energy and achieving tissue necrosis. It is performed with needles placed in the prostate through transurethral passage. It is believed that as it also causes damage to nerve ends, it creates an alpha blocker effect and reduces obstruction. In studies conducted with transurethral needle ablation (TUNA) and radiofrequency ablation, it has been seen that it creates similar effects to TURP in terms of functional outcomes. In many studies conducted, it has been shown that TUNA is superior in terms of postoperative bleeding, sexual dysfunction (retrograde ejaculation), and short duration of hospitalization. However, in many other studies, it has been reported to be inferior to TURP in terms of clinical results (Bouza et al., 2006).

### **2.2.7. Microwave Thermotherapy**

Transurethral microwave therapy (TUMT) is a treatment method in which a catheter placed in the prostate through transurethral passage turns high microwave energy into heat and causes sympathetic nerve damage and leads to apoptosis. There are fewer studies than expected on TUMT in high-risk patients. It is an advantageous method in cases which directly affect the patient's quality of life such as retrograde ejaculation, urethral stricture, and hematuria. However, it has been reported that dysuria, urinary retention and need for repetitive intervention are high after the procedure (Hoffman et al., 2012).

### **2.2.8. Transurethral Bipolar Radiofrequency Thermotherapy**

Bipolar radiofrequency (RF) thermotherapy is applied to patients under local anesthesia of the urethra through middle model gradient method at 55°C for one hour with the help of an applicator with three separate sensors placed on a silicon-covered catheter. It is an important treatment choice especially in patients in advanced age who cannot tolerate anesthesia and surgical risks. It has been demonstrated that it eliminates the need for catheter by up to 60% in patients who are dependent on catheter due to BPO. Although it causes significant recovery in maximum flow rate, it has acceptable procedure related postoperative complications such as suprapubic pain and dysuria (Yüce et al., 2022). In addition, it is effective on urinary symptoms as well as storage symptoms. It is an important technique in terms of protecting patients against pharmacological load. Compared to TURP, it has provided better outcomes due to its denervation effect (Yuce et al., 2022). It is reported to be a reliable method that does not require anesthesia and can be applied in outpatient clinic conditions.

### **2.2.9. High Intensity Focused Ultrasound**

HIFU shows its effect by creating cavitation with tissue damage and mechanical and thermal damage caused by waves spreading through a transducer. However, as it can create 10 g of tissue damage per one hour, it lasts long and requires anesthesia. Its results have not reached the level of the results obtained through TURP. The requirement for re-operation or TURP has been determined to be up to 40%. Among its important side effects, stress incontinence, erectile dysfunction, rectourethral fistula, and suprapubic catheter need can be listed (Netsch et al., 2011)

### **2.2.10. Open Surgery**

Open surgery now occupies less place among methods applied for BPO in geriatric and fragile patients. It presents high rates of general complications, transfusion need, infection, re-operation, and mortality risk. Therefore, it is not seen as an appropriate choice in high-risk patients.

## **CONCLUSION**

In geriatric patients, BPO is a frequent problem that needs to be treated. BPO treatment choice should be made by considering patients' comorbidities

and their expectations from the treatment. It is thought that applying standard treatments may not always be possible in geriatric patient group, and that alternative minimally invasive treatments have an important place for this patient group.



## REFERENCES

- Bellos, T. C., Tzelves, L. I., Manolitsis, I. S., Katsimperis, S. N., Berdempes, M. V., Skolarikos, A., & Karakousis, N. D. (2022). Frailty and benign prostatic hyperplasia: The thrilling underlying impact. *Archivio italiano di urologia, andrologia : organo ufficiale [di] Societa italiana di ecografia urologica e nefrologica*, 94(3), 345–349. <https://doi.org/10.4081/aiua.2022.3.345>
- Benli, E., Yuce, A., Nalbant, I., Cirakoglu, A., & Yazici, I. (2020). Can transurethral thermotherapy save elderly patients with benign prostatic obstruction and high ASA score?. *The aging male : the official journal of the International Society for the Study of the Aging Male*, 23(5), 1316–1320. <https://doi.org/10.1080/13685538.2020.1765329>
- Bouza, C., López, T., Magro, A., Navalpotro, L., & Amate, J. M. (2006). Systematic review and meta-analysis of Transurethral Needle Ablation in symptomatic Benign Prostatic Hyperplasia. *BMC urology*, 6, 14. <https://doi.org/10.1186/1471-2490-6-14>
- Chapple, C. R., Roehrborn, C. G., McVary, K., Ilo, D., Henneges, C., & Viktrup, L. (2015). Effect of tadalafil on male lower urinary tract symptoms: an integrated analysis of storage and voiding international prostate symptom subscores from four randomised controlled trials. *European urology*, 67(1), 114–122. <https://doi.org/10.1016/j.eururo.2014.08.072>
- Cui, D., Sun, F., Zhuo, J., Sun, X., Han, B., Zhao, F., Jing, Y., Lu, J., & Xia, S. (2014). A randomized trial comparing thulium laser resection to standard transurethral resection of the prostate for symptomatic benign prostatic hyperplasia: four-year follow-up results. *World journal of urology*, 32(3), 683–689. <https://doi.org/10.1007/s00345-013-1103-6>
- Descazeaud, A., Robert, G., Lebdai, S., Bougault, A., Azzouzi, A. R., Haillot, O., Devonec, M., Fourmarier, M., Saussine, C., Barry-Delongchamps, N., & de la Taille, A. (2011). Impact of oral anticoagulation on morbidity of transurethral resection of the prostate. *World journal of urology*, 29(2), 211–216. <https://doi.org/10.1007/s00345-010-0561-3>
- Desgrandchamps, F., De La Taille, A., Doublet, J. D., & RetenFrance Study Group (2006). The management of acute urinary retention in France: a

- cross-sectional survey in 2618 men with benign prostatic hyperplasia. *BJU international*, 97(4), 727–733. <https://doi.org/10.1111/j.1464-410X.2006.06109.x>
- Geavlete, B., Multescu, R., Dragutescu, M., Jecu, M., Georgescu, D., & Geavlete, P. (2010). Transurethral resection (TUR) in saline plasma vaporization of the prostate vs standard TUR of the prostate: 'the better choice' in benign prostatic hyperplasia?. *BJU international*, 106(11), 1695–1699. <https://doi.org/10.1111/j.1464-410X.2010.09433.x>
- Hoffman, R. M., Monga, M., Elliott, S. P., Macdonald, R., Langsjoen, J., Tacklind, J., & Wilt, T. J. (2012). Microwave thermotherapy for benign prostatic hyperplasia. *The Cochrane database of systematic reviews*, (9), CD004135. <https://doi.org/10.1002/14651858.CD004135.pub3>
- Jan Teper, S., Dobrowolski, D., & Wylegala, E. (2011). Complications of cataract surgery in patients with BPH treated with alpha 1A-blockers. *Central European journal of urology*, 64(2), 62–66. <https://doi.org/10.5173/ceju.2011.02.art2>
- Kay, G. G., & Granville, L. J. (2005). Antimuscarinic agents: implications and concerns in the management of overactive bladder in the elderly. *Clinical therapeutics*, 27(1), 127–140. <https://doi.org/10.1016/j.clinthera.2005.01.006>
- Liu, T. T., Thomas, S., Mclean, D. T., Roldan-Alzate, A., Hernando, D., Ricke, E. A., & Ricke, W. A. (2019). Prostate enlargement and altered urinary function are part of the aging process. *Aging*, 11(9), 2653–2669. <https://doi.org/10.18632/aging.101938>
- Madersbacher, S., Lackner, J., Brössner, C., Röhlich, M., Stancik, I., Willinger, M., Schatzl, G., & Prostate Study Group of the Austrian Society of Urology (2005). Reoperation, myocardial infarction and mortality after transurethral and open prostatectomy: a nation-wide, long-term analysis of 23,123 cases. *European urology*, 47(4), 499–504. <https://doi.org/10.1016/j.eururo.2004.12.010>
- Mari, A., Antonelli, A., Cindolo, L., Fusco, F., Minervini, A., & De Nunzio, C. (2021). Alfuzosin for the medical treatment of benign prostatic hyperplasia and lower urinary tract symptoms: a systematic review of the literature and narrative synthesis. *Therapeutic advances in*

- urology*, 13, 1756287221993283.  
<https://doi.org/10.1177/1756287221993283>
- Naji, L., Randhawa, H., Sohani, Z., Dennis, B., Lautenbach, D., Kavanagh, O., Bawor, M., Banfield, L., & Profetto, J. (2018). Digital Rectal Examination for Prostate Cancer Screening in Primary Care: A Systematic Review and Meta-Analysis. *Annals of family medicine*, 16(2), 149–154. <https://doi.org/10.1370/afm.2205>
- Netsch, C., Bach, T., Gross, E., & Gross, A. J. (2011). Rectourethral fistula after high-intensity focused ultrasound therapy for prostate cancer and its surgical management. *Urology*, 77(4), 999–1004. <https://doi.org/10.1016/j.urology.2010.10.028>
- Oelke, M., Kirschner-Hermanns, R., Thiruchelvam, N., & Heesakkers, J. (2012). Can we identify men who will have complications from benign prostatic obstruction (BPO)? ICI-RS 2011. *Neurourology and urodynamics*, 31(3), 322–326. <https://doi.org/10.1002/nau.22222>
- Pascal, L. E., Igarashi, T., Mizoguchi, S., Chen, W., Rigatti, L. H., Madigan, C. G., Dhir, R., Bushman, W., DeFranco, D. B., Yoshimura, N., & Wang, Z. (2022). E-cadherin deficiency promotes prostate macrophage inflammation and bladder overactivity in aged male mice. *Aging*, 14(7), 2945–2965. <https://doi.org/10.18632/aging.203994>
- Rassweiler, J., Teber, D., Kuntz, R., & Hofmann, R. (2006). Complications of transurethral resection of the prostate (TURP)—incidence, management, and prevention. *European urology*, 50(5), 969–980. <https://doi.org/10.1016/j.eururo.2005.12.042>
- Roehrborn, C. G., Boyle, P., Bergner, D., Gray, T., Gittelman, M., Shown, T., Melman, A., Bracken, R. B., deVere White, R., Taylor, A., Wang, D., & Waldstreicher, J. (1999). Serum prostate-specific antigen and prostate volume predict long-term changes in symptoms and flow rate: results of a four-year, randomized trial comparing finasteride versus placebo. PLESS Study Group. *Urology*, 54(4), 662–669. [https://doi.org/10.1016/s0090-4295\(99\)00232-0](https://doi.org/10.1016/s0090-4295(99)00232-0)
- Ruiz, M., Cefalu, C., & Reske, T. (2012). Frailty syndrome in geriatric medicine. *The American journal of the medical sciences*, 344(5), 395–398. <https://doi.org/10.1097/MAJ.0b013e318256c6aa>

