

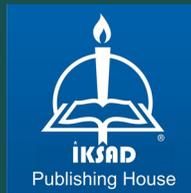


GERIATRIC EMERGENCIES

EDITORS

Assoc. Prof. Dr. Atakan SAVRUN

Assist. Prof. Dr. Şeyda Tuba SAVRUN



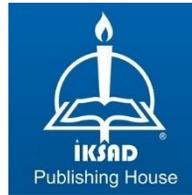
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PREFACE

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
IMMUNIZATION (VACCINATION)
THE GERIATRIC AGE
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INTRODUCTION

It is seen that the human lifespan becomes longer and the elderly population increases day by day nowadays. In reference to WHO, chronologically 65 years or older is considered to be elderly (He W et al., 2017) Vaccination is the most effective method in preventing deaths from infectious diseases. With aging, the immune system weakens. Mortality increases as a result of chronic diseases and complications related to these diseases. It has been reported that few of the targeted groups in the elderly can be vaccinated. (Ekmud., 2019).

With age, the thymus gland begins to shrink. In a 60-year-old person, the thymus gland regresses to 5% of its normal size. This leads to a decrease in the number of T lymphocytes and a weakening in the fight against infections caused by bacteria and viruses. (Naylor K et al., 2005)

Individuals aged 65 and over also have a state of extreme vulnerability to all kinds of stress factors, especially infections, called “fragility”, which precautions should be taken for this special period. (Kutlu R et al., 2019) (Siegrist CA et al., 2015).

1. Cellular and Humoral Immunization

During the development of the primary antibody response after vaccination, both T cells and B cells are activated by protein-containing antigens. In this way, they allow the differentiation of B cells with strong activity in the germinal center. As a result of the formation of antigen-specific B cells, they turn into antibody-secreting plasma cells or memory B cells. On the other hand, T cells are not activated after administration of vaccines containing polysaccharide antigens. It is only B cells that are activated. This causes a weak and short-lived antibody response. Memory cells are not formed. Such vaccines require repeat doses of vaccine to obtain effective protection, or such vaccines are conjugated with protein to stimulate T cells. (Weintraub A. et al., 2003, Lee CJ et al., 2001)

2. Active-Passive Immunization

Vaccines that are used in order to provide active immunization consist of dead bacteria vaccines, live attenuated bacteria and virus vaccines, and vaccines containing only the antigenic structures of microorganisms. In passive immunization, ready-made immune globulins or antitoxins are given directly to protect individuals.

In passive immunization, ready-made immune globulins or antitoxins are given directly to protect individuals. It is aimed to protect the person

against the infectious disease in the period that will pass until the antibody response occurs as a result of the vaccine.(Baxter D. et al.,2007).

3. Substance of the Vaccine

The vaccine contains substances related to the environment in which the vaccine is produced (such as egg antigens, serum proteins, cell culture residues), preservatives, stabilizer antibiotics and adjuvants (aluminum hydroxide, aluminum phosphate) used to prevent bacterial growth and maintain the stability of the antigen. Aluminum salts have been used in vaccines for a long time and are substances that strengthen the immune response. WHO has required that at least 80% of the antigen in vaccines be adsorbed with aluminum.

3.1. Vaccine Types

The main vaccine types currently used in the world and in Turkey are viral vaccines (attenuated live viral vaccines, inactivated-dead vaccines, subunit vaccines) and bacterial vaccines (whole cell vaccines, toxoid vaccines, subunit vaccines, polysaccharide vaccines). There are recombinant antigen vaccines and there are also combined forms of different types of vaccines.

3.Recommended Vaccines for Geriatric Age

Vaccines recommended by Advisory Committee on Immunization Practices (ACIP) for the elderly aged 65 and over are influenza, pneumococcal, shingles and tetanus vaccines. In addition to these vaccines, recommended vaccines for elderly individuals in at-risk group are

Measles, Mumps, and Rubella (MMR) vaccine, hepatitis A, hepatitis B vaccine, and meningococcal vaccine. (Kim D.K et al.,2017,CDC-WHO 2022.). It is also recommended to vaccinate the people around them in order to protect the elderly from vaccine-preventable diseases and their complications. (Lang PO et al. 2011).

3.1.Influenza (flu)

Influenza A gives rise to seasonal epidemics and pandemics whilst influenza B gives rise to seasonal epidemics. Besides, influenza C gives rise to the sporadic cases and limited regional epidemics. While influenza infection causes a significant increase in the number of hospitalizations, it can cause death due to complications, especially in at-risk groups consisting of patients over 65 years of age and/or patients with comorbidities.

ACIP recommends influenza vaccination to anyone older than six months without contraindications. In the general assembly of the World Health Organization (WHO) held in 2003, it was decided to provide influenza vaccination to all elderly people. Timing for seasonal flu vaccine usually begins in October and can continue into December and January. Early administration may cause antibody titration to drop before virus enters the circulation, and late administration may result in virus exposure before protective antibody development. (Wong, K., et al., 2012) Individuals aged 65 and over are recommended to receive this vaccine once a year. It has been shown that the influenza inactivated vaccine is 60% effective in healthy individuals under the age of 65, 50-60% in preventing hospitalization and 80% in preventing death in the elderly. (Hamborsky et al., 2015).

3.2. Pneumococcal Vaccines

Hospitalization, bacteremia, meningitis, sepsis and death are more common due to pneumonia in the elderly and those with chronic diseases.

The incidence and mortality of pneumococcal disease increases markedly above 65 years of age. There are two types of pneumococcal vaccines, one polysaccharide (PPSV23) and the other conjugated (PCV13 or PVC15-20). Since PPSV23 interacts directly with B-cells, their immunogenic potential is lower and their immune memory is less. PCV13, on the other hand, provides long-term protection thanks to the T-cell-dependent feature of its antigen by "conjugation". It is the most effective method to administer both vaccines at certain intervals in order to ensure wider antibody response and higher protection. (Hurley L.P., et al, 2014)

Both vaccines are recommended by the CDC for individuals aged 65 and over, as the conjugated vaccine provides effective protection against pneumonia and the polysaccharide vaccine provides effective protection against the complications of pneumonia. Figure 1. (Romani et al., 2011)

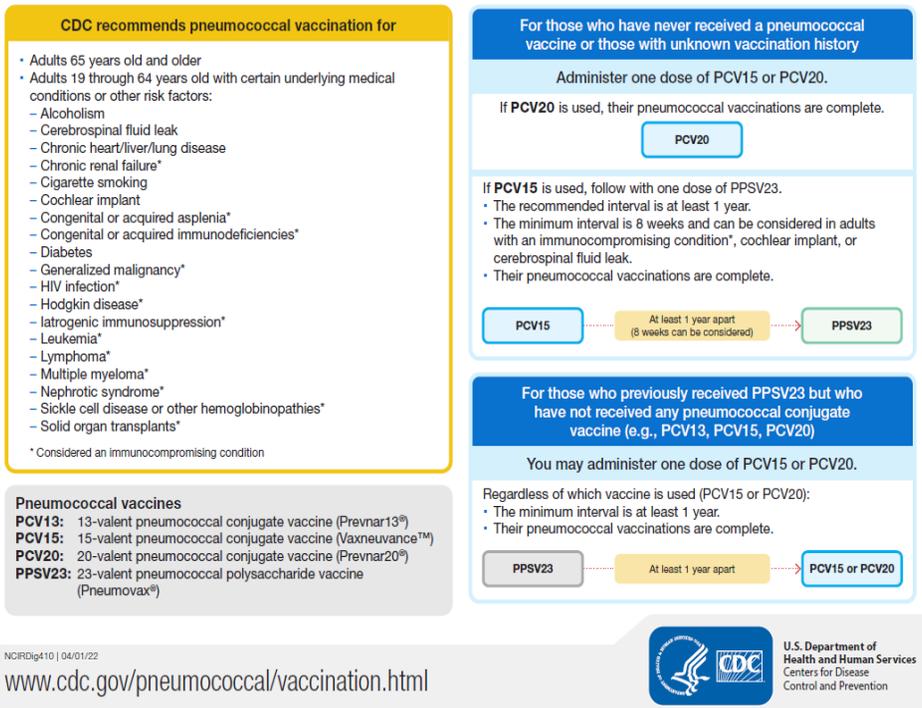


Figure 1. Pneumococcal Vaccine Timing for Adults, CDC, 2022

3.3. Tetanus vaccine

The protective antitoxin levels produced by childhood tetanus vaccine decrease significantly with advancing age. In general, it is known that the immune response due to CD4+ and T-cells changes with age and the protective effects of vaccines decrease in the elderly compared to the young (Johnson, et al, 2008). Regardless of whether Td (tetanus-diphtheria) vaccine has been administered in the last 10 years, and if so, the time of administration, 1 dose of Td vaccine should be administered to individuals aged 65 and over. In individuals aged 65 and over, the CDC's recommendation is to make boosters every 10 years (ACIP 2012). In case of any injury, if the previous vaccination status of the person is unknown, tetanus immunoglobulin should not be neglected in addition to the vaccine.

3.4. Herpes Zoster (shingles)

Shingles occurs due to the reactivation of the varicella zoster virus as a result of the weakening of the immune system. In individuals over 65 years of age, zoster vaccine is recommended as a single subcutaneous dose regardless of previous disease. Like all other live vaccines, herpes zoster

vaccine is contraindicated in cases of severe immunosuppression (Ünal, S., et al., 2015).

In clinical studies, vaccination has been shown to reduce the incidence of the disease by 51% and postherpetic neuralgia by 5-55% (Schmader, K.E., et al., 2012). Since the pneumococcal vaccine reduces the immunogenicity of the zoster vaccine, these two vaccines should not be given together.

4. Other Vaccines for Elderly People in At-Risk Group

Vaccines recommended by ACIP for the elderly aged 65 and over are influenza, pneumococcal, shingles and tetanus vaccines. In addition to these vaccines, recommended vaccines for elderly individuals in at-risk group are MMR vaccine, hepatitis A, hepatitis B vaccine, and meningococcal vaccine. (Kim, D.K., et al., 2017) (Ekmud,2019).

4.1.Hepatitis B (HBV)

Hepatitis B is a serious disease that affects the liver. It is reported that the highest mortality rate due to the disease is seen in patients over 60 years of age. In old age, hepatitis B vaccine can be made when deemed necessary by the physician. The hepatitis B vaccine can prevent hepatitis B and its serious consequences, liver cancer and cirrhosis. Hepatitis B vaccine can be given alone or in combination with other vaccines(Atabay,2017)

The vaccine is given in 3 doses. The second dose is applied one month after the first dose, and the third dose 6 months later. If a dose is missed after the first dose, the second dose is given as soon as possible and the third dose is applied two months later. Adequate antibody titer develops in only 75% of patients at the age of 60 and beyond(WHO,2022).

4.2.Chickenpox (Varicella) Vaccine

Chickenpox is a disease caused by Varicella Zoster Virus (VZV). Infected individuals are contagious from 1-2 days before the onset of rashes until the lesions crust over (4-7 days) (Atkinson, et al., 2011). It is recommended that the vaccine be given to seronegative adults in two doses, four or eight weeks apart. According to the ACIP's 2013 vaccine recommendations, varicella vaccine is recommended as two doses of vaccine to all adults without evidence of immunity, with a second dose if the first dose has already been applied. Vaccination for chickenpox is recommended for those with a high risk of contact and transmission (Koldaş .,2017).

4.3 Hepatitis A Vaccine (HAV)

Hepatitis A is a viral liver disease that can cause mild to severe illness. It is a disease that can be transmitted through infected food and water or after contact with an infected person. Generally, everyone recovers from hepatitis A without sequelae, which confers lifelong immunity. In a very small percentage of people, fulminant hepatitis can be seen with a picture and can be fatal. Current vaccines are inactivated vaccines. Inactivated hepatitis HAV vaccine is applied in two doses, 6-18 months apart, in childhood or adulthood(ACIP,2009).

4.4.Measles-Mumps and Rubella (MMR) Vaccine

MMR vaccine is given to young adults and adults who have not had these diseases before, and immunity is provided with two doses of vaccine applied one month apart. A single dose of MMR vaccine is recommended in selected at-risk situations (chronic lung, liver, kidney failure, splenectomy, complement failure) in individuals aged 65 and over (Gökçe-Kutsal Y.et al., 2010).

4.5.Meningococcal Vaccine

The important clinical picture caused by meningococci is invasive meningococcal infections, and sometimes it can present as sepsis. ACIP also recommends the use of meningococcal B vaccine in adults in at-risk group with the 2016 adult vaccination calendar. In Turkey, the meningococcal vaccine is compulsory for soldiers and those who go to hajj and umrah(NilayEtiler et al.,2019).

Vaccine	19–26 years	27–49 years	50–64 years	≥65 years
Influenza inactivated (IIV4) or Influenza recombinant (RIV4)	1 dose annually			
Influenza live, attenuated (LAIV4)	1 dose annually			
Tetanus, diphtheria, pertussis (Tdap or Td)	1 dose Tdap each pregnancy; 1 dose Td/Tdap for wound management (see notes)			
	1 dose Tdap, then Td or Tdap booster every 10 years			
Measles, mumps, rubella (MMR)	1 or 2 doses depending on indication (if born in 1957 or later)			
Varicella (VAR)	2 doses (if born in 1980 or later)		2 doses	
Zoster recombinant (RZV)	2 doses for immunocompromising conditions (see notes)		2 doses	
Human papillomavirus (HPV)	2 or 3 doses depending on age at initial vaccination or condition	27 through 45 years		
Pneumococcal (PCV15, PCV20, PPSV23)	1 dose PCV15 followed by PPSV23 OR 1 dose PCV20 (see notes)			1 dose PCV15 followed by PPSV23 OR 1 dose PCV20
Hepatitis A (HepA)	2 or 3 doses depending on vaccine			
Hepatitis B (HepB)	2, 3, or 4 doses depending on vaccine or condition			
Meningococcal A, C, W, Y (MenACWY)	1 or 2 doses depending on indication, see notes for booster recommendations			
Meningococcal B (MenB)	2 or 3 doses depending on vaccine and indication, see notes for booster recommendations			
	19 through 23 years			
Haemophilus influenzae type b (Hib)	1 or 3 doses depending on indication			

■ Recommended vaccination for adults who meet age requirement, lack documentation of vaccination, or lack evidence of past infection
■ Recommended vaccination for adults with an additional risk factor or another indication
■ Recommended vaccination based on shared clinical decision-making
■ No recommendation/Not applicable

Figure 2. Recommended Adult Immunization Schedule by Age Group, USA, 2022

5. Ways of Appliace of Vaccines

Most vaccines are applied intramuscularly or subcutaneously, usually in or near the deltoid muscle. Intramuscular injection of the needle about 5 mm is sufficient for intramuscular applications. If two different vaccines are to be applied at the same time, the vaccine is given separately to two different deltoid muscles. This practice does not change the effectiveness of vaccines. If live vaccines are to be applied, both should be applied on the same day. If it is not done on the same day, the other live vaccine can be given one month later. Immune globulins should not be given together with live vaccines (Büke et al.,2015).

6. Vaccine-Related Side Effects

Acute vaccine side effects are basically evaluated in three groups: local, systemic and allergic. The most common side effects are local reactions, swelling, redness, etc. at the injection site. Systemic side effects: These are more general effects such as fever, weakness, myalgia, headache, loss of appetite. Vaccine-related rash mostly occurs following live attenuated vaccines. Fever can be seen in all vaccines, live or non-live. Allergic reactions may occur due to another component of the vaccine, such as the vaccine antigen or cell culture material, preservative, stabilizer, or antibiotic used to inhibit bacterial growth(Gökçe-Kutsal Y.et al., 2010)

7.Vaccine Contraindications

Actual vaccine contraindications are: Cases with a previous history of anaphylactic reaction to the vaccine: in this case, the vaccine should not be given. Cases with a history of anaphylaxis to eggs or egg proteins: measles, rubella, mumps, influenza and yellow fever vaccines should not be applied to such individuals as they are prepared in embryonated chicken eggs. Cases with a history of anaphylactic reaction to neomycin or streptomycin should not be applied to such people, since neomycin is included in the measles, rubella, mumps vaccines. Cases with suppressed immune system due to disease or medication: live vaccines should not be given to such cases. (Pickering LK, Baker CJ, Freed GL, et al. 2009).

CONCLUSION

Influenza, pneumococcal diseases, tetanus and shingles are the leading diseases that can be prevented by vaccination in the elderly. It is important to vaccinate the geriatric age group against these diseases with high mortality and morbidity.