- Sachdeva, R., Kaur, N., Kapoor, P., Singla, P., Thakur, N., & Singhmar, S. (2022). Computational analysis of protein-protein interaction network of differentially expressed genes in benign prostatic hyperplasia. *Molecular biology research communications*, *11*(2), 85–96. <https://doi.org/10.22099/mbrc.2022.43721.1746>
- Saengmearnuparp, T., Lojanapiwat, B., Chattipakorn, N., & Chattipakorn, S. (2021). The connection of 5-alpha reductase inhibitors to the development of depression. *Biomedicine & pharmacotherapy = Biomedecine & pharmacotherapie*, *143*, 112100. <https://doi.org/10.1016/j.biopha.2021.112100>
- Schiavina, R., Bianchi, L., Giampaoli, M., Borghesi, M., Dababneh, H., Chessa, F., Pultrone, C., Angiolini, A., Barbaresi, U., Cevenini, M., Manferrari, F., Bertaccini, A., Porreca, A., & Brunocilla, E. (2020). Holmium laser prostatectomy in a tertiary Italian center: A prospective cost analysis in comparison with bipolar TURP and open prostatectomy. *Archivio italiano di urologia, andrologia : organo ufficiale [di] Societa italiana di ecografia urologica e nefrologica*, *92*(2), 10.4081/aiua.2020.2.82. <https://doi.org/10.4081/aiua.2020.2.82>
- Shao, I. H., & Kuo, H. C. (2019). Role of poor urethral sphincter relaxation in men with voiding dysfunction refractory to  $\alpha$ -blocker therapy: Clinical characteristics and predictive factors. *Lower urinary tract symptoms*, *11*(1), 8–13. <https://doi.org/10.1111/luts.12187>
- Shapiro, K. K., & Brucker, B. M. (2022). Treatment of overactive bladder in men: Is it really different?. *Neurourology and urodynamics*, *41*(8), 1975–1982. <https://doi.org/10.1002/nau.25000>
- Sherrington, C., Fairhall, N., Kwok, W., Wallbank, G., Tiedemann, A., Michaleff, Z. A., Ng, C. A. C. M., & Bauman, A. (2020). Evidence on physical activity and falls prevention for people aged 65+ years: systematic review to inform the WHO guidelines on physical activity and sedentary behaviour. *The international journal of behavioral nutrition and physical activity*, *17*(1), 144. <https://doi.org/10.1186/s12966-020-01041-3>
- Tao, W., Xue, B., Zang, Y., Sun, C., Yang, D., Zhang, Y., & Shan, Y. (2013). The application of 120-W high-performance system GreenLight laser

- vaporization of the prostate in high-risk patients. *Lasers in medical science*, 28(4), 1151–1157. <https://doi.org/10.1007/s10103-012-1212-2>
- Weber, D. C., Fleming, K. C., & Evans, J. M. (1995). Rehabilitation of geriatric patients. *Mayo Clinic proceedings*, 70(12), 1198–1204. <https://doi.org/10.4065/70.12.1198>
- Yilmaz, M., Esser, J., Suarez-Ibarrola, R., Gratzke, C., & Miernik, A. (2022). Safety and Efficacy of Laser Enucleation of the Prostate in Elderly Patients - A Narrative Review. *Clinical interventions in aging*, 17, 15–33. <https://doi.org/10.2147/CIA.S347698>
- Yuce, A., Benli, E., Cirakoglu, A., Yazici, I., & Nalbant, I. (2022). Bipolar radiofrequency thermotherapy vs. transurethral resection of the prostate: Effect on nocturia as a result of benign prostatic obstruction. *Canadian Urological Association journal = Journal de l'Association des urologues du Canada*, 16(11), E545–E551. <https://doi.org/10.5489/cuaj.7899>
- Yüce, A., Benli, E., Çirakoğlu, A., Yazıcı, İ., & Nalbant, İ. (2022). Effect of Transurethral Thermotherapy on Storage Symptoms Associated with Lower Urinary System Complaints in Elderly. *Archivos espanoles de urologia*, 75(9), 764–770. <https://doi.org/10.56434/j.arch.esp.urol.20227509.112>

**CHAPTER 16**  
**SEPSIS IN GERIATRIC PATIENT**

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## **INTRODUCTION**

Sepsis, which has a high morbidity and mortality rate, is a major public health problem worldwide. It is a life-threatening organ dysfunction that occurs due to the dysregulated immune response of the host to infection and may present with a wide range of clinical manifestations. The high rates of sepsis among the elderly population have critical implications for our healthcare system, especially given that the incidence of sepsis is expected to increase with the aging of our population.

## **EPIDEMIOLOGY**

Today, we see that the world's population is getting older. In addition to the improvement in living standards, advances in medicine are also contributing to this. In recent years, a demographic transition has been observed in patients followed in intensive care units (ICU). Along with the decrease in the fertility rate, the increase in life expectancy, and the decrease in the death rate, the incidence of elderly patients followed up in ICU has also increased. The World Health Organization defines under 65 as young, 65-85 years as young old, and 85 and over age group as advanced old, and there is a regular increase in the proportion of people over 60 years old compared to the total population (Sherrington et al., 2020). While this rate was about 8% of the population in the 1950s, today, the rate is above 10% and is predicted to increase to 21% in 2050 (Rusinova et al.,2014). This aging trend increases the incidence of diseases such as sepsis. In the studies performed, the rate of hospitalization in intensive care units of patients over the age of 65 approaches 60%, and it is predicted that this increase will increase by 5-8% every year in proportion to the aging population and the number of patients over the age of eighty-five will double until 2030 (Nasa et al.,2011). While the rate of benefiting from intensive care units increases, spending increases according to all hospital expenses simultaneously. The overall mortality rate due to sepsis was reported as 28.6%, and it was observed that the mortality rate increased to 38.4% in patients over 85 years of age (Angus et al.,2012).

It is generally observed that with the aging of society, the increase in the incidence of sepsis in the elderly has become increasingly crucial due to the social and economic burdens it brings.

## **SUSCEPTIBILITY TO INFECTION**

Geriatric hasta grubunda enfeksiyon yatkınlığının birçok sebebi vardır. In this group, there are studies that see old age as a direct independent risk factor (Martin et al., 2006). Although the age in the geriatric patient group is not a critical determinant on its own, the pre-admission status is a critical and



independent risk factor (Vosylius et al.,2005). Isolation, inactivity, functional limitations, malnutrition, resulting atrophy, sarcopenia due to muscle wasting, and accompanying comorbidities cause further aggravation of the picture (Quagliarello et al.,2005-Duin et al.,2011). Staying in care homes for a long-term, long and frequent hospitalizations, and excessive instrumentation during the process are common risk factors (Ely et al.,2003). The rate of sepsis has been reported to be close to 50% in patients diagnosed with dementia (Shen et al.,2012). Age-related poor skin integrity increases the risk of developing skin and soft tissue infections. While existing diabetes mellitus may cause delayed phagocytosis by affecting the immune system, conditions such as hypogonadism, hypothyroidism, and hypoadrenalism alter the sepsis response and predispose it to infection (Nasa et al.,2012). Preexisting comorbidities such as renal or pulmonary disease are often associated with increased susceptibility to sepsis (Retamar et al.,2014) . Chronic obstructive pulmonary disease (COPD), impaired mucociliary clearance, alveolar macrophage dysfunction, and suppressed cough mechanism significantly increase the risk of lower respiratory tract infections in elderly individuals (Reilly et al.,2017). Congestive heart failure, malignancies, chronic renal diseases, and liver diseases also increase the risk of sepsis (Esper et al.,2006). For older men, prostatic hypertrophy leads to urinary retention and stasis, predisposing this group to UTIs (Rowe et al.,2014), while urinary tract infections are increased due to decreased estrogen levels in women (Theresa et al.2017).

Polypharmacy and inappropriate drug use are common in this group, which increases the risk of resistance, colonization, and sepsis. Frailty, a common clinical syndrome, is associated with decreased activities of daily living and decreased physiological reserve and has been associated with mortality in sepsis (P. Fried et al. 2001).

### **PATHOPHYSIOLOGY**

The pathophysiology of sepsis differs in young and geriatric patients. We see that the rate of sepsis is higher in the geriatric age group. (Mart'in et al.,2017) The rate of sepsis is observed to be higher in the geriatric age group. Somatic mutations occur as a result of genetic and environmental factors and a decrease in the cell regeneration capacity, decrease in cell repair, and change in the immune system response (Weiskopf et al.,2009). Changes in the immune system cause both the development of new infections and a worsening in the severity and duration of the current infection.

Innate immunity is the first line of host resistance and responds directly to the pathogen (Weiskopf et al.,2009). The first response also acts as a bridge for the activation of acquired immunity (Bergman et al., 2020). Although monocyte and macrophage numbers did not seem to change in this group,

macrophage precursors decreased (Martin et al.,2017). There isn't a decrease in neutrophil phagocytic properties and an increase in apoptosis. It is determined that the innate immune system remains intact in the geriatric age group. Nevertheless, the production and effects of cytokines produced by innate immunity elements are very complex. It is considered that interleukin (IL)-1, IL-6, and Tumor necrosis factor (TNF) levels are high, and the constant elevation of these proinflammatory cytokines causes subclinical inflammation (Weiskopf et al.,2009). IL-10, which functions to suppress cell-mediated immunity, is increased in elderly healthy individuals (Rink et al.,1998). Although it is thought that there is no change in neutrophil adhesion, migration, phagocytosis, and granule secretion in PMNLs, a decrease in tissue migration is observed. It is generally accepted that phagocytosis ability does not change in healthy elderly people (Martin et al.,2017). The number of NK cells increases to compensate, but target cell interactions may decrease. Lymphokine-activated killer (LAK) and activated NK cells decrease. NK cell count is associated with poor prognosis (Lorenzo et al.,1999).

Adaptive immunity includes T and B lymphocytes and has two components: humoral and cellular. With age, the regression of the Thymus gland, where T lymphocytes are produced, causes a significant decrease in T lymphocytes (Martin et al.,2017). A decrease in macrophage function was observed, along with decreased levels of major histocompatibility complex type II (MHC II) molecules, resulting in a reduced CD4 histocompatibility response, with significant differences in the CD4/CD8 ratio. The decrease in this ratio is a marker of both immune aging and activation (Grubeck et al.,2020). The previously mentioned increase in IL-6 and TNF- $\alpha$  levels also increases CD4/CD8 inverse ratio apoptosis. B cell and plasma cell populations gradually decline with aging, but immunoglobulin levels gradually increase with age. However, immunoglobulins from polyspecific antibody-producing B cells increase in circulation and act as autoantibodies (Miyaj, et al.,2000).