Vaccinations should be done at all ages, stay healthy.

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CHAPTER 2
PHYSICAL EXAMINATION
IN THE GERIATRIC PATIENT

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1. INTRODUCTION

Although medical technology is advanced in today's world, anamnesis and physical examination are still the most important way of diagnosis. The physical examination rules are almost the same for each patient. It should be done more carefully in geriatric patients. Geriatric patients do not always have the ability to express themselves like younger patients. This puts the physical examination ahead of the anamnesis in the geriatric patient group.

2. PHYSICAL EXAMINATION

The physical examination begins as soon as the patient enters the examination room. Information about muscle strength and neurological status can be obtained from the patient's walking, posture, handshake, and speech. The patient may be bedridden. Therefore, the examination table should be at a height where the patient can climb out. Adequate time should be allocated as examinations may take longer than normal patients. In addition, the general appearance of the patients (comfortable, restless, malnourished, careless, pale, dyspneic, cyanotic) should be described and noted (Erdinçler, 2012).

2.1 VITAL SIGNS

When we say vital signs, we talk about fever, pulse, blood pressure and respiratory rate. Body temperature can be measured from the forehead with an infrared non-contact thermometer. If the patient has come from an open area and the weather is cold, the measurement from the anterior chest wall will give a more accurate value. Absence of fever does not rule out infection in a geriatric patient, since a fever response to infection may not occur (Elsawy et al., 2011).

The heart rate should be measured on both arms. If possible, one minute should be followed and the rhythm pattern should be evaluated.

Blood pressure should also be measured in both arms. Orthostatic hypotension is common in geriatric patients. Therefore, it should be measured in a sitting position after the patient has rested for 5 minutes.

Since atherosclerosis will develop with age, hypertension may occur even if the measurement from the brachial artery is normal (Beers, 2001).

A normal respiratory rate in geriatric patients is 16-25/minute. A respiratory rate greater than 25 may be the first sign of a respiratory infection, heart failure, or other disorder (Elsawy et al., 2011).

2.2 SKIN

Degeneration of the skin, decrease in subcutaneous adipose tissue and increase in vascular fragility occur with aging. Malignant lesions (especially basal cell ca) are common in the elderly patient. Abuse should be considered in the presence of widespread and multiple ecchymosis. Keratosis, cherry angioma and seborrheic dermatitis are common in geriatric patients. Care should be taken in terms of decubitus ulcer in bedridden patients (Fields et al., 1991).

2.3 HEAD AND NECK EXAMINATION

Annual visual and hearing examination is recommended in the geriatric patient. Enophthalmia and presbyopia are frequently detected. Light reflex and accommodation are slowed down. There is hearing loss to high frequency sounds. Comprehension is developing. Hearing can be tested with “the whisper test. Oral hygiene can give clues about nutritional disorders. Somatitis can be seen in vitamin deficiencies. Cervical lymphatic examination should be performed in neck examination. The thyroid gland should be palpated for size and nodule. The carotic artery should be evaluated for murmur (Fields et al., 1991; Johnson, 2004).

2.4 CHEST EXAMINATION

Chest examination should begin with palpation. The rates of osteoporosis and fragility increase with age. Therefore, the ribs and vertebral prominences should be examined for tenderness. Lung auscultation should be performed to include the entire lung. During the examination, patients are asked to take deep breaths through their

mouths. Crepitant rales at the bases may normally also be heard. These sounds usually disappear after the patient is asked to cough several times. It is important to auscultate the patient in a rested state as lung capacities may be low (Beers, 2001; Fields et al., 1991).

2.5 CARDIOVASCULAR EXAMINATION

In geriatric patients, cardiovascular system examination is very important. Beginning the examination with the evaluation of the pulses, information about rhythm disorders can be obtained. On auscultation of the heart, diastolic or systolic murmurs, bruising, and additional sounds may be heard. A systolic murmur can be detected in about one-third of the geriatric population. Systolic murmurs can be signs of aortic stenosis. S4 can be heard in the elderly, but S3 and diastolic murmurs are always pathological (Bickley et al., 2003).

2.6 ABDOMEN EXAMINATION

Abdominal examination begins with inspection and, unlike other examinations, continues with auscultation. Palpation increases bowel motility, thus affecting the auscultation examination. Inspected surgical scars are noted and skin discoloration such as ecchymosis should be looked for. Auscultation should be performed in all four quadrants for at least one minute. The most important examination of the abdomen is palpation. Liver and spleen size, presence of pulsatile mass can be palpated. Presence of defense, rebound and tenderness are helpful for intra-abdominal pathology location. Cost-vertebral angle sensitivity should be checked. A rectal examination should be performed in every patient with constipation or abdominal pain. In addition, hemorrhoids, fecaloma, rectal cancer and prostate sizes in men can be detected by rectal examination (Reuben, 2016; US Preventive Services Task Force, 2005).

2.7 MUSCULOSKELETAL SYSTEM EXAMINATION

Swelling, redness, crepitation, limitation of movement and tenderness can be seen in the joints. Venous insufficiency and ulcers

can be seen in the lower extremities due to comorbidities. Since joint pathologies and muscle wasting will change the neurological examination, the source of the problem should be determined. Passive and active joint spacing in the joints should be noted. Since there may be pathological fractures, fractures should be suspected in cases of tenderness on palpation, even in the absence of trauma. Peripheral arteries should be palpated. The distal limbs should be compared with each other in terms of temperature (Nelson et al., 2007).

2.9 NEUROLOGICAL EXAMINATION

The most important and most difficult examination in the geriatric patient is the evaluation of the neurological system. Decreased vision and hearing caused by advanced age, as well as physiological decrease in motor functions, make it difficult to evaluate the neurological examination. Muscle strength and sensory examination of all four extremities of the patient should be noted in detail. Motor loss is expected in patients with sarcopenia, which we call muscle wasting. The sense of vibration decreased with advanced age; however, no reduction in tactile sensation is expected. No change is expected in tendon reflexes, either. The extensor response, which is pathological in the Babinski reflex, can be seen normally in geriatric patients. The cerebellar system should be examined with finger-nose test and dysdiadokinesia (Fure et al., 2011).

3. CONCLUSION

Performing a physical examination in geriatric patients is a situation that, by its nature, takes longer and needs to be done in more detail. It becomes the most important diagnostic tool in cases where patients have difficulty in expressing their problems, have the support of caregivers, and a good anamnesis cannot be obtained. Despite all the developing technologies, physical examination still remains the most important diagnostic tool.

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CHAPTER 3
CHANGES IN CARDIOVASCULAR FUNCTIONS WITH
AGING

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INTRODUCTION

Aging is a progressive natural process seen in all organisms that makes it difficult to maintain balance due to the decrease in organ function capacity. Although the definition of old age is made on the basis of calendar age, the physiological changes that occur with age do not develop at any fixed age. It progresses at a different pace in each individual. Therefore, rather than the chronological age defined as “aging”, the physiological age defined as “aging” gains importance. Aging is related with prominent impairment in physiological pathways to maintain the homeostasis in both vascular and cardiac tissues function that lead to be more susceptible for older people to cardiovascular diseases, morbidity and mortality. Age is the main risk factor for cardiovascular diseases in developed countries (Hamczyk et. al, 2020). As the elderly population of the world increases, comprehension the physiological changes caused by aging on the cardiovascular system is important for a better understanding of cardiovascular system diseases in the elderly. In this chapter we shall describe the age-related changes in both vascular and cardiac structures.

1- Age-Related Physiological Vascular Changes

In the wall structure of the arteries are observed some alterations with age such as stiffening progressively and decreased dilation ability called vascular aging. In addition to stiffening and enlargement of the vessel wall, endothelial layer also changes with aging. Due to the high velocity of laminar blood flow, the endothelial cells become irregular (Erdem A. 2013). Endothelial dysfunction including less nitric oxide and more endotelin-1 and thromboxane releasing leads to the process of vascular aging. Nitric oxide has protective effects in the vessels via inhibition of platelet aggregation and inflammatory cell adhesion to endothelial cells. It also inhibits releasing of pro-inflammatory cytokines and apoptosis. Decreased releasing of nitric oxide causes to deterioration of blood flow in tissues and leads to organ dysfunction (Ungvari et. al, 2010).

In senescent people, the wall of large arteries become wall thickening independent of atherosclerosis and stiffer due to increasing of collagen fibers and calcium deposition and fragmentation of the elastic fibers. The rate of these changes determines the degree of vascular aging in the individual. Arterial stiffness increases systolic blood pressure and lowers diastolic blood pressure. Endothelial aging and inflammation accompanies to some molecular pathways over time such as impaired oxidative balance, telomere shortening,

and mitochondrial dysfunction. The main participant to the age-associated alterations in the vasculature is oxidative stress (Lakatta and Levy, 2013). Stiffening and thickening are seen especially at the beginning part of aorta. As a result of increased blood volume in these part, afterload increases and leads to ventricular hypertrophy. Therefore, aortic root dilatation and mediastinum enlargement are seen in radiological imaging (Hochhegger et. al, 2012). In diastole, the pressure decreases as the amount of blood stored by the aorta decreases. So, pulse pressure, meaning the difference between systolic and diastolic pressure, increases with age. For this reason, pulse pressure is used as an effective hemodynamic indicator of elastic vascular structure and arteriosclerosis (Franklin et. al, 1997).

Age-related activated these inflammatory pathways can cause a wide range of macro and microvascular pathologies such as atherosclerotic plaque formation, aneurysm formation and microvascular dysfunction (Csiszar et. al, 2008). Impaired oxidant balance in aging also aggravates vascular inflammation seen in obesity, metabolic diseases and hypertension, which are risk factors for cardiovascular diseases (Tuczek et. al, 2014).

Stiffening of arterial wall is caused not to only by structural changes in the vessel wall but also an increase in sympathetic nervous system activity. Increased norepinephrine amount of blood causes to vasoconstriction. The reasons of increased norepinephrine level in circulation are increased releasing from the nerve terminals and decreased metabolism and reuptake by nerve terminal and as a result increased pass to blood (Rooke G. A, 2003).

Vascular senescent does not develop the same in women and men. Women in pre-menopausal period have lower incidence of cardiovascular disease (CVD) compared to men in similar age thanks to the protective effect of estrogen. CVD prevalence in post-menopausal women is more than men worldwide. In addition smoking, sedentary lifestyle, unhealthy diet, obesity, hypertension and to have other metabolic diseases such as diabetes mellitus, dyslipidemia are other risk factors (Nair et. al, 2021).

2- Age-Related Physiological Cardiac Changes

Cardiac aging is characterized with progressive loss of myocytes. To compensate this decline, mild hypertrophy occurs. It is also seen a decreased sensitivity to sympathetic stimuli that compromises myocardial contractility and pumping capability in older people (Lakatta and Levy, 2013). The senescent people tend to have higher blood pressures with similar heart rates and ejection fractions, and lower left ventricular end-diastolic volumes, stroke

volumes, and cardiac outputs compared to younger people. These age-associated changes in the cardiovascular system first start with changes in connective tissues that stiffens within the arteries, veins, and myocardium, causing them to become less compliant (Rooke G. A, 2013).

The changes seen in the vessel walls mentioned above are similarly seen in the heart valves. It causes hardening and calcification in the heart valves. The prevalence of valvular aortic stenosis increases with age, particularly because of aortic valve hardening, scarring, and calcification (Jung and Vahanian, 2014).

Senescent people have less cardiac relaxation ability due to weakened ventricular diastolic function related to ventricular stiffening. The increase in the amount of collagen and extracellular matrix in the ventricle causes hardening of the ventricular wall and decreased ventricular flexibility. Decreased ventricular flexibility and decreased cardiomyocyte count lead to slower and delayed relaxation rate in diastole. Over time, there is not only diastolic dysfunction in the ventricle, but also a decrease in systolic function. However cardiac output and myocardial contractility are not affected by age (Feridooni et. al, 2015).

While the diameter of the left atrium increases in aging, the left ventricular both cavity size decreases and wall thickness increases defined as concentric hypertrophy (Yoneyama et. al, 2017). Both increased fibrosis and increased aromatase expression are the results of increase in pericardial adipose tissue deposition due to releasing proinflammatory adipokines in pericardium (Fei et. al, 2010).

The main radiological signs of the heart include increased myocardial muscle mass and thickness especially left ventricle, due to myocyte hypertrophy and increased connective tissue matrix, due to fat, collagen, and calcium deposition. Most of these changes do not lead to clinical symptoms in healthy patients, they can contribute to decompensation in cases of cardiac overload due to external factors (Hochhegger et. al, 2012).

Beta-receptors located in the myocardium are impressed on aging. The changes of beta-receptors such as decreased contractile response to stimulation cause to reduced heart rate. Weak baroreflex functions and decreased vagal tone are also leads to decreased heart rate and impaired stable cardiac flow (Alvis and Hughes, 2015).

The cardiac conduction system also changes with age. The number of pacemaker cells in the sinus node decreases with age. In addition, adipose tissue, amyloid and collagen deposition increases in this region. This causes

diseases of the sinus node. Moslehi et. al, showed that the number of nodal cells decreases about 20% in older mice over time due to autophagy, apoptosis, and necrosis (Moslehi et. al, 2012). Several animal studies evaluated sinus node in aging revealed that there is slower action potential firing rate (Sharpe et. al, 2017).

Disruptions in the Purkinje system are also observed, especially in the atrioventricular node, his beam, and also in the branches of his beam. All these cause rhythm and conduction disorders. Atrial fibrillation is also an age-related rhythm disorder, but its reason has not been fully explained (Obas and Vasan, 2018).

CONCLUSION

Aging effects both the functions and the structures of cardiovascular system tissues. Especially, the impairment of vascular endothelial function is blamed impaired oxidant-antioxidant balance and consequently inflammation cellular aging in older age. The aging process in cardiovascular structures should be considered by clinicians in the diagnosis and treatment of geriatric patients. All these age-related changes in the cardiovascular system cause difficulties for the heart to deal with stress. This situation often leads to become the senescent people more vulnerable for life-threatening diseases. So, it is important to understanding the physiological changes caused by aging on the cardiovascular system and to better understand the factors that initiate these change processes in order to manage age related disorders.

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CHAPTER 4

**URINARY INCONTINENCE MANAGEMENT IN GERIATRIC
PATIENT GROUP**

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INTRODUCTION

1. Definition and Prevalence of Urinary Incontinence

Although urinary incontinence has many different definitions, its most frequently used definition determined by International Continence Society is “all types of involuntary loss of urine condition regardless of its amount” (Abrams et al., 2002). Urinary incontinence is a significant geriatric syndrome whose incidence increases along with aging and which emerges alone or accompanied by other clinical symptoms that should be treated. Though it is reported in various ratios in geriatric patient group, it is a serious public health problem with a prevalence of 10-15% in individuals at the age of 60 years and above, 25-30% in the age group above 65 years, 50% in bed-ridden or socially restricted patients, and 50% in patients over the age of 65 years and residing in nursing homes (Saxer et al., 2008).

Urinary incontinence should not be considered as a routine change that can be seen as a result of aging. It is a picture that should be evaluated along with age-related urinary and genital systems, social and cognitive changes, comorbid diseases, psychosocial factors, and functional changes. For normal urination, somatic and autonomous nervous system and coordination between cerebral cortex and brain stem should be healthy, and detrusor muscle and sphincteric muscles should function at an adequate level and in harmony (Burgio et al., 1991). In addition to neurological and physiological processes, mobilization, toilet habits, hygiene attitudes, and psychosocial and mental conditions are effective on urinary incontinence, and they should be considered while approaching this patient group (Batmani et al., 2022).

2. Causes of Urinary Incontinence in Geriatric Patients

In aging process, physiological changes are observed in the urogenital system as in other parts of the body. In the patient evaluation process of an elderly patient presenting with urinary system complaints, a clinician should have a mastery of aging-related physiological changes. Functional and histological changes that develop in the detrusor muscle are at the top of these changes. The detrusor muscle has a highly strong innervation network. Along with anatomical, histological, neurological, and vascular changes, a significant decrease can be observed in the detrusor muscle function (Valentini et al., 2021). As a result of patient-specific changes in contractility and storage functions of the detrusor muscle, loss of contractility in the detrusor muscle, urination symptoms, increased post-void residual amount, and both urination and storage complaints start to emerge. In some patient

groups, excessive activation is observed in the detrusor muscle. This situation can generally develop secondary to an underlying obstructive or irritative condition (Maxwell et al., 2021). There may occur disruptions in the sphincteric muscle tonus and detrusor-sphincter organization. For sphincter-detrusor harmony, musculo-skeletal system, central and peripheral nervous system, and neurotransmitter mechanisms should work harmoniously (Zheng et al., 2020). Clinical symptoms and results are seen where the pathology that causes the disruption of this harmony is (Tsuchiya et al., 2020). Among the leading tissues that do not progress to atrophy with aging in male patients is the prostatic tissue. Especially the obstruction that the prostatic tissue applies to the urethra and subsequent urination and storage complaints that could be observed are very important. The severity and duration of the obstruction and the response given to the obstruction are among the leading lower urinary system complaints that are prevalent in old-age male patients (Kalil & Ancona, 2020). As for women, while the effect of anatomical, neurological, and vascular system on the detrusor muscle is very prevalent, especially changes seen after menopause are important. Atrophic changes in the vaginal tissue and periurethral tissue along with the withdrawal of estrogen support from peripheral tissues, atrophy that starts in pelvic floor muscles and gradual decrease in the support of this muscle group, increase in the hypermobility of the urethral tissue, change in urethral pressures, and as a result of all these changes, a decrease in urinary retention capacity, urinary incontinence or urination disorder can be observed (Lau et al., 2021). In addition to all these changes that occur in the lower urinary system, functional and anatomical changes can also develop in the upper urinary system. Neurogenic mechanisms and functional losses at the receptor level lead to changes in the neurohumoral system (Wu et al., 2021). Along with these changes, as a result of both vascular pathologies and central problems and decreases in renal blood flow, a decrease of approximately 10 ml/min on average in glomerular filtration rate occurs every ten years (Glasscock & Rule, 2016). As a result of this decrease, glomerular filtration rate in individuals at the age of 80 years is expected to have decreased by 50% (Denic et al., 2016). As a result of the total decrease in glomerular blood flow rate and related compensatory changes, chronic renal failure at different stages is seen in 26% of the individuals over the age of 70 years (Hanlon et al., 2009). Consequently, the capacity of the renal tissue to concentrate the urine decreases, and thus, more diluted and larger volume of urine is produced. Considering the changes in the lower urinary system, there is a serious inclination towards urinary

incontinence as a result of increased urine volume and decreased storage capacity. In addition, along with the change in neurohumoral mechanism, changes in the production of anti-diuretic hormone and atrial natriuretic peptide, and changes in daily liquid intake, differences in urine production can be observed (Filippatos et al., 2017). Due to all these changes, tendency towards urinary incontinence develops along with aging, and factors added to these conditions facilitate the development of urinary incontinence.

Examination of a patient presenting to urology outpatient clinics with the complaint of urinary incontinence is aimed at the lower urinary system problems, and inquiries and diagnostic tests aim this target. However, the path to be followed in geriatric patient group is slightly different. Undoubtedly, each patient presenting with urinary incontinence complaint should be systematically examined and inquired, but this inquiry is more important in geriatric patient group than in young age group. In geriatric patients, causes other than the urinary system that could lead to urinary incontinence should be inquired in detail (Hellman-Bronstein et al., 2022). Among these causes, infections and metabolic events such as increase in urine production and hyperglycemia are the leading ones (Pop-Busui et al., 2022). Sugar regulation is highly important for diabetic patients, and due to increased urine production in hyperglycemic conditions, a disposition for urinary incontinence can be observed. However, as a result of diabetes-related endothelial damage, microvascular problems, and degenerative neuropathic events, urinary incontinence is seen in 27-39% of diabetic patients (Nazzal et al., 2019). Diabetes-related glycosuria, recurrent urinary system infections related to deterioration in urine quality, diabetic autonomous neuropathy, and diabetic cystopathy are known to have serious effects on the development of urinary incontinence (Ströher et al., 2020). Obesity is also a prevalent disease, and it usually accompanies diabetes. In obese patients, in addition to disrupted blood sugar and oxidative effects of cholesterol metabolism in microvascular environment, intraabdominal pressure elevation, decrease in the functional storage area of the bladder due to colon and rectum, and decrease in mobility are observed (Fuselier et al., 2018). In vitamin deficiencies, i.e., vitamins B12 and B6 deficiency, risks in these patients increase due to developing peripheral neuropathy, while in electrolyte balance disorders, reasons such as inclination towards diuresis increase the risk (Kesiktas et al., 2012). Regarding gastrointestinal problems, in cases such as constipation or fecal impaction frequently seen in elderly individuals, a decrease in the functional capacity of the bladder is seen, and urinary incontinence frequency increases

(Qiu et al., 2022). In chronic ischemic diseases related to vascular problems, detrusor muscle atrophy related to myopathy and neuropathy can develop, and in cases such as cardiac failure and peripheral venous insufficiency, similar conditions and nocturnal polyuria can occur (Jacob et al., 2020). In addition to central and peripheral nervous system being affected in neurological events, immobility, constipation, and disruption in functional and mental condition significantly increase the incidence of urinary incontinence in elderly patients (Rotar et al., 2011).

One of the most frequent non-urinary system causes of urinary incontinence in geriatric patient group is drug use (Tai et al., 2021). Among the drugs used frequently, antihypertension drugs take the lead. Especially polyuria developing related to loop diuretics, forcing sphincteric mechanisms due to side effects such as cough caused by angiotensin converting enzyme inhibitors, decrease in detrusor muscle contractility related to calcium canal blockers, and urinary retention are frequently encountered (Tannenbaum & Johnell, 2014). Another frequently used drug agent in geriatric patient group is non-steroid anti-inflammatory drugs in pain relieving drug group (Kashyap et al., 2013). Commonly used drugs in advanced age patient group such as antipsychotics used for psychiatric and neurological disorders, GABAergic drugs, narcotic analgesics, and tricyclic antidepressants lead to cognitive function deterioration, sedation, constipation, fecal impaction, immobility, and nocturia and thus cause a significant increase in urinary incontinence risk (Kim et al., 2022). All these factors should be considered in elderly patients who present to outpatient clinics or receive home care due to urinary incontinence complaint. The clinician should evaluate the geriatric patient factor in diagnosis, treatment, and follow-up processes.

3.Types of Urinary Incontinence

3.1.Urge Urinary Incontinence

It is the most commonly observed type of urinary incontinence. It occurs with a sudden and intense urge to urinate, and patients leak urine before they make it to the toilet. It is the most frequent type of urinary incontinence observed in geriatric patient group with rates up to approximately 60% (Russo et al., 2021). The most common underlying cause is overactivity of the detrusor muscle.

3.2.Stress Urinary Incontinence

It generally occurs during physical activity or due to conditions that could lead to an increase in intraabdominal pressure such as coughing,

bending, and laughing, and it is accompanied by weakening of the pelvic floor muscles and urethral hypermobility (Searcy, 2017). It is frequently observed in women after vaginal delivery, pelvic surgeries, obesity, and pelvic radiotherapy. It is most frequently seen in men after radical prostatectomy and pelvic radiotherapy.

3.3.Mixed Type Urinary Incontinence

It is a type of incontinence in which complaints of both urge incontinence and stress incontinence are seen, and in addition to urgent need for urination, urine is leaked as a result of coughing, activity, and exercise. Its prevalence is increasing especially in elderly women (Porena et al., 2013).

3.4.Overflow Urinary Incontinence

It is a urinary incontinence type in which contractility function of the detrusor muscle is lost, and the bladder outflow is obstructed, and it is characterized by excessive distension of the bladder (Maeda et al., 2021).

3.5.Functional Type Incontinence

It is a urinary incontinence type which restricts the patient's movement and is frequently accompanied by dementia, delirium, and psychological disorders, and is prevalent among fragile elderly individuals (Steers & Lee, 2001)

4.Urinary Incontinence Treatment in Geriatric Patients

Urinary incontinence treatment in especially geriatric patient group should be individualized by considering mostly lifestyle changes and the presence of non-urinary system causes. Patients' incontinence severity, opportunities, and care conditions are important.

In urinary incontinence treatment in geriatric patients, the presence of comorbid diseases that could be associated should be investigated. Diabetes mellitus, urinary system infections, chronic renal failure, cardiac failure, metabolic syndrome, and psychological disorders and medical treatment methods for these diseases, if any, should be primarily inquired. In patients with urinary incontinence related diseases or who receive medical treatment, appropriate treatment of the disease or modifying the drug used according to lower urinary system functions can treat the existing urinary incontinence or reduce its severity and thus can change the patient's and relatives' expectations from the treatment.

4.1.Lifestyle Changes

In the treatment of urinary incontinence in geriatric patient group, one of the first and reliable methods to be applied in terms of side effects and cost is lifestyle changes. First of all, regulating daily liquid intake is important in terms of keeping irritant matters away from the bladder, preventing dehydration, reducing irritating effect on the bladder mucosa which increased urine density may cause and decreasing need for frequent urination, and reducing tendency towards urinary system infections. There is an ongoing debate over the adequate amount or liquid that elderly patients should take. However, considering comorbid diseases in geriatric patients, it is usually recommended for them to drink 1,500-2,000 ml liquid per day (Kayser-Jones et al., 1999). Another lifestyle change is reducing the amount of caffeine intake. It has been stated that caffeine increases inclination to urinary incontinence by increasing the detrusor muscle contractility pressure, that the risk of urinary incontinence in women who drink caffeine is more than two times higher compared to those who do not intake caffeine, and that when caffeine intake amount is reduced from 23 g to 14 g, there occurs a significant decrease in urinary incontinence (Tomlinson et al., 1999). It has also been recommended in studies to avoid too spicy foods and reduce alcohol intake due to its diuretic effect.

It has been reported that obesity is an important risk factor in terms of stress type urinary incontinence as it both increases intraabdominal pressure and leads to urethral hypermobility. Each one-unit increase in body mass index is estimated to increase urinary incontinence by approximately 10% (Brown et al., 1999). Constipation is also an important parameter that should be prevented in patients with urinary incontinence, as it leads to a decrease in the bladder's functional capacity and a decrease in pelvic floor muscle functions as a result of difficulty during defecation, and it causes detrusor muscle instability related to progressive neuropathy in the pelvic floor (Alhababi et al., 2021).

4.2.Behavioral Treatments

Also known as habitual training, it aims to ensure that the patient goes to the toilet at certain times of the day whether s/he needs to urinate or not. The purpose is to keep the suitable patients dry.

Independent bladder training involves the patient resisting to the urge when s/he feels the need to urinate and postponing urination. Patients try to urinate at certain periods instead of according to the urge to urinate, and they

learn to control the urge and aim to reduce the frequency of urination, increase bladder storage capacity, and prevent incontinence. This method is based on the principle that involuntary contraction of the detrusor muscles is similar to a muscular spasm, and if the patient can hold it for two minutes, this contraction and spasm will go away. In studies conducted in this regard, it has been reported that there has been a significant decrease in the number of incontinence attacks and the amount leaked (Ersin et al., 2020).

With pelvic floor exercises, it is aimed to increase the continence support of the urethral sphincter and detrusor muscles and thus to prevent urinary incontinence. It is also aimed to increase the contraction of the pelvic floor muscle, especially the levator ani muscle, at continuous and low density, and the support of pelvic floor support and urethral closing pressure. These exercises increase the feeling of pelvic floor muscles in patients and enable them to control this muscle group, as well as increasing the features of this muscle group in terms of resilience, strength, and width. In studies conducted on pelvic floor exercises and pelvic floor muscle training, it has been observed that this treatment method leads to a significant decrease in complaints related to urinary incontinence. In order to increase the efficiency of these exercises and to raise the awareness of patients about these muscle groups, nanometric measurements have been made through methods such as electromyography, vaginal sensor, anal sensor, skin sensors, and needle electrode (Workman et al., 1993). Vaginal weight and electrical stimulation of the pelvic floor are among other methods that can be used in this regard.

4.3. Medical Treatments

Medical agents have long been used in the treatment of urinary incontinence. However, it should be noted that before starting medical treatment, lifestyle changes and behavioral therapies in suitable patients should either be started before the treatment or be recommended in combination. Antimuscarinic agents are actively used in urge urinary incontinence. The main effect mechanism of these drugs is increasing bladder capacity by affecting acetylcholine secretion. They have significant effects on urinary incontinence and overactive bladder. These drugs should either be avoided or used with caution in patients who experience severe arrhythmia when using these drugs, who are in urinary retention, and who have uncontrolled narrow-angle glaucoma, myasthenia gravis, and advanced stage liver and renal failure. In addition, due to comorbid diseases and multiple drug use in geriatric patients, care should be taken in terms of anticholinergic load.

Oxybutynin, darifenacin, solifenacin, fesoterodine, tolterodine, trospium, and propiverine are among antimuscarinic drugs currently used. Although these agents do not have a distinct superiority in terms of their effect in urinary incontinence treatment, due to their unique properties, they should be chosen according to patient groups in terms of their side effects.

General side effects of antimuscarinics are constipation, mouth dryness, decreased mucus and tear, blurred vision, anxiety, cognitive deterioration, and cardiovascular problems. Their side effect levels are higher especially in geriatric patients. Age-related metabolic changes, increase in blood-brain permeability, and decrease in acetylcholine-mediated passage are frequently observed. As a result, brain atrophy, decrease in ventricular volume along with cortical volume, and dementia development can be seen at rates of more than 20%. They can manifest in the form of acute deterioration in functions such as executive functions, attention, and psychomotor rate (Gray et al., 2015).

Another significant effect of anticholinergic drugs is on the cardiovascular system. With M2 receptor blockage at sinoatrial and atrioventricular nodes, an increase is observed in heart rhythm and transmission rate. An increase of >10 bpm in heart rate can be seen with tolterodine use, 4-5 bpm with fesoterodine use, and 18 bpm with the use of 100 mg form of trospium (Rosa et al., 2013). As a result of the increase in heart rate, tachycardia, prolonged QT duration, ventricular arrhythmia like polymorphic ventricular tachycardia and sudden death risks may occur. In addition, increased heart rate can lead to myocardial ischemia, arrhythmia, angina, and ischemic heart diseases. In geriatric patient group, this can exacerbate congestive cardiac failure which could be caused by advanced age and comorbid diseases.

Mirabegron is an agent that shows its effect through a different mechanism and can be used as the primary choice in irritative complaints or in combination with other agents. It is effective with B3 receptor agonism, but there is still no clear information about the distribution and function of these receptors in the body. Regarding its effect especially on the cardiovascular system, it can lead to an increase in heart rate. In studies conducted, it has been reported to cause an increase of 1.6-17 bpm in heart rate in individuals through its positive inotrope effect. Considering the blood pressure in patients, an increase of 4 mmHg in systolic pressure and 1.6 mmHg in diastolic pressure can be observed (Chapple et al., 2014). Although these figures may seem not so high, it is estimated that each 1 mmHg increase in diastolic blood

pressure increase mortality by 3%, and each 1 mmHg increase in systolic blood pressure increase stroke-related mortality by 2% and congestive heart disease related mortality by 1%. Moreover, in studies involving 12-month follow-up, it has been determined to lead to prolongation in QT value in patients, and it has been stated that it can lead to significantly dangerous QT prolongation in approximately one out of 200 patients (Chapple et al., 2013).

Although medical treatment is routinely used in the treatment of urinary incontinence in adult population, while starting medical therapy in geriatric and fragile patients, utmost care should be taken in terms of long duration of use and potential side effects.

4.4.Surgical Treatments

Although success rate of surgical treatments is lower in geriatric patients compared to young patients, it is routinely used nowadays. Midurethral sling surgeries are reliable surgeries that have long been used with success in stress type urinary incontinence and have low side effects. Tension-free vaginal tape and transobturator tape have success rates of above 90%, and the success rate mostly depends on the patient's age, pelvic floor muscle strength, obesity, chronic obstructive pulmonary disease, constipation, diabetes, and intrinsic sphincter insufficiency. Therefore, while recommending surgery to geriatric patient group, patients should be selected carefully (Kołodzyńska et al., 2021). As regards urge incontinence treatment, Onabotulinum Toxin A treatment, which is injected to the bladder wall, is used effectively and reliably. However, in geriatric patient group, especially patients with high post-void residual urine volume, urinary retention risk should be considered. This treatment method is applied under sterile conditions as 100 units to 20 separate points endoscopically (Atamian et al., 2021).