The coagulation system, which is of great importance in sepsis, has vital importance. There is an increasing risk of thrombosis and thromboembolism with age. While fibrinogen, factor VII, factor VIII, and factor IX increase, plasminogen activator inhibitor type 1 (PAI-1), which causes a decrease in fibrin clearance, also accompanies this increase. D-dimer levels increase progressively in the elderly and are associated with an unfavorable prognosis (Solana et al.,2012).

The increase in cytokines such as IL-6, IL-1, and TNF-A in this patient group also contributes to myocardial depression. This situation, due to the negative inotropic effect, increases myocardial depression (Kumar et al.,1999). The response of the elderly to endotoxins is more severe than that of the young

due to the cytokine response, delayed blood pressure response, and excess epinephrine.

## DIAGNOSIS AND TREATMENT

Although sepsis is a disease in which early diagnosis and management directly affect mortality, it can be delayed in the elderly. The diagnosis becomes quite complex in geriatric patients with the addition of cognitive disorders, lack of communication, accompanying delirium, dementia, weakness, and anorexia (Girard et al., 2005). The blunting response to infection hides the clinical picture. In the studies performed, it was observed that there was no fever response in the geriatric patient group at a rate approaching 50% (Castel et al., 1991). In 2008, the American Infectious Diseases Association revised the measurement of  $>38.0^{\circ}\text{C}$  ( $100.4^{\circ}\text{F}$ ) accepted in adults and adopted a different definition in the geriatric patient group. In this group, a single temperature of  $>37.8^{\circ}\text{C}$  ( $100^{\circ}\text{F}$ ), repeated oral temperature of  $>37.5^{\circ}\text{C}$  ( $99.5^{\circ}\text{F}$ ), rectal temperature of  $>37.5^{\circ}\text{C}$  ( $99.5^{\circ}\text{F}$ ), or an increase of more than  $1.1^{\circ}\text{C}$  ( $2^{\circ}\text{F}$ ) compared to basal temperature was considered as fever. The high comorbidity also complicates the evaluation of biomarkers. The presence of anemia and dehydration complicates the interpretation of lactate, which is a critical marker in sepsis. Orthopedic problems and deformities that occur with age not only obscure physical examination findings but also affect the interpretation of imaging methods. The difficulty in diagnostic methods also manifests in applying intensive care score systems (Nasa et al., 2012). When frailty criteria were compared with the SIRS and SOFA criteria used in sepsis assessment, frailty assessment was found to be more effective in predicting poor outcomes (Bastoni et al.)

Respiratory tract infections and genitourinary system infections are the most common sources, followed by gastrointestinal infections with skin and soft tissue infections. It is predicted that prolonged and frequent hospitalizations, frequency of instrumentation, frequent and broad-spectrum antibiotic use, reproduction due to previous infections, and comorbidity excess will increase multi-resistant organisms in this group. Studies have demonstrated an increase in the rates of methicillin-resistant *S. aureus* and vancomycin-resistant *Enterococcus*. The incidence of *Klebsiella* species with extended-spectrum  $\beta$ -lactamase phenotypes was particularly high in the over-65 age group. When choosing empirical antibiotic therapy, clinicians should be aware of the pathogens that can cause sepsis in the elderly population, as well as the risk of developing antibiotic resistance (Martin et al., 2006-Castle et al., 1991).

Adult sepsis guideline is valid as treatment, and there is no separate sepsis guideline for the elderly (Esme et al., 2019). Early source control, target-driven treatment, hemodynamic monitoring, recommended mechanical

ventilation strategies, antibiotics, and nutritional recommendations should be applied. However, there are a few considerations to keep in mind when managing severe sepsis and septic shock in the elderly. Diastolic dysfunction, inadequate heart rate response to fluid, and drug resistance should be considered in the geriatric patient group in early targeted therapy applications. While adequate preload should be provided, problems related to excessive fluid administration that may occur in the case of diastolic dysfunction should be closely monitored. Necessary vasopressors and adrenergic agents can be administered (Nasa et al., 2012). The blood transfusion threshold is 7-9g/dL, but we should be careful in patients with low central venous oxygen saturation and ischemic myocardopathy, which can frequently occur in the elderly (Martin et al., 2017).

Side effects are observed more frequently in the use of antibiotics. In this group, differences in renal functions, pharmacokinetics, and pharmacodynamics should also be considered, and special attention should be paid to dose adjustment (Levisky et al., 2001). Appropriate nutrition, ulcer prophylaxis, and thromboprophylaxis should be applied meticulously in patients. It should be implemented with accepted strategies such as mechanical ventilatory support and lung protective ventilation where necessary. Non-pharmacological approaches should be investigated in treating pain, agitation, and delirium, and treatment strategies should be carefully reviewed. There is a higher risk of developing delirium in the geriatric patient group with sepsis, and it is more likely to be overlooked due to age. In the studies, the mortality rate was higher in the patients who developed delirium (Pisani et al., 2009). In addition, balancing the uncontrolled immune response brings promising approaches. Although hemadsorption approaches that try to control the cytokine response have been used frequently in recent years, adequate studies and satisfactory results have not been obtained yet (Hara et al., 2015). The second approach is being tested using new methods to enhance the immune system. Determining the HLA-DR expression and determining the direction of treatment, the use of recombinant human IL-7 (Döcke et al., 1997) and IL-1 blocking agents seems promising for the future (Shakoory et al., 2016)

## **EPILOGUE**

Identifying, diagnosing, and treating geriatric patients remains a major challenge for clinicians. Although survival rates from sepsis increase, overall mortality remains high. The clinician needs to evaluate this disease group better and understand it socially and economically. The treatment, survival, post-discharge survival, social independence, and quality of life of these patients in wards and intensive care units should be further examined and investigated.

## REFERENCES

- Angus DC, Linde-Zwirble WT, Lidicker J, Clermont G, Carcillo J, Pinsky MR. Epidemiology of severe sepsis in the United States: analysis of incidence, outcome, and associated costs of care. *Crit Care Med* 2001; 29:1303–10. doi: 10.1097/00003246-200107000-00002
- Bastoni D, Ticinesi , Lauretani F, Calamai S ,Catalano ML , Catania P, Cecchia M, Cerundolo N , Galluzzo , Giovini M, Mori G, Zani MD , Nouvenne A and Meschi T. Application of the Sepsis-3 Consensus Criteria in a Geriatric Acute Care Unit: A Prospective Study. *J. Clin. Med.* 2019, 8, 359; doi:10.3390/jcm8030359
- Bergman P, Raqib R, Sultana RR , Agerberth B and Gudmundsson GH. Host Directed Therapy Against Infection by Boosting Innate Immunity. *Front. Immunol.* 11:1209. doi: 10.3389/fimmu.2020.01209
- Castle SC, Norman DC, Yeh M, Miller D, Yoshikawa TT. Fever response in elderly nursing home residents: are the older truly colder? *J Am Geriatr Soc* 1991; 39: 853-857. doi: 10.1111/j.1532-5415.1991.tb04450.x
- David van Duin. Diagnostic Challenges and Opportunities in Older Adults with Infectious Diseases. *Clinical Infectious Diseases* 2012;54(7):973–8. doi.org/10.1093/cid/cir927
- Döcke WD, Randow F, Syrbe U, Krausch D, Asadullah K, Reinke P, et al. Monocyte deactivation in septic patients: restoration by IFN-gamma treatment. *Nat Med* (1997) 3:678–81. doi:10.1038/nm0697-678
- Ely EW, Angus DC, Williams MD, Bates B, Qualy R, Bernard GR. Drotrecogin alfa (activated) treatment of older patients with severe sepsis. *Clinical infectious diseases: an official publication of the Infectious Diseases Society of America.* 2003; 37(2): 187-95. doi: : 10.1086/375775
- Esme M , Topeli A , Yavuz BB, and Akova M . Infections in the Elderly Critically-Ill Patients. *Front. Med.* 6:118. doi: 10.3389/fmed.2019.00118 doi.org/10.3389/fmed.2019.00118
- Esper AM, Moss M, Lewis CA, et all. The role of infection and comorbidity:factors that influence disparities in sepsis. *Crit Care Med* 2006;34(10):2576-82. doi: 10.1097/01.CCM.0000239114.50519.0E
- Fried LP, P Tangen CM, Walston K, Newman AB, Hirsch C, Gottdiener J, Seeman T, Tracy R, Kop WJ, Burke G, and McBurnie MA. Frailty in Older Adults: Evidence for a Phenotype. *The Gerontological Society of America.* 2001, Vol. 56A, No. 3, M146–M156. doi.org/10.1093/gerona/56.3.M146
- Girard TD, Opal SM, Ely EW. Insights into severe sepsis in older patients: from epidemiology to evidence-based management. *Clin Infect Dis* 2005; 40: 719-727. doi: 10.1086/427876

- Gruberck-Loebenstein B, Wick G. The aging of the immune system. *Adv Immunol* (2002) 80: 243-84. doi:10.1016/S0065-2776(02)80017-7
- Hara Y, Shimomura Y, Nakamura T, Kuriyama N, Yamashita C, Kato Y, et al. Novel blood purification system for regulating excessive immune reactions in severe sepsis and septic shock: an ex vivo pilot study. *Ther Apher Dial* (2015) 19:308–15. doi:10.1111/1744-9987.12338
- Kirby JT, Fritsche TR, Jones RN. Influence of patient age on the frequency of occurrence and antimicrobial resistance patterns of isolates from hematology/oncology patients: report from the Chemotherapy Alliance for Neutropenics and the Control of Emerging Resistance Program (North America). *Diagn Microbiol Infect Dis* 2006; 56: 75-8229:1303–10. doi:10.1097/00003246-200107000-00002
- Kumar A, Thota V, Dee L, Olson J, Uretz E, Parrillo JE. Tumor necrosis factor alpha and interleukin 1beta are responsible for in vitro myocardial cell depression induced by human septic shock serum. *J Exp Med* 1996; 183: 949-958. doi.org/10.1084/jem.183.3.949
- Lorenzo GD, Balistreri CR, Candore G, Cigna D, Caruso C. Granulocyte and natural killer activity in the elderly. *Mechanisms of Ageing and Development* Volume 108, Issue 1, 1 April 1999, Pages 25-38 doi.org/10.1016/S0047-6374(98)00156-0
- Lu W, Mehraj V, Vyboh K, Cao W, Li T, Routy JP. CD4:CD8 ratio as a frontier marker for clinical outcome, immune dysfunction and viral reservoir size in virologically suppressed HIV-positive patients. *J Int AIDS Soc* (2015) 18:20052. doi:10.7448/IAS.18.1.20052
- Martin GS, Mannino DM, Moss M. The effect of age on the development and outcome of adult sepsis. *Crit Care Med* 2006; 34: 15-21. doi: 10.1097/01.ccm.0000194535.82812.ba
- Martín S, Pérez A and Aldecoa C. Sepsis and Immunosenescence in the Elderly Patient: A Review. *Intensive Care Medicine and Anesthesiology*.2017 4:20. doi: 10.3389/fmed.2017.00020
- Miyaji C , Watanabe H, Toma H , Akisaka M, Tomiyama K, Sato Y, Abo T. Functional alteration of granulocytes, NK cells, and natural killer T cells in centenarians. *Hum Immunol* (2000) 61:908-16. doi:10.1016/s0198-8859(00)00153-1
- Nasa P, Juneja D, Singh O, Dang R, Arora V. Severe Sepsis and its Impact on Outcome in Elderly and Very Elderly Patients Admitted in Intensive Care Unit. *J Intensive Care Med* 2011; Epub ahead of print
- Nasa P, Juneja D, Singh O. Severe sepsis and septic shock in the elderly: An overview. *World J Crit Care Med* 2012 February 4; 1(1): 23-30 doi:10.5492/wjccm. v1. i1.23. doi.org/10.1177/0885066610397116

- Pisani, AM, Kong SYJ, Kasl SV, Murphy TE, Araujo, KL, Van Ness PH. Days of delirium are associated with 1-year mortality in an older intensive care unit population. *American Journal of Respiratory and Critical Care Medicine* 2009. 180 1092-1097. doi 10.1164/rccm.200904-0537OC
- Quagliarello V, Ginter S, Han L, Ness PV, Allore H, and Tinetti M. Modifiable Risk Factors for Nursing Home–Acquired Pneumonia. *Clinical Infectious Diseases* 2005; 40:1–6 doi.org/10.1086/426023
- Reilly JJ Jr, Silverman EK, Shapiro SD. Chapter 260. Chronic Obstructive Pulmonary Disease. In: Longo DL, Fauci AS, Kasper DL, et al, editors. *Harrison’s Principles of Internal Medicine*. 18th edition. New York: McGraw-Hill; 2012.
- Retamar P, López-Prieto MD, Rodríguez-López F, de Cueto M, García MV, González-Galan V, et al. Predictors of early mortality in very early patient with bacteremia: a prospective multicentre cohort. *Int J Infect Dis* (2014) 26:83–8. doi: 10.1016/j.ijid.2014.04.029
- Rink I, Cakman I, Kirehner H. Altered cytokine production in the elderly. *Mech Ageing Dev* (1998) 102:199-209. doi:10.1016/S0047-6374(97)11153-X
- Rowe TA, Mehta MJ. Diagnosis and Management of Urinary Tract Infection in Older Adults. *Infect Dis Clin N Am* 28 (2014) 75–89 .doi.org/10.1016/j.idc.2013.10.004
- Rusinova K, Guidet B. Are you sure it’s about ‘age’? *Intensive Care Med* (2014) 40:114–6. doi:10.1007/s00134-013-3147-x
- Shakoory B, Carcillo JA, Chatham WW, Amdur RL, Zhao H, Dinarello CA, et al. Interleukin-1 receptor blockade is associated with reduced mortality in sepsis patients with features of macrophage activation syndrome: reanalysis of a prior phase III trial. *Crit Care Med* (2016) 44:275–81. doi:10.1097/CCM.0000000000001402
- Sherrington, C., Fairhall, N., Kwok, W., Wallbank, G., Tiedemann, A., Michaleff, Z. A., Ng, C. A. C. M., & Bauman, A. (2020). Evidence on physical activity and falls prevention for people aged 65+ years: systematic review to inform the WHO guidelines on physical activity and sedentary behaviour. *The international journal of behavioral nutrition and physical activity*, 17(1), 144. doi.org/10.1186/s12966-020-01041-3
- Solana R, Tarazona R, Gayoso I, Lesur O, Dupuis G, Fulop T. Innate immunosenescence: effect of aging on cells and receptors of the innate immune system in humans. *Semin Immunol* (2012) 24:331–41. doi: 10.1016/j.smim.2012. 04.008
- Theresa A. Rowe, June M. McKoy. Sepsis in Older Adults. *Infect Dis Clin N Am* 31 (2017) 731–742. doi.org/10.1016/j.idc.2017.07.010

- Weiskopf D, Weinberger B, Grubeck-Loebenstein B. The aging of the immune system. *Transpl Int* (2009) 22:1041–50. doi:10.1111/j.1432-2277.2009.00927.x
- Vosylius S, Sipylaite J, Ivaskevicius J. Determinants of outcome in elderly patients admitted to the intensive care unit. *Age Ageing* (2005) 34:157–62. doi:10.1093/ageing/afi037





## **CHAPTER 17**

### **GERIATRIC DENTAL DISEASES**

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## INTRODUCTION

Among the most important effects of aging are changes in the oral cavity and surrounding tissues. With aging, tooth loss increases, the salivary flow rate decreases, and atrophy occurs in the oral mucosa and muscles. These structural changes lead to differentiation in the chewing function of the elderly and, consequently, in their eating habits. Disruption of nutrition paves the way for the development of a number of pathological changes (Ho et al., 2022; Khanagar et al., 2020; Torres-Carranza et al., 2008). Thus, a thorough understanding of the changes that occur with aging in the oral mucosa, teeth, bones, salivary glands, temporomandibular joints, and masticatory muscles is of paramount importance in diagnosing and treating geriatric patients.

### 1. Effect of Aging on Oral Tissues

#### 1.1. Tooth

In the elderly, the teeth are structurally different from those of young people. As a result of the age-related incisions in the enamel, formal changes can be observed. As a result of attrition, the crown lengths of the teeth shorten, and the dentin tissue under the enamel is exposed. Due to the attrition of enamel as a result of the incision, the teeth whose light transmission changes appear darker (Jaeggi & Lussi, 2014) (**Figure 1**). Besides, tooth loss increases with age. Mandibular molars are the first to be lost, followed by maxillary, molar, and premolar teeth. Mandibular canines are usually the last teeth to be lost (Celenligil & Hastaliktan, 1997; Hand et al., 1991).



**Figure 1** Age-related incisor tooth attrition

## 1.2. Periodontium

The functional unit consisting of the gingiva, cementum, alveolar bone, and the periodontal ligament is called the periodontium. The thickness of the periodontal ligament decreases with age. Similarly, the number of cells in the gingiva and periodontal ligament, mitotic activity, collagen fibers, and collagen synthesis decrease (4). Epidemiological studies show that the frequency and severity of periodontal diseases increase with age (Bodineau et al., 2009; Müller et al., 2022). However, in older people with good oral hygiene, the incidence of periodontal disease is low. Periodontal diseases develop due to various pathological changes (3).

Gingival recession is a common clinical finding in the elderly. This results in an increase in the clinical crown length of teeth. Due to its structure, the cementum layer, which is exposed to the oral environment, is more vulnerable to environmental factors. Consequently, as gingival recession increases in parallel with advancing age, root caries also increase (Carvalho & Lussi, 2017; Hjertstedt et al., 2014). (**Figure 2**)



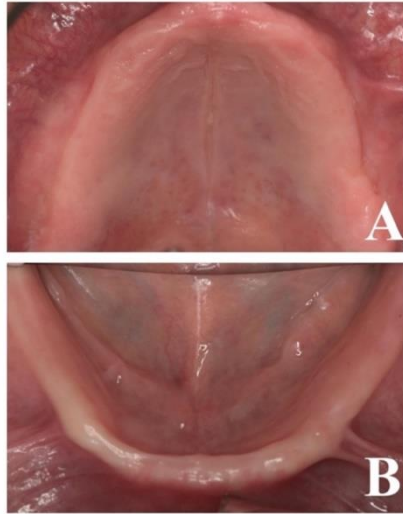
**Figure 2** Gingival recession (white narrows)

## 1.3. Bone

With age, calcified tissue in bones decreases, and porosities develop. Therefore, the brittleness of the bones increases. Due to arteriosclerotic changes or tooth loss, blood flow is reduced in both the maxilla and mandible in the elderly (Oh et al., 2020).

### 1.3.1. Bone loss in the edentulous mouth

Because alveolar bone integrity depends on the presence of teeth, tooth loss increases resorption into the jaw bone. When the extracted teeth are replaced by prostheses, different forces are applied to the alveolar bone. **(Figure 3)** While some regions are overloaded, other regions are never overloaded. This leads to remodeling in the bone, and alveolar resorption can be seen more often in patients using prostheses (Oh et al., 2020; Van Waas et al., 1993). However, as vertical size decreases in completely edentulous patients when the prosthesis is not used, facial and lip collapse, mouth enlargement, and folds at the corners of the lips occur (Martins et al., 2021). **(Figure 4)**



**Figure 3** Edentulous maxilla (A) and Mandibula (B)



**Figure 4:** An edentulous patient without dentures (A), with dentures (B)

It should be noted that the resorption of the mandible crest becomes thinner when resorption reaches very severe levels, thus making the use of conventional prostheses impossible in these cases. For this reason, teeth or tooth roots that can function should be kept in the mouth to protect the bone structure. The palatal bone and alveolar ridge may flatten completely as a result of resorption in the maxilla. Additionally, as a result of alveolar bone resorption, the maxilla also decreases in volume, separating the maxillary sinus from the oral mucosa by only a thin layer of bone (Betts & Barber, 1995).**(Figure 5)**



**Figure 5** A Radiograph of edentulous patient with excessive resorbed jaw bones

### 1.4. Salivary Glands:

In maintaining oral health continuity, saliva plays an important role with its numerous functions (Tanasiewicz et al., 2016):

- Keeping the oral mucosa moist
- Mechanical cleaning of oral structures
- Regulation of oral pH
- Maintaining microbial ecological balance
- Antibacterial and antifungal activities
- Remineralization of teeth
- Taste
- Facilitating the chewing of food (bolus formation) and swallowing

With age, various changes occur in both the major and minor glands. Rather than a physiological effect of aging, these changes are caused by pathological events, medications, and radiation therapy. The most important cause of gland hypofunction in the elderly is the use of medications (Khanagar et al., 2020). The pharmacological agents that reduce the flow rate of saliva due to their side effects and thus cause dry mouth are listed (Tanasiewicz et al., 2016). (**Table 1**)

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**Table 1** Medications that cause dry mouth

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Antihypertensives	Monoamine oxidase inhibitors	Diuretics
Narcotic analgesics	Antispasmodics	Muscle relaxants
Anticonvulsants	Antiemetics	Antiarrhythmics
Parkinson's drugs	Parasitic drugs	Sedative-tyrankilizants
Antipsychotics	Antidepressants	Antineoplastics
Antihistamines	decongestants	Expectorants

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With age, saliva becomes mucinous and the risk of bacterial plaque accumulation and therefore, caries and/or periodontal disease increases. Mouth dryness makes mucous membranes more susceptible to mechanical irritation; and therefore oral ulcers are common in the elderly (Hahnel et al., 2014; Porter et al., 2015). Additionally, because of insufficient saliva



secretion, the retention of prosthetic restorations decreases, and depending on this situation, the chewing, swallowing, and speaking functions of the patients are adversely affected. Dry mouth causes changes in the tongue and food residues to accumulate on the tongue. Therefore, taste buds are affected, resulting in a difficult tasting (Singh & Papas, 2014).