CONCLUSION

In geriatric patient group, urinary incontinence is a prevalent symptom which greatly affects quality of life and should be treated and managed. In geriatric patient management, detailed examination, history, and physical examination should be performed, existing comorbidities and pharmacological load should be evaluated, and by considering benefit-harm ratio, an individualized treatment specific to each patient should be applied.

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CHAPTER 5

HEART FAILURE IN ELDERLY

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INTRODUCTION

There is no common definition of elderly patients. Age 65 has been accepted as the traditional threshold for advanced age, as this age limit traditionally represents the retirement age in many cultures (Jugdutt, 2010). In recent studies at heart failure (HF) patients over 70-80 years of age are defined as "old patients", while patients over 85 years of age are often classified as "very old" patients (Barsheshet et al., 2010; Komajda et al., 2009; Manzano et al., 2011; Mogensen et al., 2011). HF is mostly the elderly's illness (Go et al., 2013). HF is one of the most common reasons of morbidity and mortality that derived cardiovascular system in the elderly (Díez-Villanueva et al., 2021). The number of heart failure patients worldwide is around 26 million, and this number is increasing over time (Ambrosy et al., 2014). According to the 2016 HF National Health and Nutrition Examination Survey statistics, HF is mostly seen in patients over the age of 80 (Mozaffarian et al., 2016).

With the understanding of its pathophysiology better with each passing day, significant advances are seen in the treatment approach of HF and especially HF by decreased ejection fraction (HFrEF). Acting quickly both of diagnosis and initiation of treatment are very important in terms of determining the prognosis (van Riet et al., 2014). There have been significant advances in technological approaches or drug treatments for HF in the last decade (McMurray et al., 2012).

The clinical profile in elderly patients with HF is different from younger patients (Mizuno et al., 2016). Elderly patients with HF usually present with multiple drug use for many reasons (Metra et al., 2015). On the other hand, physical performance is often low in elderly patients. As a result, effort-related symptoms are difficult to interpret in elderly patients. Again, low weight and low exercise performance seen in this age group have worse clinical outcomes (Rossignol et al., 2015).

1. PATHOPHYSIOLOGY AND ETIOLOGY

As a multisystem ailment, HF includes activation in the sympathetic nervous system, some neurohormonal changes, and also abnormalities in heart, skeletal muscle and kidney functions (Hajouli et al., 2022). The HF clinic is characterized with key symptoms (tiredness, dyspnea, and edema) that occur after cardiac damage and impair the heart's ability to function as an effective pump (Jackson et al., 2000). Fluid retention in HF may reduce

exercise capacity, cause pulmonary or splanchnic congestion or peripheral edema(Yancy et al., 2017).

When cardiac output decreases due to myocardial damage or stress, the sympathetic nervous system and renin-angiotensin-aldosterone system(RAAS) are activated and then the neurohormonally mediated cascade occurs. In response to this activation, norepinephrine, vasopressin, endothelin, and tumor necrosis factor- α are released. Neurohormonal activation causes an increase in systemic vascular resistance, along with sodium and water retention, resulting in clinical symptoms. Blood pressure and perfusion are maintained, but there have been increasing at myocardial oxygen request, workload of the heart, and cardiac wall strain. Some patients initially appear asymptomatic, but a secondary pathological process called cardiac remodeling may have started in these patients and may present with a more complicated clinic later on(Tintinalli et al., 2020).

In heart failure, natriuretic peptides are released as an endogenous response to neurohormonal activation(Rouleau et al., 1991). It is available in three types: atrial, type B and type C natriuretic peptide. Both type B and N-terminal pro-B-type natriuretic peptide are synthesized from N-terminal pre-pro-B-type natriuretic peptide. These two tests can be used for diagnostic purposes in the emergency department. Natriuretic peptides cause vasodilation, natriuresis, decrease in endothelin level. And also causes inhibition in the RAAS and sympathetic nervous system. Pump dysfunction caused by acute myocardial infarction may also cause HF(Tintinalli et al., 2020).

2. DIAGNOSIS

The first symptom in heart failure is decreased exercise tolerance (Spiecker, 2006). The importance of recognizing symptomatic heart failure and HF with maintained capacity of left ventricle has increased in recent years. The distinction between these two types may not be made just by patient history and physical examination(Spiecker, 2006). Echocardiography is often helpful in demonstrating systolic dysfunction, but is not sufficient alone(Spiecker, 2006).

2.1.Classification of Heart Failure

For the classification of the HF there are many different methods (Ron et al., 2018).

Table 1: Common Causes of Heart Failure (Dumitru , 2022)

Causes of systolic heart failure:	Causes of diastolic heart failure :
<ul style="list-style-type: none"> • Coronary artery disease • Diabetes mellitus • Hypertension • Valvular heart disease • Arrhythmias • Infections and inflammation • Peripartum cardiomyopathy • Congenital heart disease • Drugs • Idiopathic cardiomyopathy • Rare conditions (endocrine abnormalities, rheumatologic disease, neuromuscular conditions) 	<ul style="list-style-type: none"> • Coronary artery disease • Diabetes mellitus • Hypertension • Valvular heart disease • Hypertrophic cardiomyopathy • Restrictive cardiomyopathy • Constrictive pericarditis
Causes of acute heart failure:	Causes of high-output heart failure:
<ul style="list-style-type: none"> • Acute valvular regurgitation • Myocardial infarction • Myocarditis • Arrhythmia • Drugs • Sepsis 	<ul style="list-style-type: none"> • Anemia • Systemic arteriovenous fistulas • Hyperthyroidism • Beriberi heart disease • Paget disease of bone • Albright syndrome • Multiple myeloma • Pregnancy

	<ul style="list-style-type: none"> • Glomerulonephritis • Polycythemia vera • Carcinoid syndrome
Causes of right ventricular heart failure:	
<ul style="list-style-type: none"> • LV failure • Coronary artery disease • Pulmonary hypertension • Pulmonary valve stenosis • Pulmonary embolism • Chronic pulmonary disease • Neuromuscular disease 	

The Framingham system requires two of major criterias simultaneously or one of majors + two of minor criterias simultaneously for HF diagnosis (Löfström, 2019).

Table 2: Framingham Heart Failure Diagnostic Criteria of Heart Failure (Löfström et al., 2019)

Major Criteria	Minor Criteria
✓ Paroxysmal nocturnal dyspnea	✓ Nocturnal cough
✓ Weight loss of 4.5 kg in 5 days in response to treatment	✓ Dyspnea on ordinary exertion
✓ Neck vein distention	✓ A decrease in vital capacity by one third the maximal value recorded
✓ Rales	✓ Pleural effusion
✓ Acute pulmonary edema	✓ Tachycardia (rate of 120 bpm)
✓ Hepatojugular reflux	

<ul style="list-style-type: none"> ✓ S₃ gallop ✓ Central venous pressure >16 cm water ✓ Circulation time of ≥ 25 seconds ✓ Radiographic cardiomegaly ✓ Pulmonary edema, visceral congestion, or cardiomegaly at autopsy 	<ul style="list-style-type: none"> ✓ Hepatomegaly ✓ Bilateral ankle edema
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Invasive coronary angiography is recommended in patients whose angina persists or who develop clinical findings by ventricular rhythm disorder despite adequate and appropriate drug therapy (Cook et al., 2022). Cardiac and pulmonary exercise tests may be performed to assessing of need for heart transplantation or mechanical circulatory support (MCS) (Cook et al., 2022).

2.2. Routine Laboratory Tests

Laboratory evaluation consists of routine laboratory tests. Extra tests can also be used in specific patient groups. Complete blood count is necessary for the evaluation of deep anemia, which can be cause of HF or worsen the clinic (Beverborget al., 2018; Hessel et al., 2008). The presence of leukocytosis may be a sign of underlying infection. Apart from these, the CBC number usually gives little information. Pulmonary function tests are generally not helpful in diagnosing heart failure, pulmonary tests are used to identify or exclude respiratory causes of dyspnea. BUN and creatinine levels may be elevated due to long-term decline blood flow of kidney due to decreased cardiac output at patients who have violent HF and especially those taking high doses of diuretics for a long time.

In some cases, laboratory tests and clinical findings may not be diagnostic for heart failure. In such unusual situations, BNP or NT-proBNP measurement may help distinguish causes at shortness of breath (Januzzi et al., 2006; Maisel et al., 2002).

Other laboratory tests; arterial and venous blood gases (evaluation of hypoxemia), genetic testing, scanning electrocardiogram (ECG), X-Ray, Echocardiography, CT Scan and MRI, and angiography.

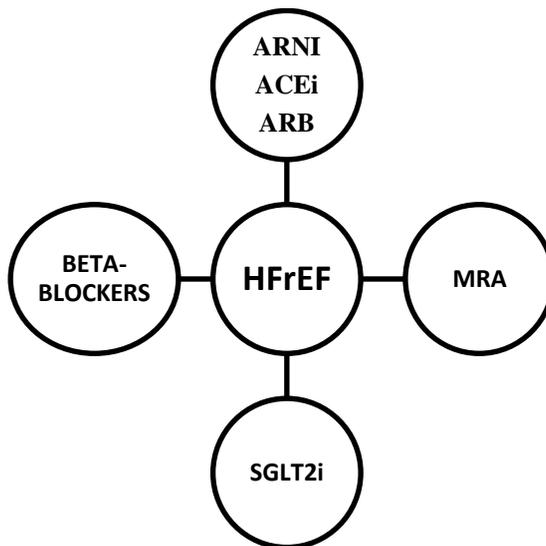
3. TREATMENT AND MANAGEMENT

HF in elderly patients may differ from younger patients in terms of pathophysiology and prognostic determinants. HF studies mostly in young patients with different clinical presentations and there are not enough studies in elderly patients.

The treatment of HF consists of two parts: pharmacological treatment and non-pharmacological interventions. Non-pharmacological treatment of heart failure; it consists of appropriate diet, fluid restriction, smoking cessation and restriction of excessive alcohol use, and physical activity is strongly recommended in these patients (Ponikowski et al., 2016).

Pharmacological recommendations for the treatment of HF are the same for younger and older patient groups. However, multiple drug use and co-morbidities are common in elderly patients, and therefore drug side effects and drug interactions are also common in this group.

There are four main pharmacological groups in HFrEF patients:



ACEi: angiotensin-converting enzyme inhibitor; ARB: angiotensin receptor blocker; ARNI: angiotensin receptor neprilysin inhibitor; HFrEF: heart failure with reduced left ventricular ejection fraction; MRA: mineralocorticoid receptor antagonist; SGLT2i: sodium-glucose cotransporter 2 inhibitor.

Figure 1: Pharmacological treatment in HFrEF (Diez-Villanueva et al., 2021)

Studies have shown that perindopril which is an ACEI is the first drug to decrease hospitalization and mortality in HF(Cleland et al., 2006). In some other studies, enalapril has been shown to reduce mortality and improve symptoms in HFrEF patients (John et al., 2014). In some studies, using high dose of ACEIs in old aged groups has been shown to decrease HF-related mortality (Barywani et al., 2015).

Tehre are similar results for ARBs. The study named CHARM (Candesartan in Heart Failure—Assessment of Mortality and Morbidity) found that hospitalization or cardiovascular death due to HF was similar in all age groups, but the total utility was higher at elderly (Cohen-Solal et al., 2008).

Beta blockers (BB) decrease mortality and staying time at hospital in elderly groups who have HFrEF and have sinus rhythm on ECG(30). In some studies, it has been shown that the use of nebivolol provides a reduction in all-cause deaths or hospitalizations due to HF, and the incidence of ischemic events (Ambrosio et al., 2011; Flather et al., 2005).

The use of mineralocorticoid receptor antagonists (MRAs) in elderly groups who have HFrEF has been associated with fewer hospitalizations, cardiovascular death, and decrease of noncardiac based mortality and MRA should be used with caution, especially in the presence of renal impairment(Ferreira et al., 2019; Japp et al., 2017).

The use of sodium-glucose cotransporter 2 inhibitors (SLGT2i), such as empagliflozin, canagliflozin and dapagliflozin, diminish staying at hospital in elderly heart failure groups who have diabetes mellitus(Zelniker et al., 2019).

3.1. Other Drugs

Although diuretics have no effect on morbidity or mortality, they are recommended to prevent congestion-related symptoms of HF(Ponikowski et al., 2016). Close observation is recommended, especially when high doses of loop diuretics are used, as elderly patients are prone to adverse reactions.

Age has no effect on the effects of digoxin therapy. Digoxin toxicity is more common in elderly female patients with a low weight (Rich et al., 2001).

Ivabradine is also associated with cardiovascular mortality and hospitalization for HF(Tavazzi et al., 2013).

Antiplatelet and anticoagulant therapy is also recommended for HF patients(Ponikowski et al., 2016).

Anemia that is a frequent comorbidity in old age, especially in elderly women and with renal failure(Westenbrink et al., 2008) causes worse prognosis.

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CHAPTER 6
CARDIOVASCULAR EMERGENCIES IN GERIATRIC
PATIENTS

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INTRODUCTION

While cardiovascular diseases are currently one of the most widespread incentives of death in all age groups, excluding childhood, in the future, if it is accepted that both parameters of the graphic will continue to increase rapidly, it will be fundamental to disannex more time to emergencies related to cardiovascular diseases in elderly patients. Structural changes and deformation of the heart and vessels with aging increase the incidence of cardiac and vascular diseases; unfortunately, it does not give the intended response to both acute and long-term treatments as expected (Borowiak, Tomasz, 2006).

This chapter flashes the approach against patients over the age of 65 in the Emergency Department (ED) whining about cardiovascular disease. General view, diagnosis, and treatment can be lifesaving for these patients who already suffer from old age and other accompanying disorders. Along with the five leading diseases such as acute coronary syndrome, dysrhythmias, heart failure, syncope, and acute thoracic aortic syndromes, which are frequently the instance for admission to the emergency department, together with other emergencies accompanied by vascular problems and long-term drug use, other emergencies associated with COVID-19 are also mentioned. Coronary issues will be converged from the point of view of geriatric patients.

GENERAL MODALITY

Every patient over the age of 65 can be counted in the geriatric patient (GP) class. The increasing population of GP entailed the necessity of sorting out fast and effective solutions in the health industry as soon as possible. It is essential to review diagnostic and therapeutic protocols, especially in order to reduce the burden of emergency services and to approach patients in the fastest, most efficient, and cost-effective way (Yazdanyar and Newman, 2009). Life expectancy is waiting to ascend in people aged 60 and over. Every country in the world makes forward-looking health plans, strengthens the foundations of its demographic structure, and creates an infrastructure for the prevention and treatment of the increasing percentage of the elderly and their accompanying diseases. According to the World Health Organization, it is not surprising that all entities to be caused by cardiovascular diseases are at the top of the list, as it is predicted that the population over 60 will increase from 12% to 22%, which is almost twice, in the time period between 2015-2050 (Ageing and Health, WHO, 2022) (Passel and D'Vera, 2008).

It would not be an exaggeration to say that the structural changes schlepped about by aging are provoked by the heart. Over time, myocardial contraction and speed decrease, cardiac conductivity system retrograde, resistance to peripheral blood rise, and blood vessels decay ability of elasticity (Kahn, Magauran and Olshaker, 2014). Taking into consideration all these chief factors, CVD progression is much worse than in young patients from geriatric patients (Kawakami, Ohshige, and Tochikubo, 2008).

1. ACUTE CORONARY SYNDROME

Acute Coronary Syndrome (ACS) is an expression that encompasses a widespread symptom integration that differs from each other in clinical presentation and a varied bundle of diseases. Lexical item of ACS is thriving day by day with novel developments in medicine (Gupta and Kaufman, 2006).

Unfortunately, current guidelines are insufficient in the geriatric group with multiple diseases, requiring a multidisciplinary approach, and are often overlooked in emergency departments (van der Meer, Gaggin, and G. William, 2019).

ACS is the title of conditions that require aggressive treatment such as unstable angina (UA), non-ST segment elevated myocardial infarction (NSTEMI) and ST elevated myocardial infarction (STEMI), including ischemic events in the heart. It has a reputation as a locomotive among the causes of death in the world (Sanchis, Perez, Leischik, and Lucia, 2016).

1.1 Clinic Presentation

Although it is expected that the geriatric patient will come with substernal chest pain that starts suddenly and can spread to the arm, shoulder, or jaw, Canto et al. stated in their study that it can present without chest pain at a rate of 33% and they emphasized that the sensitivity of astringent chest pain symptoms is only 67% (Canto et.al, 2000). In the GRACE study, the leading atypical symptoms were, in order of frequency; dyspnea, diaphoresis, nausea or vomiting, syncope, and indigestion-like symptoms (Fox et.al, 2002).