### **1.5. Temporomandibular Joint and Masticatory Muscles:**

Age-related changes in oral structures can also affect the temporomandibular joint (TMJ) over time, causing some structural and functional changes. Events such as temporal bone glenoid fossa deepening and articular eminent leveling occur due to adaptive changes. With advancing age, the articular disk becomes thinner. Particularly in the elderly, TMJ problems increase as the number of teeth decreases (Iacopino & Wathen, 1993). With age, the tone of the masticatory muscles decreases, and the masticatory efficiency decreases (Sheiham & Steele, 2001).

### **1.6. Mucous membrane**

The mucosa is a mechanical barrier for toxic or infectious agents and an inflammatory and immune response that renders these agents harmless. With age, the oral mucosa is thinned and flattened, dryness begins, and these changes decrease the resistance of the mucosa to mechanical irritation. Moreover, capillary blood flow decreases, and as a result, the mucosa becomes pale, and wound healing is delayed. The papillae become faint on the tongue, the burning sensation begins, and the sense of taste diminishes (Singh & Papas, 2014).

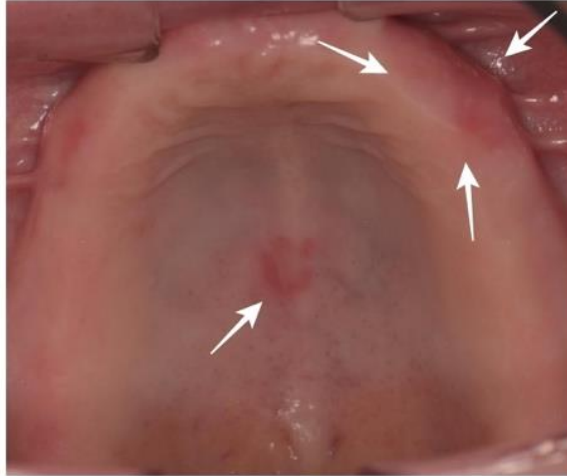
Due to aging, oral mucosa usually develops due to the oral findings of systemic diseases, side effects of medications, oral infections, and nutritional disorders. In addition, traumatic injuries can also be observed (Chávez et al., 2018).

#### **1.6.1. Prosthetic stomatitis:**

Changes in the inflammation of the mucosa due to the use of prostheses in the elderly are called prosthetic stomatitis and are common. It may be characterized by erythema in mucosal tissues in contact with complete or

segmented prostheses. Poor oral hygiene and *Candida albicans* play a role in its etiology. Since the continuity of oral hygiene becomes more difficult in geriatric patients, it is observed in the elderly (Santos Sousa et al., 2021).

**(Figure 6)**



**Figure 6** Prosthetic stomatitis (white narrows)

### **1.6.2. Angular cheilitis:**

This clinical manifestation, particularly common in the elderly and patients using full prostheses and characterized by the formation of fissures in the lip corners, is called angular cheilitis. *Candida albicans* plays a role in its etiology, and the lip corners become infected with the *Candida* found in the patients' dentures. In the denture, factors such as small vertical size and moist lip corners cause the development of angular cheilitis (Oza & Doshi, 2017).

### **1.6.3. Prosthetic hyperplasia (epulis):**

Resorptions in the bones supporting the prostheses disrupt the harmony with the tissues beneath the dentures, and hyperplastic tissue growth is observed in the mucosa when exposed to prolonged low-level irritation of the mucosa. Hyperplastic tissue is usually observed in the areas where the dentures end and at the border between the gums and the mucosa. These lesions are also called 'epulis fissuratum'. Generally, long denture wings or sharp denture edges cause hyperplasia in the oral mucosa (Khalifa et al.,

2021). In the event of increased trauma, ulceration or hyperkeratosis may develop in tissues, and these areas may, over time, undergo malignant transformation (Mohan et al., 2013).

## **2. Geriatric Dental Emergencies**

With age, some disorders may occur depending on the destruction of the body. These disorders can be systemic and seen in soft and hard tissues in the mouth, which are of interest to dentistry. Depending on the degree of destruction, geriatric individuals may develop symptoms that require urgent clinical intervention.

### **2.1. Endodontic-periodontal problems:**

Several recent studies have revealed that the incidence of complete edentulism decreases with advancing age (Müller et al., 2007). Caries, gum disorders, and dental abrasions are common problems in geriatric individuals, and these conditions can cause many problems until the tooth is necrotized (Khanagar et al., 2020). This condition can be controlled by endodontic treatment or tooth extraction. The calcification of root canal dentin with aging is one of the most challenging aspects of endodontic therapy in the elderly (Carvalho & Lussi, 2017). Despite these challenges, endodontic treatments are preferred over tooth extraction today because the response to treatment is similar to that of young people (Friedman, 2002; Sperber & Yu, 2003). Currently, there are only a few contraindications to endodontic treatment in older patients. These are as follows:

1. Patients who have undergone radiation therapy to the head and neck region. In a study that investigated the incidence of osteoradionecrosis in patients who received radiotherapy, it was found that 50% of all osteoradionecrosis was caused by tooth extractions (Reuther et al., 2003). For this reason, the treatment of these patients should be completed before radiotherapy, and radical treatment may be required.
2. Patients who are unable to cooperate due to Parkinson's disease, tremors, or dementia (Toman et al., 2014).

Although the classic acute symptoms of pulpal and periapical pathologies are expressed by many elderly patients, the disease often develops

without the patient being aware of it. Pulp destruction develops without a painful period, and the patient mentions swelling and self-healing fistula mouth from time to time (Michaelson & Holland, 2002). Such conditions can be characterized as dental emergencies in geriatric patients, and patient treatment should be completed as soon as possible.

In the past, tooth loss was thought to occur with aging, particularly as a result of periodontitis. However, many recent cross-sectional studies have discussed aging and tooth loss in relation to periodontitis. According to these studies, the relationship between the aging process, cellular aspects, and periodontitis has not been fully elucidated and requires further research. In well-designed studies of elderly individuals, periodontitis has been shown to be a multifactorial disease that affects only a small proportion of the aging population both in terms of prevalence and severity (Kanasi et al., 2016). The presence of a medical problem rather than direct physiological aging in many elderly patients can be demonstrated as an important effect on the development of periodontitis. On the other hand, periodontitis may also worsen the systemic health of elderly individuals. Periodontal diseases may develop in elderly individuals due to the side effects of systemic diseases and medications, psychological effects, and the inability to perform oral hygiene practices as a result of decreased interest/ability, which may eventually lead to tooth loss (Kiyak et al., 1998).

## **2.2. Prosthetic Problems:**

In addition to endodontic and periodontal problems, prosthodontic problems may also occur, requiring the geriatric patient to apply to the emergency department. Allergies are the main cause of these. Allergies may develop from the local anesthetic used in the fabrication of the prosthesis or the materials used in the fabrication of the prosthesis. In such a case, the metal alloy or acrylic material to be used for the prosthesis is applied to the forearm surface of the patient for 48 h, and prostheses are made from a material that does not develop allergies (Cifuentes et al., 2017; Levi et al., 2012; Ogle & Mahjoubi, 2012).

In patients receiving cancer treatment, particularly when radiotherapy is performed in the head and neck region, mucous membranes become sensitive, salivation decreases, and xerostomia may be observed. If a full denture is to

be placed in such a case, the retention of the denture is reduced and it is important to use salivary preparations (Schimmel et al., 2018; Singh & Papas, 2014). In Parkinson's disease, on the other hand, salivary flow increases, and prosthesis retention decreases (Isaacson et al., 2020). Working in the clinic is also quite challenging for treating these patients.

It is therefore necessary to be aware of the special conditions and needs of geriatric patients when designing a treatment plan for them, even if urgent treatment is required. These patients are not always in the same condition at all times of the day and should usually be treated in the morning. During treatment, the patient should rest frequently, and the general condition should be monitored.

### 3. Emergencies That May Develop During Dental Treatments

As with all other patient groups, conditions requiring urgent intervention may occur for various reasons during the treatment of dental hard tissues of geriatric patients or during the application of fixed or mobile prostheses. The first step in the prevention of medical and dental emergencies is to identify the risk (Toman et al., 2012). A thorough systemic assessment and comprehensive history are essential, especially in geriatric individuals (Murray & Dodds, 2004). Emergencies that may occur during dental treatment of geriatric patients (Toman et al., 2012): **(Table 2)**

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**Table 2** Emergencies that may occur during dental treatment of geriatric patients

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Allergy

Orthostatic hypotension-Vasovagal syncope

Aspiration of stomach contents as a result of nausea-vomiting-vomiting

Foreign body aspiration

Hyperventilation

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### **3.1. Allergy:**

If the patient has a fixed prosthesis inserted during dental treatment, anaphylactic reactions may occur during local anesthesia. They develop 1-2 minutes after the parental administration of the antigenic drug, and the main symptoms occur in the cardiovascular and respiratory systems. Anaphylactic reactions typically begin with the patient feeling restless, followed by itching and nausea. This may be followed by vomiting, abdominal cramps, wheezing, and eventually complete airway obstruction. Tachycardia, cardiac arrhythmias, and decreased blood pressure following irregular cardiovascular function accompany the picture. Despite cardiovascular dysfunction, the cause of death of the patient after anaphylaxis is laryngeal obstruction (Mendoza Magaña et al., 2007).

As in any potential emergency, the best treatment is to prevent the condition from developing. The patient's medical history should be thoroughly questioned. However, if anaphylactic shock develops or is seen for the first time, intramuscular adrenaline, oxygen support, fluid infusion, antihistamines, and corticosteroids are administered (Tokgöz & Yiğitbaşı, 2011).

### **3.2. Orthostatic Hypotension-Vasovagal Syncope:**

Orthostatic hypotension in geriatric patients during dental procedures may cause transient loss of consciousness. As a result of the accumulation of blood in peripheral tissues, it is observed when the patient stands up quickly. The patient feels dizzy and heals quickly when lying down. Some geriatric patients are prone to orthostatic hypotension because of the medications they are taking (diuretics, antihypertensives, opioid analgesics, psychiatric medications, and medications to maintain heart rhythm). Slow standing of the patient after treatment prevents the occurrence of a problem (Rubenstein et al., 1991; Tokgöz & Yiğitbaşı, 2011).

Vasovagal syncope is observed as a result of dental treatment or increased peripheral vascular resistance due to stress-induced catecholamine release during waiting. Patients complain of weakness and dizziness. When vasovagal syncope occurs, the patient is placed in the Trendelenburg position and is expected to recover (Tokgöz & Yiğitbaşı, 2011).

### **3.3. Aspiration of stomach contents due to nausea-vomiting:**

Some geriatric individuals may have a strong nausea reflex, which indicates that they feel nauseous even when brushing their teeth. In such cases, difficult situations may arise, especially during prosthetic dental treatment. Patients may have a strong nausea reflex if the water accumulates in the oral cavity during tooth cutting while performing a fixed prosthesis or if the pharyngeal gauge escapes during measurement. In such cases, applying a local anesthetic to the soft palate, tilting the patient's head forward while sitting upright and taking measurements, and using fast-freezing gauges can reduce the reflex (Toman et al., 2012).

Aspiration of the gastric contents into the airway causes physical obstruction, and the acidic pH of the gastric contents causes burns in the airway. In such a case, vomit should be removed with a strong saliva absorber, and emergency assistance should be called immediately. Bronchodilators should be administered by intravenous access (Rudberg, 1996).

### **3.4. Foreign body aspiration**

Water, saliva, small hand tools, measuring devices, and small dentures are substances that may be aspirated during dental procedures. This usually occurs when the patient is in the supine position, and an attempt is made to remove the substance that has entered the pharynx if it is in the pharyngeal region. Thoracic and abdominal radiographs should also be taken even if it is ensured that the substance has been swallowed. If the airway is not completely blocked, the patient is tried to be removed by coughing; if the substance is not removed, emergency assistance is called immediately, and oxygen support is provided to the patient while waiting (Tokgöz & Yiğitbaşı, 2011).

### **3.5. Hyperventilation**

This syndrome is a set of symptoms that cause reactions such as epilepsy or heart attack that affect people. A hyperventilation-induced seizure begins with the patient's rapid and superficial breathing, and frequent breathing changes body chemistry. A tingling sensation and darkening of the

eyes are observed around the lips on the fingers. The reason is that the patient has high anxiety and is not medically dangerous (Tokgöz & Yiğitbaşı, 2011).

### **CONCLUSION**

Necessary measures should be taken to eliminate these risks when some systemic diseases that are likely to occur in each individual but are more likely to occur in geriatric individuals and may cause various complications during dental treatment. One should be aware of the differences in oral tissues and teeth of geriatric people and adjust the treatment accordingly. One should take the necessary time for each patient and patiently listen to their complaints. These details will provide the physician with crucial clues about the treatment that the patient needs.



## REFERENCES

- Betts, N., & Barber, H. (1995). *The Pathophysiology of Aging*, Fonseca RJ-Davis WH (Ed.): Reconstructive Preprosthetic Oral and Maxillofacial Surgery. In: WB Saunders Co, Philadelphia.
- Bodineau, A., Folliguet, M., & Séguier, S. (2009). Tissular senescence and modifications of oral ecosystem in the elderly: risk factors for mucosal pathologies. *Curr Aging Sci*, 2(2), 109-120. <https://doi.org/10.2174/1874609810902020109>
- Carvalho, T. S., & Lussi, A. (2017). Age-related morphological, histological and functional changes in teeth. *J Oral Rehabil*, 44(4), 291-298. <https://doi.org/10.1111/joor.12474>
- Celenligil, H., & Hastalıkçı, Y. D. (1997). Kutsal YG-Çakmakçı M-Ünal S (Ed.) Geriatri. *Hekimler Yayın Birliği Ankara*, 2, 815-837.
- Chávez, E. M., Wong, L. M., Subar, P., Young, D. A., & Wong, A. (2018). Dental Care for Geriatric and Special Needs Populations. *Dent Clin North Am*, 62(2), 245-267. <https://doi.org/10.1016/j.cden.2017.11.005>
- Cifuentes, M., Davari, P., & Rogers, R. S., 3rd. (2017). Contact stomatitis. *Clin Dermatol*, 35(5), 435-440. <https://doi.org/10.1016/j.clindermatol.2017.06.007>
- Friedman, S. (2002). Prognosis of initial endodontic therapy. *Endodontic topics*, 2(1), 59-88.
- Hahnel, S., Schwarz, S., Zeman, F., Schäfer, L., & Behr, M. (2014). Prevalence of xerostomia and hyposalivation and their association with quality of life in elderly patients in dependence on dental status and prosthetic rehabilitation: a pilot study. *J Dent*, 42(6), 664-670. <https://doi.org/10.1016/j.jdent.2014.03.003>
- Hand, J. S., Hunt, R. J., & Kohout, F. J. (1991). Five-year incidence of tooth loss in Iowans aged 65 and older. *Community Dent Oral Epidemiol*, 19(1), 48-51. <https://doi.org/10.1111/j.1600-0528.1991.tb00105.x>
- Hjertstedt, J., Barnes, S. L., & Sjøstedt, J. M. (2014). Investigating the impact of a community-based geriatric dentistry rotation on oral health literacy and oral hygiene of older adults. *Gerodontology*, 31(4), 296-307. <https://doi.org/10.1111/ger.12038>

- Ho, B. V., van der Maarel-Wierink, C. D., de Vries, R., & Lobbezoo, F. (2022). Oral health care services for community-dwelling older people with dementia: A scoping review. *Gerodontology*. <https://doi.org/10.1111/ger.12670>
- Iacopino, A. M., & Wathen, W. F. (1993). Craniomandibular disorders in the geriatric patient. *J Orofac Pain*, 7(1), 38-53.
- Isaacson, J., Patel, S., Torres-Yaghi, Y., & Pagán, F. (2020). Sialorrhea in Parkinson's Disease. *Toxins (Basel)*, 12(11). <https://doi.org/10.3390/toxins12110691>
- Jaeggi, T., & Lussi, A. (2014). Prevalence, incidence and distribution of erosion. *Monogr Oral Sci*, 25, 55-73. <https://doi.org/10.1159/000360973>
- Kanasi, E., Ayilavarapu, S., & Jones, J. (2016). The aging population: demographics and the biology of aging. *Periodontol 2000*, 72(1), 13-18. <https://doi.org/10.1111/prd.12126>
- Khalifa, C., Bouguezzi, A., Sioud, S., Hentati, H., & Selmi, J. (2021). An innovative technique to treat epulis fissuratum: A case report. *SAGE Open Med Case Rep*, 9, 2050313x211063135. <https://doi.org/10.1177/2050313x211063135>
- Khanagar, S. B., Al-Ehaideb, A., Shivanna, M. M., Haq, I. U., Al Kheraif, A. A., Naik, S., Maganur, P., & Vishwanathaiah, S. (2020). Age-related Oral Changes and Their Impact on Oral Health-related Quality of Life among Frail Elderly Population: A. *J Contemp Dent Pract*, 21(11), 1299.
- Kiyak, H. A., Persson, R. E., & Persson, G. R. (1998). Influences on the perceptions of and responses to periodontal disease among older adults. *Periodontol 2000*, 16, 34-43. <https://doi.org/10.1111/j.1600-0757.1998.tb00114.x>
- Levi, L., Barak, S., & Katz, J. (2012). Allergic reactions associated with metal alloys in porcelain-fused-to-metal fixed prosthodontic devices-A systematic review. *Quintessence Int*, 43(10), 871-877.
- Martins, A. M. C., Guimarães, L. S., Campos, C. H., Küchler, E. C., Pereira, D. M. S., Maia, L. C., Antunes, L. S., & Antunes, L. A. A. (2021). The effect of complete dentures on edentulous patients' oral health-

- related quality of life in long-term: A systematic review and meta-analysis. *Dent Res J (Isfahan)*, 18, 65.
- Mendoza Magaña, M. J., Vargas Rosasm, M. A., Guillén Escalón, J. E., Moncada Alcon, A. M., del Río Navarro, B. E., & Sienna Monge, J. J. (2007). [Anaphylaxis and anaphylactic shock]. *Rev Alerg Mex*, 54(2), 34-40. (Anafilaxia y choque anafiláctico.)
- Michaelson, P. L., & Holland, G. R. (2002). Is pulpitis painful? *Int Endod J*, 35(10), 829-832. <https://doi.org/10.1046/j.1365-2591.2002.00579.x>
- Mohan, R. P., Verma, S., Singh, U., & Agarwal, N. (2013). Epulis fissuratum: consequence of ill-fitting prosthesis. *BMJ Case Rep*, 2013. <https://doi.org/10.1136/bcr-2013-200054>
- Murray, D., & Dodds, C. (2004). Perioperative care of the elderly. *Continuing Education in Anaesthesia, Critical Care & Pain*, 4(6), 193-196.
- Müller, F., Naharro, M., & Carlsson, G. E. (2007). What are the prevalence and incidence of tooth loss in the adult and elderly population in Europe? *Clin Oral Implants Res*, 18 Suppl 3, 2-14. <https://doi.org/10.1111/j.1600-0501.2007.01459.x>
- Müller, F., Srinivasan, M., Krause, K. H., & Schimmel, M. (2022). Periodontitis and peri-implantitis in elderly people experiencing institutional and hospital confinement. *Periodontol 2000*, 90(1), 138-145. <https://doi.org/10.1111/prd.12454>
- Ogle, O. E., & Mahjoubi, G. (2012). Local anesthesia: agents, techniques, and complications. *Dent Clin North Am*, 56(1), 133-148, ix. <https://doi.org/10.1016/j.cden.2011.08.003>
- Oh, W. S., Saglik, B., & Bak, S. Y. (2020). Bone Loss in the Posterior Edentulous Mandible with Implant-Supported Overdentures vs Complete Dentures: A Systematic Review and Meta-Analysis. *Int J Prosthodont*, 33(2), 184-191. <https://doi.org/10.11607/ijp.6636>
- Oza, N., & Doshi, J. J. (2017). Angular cheilitis: A clinical and microbial study. *Indian J Dent Res*, 28(6), 661-665. [https://doi.org/10.4103/ijdr.IJDR\\_668\\_16](https://doi.org/10.4103/ijdr.IJDR_668_16)
- Porter, J., Ntouva, A., Read, A., Murdoch, M., Ola, D., & Tsakos, G. (2015). The impact of oral health on the quality of life of nursing home residents. *Health Qual Life Outcomes*, 13, 102. <https://doi.org/10.1186/s12955-015-0300-y>