1.2 Diagnoses

As in the diagnosis of all diseases, a good anamnesis is the touchstone of diagnostic integrity (Gupta and Kaufman, 2006) (Be, Polat, and Karabudak, 2019) (Zanarelli et.al, 2022).

Electro Cardio Gram (ECG) still maintains its pinnacle of being an indispensable test in the diagnosis of all cardiovascular diseases, as well as being so cheap and meaningful, and easily accessible (Murin et.al, 2014).

Dynamic changes in the ST and T waves are highly sensitive in demonstrating acute ischemia. However, it should be kept in mind that left bundle branch block changes may be among the other common ECG findings in elderly patients, and *trouvailles* due to pacing rhythm may be concealed (Dai, Whitehead and Alexander, 2016). It should be kept in mind that geriatric patients are more inclined to NSTEMI (Goch, Misiewicz and Rysz, 2009).

The fact that cardiac enzymes are specific enough to detect microinfarcts is an advantage for emergency services. The sensitivity of troponins, which is 50% from the onset of symptoms within 4 hours, increases to 95% after eight hours. Although the elevation of troponins, which are the contractile proteins of cardiac myocytes, is accepted as the gold standard, the specificity is reduced in elderly patients when diseases such as chronic kidney disease or cerebrovascular events are generally associated with a high rate compared to younger patients (Noeller et.al, 2003).

1.3 Treatment

Basically; rapid revascularization, medical treatment, and regulatory treatments for risk factors are the cornerstones (Kayani, Khan, Deshotels and Jneid, 2020).

Early aggressive or initially conservative treatment may be preferred in the first phase, depending on the other accompanying diseases, the general condition of the patients, and whether they have STEMI or NSTEMI (Savonitto et.al, 2012). The use of antithrombotic, antiplatelet, and anticoagulant agents in the geriatric age group requires caution (Savonitto, Morici, and De Servi, 2014).

According to the American College of Cardiology Foundation/ American Heart Association Task Force on Practice Guidelines (ACCF-AHA 2013) guideline, the approach recommendations in STEMI patients can be listed as follows (O'Gara et.al, 2013).

- Transport to the hospital with an ambulance if it is possible
- Evaluate a 12-Lead EKG
- Administer reperfusion therapy within 12 hours of symptom onset in all patients without contraindications
- Prepare the patient for primary Percutaneous Coronary Intervention (PCI) therapy to reduce the abundance of ischemia

- The target of the First Medical Contact (FMC) to Device Time is to rush the patient to the appropriate hospital in 90 or exceeds 120 minutes and transfer the patient to a PCI-capable hospital for winning time.
- Use fibrinolytic therapy if there are any contraindications in 30 minutes.
- Door to Balloon (D2B), Door to Needle or Door to Device (D2D) time is recommended to be less than 90 minutes.

According to ACCF-AHA Guidelines Advised Antithrombotic treatment steps are (O'Gara et.al, 2013):

1. Aspirin 162 to 325 mg should be given before primary PCI
 2. After PCI, aspirin should be continued indefinitely
 3. A loading dose of a P2Y₁₂ receptor inhibitor should be given as early as possible or at the time of primary PCI to patients with STEMI.
- Options include; Clopidogrel 600 mg, Prasugrel 60 mg, and Ticagrelor 180 mg”.

Of course, extra caution should be exercised when administering these drugs to geriatric patients (Capodanno and Angiolillo, 2010). Therefore, these doses have been revised in elderly patients (Abraham et. al, 2013). In light of the recommendations of the European Society of Cardiology does are (Timmis et.al, 2021);

Aspirin 75-100 mg, Clopidogrel 75 mg, Prasugrel 10 mg, Ticagrelor 90 mg, Voraxaper 2,5 mg, Vitamin K antagonists lower doses with close monitoring of INR, Dabigatran 110 mg, Low Molecular Weight Heparin 1,5 mg (Andreotti et. al, 2015).

The approach in the ED to geriatric patients with NSTEMI is still ambiguous but similar to NSTEMI. It is obvious the invasive strategy can prevent morbidities after a long ischemic duration (Kumar and Cannon, 2009) (Sanchis, 2019).

2. CONGESTIVE HEART FAILURE

Although it is known that different cardiovascular diseases predispose at different rates, it is a known fact that the primary factor causing congestive heart failure (CHF) is hypertension (HT). Besides, degenerative changes in heart muscle and structure interrelated to ACS or myocardial infections can

disrupt the systolic or diastolic function according to Framingham study (Ho, Pinsky, Kannel, and Levy, 1993).

2.1 Clinical Presentation

CHF, which is at the top of the list of reasons for admission to the hospital, can appear in many different forms. The network of symptoms is quite wide. Lethargy, fatigue, confusion, dyspnea, mostly lower extremity edema, exercise intolerance, and perspiration are the principal symptoms of CHF (Senni and Redfield, 1993). The presence of diseases such as vascular degeneration with aging, long-term high blood pressure, lung diseases, obesity, orthopedic problems, immobility, accompanying chronic kidney failure, diabetes, anemia, and malignancy are auxiliary factors in the formation of the disease.

2.2 Diagnosis

After an intimate history and physical examination, EKG and laboratory tests must be performed without wasting time. Ekg can support to asses of the diastolic and valvular function (Deleme and Ray, 2008). Complete blood cell counts, electrolytes, and creatinine levels must be screened. Hyperkalemia is an inherent element of the disease and may cause ventricular arrhythmias and lead to a rapid progression to mortality (Atherton et.al, 2018). Despite the fact of increased afterload and left ventricular hypertrophy, GP may not be tachypneic because of being less sensitive to hypoxia or hypercapnia (Gupta and Kaufman, 2006). Chest X-Ray (CXR) is among the tests that should be applied urgently (Gottdiener, 2002). The natriuretic peptide is another marker that gives a dependable clue about CHF.³ Transthoracic echocardiography is an incremental diagnostic way to confirm CHF (Tsang, 2003). It can be reclamaied HFrEF if LVEF \leq 40% ,HFmrEF LVEF is 41-49 % and HFpEF LVEF \geq 50 %⁴ (Heidenreich, 2022).

2.3 Treatment

The aim of treatment in the emergency room should be to relieve breathing quickly, to clear the airway of secretions that may obstruct the patient's respiratory tract in case of possible fainting or syncope, and to

³ NT-proBNP $>$ 125 PG/mL and BNP $>$ 35 pg/mL

⁴ HFrEF: Heart Failure with reduced ejection fraction, LVEF: Left Ventricle ejection fraction
HFmrEF: Heart Failure with mildly reduced ejection fraction, HFpEF: Heart Failure with preserved ejection fraction

correct other accompanying problems in order of urgency. The treatments to be applied are as follows, respectively (Howat, 1970) (Atherton et.al, 2018).

- Oxygenation with non-invasive ventilatory support, if it is necessary bilevel positive airway pressure (BiPAP) or continuous positive airway pressure (CPAP) for preventing endotracheal intubation (Crane, Elliot, Gilligan, Richards and Gray, 2004) (Sharon, 2000).
- Angiotensin Converting Enzyme Inhibitors (ACEi)
 - Captopril; 50 mg target dose for dilatation of vessels and reduction after and pre-load (Flather, 2000).
- Angiotensin receptor Blockers (ARBs)
 - Candesartan; 32 mg target dose for sympatholytic and antiproliferative effects as well as reducing RAS activity. They provide natriuresis because of their indirect effects on aldosterone (Leong, McMurray, Joseph and Yusuf, 2019).
- Beta Blockers (BBs)
 - Bisoprolol: 10 mg target dose for slowing the heart rate and making the heart more effective at pumping blood around the body (Shah, A., Gandhi, Srivastava, Shah, K. Mansukhani, 2017). (Liu, 2014)
- Mineralocorticoid receptor antagonists
 - Spironolactone; 25-50 mg target dose for antihypertensive effect occurs to reduce proliferation and remodeling in cardiac and vascular smooth muscle cells (Ferreira, 2017).
- Isosorbit dinitrate and hydralazine
 - Combined use; 40-75 mg target dose, respectively for vasodilatation but dosage must be followed carefully in terms of life-threatening hypotension (Cole, 2011).
- Soluble guanylate cyclase stimulator
 - Digoxin; 0,5-<0,9 ng/mL target dose for slowing down the heartbeat, it increases the contraction power of the heart muscle, allowing the heart to work more effectively. It also slows abnormal electrical conduction between the heart chambers (atria and ventricles) (Heidenreich, 2022).

3. DYSRHYTHMIAS

Arrhythmia, or more appropriately, dysrhythmia, refers to all irregularities other than the normal beat pattern (rhythm) of the heart. (Carina Blomström-Lundqvist, 2003)

Rhythm disturbance occurs as a result of disturbances in the formation of stimulus in the heart and the transmission of stimulus, or both (Aronow, 1988). Symptoms of arrhythmias are usually glared as:

- Flutter
- Dizziness
- Syncope, presyncope (Grubb and Olshansky, 2008)
- Chest pain (Wilber and Hun, 2014)
- Temporary stupor (Brignole, 2018)
- Exercise intolerance (Jurgens, 2022)
- Heart failure (Aronow and Epstein , 1990)

Factors play a role in etiology

- Increased automaticity
- Re-entry
- Trigger (Assayag, Carre, Chevalier, Delcayre, Mansier and Swynghedauw, 1997)

3.1 Tachyarrhythmias

3.1.1 Dysrhythmias with narrow QRS

3.1.1.1 Sinus tachycardia

3.1.1.2 Premature atrial contractions

3.1.1.3 Multifocal atrial tachycardia

3.1.1.4 Atrial flutter

3.1.1.5 Atrial fibrillation (AF)

3.1.1.6 Supraventricular tachycardia (PSVT)

3.1.1.6.1 Atrioventricular reentry tachycardia (AVRT)

3.1.1.6.2 Atrioventricular nodal reentrant tachycardia (ANVRT)

3.1.2 Dysrhythmias with wide QRS; originating from the ventricle;

3.1.2.1 Idioventricular rhythm

3.1.2.2 Accelerated ventricular rhythm

3.1.2.3 Premature ventricular contraction

3.1.2.4 Ventricular tachycardia (VT)

3.1.2.5 SVT with aberrant transmission**3.1.2.6 Pre-excitation tachycardias (accessory pathway)****3.2 Bradyarrhythmias****3.2.1 First-degree AV block****3.2.2 Second-degree AV block; Type I and Type II****3.2.3 Third-degree AV block** (Epstein, 2008) (Adalet, 2014)

After a fast but punctilious anamnesis and examination, a technically well-drawn ECG is the most important step in diagnosing arrhythmia (Aronow W. , 2014). Although all of the listed arrhythmias have their own specific clinical, symptom or treatment, the most common and mortal outcomes, the points that an emergency physician should pay attention to are as follows:

Ventricular Tachycardia

It can be monomorphic or polymorphic. It can manifest itself as a result of acute or chronic ischemic heart diseases, hypertensive heart disease, or almost all heart diseases, which are more common in the geriatric group ((Adalet, 2014)).

In this situation, where the number of beats reaches 100-200 per minute, the P waves generally disappear on the ECG, but the QRS complexes are wide and sometimes notched (Steurer, 1994).

Ventricular Flutter

It should be treated like Vt, knowing that it is life-threatening (Arnett, 2014). Although It rarely reverts to sinus rhythm, the percentage of progression to VF is higher (Adalet, 2014).

Ventricular Fibrillation

It is a terminal increment and usually proceeds unstable. In all three ventricular dysrhythmias, the patient's primary treatment should be cardioversion or resuscitation, bearing in mind that hemodynamics will usually be impaired (Tresch, Platia, Guarnieri, Reid, and Griffith, 1987).

Atrioventricular Blockade

AV Blockade is a condition caused by a disruption of communication between the atrium and the ventricle. In geriatric patients, the riskiest in terms of emergency service is third-degree AV block, and all atrial conduction is not transmitted (Gupta and Kaufman, 2006).

In the treatment; the presence of bradycardia with hypotension, pharmacological agents should be applied immediately after transcutaneous or transvenous pacing to ensure adequate perfusion as soon as possible. The most popular drug on the list in terms of application and safety is atropine (Neumar et. al, 2010) (Zoob and Smith, 1963).

Atrial Fibrillation

It is the most common arrhythmia in the geriatric age group (Yamashita, 2016) (Furberg, 1994). Although it is not considered a demonstrative lethal, complications such as CHF and stroke impair the quality of life and can become life-threatening in case of hemodynamic instability (anuary, 2019) (Koca, 2018). Controlling possible undesirable results is possible with warfarin, aspirin, or new-generation anticoagulants, with the right dose and follow-up (Norby, 2016).

4. AORTIC DISSECTION AND AORTIC ANEURYSM

4.1 Aortic Aneurysm

4.1.1 Clinical Presentation

Aortic aneurysm and its associated fatal outcomes may result from deformation of the wall structure of the aorta with senility over time, as well as as a result of other ischemic heart diseases, traumatic or after other inflammatory processes (f). The biggest risk it carries is rupture. they are usually asymptomatic and give specific compression findings for their localization. There is a wide spectrum of symptoms ranging from hoarseness to back pain, from syncope to nausea and vomiting (Ede, 2021) (Adalet, 2014) (Gupta and Kaufman, 2006).

4.1.2 Diagnoses

Anamnesis is an indispensable element, and the diagnosis can be made by blood examination, chest or direct abdominal X-ray, ECHO, USG, and Contrast-enhanced abdominal or thorax tomography upon clinical suspicion (Svensjö, 2014).

4.1.3 Treatment

In medical treatment, beta-blocking agents to slow aneurysm dilatation, statins and ACEi to reduce vessel wall tension can be preferred (de Leur, 2015). Although surgery is an option in appropriate indications, palliative methods are mostly preferred in geriatric patients due to their comorbid conditions (Geraghty and Sicard, 2003).

4.2 Aortic Dissection

Although it is rare in percentage, it progresses catastrophically and antemortem diagnosis is very difficult. As a result of normal heart contractions, the heart in the pericardium performs a swinging motion (Yamada, Sakata, Wada, Tashiro and Tayama, 2015).

4.2.1 Clinical Presentation

Visceral complaints accompanying severe, tearing chest pain, blood pressure-pulse inconsistency, nearly normal ECG, and mediastinal enlargement of the lung in CXR may present with a clinical presentation of a long list of differential diagnoses that can be overlooked (Marston, Ahlquist, Johnson, and Meyer, 1992). It must be remembered that in geriatric patients, the pain may be more benign and not noisy, as are gastrointestinal symptoms (Hirsch, 2006) (Adalet, 2014).

4.2.2 Diagnosis

Similar to aortic aneurysm.

4.2.3 Treatment

Morphine + Esmolol + Nitroprusside combination can be used for analgesia and keeping systolic blood pressure between 100-120 mmHg. (Erbel, 2001)

- If there is no contraindication, IV B-blocker can be given with a pulse of 60 target, if there is a contraindication, a calcium channel blocker can be given. (Chaikof, 2009)
- If SBP is still >120 mmHg after reaching the target heart rate, a vasodilator can be given.
- In order to avoid reflex tachycardia, after speed control is vasodilator can be applied.

Surgical treatment can must be considered if the geriatric patient could tolerate the surgery and anesthesia (nn,hhh,iii,jjj).

(Gollodge, 2019) (Booher, 2013) (American College of Cardiology Foundation, 2010)

5. COVID-19 AND CARDIAC COMPLICATIONS

COVID-19, which took the world under effect like a storm in 2019, is a severe acute respiratory syndrome caused by SARS-CoV-2 (Bader, 2019). It is estimated that it directly affects ACE2 receptors, and directly or indirectly damages the heart, by disrupting the thrombotic activity to rise and causing

stress myopathy by systemic inflammation and disconcerting the balance between offer-demand relation of myocard (Daoust , 2020). In geriatric patients underlying comorbidities are worsening the prognosis (Zhou, 2020). Although it is still in the research phase, one of the findings confirmed by case studies, in a study by Zhou F. et al. reported that the disease was fatal in 52% of patients with CHF .

During the spread of the disease, QTc prolongation due to potassium channel blockade due to the use of hydroxychloroquine caused torsades de pointes in some patients, and this situation was exacerbated in cases where azithromycin, lopinavir-ritonavir or macrolide treatment was added (Bader, 2019).