- Reuther, T., Schuster, T., Mende, U., & Kübler, A. (2003). Osteoradionecrosis of the jaws as a side effect of radiotherapy of head and neck tumour patients--a report of a thirty year retrospective review. *Int J Oral Maxillofac Surg*, 32(3), 289-295. <https://doi.org/10.1054/ijom.2002.0332>
- Rubenstein, L. Z., Stuck, A. E., Siu, A. L., & Wieland, D. (1991). Impacts of geriatric evaluation and management programs on defined outcomes: overview of the evidence. *J Am Geriatr Soc*, 39(9 Pt 2), 8S-16S; discussion 17S-18S. <https://doi.org/10.1111/j.1532-5415.1991.tb05927.x>
- Rudberg, M. A. (1996). The Merck Manual of Geriatrics. *JAMA*, 275(18), 1452-1453.
- Santos Sousa, T. M., Rodrigues de Farias, O., Dantas Batista, A. U., Souto de Medeiros, E., Santiago, B. M., & Cavalcanti, Y. W. (2021). Effectiveness of denture microwave disinfection for treatment of denture stomatitis: A systematic review and meta-analysis. *Int J Dent Hyg*, 19(1), 62-77. <https://doi.org/10.1111/idh.12477>
- Schimmel, M., Srinivasan, M., McKenna, G., & Müller, F. (2018). Effect of advanced age and/or systemic medical conditions on dental implant survival: A systematic review and meta-analysis. *Clin Oral Implants Res*, 29 Suppl 16, 311-330. <https://doi.org/10.1111/clr.13288>
- Sheiham, A., & Steele, J. (2001). Does the condition of the mouth and teeth affect the ability to eat certain foods, nutrient and dietary intake and nutritional status amongst older people? *Public Health Nutr*, 4(3), 797-803. <https://doi.org/10.1079/phn2000116>
- Singh, M. L., & Papas, A. (2014). Oral implications of polypharmacy in the elderly. *Dent Clin North Am*, 58(4), 783-796. <https://doi.org/10.1016/j.cden.2014.07.004>
- Sperber, G. H., & Yu, D. C. (2003). Patient age is no contraindication to endodontic treatment. *J Can Dent Assoc*, 69(8), 494-496.
- Tanasiewicz, M., Hildebrandt, T., & Obersztyń, I. (2016). Xerostomia of Various Etiologies: A Review of the Literature. *Adv Clin Exp Med*, 25(1), 199-206. <https://doi.org/10.17219/acem/29375>
- Tokgöz, M., & Yiğitbaşı, M. (2011). *Dentistry and systemic diseases* 5th edition. Quintessence, 13.

- Toman, M., Toksavul, S., Çal, E., & Türkün, M. (2012). Emergencies that may occur during dental treatment of geriatric patients. *Aegean Medical Journal*, 51.
- Toman, M., Türkün, M., Toksavul, S., & Çal, E. (2014). Dental problems requiring urgent intervention in geriatric patients. *Aegean Medical Journal*, 53.
- Torres-Carranza, E., Infante-Cossío, P., Hernández-Guisado, J. M., Hens-Aumente, E., & Gutierrez-Pérez, J. L. (2008). Assessment of quality of life in oral cancer. *Med Oral Patol Oral Cir Bucal*, 13(11), E735-741.
- Van Waas, M. A., Jonkman, R. E., Kalk, W., Van 't Hof, M. A., Plooiij, J., & Van Os, J. H. (1993). Differences two years after tooth extraction in mandibular bone reduction in patients treated with immediate overdentures or with immediate complete dentures. *J Dent Res*, 72(6), 1001-1004. <https://doi.org/10.1177/00220345930720060101>

**CHAPTER 18**  
**GERIATRIC EMERGENCY SERVICE DESIGN**

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## INTRODUCTION

### **Why is a geriatric emergency department essential?**

Emergency departments are hospital units designed to respond to patients of all age groups who need medical care because of acute-onset diseases and injuries that require urgent intervention. The emergency room design within the hospital is planned to provide fast and effective care.

The rate of the geriatric population in society is increasing gradually and it is predicted that it will reach 17-20% in 2050 and 25.6% in 2080(Chu et al., 2007). Geriatric patients have unique needs. Because of their physical limitations and co-morbidities, they require a more specific approach compared to other groups in society. Also, because of chronic diseases and acute injuries and syndromes risks geriatric patients carry, emergency service admission rates are higher than their density in society.(Demircan et al., 2017) Patients aged 65 and over constitute 15% of emergency service admissions in Türkiye.(Cesur, 2012) Geriatric patients use more resources than other age groups in terms of emergency service admissions, laboratory examinations, treatment, observation time, intensive care hospitalization time, and rates.(Limpawattana, Phungoen, Mitsungnern, Laosuankoon, & Tansangworn, 2016; Samaras, Chevalley, Samaras, & Gold, 2010; Sultanoğlu, Boğan, Akpınar, & Demir, 2021; Varışlı, 2018)

It has been determined that some difficulties are encountered when evaluating patients of this age group in the emergency services, which is one of the major areas where geriatric patients receive health services.(American College of Emergency, American Geriatrics, Emergency Nurses, Society for Academic Emergency, & Geriatric Emergency Department Guidelines Task, 2014) Cognitive and physical diseases, comorbidities, and polypharmacy are among the limitations experienced by the patients and occur with age, playing a significant role in the basis of these difficulties.(Carpenter, Griffey, Stark, Coopersmith, & Gage, 2011; Inouye, Studenski, Tinetti, & Kuchel, 2007) In addition to these, some other limitations are derived from emergency room design such as the absence of silent waiting rooms due to routine emergency service design, triage areas where there is no appropriate communication opportunity, lack of time required for obtaining anamnesis and physical examination, inability to receive information that can be obtained through patient relatives only, and lack of appropriate sound and illumination in the



environment.(Keleş., 2019) As a result, expected rapid and effective results cannot be achieved for geriatric patients in emergency services.(McCusker., 2009) While seeking solutions to the problems related to the geriatric patient group, the positive results of special arrangements that have been developed especially in emergency service applications for patient groups and diseases such as pediatric patients and coronary syndromes supported the idea of age group-specific emergency service.(American College of Emergency et al., 2014; Cales & Trunkey, 1985; Pena & Snyder, 1995)

### **Geriatric Emergency Service**

Specialized emergency services to serve the geriatric age group were defined in England and were first established in the United States of America (USA) in 2008, and their numbers have increased over the years.(American College of Emergency et al., 2014; Banerjee, Conroy, & Cooke, 2013) With the publication of the geriatric emergency guideline in 2014, recommendations regarding the standards of geriatric emergency service have been offered.(American College of Emergency et al., 2014) In the planning of the emergency service for geriatric patients, arrangements should be made to eliminate the disadvantages arising from the limitations of this patient group.(American College of Emergency et al., 2014) The Senior Emergency Center (SEC) emergency service samples designed for elderly patients have been established in USA.(Smith SS, 2014) In SECs, patients were evaluated in a 5 triage category in an 8-bed unit. Level 1 constituted the most severe patient group, while level 5 formed the least severe group.(Smith SS, 2014) In addition to the limitations and chronic diseases of the patients in the triage areas, polypharmacy, emergency service hospital admissions, and geriatric risk scores were also recorded.(Smith SS, 2014) In SECs, patients are isolated with walls, while they are provided the opportunity to be together with their relatives as much as possible.(Smith SS, 2014) The example of SEC practice has demonstrated the necessity of training for practitioners to provide care for the complex medical conditions of this age group, as well as the physical characteristics in geriatric emergency services.(Keleş., 2019)

Within the framework of these examples and guidelines, recommendations regarding the design of the areas planned to take care of geriatric patients in emergency services were presented.

In this section, geriatric emergency service design will be reviewed.

### **1. Physical Structure:**

For geriatric patients, there should be doors with sensors that do not create obstacles and do not require contact at the hospital entrance. Doors that can be opened and closed by physical contact should not be located in any areas.

Door widths should allow the passing of stretchers and wheelchairs; sliding door systems with a wider opening capacity should be used in case of further needs. All factors that may pose a risk of falling for patients should be removed from the transition areas of the geriatric patient.

Wheelchairs and stretchers should be available near the doors for the transport of patients.

The triage areas, where the first evaluation of the patients has carried out at the entrance, should be specialized for a single patient but should be wide enough to accommodate the patient's relatives.

Soft chairs that will not create a pressure effect and with suitable width and height for the patient and his/her relatives to sit in should be available. While obtaining information from the patients, one-to-one evaluation should be made, and more than one patient should not be evaluated at the same time.(Cortis, Falk, & Rothschild, 2015) The relative should be allowed to be present in the area while the patient's history and complaints are taken.(Keleş., 2019)

The triage staff, the patient, and their relatives should have a seating arrangement of equal height and no obstacles should be present between them (Figure 1). It should be ensured that possible hearing and vision-related limitations do not interfere with achieving accurate and complete information from the geriatric patient.



**Figure 1.** Seating arrangement in the triage area

The distance between the triage staff and the patient should be such that it does not interfere the communication. In geriatric triage areas, geriatric risk tests and differentiation tests of risky elderly should be performed; guidance should be made in this context.(Keleş., 2019)

Patient examination areas should have suitable entry, exit, and movement areas for stretchers, wheelchairs, and other patient transport vehicles. Barriers ensuring geriatric patient privacy should be provided in all areas.

## **2. Floors**

In studies on the use of hospital services by the geriatric patient group, evaluations were mostly made about the treatment and rehabilitation areas.(Keleş., 2019) Whereas in the emergency services, arrangements have been made within the framework of an ongoing health service and its standards.(American College of Emergency et al., 2014) It is not clear which floor structure is suitable for the geriatric patient group. Nevertheless, the floors should not contain the risk of falling for the geriatric patient group, should be

soft enough to cause the least injury in case of a fall, should have a skidproof floor feature, and should be flat.(Warren & Hanger, 2013) Also, one of the basic features should be that the floors should be durable for any kind of possible damage that could occur by the use of vehicles such as wheelchairs and stretchers used for patient transfer.(Warren & Hanger, 2013)

It has been observed that soft floors create a risk of falling by causing loss of postural balance in the geriatric age group. Although this increases the risk of falling due to loss of balance, it reduces the risk of injury in case of falling.(Smith SS, 2014)

In terms of color and brightness, bright white colors that can create a perception of wetness in the geriatric patient group should be avoided.(American College of Emergency et al., 2014) Instead, a skidproof, wood-like matte floor color should be preferred.(Smith SS, 2014)

### **3. Materials and Furnishing**

Reclining chairs should be used for geriatric patients to sit and be examined.(Keleş., 2019) The stretchers, chairs, and beds should be chosen in such a way that they will not cause pressure ulcers. In addition to pressure ulcers, falling from beds constitutes a significant risk. Using lower beds has been reported as a protective factor against the risk of falling.(Warren & Hanger, 2013) The presence of armrests on the sides of beds and stretchers is another protective factor in terms of fall injuries and although there are different opinions in the literature, outward-opening side armrests are used in hospitals (Figure 2).(Marques, Queirós, Apóstolo, & Cardoso, 2017) The convenience of usage should be ensured by providing integration with electrical modular motion systems in beds, stretchers, and chairs.(Terkeş & Bektaş, 2016)



**Figure 2.** Example of outward opening side armrest

Pressure ulcers are one of the risks that the geriatric patient group is exposed to during their hospital stay. The properties of fabric surfaces that are in contact with the patient's skin, especially beds and sheets, are important for the occurrence of pressure ulcers. To prevent this, antibacterial, seamless, impermeable, liquid, and moisture-proof fabrics that do not traumatize the skin should be used for surface coatings.(American College of Emergency et al., 2014)

Unlike all other patient groups, geriatric patients are at risk due to possible degeneration in their central thermoregulation systems and insufficient metabolic against environmental factors.(Kumar, 2012) Heating systems that protect patients from hypothermia could be used (Figure 3).(Smith SS, 2014)



**Figure 3.** Patient warming system

#### **4. Illumination**

In the emergency room, there should always be light in the areas where geriatric patients are, completely dark areas should be avoided. Daylight should be used in all possible areas for lighting purposes. (Keleş., 2019) Technological infrastructure should be used as much as possible in systems used for lighting purposes. The usage of smart systems with motion sensors, which are activated without a key is recommended.(Terkeş & Bektaş, 2016) In order to benefit from daylight, windows could be used in areas where possible, while ensuring patient privacy. By reducing the amount of light used for illumination at night, the day-night cycle should be preserved and time orientation should be prevented.(American College of Emergency et al., 2014) The irradiance on the surfaces should be reduced with spotlight systems fixed to the ceiling. It is

known that cognitive functions deteriorate with age and the perception of color and shape changes over time.(Aslan & Hocaoglu, 2017) Geriatric patients may not be able to distinguish different colors of light used for illumination. Light colors should be used as they do not create contrasting colors; in areas where the lighting is not fully provided, yellow light should be preferred.(American College of Emergency et al., 2014)

The lighting of areas such as the bedhead and the door entrance, where the risk of falling is high, should be made with a light that is high enough from the ground to illuminate the floor (60 cm from the ground), unlike other areas illuminated from the ceiling.(Taylor & Hignett, 2016)

## **5. Privacy**

In the emergency department, it is often necessary for patients to get undressed during both examination and interventions. In terms of the complete observation of injuries in trauma patients, the findings obtained by the inspection of body parts in the diagnosis and treatment processes of medical conditions are of great importance. The privacy of geriatric patients, like other patient groups, during those procedures, is important. While curtains are often used to provide privacy, curtains can be a source of infection and contamination. Vancomycin-resistant enterococcus infections are one of the most seen infections due to curtains.(Keleş., 2019) Curtains used to provide privacy should be made of special fabrics that reduce the risk of contamination in order to prevent infection and contamination.(Luk et al., 2019) To provide privacy, coated glass systems can be used instead of curtains (Figure 4).



**Figure 4.** Sandblasted glass sample

## **6. Room design**

In emergency services, both the examination and intervention areas as well as the follow-up areas should consist of units separated by autonomous compartments for each patient. Units should allow patients to be monitored by nurses but prevent patients from seeing each other (Figure 5). Patient units should be planned as separated by glass or walls that prevent each other from being seen. Each intervention area should have a technological infrastructure that allows patient follow-up units to be monitored from nurse and doctor desks.(Terkeş & Bektaş, 2016)





**Figure 5.** An example of a regulation that allows nurses to monitor and prevents patients from seeing each other

One of the technological systems that can be used for the follow-up of patients in autonomous areas is the close follow-up of the monitors with camera systems that allow visual monitoring, but do not allow image recording considering privacy (Figure 6).



**Figure 6.** Camera systems that allow instant visual monitoring of patients

There should be handrails in areas where there may be need of holding on the wall edges, handles on the sides of the sink, closet and shower areas.(Keleş., 2019) Devices that make it easier to see and hear, such as magnifying glasses, large signboards used for warnings, phone and call tools with flashing, and sound-enhancing audiometric devices for patients with hearing problems should be available.(American College of Emergency et al., 2014; Terkeş & Bektaş, 2016)

## REFERENCES

- American College of Emergency, P., American Geriatrics, S., Emergency Nurses, A., Society for Academic Emergency, M., & Geriatric Emergency Department Guidelines Task, F. (2014). Geriatric emergency department guidelines. *Ann Emerg Med*, 63(5), e7-25. doi:10.1016/j.annemergmed.2014.02.008
- Aslan, M., & HOCAOĞLU, Ç. (2017). Psychiatric problems associated with aging and the aging period. *Duzce University Journal of Health Sciences Institute*, 7(1), 53-62.
- Banerjee, J., Conroy, S., & Cooke, M. W. (2013). Quality care for older people with urgent and emergency care needs in UK emergency departments. *Emergency Medicine Journal*, 30(9), 699-700.
- Cales, R. H., & Trunkey, D. D. (1985). Preventable trauma deaths. A review of trauma care systems development. *JAMA*, 254(8), 1059-1063. doi:10.1001/jama.254.8.1059
- Carpenter, C. R., Griffey, R. T., Stark, S., Coopersmith, C. M., & Gage, B. F. (2011). Physician and nurse acceptance of technicians to screen for geriatric syndromes in the emergency department. *West J Emerg Med*, 12(4), 489-495. doi:10.5811/westjem.2011.1.1962
- Cesur, F. (2012). Prospective Analysis of Geriatric Trauma Patients. Ege University, Department of Emergency Medicine-Specialization Thesis.
- Chu, I., Vaca, F., Stratton, S., Chakravarthy, B., Hoonpongsimanont, W., & Lotfipour, S. (2007). Geriatric trauma care: challenges facing emergency medical services. *Cal J Emerg Med*, 8(2), 51-55.
- Cortis, J., Falk, J., & Rothschild, M. A. (2015). Traumatic asphyxia--fatal accident in an automatic revolving door. *Int J Legal Med*, 129(5), 1103-1108. doi:10.1007/s00414-015-1169-3
- Demircan, A., Aygencel Bikmaz, S. G., Kadi, G., Keles, A., Bildik, F., Oktem, B., & Cakmak, O. (2017). Evaluation of the general characteristics of patients aged 85 years and above admitted to a university hospital emergency department. *Turk J Med Sci*, 47(5), 1393-1402. doi:10.3906/sag-1701-77
- Inouye, S. K., Studenski, S., Tinetti, M. E., & Kuchel, G. A. (2007). Geriatric syndromes: clinical, research, and policy implications of a core geriatric concept. *J Am Geriatr Soc*, 55(5), 780-791. doi:10.1111/j.1532-5415.2007.01156.x
- Keleş, A. (2019). Geriatric emergency room design. . In D. A (Ed.), *Geriatric Emergencies*. (Vol. 1, pp. 5-12). Ankara Turkey Clinics;.
- Kumar, P., Clark, M. L. . (2012). *Kumar And Clarks Clinical Medicine* (8th Edition ed.).
- Limpawattana, P., Phungoen, P., Mitsungnern, T., Laosuangkoon, W., & Tansangworn, N. (2016). Atypical presentations of older adults at the

- emergency department and associated factors. *Arch Gerontol Geriatr*, 62, 97-102. doi:10.1016/j.archger.2015.08.016
- Luk, S., Chow, V. C. Y., Yu, K. C. H., Hsu, E. K., Tsang, N. C., Chuang, V. W. M., . . . Wong, A. T. Y. (2019). Effectiveness of antimicrobial hospital curtains on reducing bacterial contamination-A multicenter study. *Infect Control Hosp Epidemiol*, 40(2), 164-170. doi:10.1017/ice.2018.315
- Marques, P., Queirós, C., Apóstolo, J., & Cardoso, D. (2017). Effectiveness of bedrails in preventing falls among hospitalized older adults: a systematic review. *JBI Evidence Synthesis*, 15(10), 2527-2554.
- McCusker., J. (2009). Safety of discharge of seniors from the emergency department to the community. *Healthcare Quarterly*. (12), 24-32.
- Pena, M. E., & Snyder, B. L. (1995). Pediatric emergency medicine. The history of a growing discipline. *Emerg Med Clin North Am*, 13(2), 235-253.
- Samaras, N., Chevalley, T., Samaras, D., & Gold, G. (2010). Older patients in the emergency department: a review. *Ann Emerg Med*, 56(3), 261-269. doi:10.1016/j.annemergmed.2010.04.015
- Smith SS, M. B., Delvecchio J. (2014). Geriatric emergency medicine: Concepts and a Successful Implementation (Chapter 53). In M. T. e. Strauss RW (Ed.), *Strauss & Mayer's Emergency department management*. : McGraw-Hill, 2014. American College of Emergency Physicians.
- Sultanoğlu, H., Boğan, M., Akpınar, G., & Demir, M. C. (2021). Assessment of Patients Transferred from the Emergency Department to Home by Ambulance. *Trauma*, 25, 2.4.
- Taylor, E., & Hignett, S. (2016). The SCOPE of Hospital Falls: A Systematic Mixed Studies Review. *HERD*, 9(4), 86-109. doi:10.1177/1937586716645918
- Terkeş, N., & Bektaş, H. (2016). Elderly health and technology use. *Dokuz Eylül University Faculty of Nursing Electronic Journal*, 9(4), 153-159.
- Varişlı, B. (2018). Examination of Geriatric Patients Who Presented to the Emergency Department in Terms of Clinical, Demographic and Cost *Anatolian Journal of Emergency Medicine*, 1(2), 18-24.
- Warren, C. J., & Hanger, H. C. (2013). Fall and fracture rates following a change from carpet to vinyl floor coverings in a geriatric rehabilitation hospital. A longitudinal, observational study. *Clin Rehabil*, 27(3), 258-263. doi:10.1177/0269215512455530





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