The effect of the disease itself and the choleric treatments used will be revealed more clearly as a result of studies conducted not only in geriatric patients but also in all age groups.

CONCLUSION

Each chapter discussed geriatric patients and cardiac emergencies has enough scope to be another book chapter. However, the main topics that should be known are summarized in this section. Considering that the human body is a whole with all its organs and systems, it should be kept in mind that one simple mechanism that causes the disease can trigger another. In the geriatric patient population, which is frequently encountered in emergency services, aside from the diagnostic and therapeutic difficulties, cost-effectiveness should also be considered, and the fact that the patient can be relieved palliatively at the diagnosis-treatment-decision stage, and a clear therapeutic result cannot always be achieved.

With the studies and developments in the field of medicine, the establishment of specialization branches that can provide special emergency services for the geriatric patient population for a more organized and systematic operation of the emergency services; In the future, it can provide a solution to the increasing elderly population and the intention in emergency services.

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CHAPTER 7
ECG IN GERIATRIC PATIENT
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1. INTRODUCTION

The World Health Organization defines aging as a decrease in the ability to adapt to stressful situations and changing environmental factors. Individuals aged 60 and over constitute approximately 12% of the population in the world, and it is predicted that this rate will reach approximately 22% in 2050 (WHO,2021). In previous studies, it was reported that the most common complaints of the geriatric patient group presenting to the emergency department were falling, shortness of breath, abdominal pain, chest pain, dizziness, vomiting, and weakness (Foo et al., 2009). It has been reported that the most common diagnoses of geriatric patients in the emergency department are pneumonia, sepsis, Chronic obstructive pulmonary disease (COPD), heart failure, and ischemia (Foo et al., 2009). As is known, the risk of coronary heart disease, myocardial infarction (MI), atherosclerotic heart disease, and arrhythmia increase with age, and according to some studies, cardiovascular diseases are the leading cause of death worldwide (Yan et al., 2021) (Zoghi, 2010).

2. Cardiovascular changes in the geriatric patient

It is known that with aging, some morphological and physiological changes occur in the heart without a diagnosis of cardiovascular disease (Zoghi, 2010). The mechanisms explaining the molecular changes that occur at the cellular level include decreased autophagy, increased oxidative stress, mitochondrial dysfunction, increased fibrosis, changes in nutrition and growth-related signals, shortened telomere length, abnormal RNAs transcription and mTOR (“Mammalian Target of Rapamycin”) signals (Gülek & Yurdalan, 2021). The most common pathologies resulting from these changes are cardiac hypertrophy, arrhythmias and congestive heart failure. Apart from these, there are studies reporting that the incidence of coronary artery diseases, valve pathologies, arrhythmias, and heart failure increases with aging (Singam et al., 2021). The main reason for aging in the vascular structure is that cells lose their regeneration ability and decrease in elasticity due to the above-mentioned mechanisms. In each heartbeat, the blood hitting the aortic wall causes higher pressure due to the loss of elasticity of the aorta, and the pulse force tries to increase in order to overcome this pressure. The result is an increase in systolic blood pressure. (Singam et al., 2021). In the geriatric patient population, the clinical reflection of this situation is hypertension. In addition, changes in coronary arteries due to atherosclerosis increase with aging. Fibrous plaque accumulation on the walls of the vessels

and deterioration in the endothelial layer are other factors that increase coronary artery diseases (Akdeniz et al., 2019).

Due to the increase in apoptosis in myocyte cells, the structure of the myocardium is disrupted. To compensate for the dead cells, other cells increase their volume and this situation emerges as left ventricular hypertrophy. In previous studies, it has been reported that left ventricular wall thickness increases with aging and there is a shortening in the long axis (*Obas & Vasan, 2018*).

With aging, collagen accumulation occurs and the adipose tissue around the heart valves increases. It has been reported in previous studies that valvular diseases, which are seen at a rate of 2% under 65 years of age, are seen above 10% in the geriatric patient population due to this situation (Nkomo et al, 2006) (*Yeşilbursa, 2017*). It has also been reported that calcium accumulation occurs with aging, especially around the mitral and tricuspid valves, and this leads to stenosis (Zoghi, 2010) (*Yeşilbursa, 2017*). Aortic valve sclerosis has been reported in 80% of the geriatric patient group (Alama, 2017).

In previous studies, it has been reported that a decrease in parasympathetic activity occurs as a result of aging due to changes in baroreflex responses and heart rate (*Pascale & Govoni, 2016*). Sympathetic activity, on the other hand, increases due to the increase in the production of adrenaline and noradrenaline and the inability to reduce the catecholamine cycle (Lympelopoulos et al., 2016). In order to regulate cardiac functions that occur with aging, increased sympathetic activation functions as a compensation mechanism. For this reason, 50 times the normal amount of noradrenaline is secreted in the sinoatrial node, atrioventricular node and the nerve terminal regions of the left ventricle, and this excess noradrenaline is among the causes of congestive heart failure (*Pascale & Govoni, 2016*) (Lympelopoulos et al., 2016).

It is thought that blockade occurs on nerve conduction due to decreased myocyte, increase in apoptosis and increase in collagen tissue (*Murphy & Lazzara, 2016*). It has been reported that the incidence of syncope, bradycardia, and sudden cardiac death increases due to sinoatrial node dysfunction as a result of aging (Parashar et al., 2016).

3. ECG changes

One of the most rapid and reproducible diagnostic tools frequently used in the emergency department is the electrocardiography (ECG). ECG is

required to identify the underlying arrhythmia, primarily cardiological events, and life-threatening conditions such as pulmonary thromboembolism, electrolyte disturbances, toxications, intracranial events, and ischemic cerebrovascular disease (SVD) and mesenteric ischemia. ECG is an important test that plays a critical role in the diagnosis and treatment management of many diseases in the geriatric patient population in the emergency department.

Symptoms that require ECG recording are chest pain, palpitations, shortness of breath, abdominal pain, backache, shoulder pain, jaw pain, nausea, vomiting, syncope, near syncope, dizziness, and fatigue, which constitute the majority of the geriatric patient population's admission to the emergency department. For this reason, almost all of the geriatric patient population presenting to the emergency department are taking ECGs. In previous studies, it has been reported that the first ECG obtained in triage plays an important role in the diagnosis of the disease in patients over the age of 45 who applied to the emergency department (Moorman et al., 1985). In addition to major cardiac anomalies, electrolyte disorders are important in the diagnosis and treatment of drug-related abnormalities (Huitema et al., 2014).

It is known that abnormalities are frequently observed in the ECG of the geriatric patient population. It has been reported that ECGs evaluated as normal are detected in less than 10 percent of patients over the age of 100 (Martínez-Sellés et al., 2016). With aging, wave and segment changes such as flattening of the P wave, widening of the QRS, and changes in the ST-T wave can be seen on the ECG. In addition, it has been stated that pathologies such as left axis deviation, premature atrial complexes, premature ventricular complexes, atrial fibrillation, right bundle branch block, left bundle branch block and first degree atrioventricular block can be seen. (Jones et al., 1990).

3.1. Frequent wave and segment changes in ECG

3.1.1. P wave and PR distance

Loss of amplitude in geriatric patients due to atrial myocardial loss and fibrosis may make the P wave too small to be seen. When the rhythm is regular, ECG standard settings should be changed so that P waves can be displayed. Due to atrial fibrosis that occurs as a result of aging, there is a slowdown in conduction and atrial activity. This situation is seen at a rate of approximately 50% in patients aged 100 years and older (Martínez-Sellés et al., 2016).

3.1.2. QRS complex

Even in patients with normal sized left ventricles, the QRS may increase with aging. There are studies reporting that the presence of left ventricular hypertrophy criteria in the ECGs of elderly patients is not reliable in diagnosing left ventricular hypertrophy (Casiglia et al., 1996). QS pattern is also seen in patients without coronary artery disease due to intraseptal fibrosis.

3.1.3. ST segment and T wave

With aging, flattening of the ST segment can be seen. ST depression can also be seen in the left precordial leads (Jones et al., 1990). T wave amplitude may decrease with aging, but if there is no intraventricular conduction delay or hypertrophy, T wave inversion should suggest subendocardial ischemia. It should be kept in mind that along with these information, ST segment elevation myocardial infarction should be kept in mind together with existing complaints in the geriatric patient population.

3.1.4. QT segment

It is known that QT prolongation is common in the geriatric patient population (Rochester et al., 2018). The reason for this situation is shown as both the degeneration caused by aging and the drugs used by elderly patients with comorbid diseases (Priori et al., 2003). QT prolongation should be considered when evaluating ECG in geriatric patients, as it can cause fatal arrhythmias.

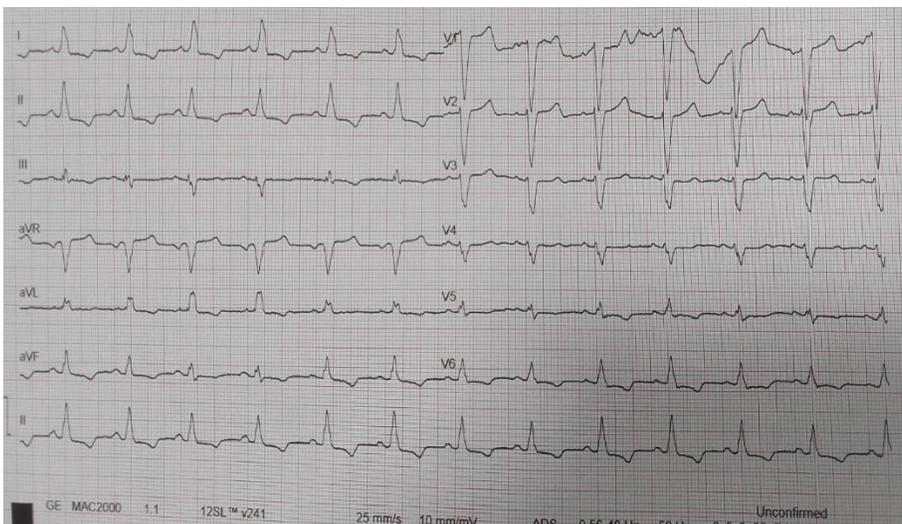


Image 1: QT prolongation

3.2. Common pathologies in ECG

3.2.1. Premature atrial and ventricular beats

There are studies reporting that the most common arrhythmias in the geriatric patient population are premature atrial and ventricular beats (Molaschi et al., 1995). It usually has a benign course, but it should be taken care of.

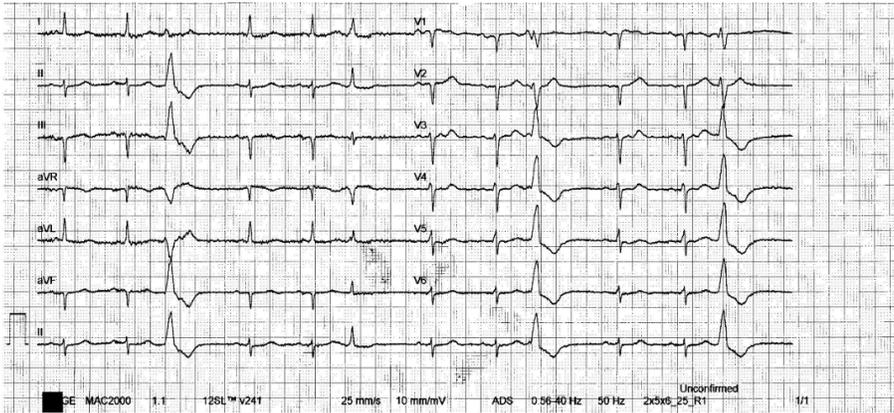


Image 2: Premature ventricular beats

3.2.2. Atrial fibrillation and flutter

It has been reported that the frequency of AF is increased in the geriatric patients, regardless the presence of both cardiac and other comorbid diseases. In a recent study, AF was found to be 6-7% in the 65-74 age group, 13-17% in the 75-90 age group, and approximately 25% over the age of 90 (26 Martínez-Sellés et al., 2015).

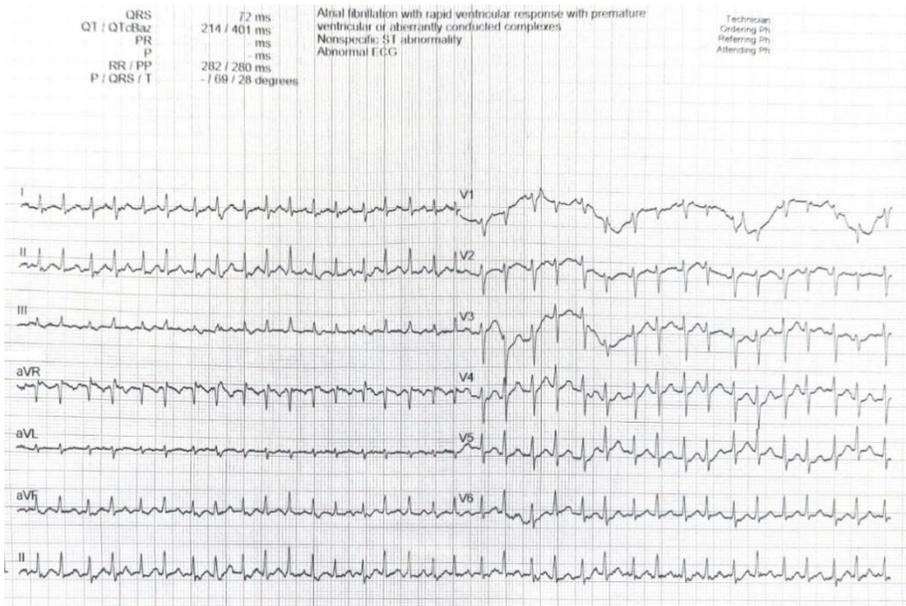


Image 3: Atrial Fibrillation

3.2.3. Atrioventricular blocks and sinus bradycardia

It has been reported that fibrocalcific changes that occur as a result of aging are responsible for conduction delays and heart blocks occurring at different levels. Progressive degeneration of the conduction system involving the atrioventricular node is responsible for the often asymptomatic PR interval prolongation and Wenckebach phenomenon. In cases where degeneration progresses, blocks that require pace maker implantation occur. In addition, the degeneration that occurs in the conduction system with aging can also appear as sinus bradycardia.

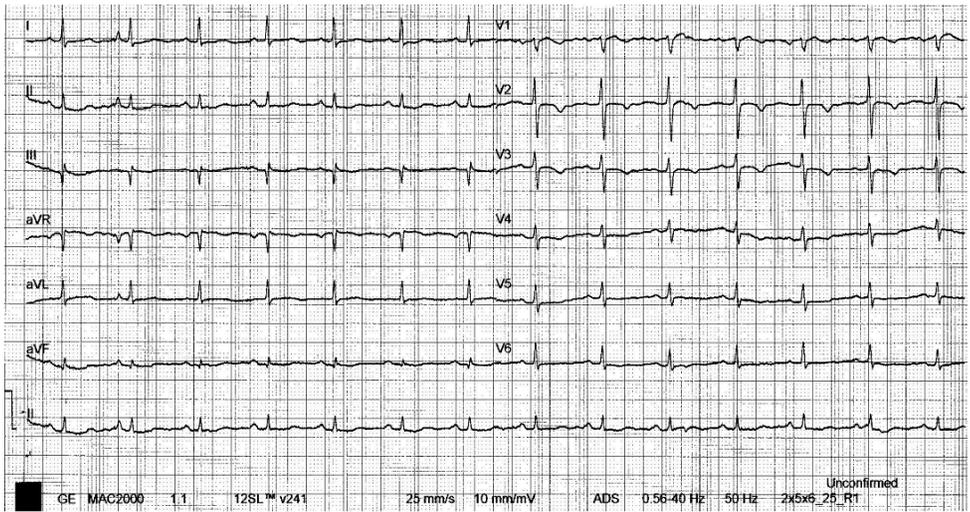


Image 4: 1st degree AV block

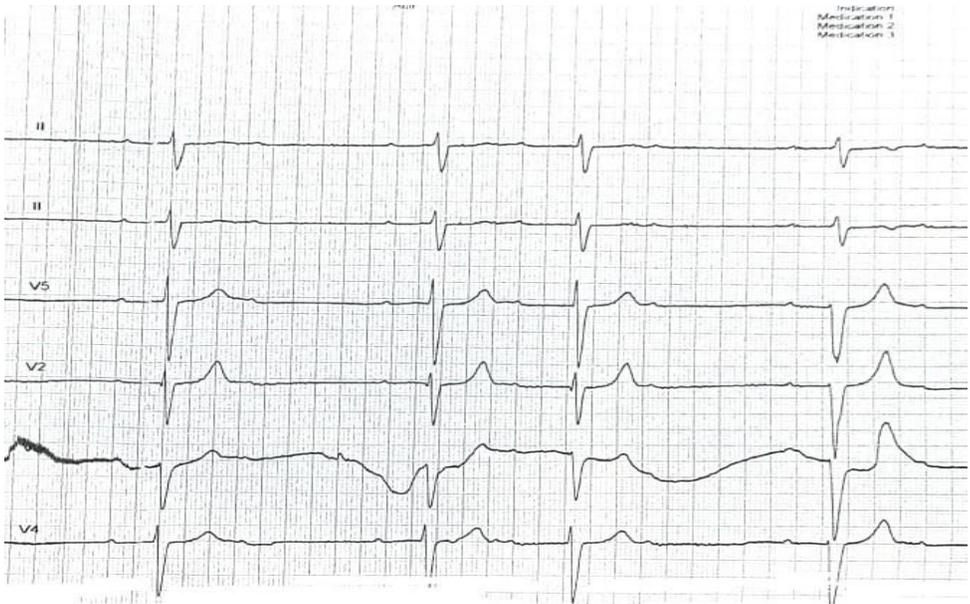


Image 5: Mobitz type 1 block

3.2.4. Branch blocks

It has been reported in previous studies that the frequency of left bundle branch block, especially left hemiblock, is increased in the geriatric patient population (*Mihalick & Fisch, 1977*). It is a point to be considered especially in the evaluation of patients presenting with chest pain.

3.2.5. Ventricular hypertrophy

The incidence of left ventricular hypertrophy (LVH) increases with age (Kannel, 1983). It was shown that the frequency of LVH increases with age and is parallel to the incidence of systemic hypertension (Kannel et al., 1969). It is stated that LVH is a poor prognostic sign even in the absence of cardiovascular disease.

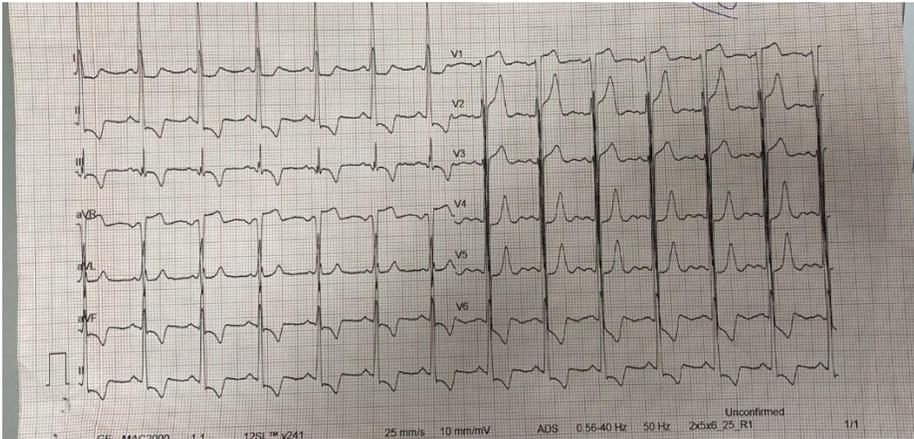


Image 6: Left ventricular hypertrophy

3.2.6. Axis deviations

It has been reported in previous studies that left axis deviation can be seen in ECG with aging. It is thought that this may be due to the displacement of the heart backward and to the left due to weight gain and emphysema after aging.

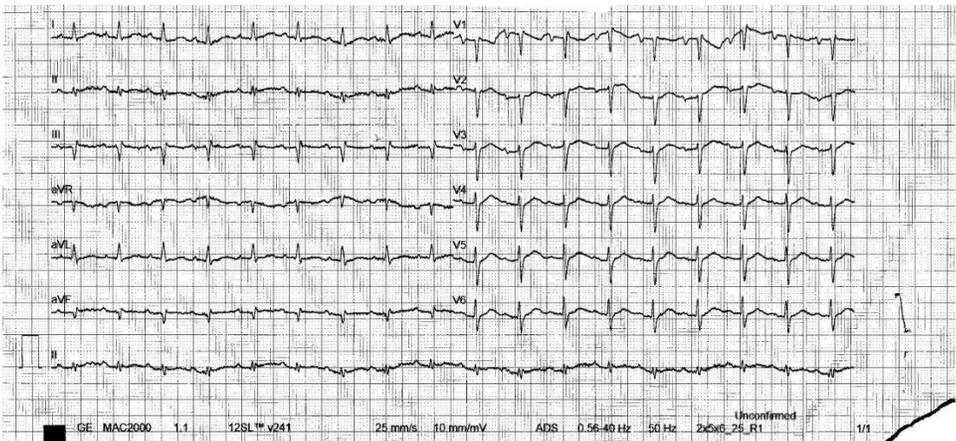


Image 7: Left axis deviation

CONCLUSION

Aging; It is a process characterized by loss of cells and a decrease in the body's regenerative capacity, bringing morbidity and mortality. Along with aging, changes occur in the cardiovascular system as well as in all other systems.

The molecular mechanisms that account for these changes; autophagy decreased, oxidative stress increased, mitochondrial dysfunction, calcium imbalance, increased fibrosis, altered nutrition and growth signals, telomere damage, RNAs transcription and abnormal mTOR signaling.

Physiological changes in the cardiovascular system with aging; Decreased vascular compliance and deterioration in vascular endothelial structure, left ventricular hypertrophy and dysfunction, decreased baroreceptor sensitivity, decreased exercise capacity, increased systolic blood pressure, differentiation in heart valve tissues and valve insufficiency, increased sympathetic activation and decreased parasympathetic nervous system activation, and decreased conduction.

ECG changes occurring in the geriatric patient population due to all these changes can be summarized as follows.

Common ECG wave and segment changes:

- A decrease in the amplitude of the P wave
- QRS widening
- QS pattern
- ST-T wave changes
- QT prolongation
- Decrease in T wave amplitude

Common ECG pathologies:

- Premature atrial and ventricular beats
- Atrial fibrillation/flutter
- Sinus bradycardia
- 1st degree AV block
- Mobitz type 1 AV block (Wenckebach phenomenon)

- AV complete block
- Left/right bundle branch block and left hemiblock
- Left axis deviation
- Left ventricular hypertrophy

Being aware of the changes that occur in the cardiovascular system with aging, as well as how these changes are reflected in the ECG, will be useful in order not to miss vital diagnoses when evaluating geriatric patients in the emergency department. ECG findings. In addition, existing comorbidities and drug use should be taken into account when evaluating geriatric patient ECGs in the emergency department. It should be kept in mind that tachycardia may be masked especially in patients using airmia drugs such as beta-blockers and calcium channel blockers, and borderline bradycardia may be due to drug use in this patient group. Therefore, remembering this information while evaluating the geriatric patient's ECG in the emergency department will contribute to the correct decision-making process..

Note: ECG images belong to the author.

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CHAPTER 8

**DIAGNOSIS AND TREATMENT OF PULMONARY
EMBOLISM IN GERIATRIC PATIENTS**

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INTRODUCTION

Pulmonary embolism is a life-threatening disease caused by occlusion of the pulmonary artery or its branches by a thrombus originating from the systemic deep venous system. The association of Deep Vein Thrombosis (DVT) and pulmonary embolism is referred to as Venous Thromboembolism (VTE). It ranks third among deaths due to cardiovascular diseases (Yeşildağ, K.2022). Pulmonary embolism is one of the preventable diseases. It is also a disease with high mortality and morbidity, recurrent and difficult to diagnose. The annual incidence of pulmonary embolism is approximately 75-269/100,000 and the incidence of the disease increases with increasing age (Yeşildağ, K.2022). Pulmonary embolism in the elderly may present with clinical complaints and findings similar to cardiopulmonary comorbidities. However, with the decrease in cognitive functions, there are difficulties in diagnosis due to the decrease in symptom perception, notification or neglect. In addition, the medications used by these patients may also cause difficulties in the treatment of pulmonary embolism. (Yeşildağ, K,2022).

The World Health Organization (WHO) considers the chronological definition of old age. It considers this period as "65 years and older". According to WHO, age groups are defined as: 65-74 age group: "young old age" period, which is often considered as the period following retirement; 75-84 age group: "advanced old age" period, in which functional losses begin to increase; 85 and over age group: "very advanced old age" period in which special care or assistance is needed. In the reports published by the United Nations, 60 years of age and above are considered as elderly (Durak et al., 2014)

1. Epidemiology

"Pulmonary embolism (PE) is a major cause of death worldwide, with more than 100,000 deaths in 2018 alone (Martinez et al, 2020). In epidemiologic studies, annual incidence rates for PE range from 39-115 per 100,000 population. Incidence rates for DVT range from 53-162 per 100,000 population. Cross-sectional data show that the incidence of VTE is almost eight times higher in individuals aged 80 years and older than in the fifth decade of life (Konstantinides et al., 2020).

Diagnosing pulmonary embolism in elderly patients is challenging due to associated comorbidity and the difficulty of elderly patients to describe symptoms. The increased risk of pulmonary embolism, which has a high mortality rate, and the development of clotting tendency are known to be

associated with severe acute respiratory syndrome coronavirus disease 2019 (Covid-19) (Quezada-Feijoo et al, 2021).

Advanced age and comorbidities are important risk factors for morbidity and mortality in Covid-19 patients. Pulmonary embolism is responsible for the majority of thromboembolic events in COVID-19. In addition, D-dimer levels are considered an independent marker for survival and thromboembolic events in COVID-19. However, the diagnostic accuracy of D-dimer tests for pulmonary embolism in patients with COVID-19 is similar to d-dimer tests in the normal population. Although pulmonary embolism has been reported to occur frequently in patients with COVID-19 and is associated with poor prognosis, the actual incidence is unknown (Suh et al, 2021).

The number of studies on pulmonary embolism in geriatric patients is high. And compared to the normal population, patients without risk factors are thought to have a better prognosis in terms of survival. (Ahoroni et al,2021).

2. Pathophysiology

The source of pulmonary embolism is mostly thrombi that form in the deep veins of the legs. Disruption of vascular integrity, increased coagulability and stasis, which are components of the Virchow triad, remain important in the pathogenesis of deep vein thrombosis (DVT) (Ahoroni et al,2021). A clot begins to form in the damaged area as a result of the release of tissue factor. The body's anticoagulant and fibrinolytic systems are activated to dissolve the clot. If the clot is small, it may dissolve spontaneously. However, large clots cause a sudden increase in pressure in the pulmonary arteries and can lead to circulatory collapse and sudden death. Obstruction of the pulmonary artery also releases some vasoactive mediators. This causes an increase in right ventricular afterload and a sudden increase in pulmonary artery pressure. If there is an underlying cardiopulmonary disease, this facilitates the onset of right ventricular dysfunction. The right ventricular wall thickness is thinner than the left ventricle. Therefore, the right ventricle dilates more easily in response to sudden load. This dilatation in the right ventricle leads to a decrease in left ventricular filling and cardiac output, resulting in decreased coronary perfusion and circulatory collapse and shock (Karalezli, A. 2018).

With aging, there is an increase in oxidative stress, telomere shortening, impaired autophagy, a decrease in stem cells, and inadequacy in cell renewal, cell and tissue repair with depletion. Depending on these, there

is a decrease in the function of physiological mechanisms covering all organs and prepares the ground for the Elderly To Get Sick (Barnes P. J. 2015).

3. Clinical Findings

The clinical picture of pulmonary embolism is variable. Some patients may not have symptoms despite pulmonary embolism. In a study conducted on this subject, it was reported that approximately 40% of patients with DVT had no symptoms (Ünlüer & Denizbaşı,2022). In symptomatic cases, chest pain (88%), shortness of breath (84%), cough (53%) and hemoptysis (30%) are among the most common symptoms (Ünlüer & Denizbaşı,2022). As in myocardial ischemia, the pain caused by pulmonary embolism can be seen in a wide and variable range such as sudden pleuritic, respiratory sharp pain, shoulder-abdominal-substernal pain that cannot be clearly expressed.

The findings are variable and nonspecific. Therefore, angina, myocardial infarction, asthma, congestive heart failure, hepatitis, herpes zoster, sepsis and pancreatitis are some of the diseases that should be considered in the differential diagnosis. In pulmonary embolism, the patient may be seen atypically in the emergency department as in abdominal pain, isolated high fever, new onset reactive airway disease, new onset atrial fibrillation, disseminated intravascular coagulation (Ünlüer & Denizbaşı, 2022).

4. Diagnosis

The diagnosis of pulmonary embolism is made by combining a careful anamnesis, physical examination, laboratory tests and appropriate imaging methods (Öner et al., 2009).

Shortness of breath is the most common symptom. Severe dyspnea, cyanosis and syncope support massive pulmonary embolism. Pleuritic pain, cough or hemoptysis indicate a smaller pulmonary embolism with peripheral localization. Tachypnea is the most important examination finding (Öner et al., 2009).Pulmonary embolism is classified as massive, submassive and nonmassive. Patients with massive PE may present with hypotension, cardiogenic shock or cardiac arrest (Öner et al., 2009). Patients with submassive embolism may show signs of right ventricular failure such as tachycardia, fullness in the neck veins, tricuspid regurgitation and aggravation of pulmonary closure sound (Ünlüer & Denizbaşı, 2022).

Signs of pulmonary embolism are rarely detected on chest radiography. They also include the Hampton hump (wedge-shaped airspace opacity indicating infarction) or the Westermark sign (proximal pulmonary

artery marked by a reduction in more peripheral blood vessel markings). On electrocardiography, the most common sign of pulmonary embolism is sinus tachycardia or atrial fibrillation. However, nonspecific signs of right heart strain include S1Q3T3, anterior precordial T wave inversions, inferior/anterior precordial ST segment elevation (Rivera-Lebron, B et al., 2019).

Biomarkers for pulmonary embolism are not specific. Elevated levels of d-dimer, troponin and lactate have been associated with higher mortality but they are not specific. At the same time, these biomarkers are valuable in identifying patients with suspected pulmonary embolism, but are not diagnostic alone (Ishaaya & Tapson, 2020).

D-dimer is elevated in plasma in the presence of acute thrombosis due to simultaneous activation of coagulation and fibrinolysis. D-dimer test has a high negative predictive value. Normal d-dimer level excludes acute pulmonary embolism or DVT. On the other hand, elevated D-dimer levels have a low positive predictive value. D-dimer testing is not useful for confirmation of pulmonary embolism. D-dimer is also frequently elevated in patients with cancer (Konstantinides et al., 2020). The specificity of D-dimer for suspected pulmonary embolism progressively decreases with age to 10% in patients >80 years of age. The use of age-adjusted cut-off values may improve the performance of D-dimer testing in the elderly (Konstantinides et al., 2020).

In patients with suspected pulmonary embolism, scoring according to symptoms, findings and risk factors for diagnosis and clinically classifying them as low, intermediate and high probability is useful in empirical diagnosis and treatment. For this reason, Wells and Geneva scoring are the most commonly used ones today. In the scoring, the probability of low, medium and high risk is determined according to the patient's score. (Ishaaya & Tapson, 2020)

Multidetector computed tomography pulmonary angiography (MDCTA) is the preferred method to visualize pulmonary vascular structures in patients with suspected pulmonary embolism. It provides adequate visualization and diagnosis of pulmonary arteries down to the subsegmental level (Konstantinides et al., 2020).

Table 1. Wells Pulmonary Embolism Clinical Prediction Scoring (Ishaaya & Tapson, 2020)

Signs	Score
Presence of symptoms and signs of DVT	3
Low probability of alternative diagnosis	3
Tachycardia (>100/min)	1,5
History of immunization or surgery in the last 4 weeks	1,5
Previous history of DVT and pulmonary embolism	1,5
Hemoptysis	1
Malignancy	1
Total score <2 score :low clinical probability 2-6 score :medium clinical probability >6 score :high clinical probability	

Table 2. Modified Geneva Scoring (Ishaaya & Tapson, 2020)

Signs	Score
>65 years of age	1
Previous history of DVT or pulmonary thromboembolism	3
History of surgery or extremity fracture within one week	2
Presence of active malignancy	2
Unilateral lower extremity pain	3
Hemoptysis	2
Heart rate 75-94/minute	3
Heart rate >95/minute	5
Pain on palpation of the leg or unilateral leg edema-swelling	4
Total score 0-3 points :low probability 4-10 points :medium probability ≥11 points :high probability	

Ventilation/Perfusion (V/P) scintigraphy is a noninvasive diagnostic method with proven reliability that evaluates regional blood supply and ventilation of the lungs in patients with suspected pulmonary embolism. However, its routine use is not common (Öz et al., 2014).

Doppler ultrasonography (USG) is a noninvasive method used to detect venous occlusion using color spectral doppler of flow and phase (Rahaghi et al., 2018)

Echocardiography (ECHO) is a semi-invasive diagnostic tool performed transthoracically or transesophageally and is especially valuable in detecting the presence of massive PE (Sharif Khan et al., 2020)

Echocardiography (ECHO) is a semi-invasive diagnostic tool performed transthoracically or transesophageally and is particularly valuable in detecting the presence of massive PE (Sharif Khan et al.)

Some exclusion criteria (PERC) are used to reduce reliance on the use of D-dimer to rule out pulmonary embolism (table 3). Pulmonary embolism can be excluded from patients who meet all of the exclusion criteria. However, these exclusion criteria cannot be used in geriatric patients due to the age criterion among the criteria.

Table 3. Pulmonary Embolism Exclusion Criteria (PERC)

PERC (Pulmonary Embolism Rule-Out Criteria)
Age < 50
Saturation > 95% (at room air)
Pulse rate <100/minute
No history of DVT/PE
<4 weeks previous surgery & trauma
No hemoptysis
No use of estrogen
No unilateral leg swelling

5. Treatment

After diagnosis, the main treatment is based on supportive care, systemic anticoagulation and reperfusion (Theroux et al., 2019). In the absence of contraindications, systemic anticoagulation should be initiated rapidly. For higher-risk patients, intravenous unfractionated heparin (UFH) is preferred and hemodynamic support and respiratory support should be provided in addition to anticoagulation (Leentjens et al.,2017).

5.1. Support treatment

Hypoxemia is one of the features of severe pulmonary embolism and is mostly caused by a disturbance in the coupling between ventilation and perfusion. Therefore, oxygen therapy should be initiated in patients with pulmonary embolism and SaO₂ <90%. In the presence of severe hypoxemia, invasive or noninvasive treatment with mechanical ventilation should be considered (Konstantinides et al., 2020).

5.2. Anticoagulant treatment

In cases where the clinical suspicion for pulmonary embolism is high and the risk of bleeding is low, anticoagulation should be initiated without waiting for diagnostic tests in case of delayed results of diagnostic tests. Low molecular weight heparin and fondaparinux are preferred over unfractionated heparin (UFH) for initial anticoagulation in pulmonary embolism because they have a lower risk of bleeding and thrombocytopenia (Konstantinides et al., 2020). In addition, UFH is recommended for patients with severe renal impairment with CrCl (creatinine clearance) below 30 mL/min (Hughes et al., 2014). Therefore, treatment should be initiated taking into account the impairments in creatinine clearance frequently encountered in the geriatric patient population (Rocca et al., 2018).

If oral therapy is to be initiated in eligible patients, the first choice of anticoagulant therapy is new generation oral anticoagulants. Dabigatran, rivaroxaban, and apixaban can be given without dose adjustment in patients with CrCl 30-60 ml/min. Edoxaban 30 mg should be given in these patients (Rocca et al., 2018).

6. Thrombolytic treatment

Systemic thrombolysis is preferred for rapid thrombus dissolution and rapid recovery of pulmonary perfusion. This leads to rapid improvement in ventilation/perfusion and right ventricular afterload. It improves hemodynamic status by reducing pulmonary vascular resistance (Rivera-Lebron, B et al., 2019). There is a risk of intraparenchymal bleeding with thrombolytic therapy (Konstantinides et al., 2020). When planning thrombolytic therapy in geriatric patients, the patient's comorbidities should be taken into consideration. In cases of cardiac arrest due to pulmonary embolism; administration of thrombolytic therapy with tissue plasminogen activator (tPA) or bolus Tenecteplase via bolus or rapid infusion increases the rate of return of spontaneous circulation and the frequency of survival (Konstantinides et al., 2020). In addition, comorbid diseases in elderly

patients increase the likelihood of major bleeding (Konstantinides et al., 2020).

Age should not be considered a contraindication for thrombolytic therapy in patients with massive pulmonary embolism.

Table 4. Thrombolytic treatment (Konstantinides et al., 2020)

RtPa	<ul style="list-style-type: none"> • 100 mg in 2 hours • 0.6 mg/kg over 15 minutes (maximum dose 50 mg)
Streptokinase	<ul style="list-style-type: none"> • 250,000 IU as a 30-minute loading dose, followed by 100,000 IU/hour over 12-24 hours • Accelerated regimen: 1.5 million IU in 2 hours
Urokinase	<ul style="list-style-type: none"> • 4400 IU/kg as a 10-minute loading dose, followed by 4400 IU/kg/hr over 12-24 hours • Accelerated regimen: 3 million IU in 2 hours

Thrombolytic treatment has absolute and relative contraindications (Konstantinides et al., 2020)

Table 5. Absolute contraindications (Konstantinides et al., 2020)

Absolute contraindications

- History of hemorrhagic stroke or stroke of unknown origin
- Ischemic stroke in the previous 6 months
- Central nervous system neoplasm
- Serious trauma, surgery or head injury in the previous 3 weeks
- Bleeding diathesis
- Active bleeding

Table 6. Relative contraindications (Konstantinides et al., 2020)

Relative contraindications

- Transient ischemic attack in the previous 6 months
- Oral anticoagulation
- First week of pregnancy or postpartum
- Non-compressible puncture sites
- Traumatic Resuscitation
- Refractory Hypertension (systolic blood pressure > 180 mmHg)
- Advanced liver disease
- Infective endocarditis
- Active peptic ulcer

Although there is no difference in diagnosis and symptoms in geriatric patients compared to the general population, more caution is required in treatment.

When treating geriatric patients, a holistic approach should be taken by considering the existing comorbidities.

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CHAPTER 9

**LIQUID AND ELECTROLYTE DISORDERS
IN GERIATRIC PATIENTS**

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INTRODUCTION

Fluid and electrolyte disorders can develop for many reasons in all age groups. However, in old age, which is an inevitable process, these disorders appear more frequently. There are many anatomical and physiological changes that facilitate this situation in old age.

With aging, differentiation is observed in the mechanisms that provide water and electrolyte balance. Water constitutes approximately 60% of body weight in adult males and 55% in females. However, with aging, a decrease in total body water is observed. This decrease is mostly in the intracellular compartment and is the main cause of cellular dehydration (Gülhan, 2018).

The kidneys are significantly affected by the aging process. Progressive loss of nephrons in the cortex, glomerular and tubulointerstitial damage, deterioration in kidney functionality are some of them. Along with functional loss, structural deterioration also occurs with increasing age; renal size decreases, glomerular sclerosis and tubulointerstitial fibrosis increase (Neugarten, Gallo, Silbiger and Kasiske, 1999).

With advanced age, the hormonal balance in the body also changes. After the increase in atrial natriuretic peptide (ANP) and suppression of the renin-angiotensin-aldosterone system (RAAS), the urinary concentration ability of the person and the feeling of thirst decrease. Body salt loss increases (Yoon and Choi, 2014).

The presence of conditions such as decreased muscle mass, multiple drug use, comorbid diseases, and nutritional disorders seen in elderly patients are also factors that play a role in the formation of fluid and electrolyte imbalances more frequently (Öktem, 2019).

1.DISORDERS OF SODIUM METABOLISM

It is the main extracellular cation responsible for plasma osmolarity in the body. It is found in concentrations of approximately 140 mEq/L and predominantly in the extracellular fluid. Its intracellular concentration is around 10-12 mEq/L. The passage of sodium (Na) through cell membranes is provided by the Na-K-ATPase pump (Kelen, Hsu, 2015).

While most of the daily dietary sodium is excreted through the kidneys (95%), the rest is removed through sweat and faeces. While almost all of the sodium filtered from the glomeruli is reabsorbed, less than 1% is excreted in the urine (Ateş, 2007). Renal excretion of sodium is mostly regulated by changes in arterial volume. A decrease in arterial volume is sensed

by baroreceptors. In response to this reduction, the RAAS comes into play. This increases the reabsorption of sodium from the tubules. In case of extracellular fluid increase, ANP activates and inhibits sodium reabsorption (Yıldız, Kayataş&Candan, 2011). Sodium loss begins to increase with kidney aging. The most important reason for this is the decrease in RAAS activation and the increase in ANP level (Bauer, 1993). Disturbances in baroreceptor perception and decreased glomerular filtration rate (GFR) may also cause changes in sodium level.

1.1. Hyponatremia

Hyponatremia, the most common electrolyte disorder, is a condition in which the serum Na value is less than 135mEq/L. It is generally seen in 5-10% of the geriatric population and this rate increases to 20% in comorbid diseases and 50% in hospitalizations (Lederer and Nayak, 2017; Wong and Campbell, 2014). Along with the deterioration of renal functions with age, the increase in chronic diseases and the use of multiple drugs that may cause hyponatremia cause serious morbidity and mortality in this population. Hyponatremia is examined in 3 groups according to the patient's plasma osmolality;

1.1.1. Isotonic Hyponatremia (Pseudohyponatremia)

Plasma osmolality is normal (275-295 mOsm/kg water). Conditions with hyperlipidemia and hyperproteinemia (multiple myeloma, Waldenström macroglobulinemia, etc.) cause low serum Na levels without reducing serum osmolality (Yıldız and others, 2011). The reason for this erroneous measurement is the calculation of mass per volume in traditional laboratory methods. Since there is no true hyponatremia, it requires evaluation and exclusion before intervention

1.1.2. Hypertonic Hyponatremia

Plasma osmolality is high (> 295 mOsm/kg water). The presence of solutes in the extracellular fluid that increase the plasma osmolality causes the passage of water to this area and a decrease in the amount of Na dilutionally. The most common cause of this condition is hyperglycemia. In addition, administration of IV mannitol and absorption of solutions such as sorbitol-glycine used in some surgeries may also lead to this type of hyponatremia (Al-Salman, Kemp, Randall, 2002). When hyponatremia due to hyperglycemia is detected, it is necessary to calculate the corrected Na plasma level. If plasma glucose is between 100-400 mg/dl, 1.6 mEq/L decrease in

sodium for every 100 mg/dl increase in glucose; If plasma glucose is > 400 mg/dl, a decrease of 2.4 mEq/L in sodium is expected for every 100 mg/dl increase (Hillier, Abbott, Barrett, 1999).

1.1.3. Hypotonic Hyponatremia

Plasma osmolality is low (< 275 mOsm/kg water). It is the most common form of hyponatremia and is characterized by insufficiency of renal fluid excretion. It is divided into 3 classes according to the extracellular fluid volume (Gülhan, 2018);

1.1.3.1. Hypovolemic Hyponatremia

Both total fluid volume and total Na amount decreased. However, Na loss is greater than water loss. Na loss may be renal or extrarenal.

Renal causes; diuretic use, salt-losing nephropathies, osmotic diuresis, mineralocorticoid deficiencies. Extrarenal causes; gastrointestinal losses such as vomiting, diarrhea, fistula, losses to the third space such as burns, pancreatitis, peritonitis, losses by sweating in cystic fibrosis patients, hypotonic fluid loading etc. In order to differentiate renal from extrarenal Na loss, urinary Na level should be evaluated. Urinary Na >20 mEq/L renal losses; Urine Na < 20 mEq/L should suggest extrarenal losses (Gülhan, 2018).

One of the most common causes of hypovolemic hyponatremia is thiazide group diuretics. Especially in the geriatric population, they may cause fatal hyponatremia even at low doses. However, hypokalemia caused by diuretics independent of Na loss also disrupts urine density and may predispose to hyponatremia (Chow, Kwan, Szeto, 2004). Another important cause in geriatric patients is cerebral salt loss. Cerebrovascular events and intracranial diseases that increase in this age group may cause volume depletion and renal salt loss. This condition should be differentiated from inappropriate ADH syndrome (IADHS) (Palmer, 2003). It should be kept in mind that geriatric patients fed with nasogastric tube and gastrostomy may have inadequate Na intake (Öktem, 2019).

1.1.3.2. Hypervolemic Hyponatremia

There is an increase in both total fluid volume and Na but the increase in water is greater than the increase in Na. It is the most common form in elderly patients. It is observed in conditions such as congestive heart failure, nephrotic syndrome and liver cirrhosis. It is characterized by edema. The degree of hyponatremia correlates with the severity of the underlying disease. This is an important prognostic factor. In oliguric acute and chronic renal

failure, decreased GFR and water intake in excess of renal function lead to severe hyponatremia in elderly patients (Eren, 2018). In cases with renal failure, urine Na > 20 mEq/L, while in other cases urine Na < 20 mEq/L.

1.1.3.3. Isovolemic Hyponatremia

While Na content is normal an increase in total fluid volume is observed. However, this fluid load does not cause an edematous picture in the patient. The most common causes are IADHS, hypothyroidism, some drugs, adrenal insufficiency, physical and emotional stress, osmostat change, polydipsia.

IADHS is the most common cause of isovolemic hyponatremia. It may develop due to malignancies, central nervous system diseases, some lung diseases and drugs. Laboratory and clinical features (Kelen, Hsu, 2015);

- Hypotonic hyponatremia,
- Inappropriately increased urine osmolality (> 100 mOsm/kg),
- Increased urinary sodium (> 20 mEq/L),
- Clinical euvolemia,
- Normal adrenal, renal, cardiac, hepatic and thyroid functions,
- Recovery of plasma osmolality by fluid restriction,
- Exclusion of other causes (Kelen, Hsu, 2015).

1.1.4. Symptoms and Signs of Hyponatremia

History, physical examination and laboratory findings should be evaluated together in geriatric patients. Symptoms and findings alone are not reliable in this group of patients due to physiologic changes that occur with age and multiple medications used. For example; changes in vital signs such as hypotension and tachycardia may occur very late or the expected physiologic response may be suppressed due to the drugs used (Öktem, 2019).

Symptoms of hyponatremia vary depending on the rate of development of hyponatremia, plasma Na level, underlying comorbid diseases and other metabolic disorders. An acute drop in Na level below 125 mmol/L often causes symptoms, especially in geriatric patients. Symptoms are primarily related to the central nervous system and are observed due to cerebral edema caused by osmotic water transfer to brain cells. Symptoms such as nausea, vomiting, anorexia and headache may be present. As hyponatremia deepens, patients may experience decreased deep tendon reflexes, hypothermia, pathological reflexes, Cheyne-Stokes respiration, lethargy, stupor, coma and convulsions (Uslu, Sinangil, Çelik, Ecdar, 2016).

In chronic hyponatremia, symptoms are milder as the loss of electrolytes and organic osmolytes from brain cells reduces the increased intracellular fluid volume.

1.1.5. Hyponatremia Treatment

The main treatment goal is to increase the Na level and correct the underlying disorder. Prior to treatment, the severity, acute-chronic differentiation, type and etiology of hyponatremia should be determined and then an appropriate treatment protocol should be followed.

1.1.5.1. According to Severity

In patients with Na < 115 mEq/L and/or severe neurologic signs and symptoms, the serum Na level should be urgently brought into the safe range. In past hyponatremia treatment protocols, replacement therapy has been given over a long period of time because of the fear of damage to central pontine myelinolysis that may occur when hyponatremia is corrected rapidly. However, it was realized that the brain edema that occurs in severe hyponatremia should be reversed rapidly. Accordingly, a new treatment protocol was regulated in the hyponatremia guideline published in 2014. Accordingly, it is recommended that 150 ml of 3% hypertonic NaCl be given to patients with severe hyponatremia in 20 minutes, serum Na level should be checked after 20 minutes, and 150 ml of 3% hypertonic NaCl infusion should be repeated. This sequential procedure can be repeated twice or until a 5 mmol/L increase in serum Na level is achieved. In case of an increase of 5 mmol/L in the first hour, it is recommended to stop hypertonic treatment and perform a study for the etiology; in case of insufficient increase, it is recommended to continue treatment with an increase of 1 mmol/L per hour in Na level. There is no need for urgent treatment in hyponatremia without severe symptoms. An increase of more than 10 mmol/L in the first 24 hours and 8 mmol/L in the other days should be avoided (Spasovski et al., 2014).

1.1.5.2. According to Development Period

Acute hyponatremia is a state of hyponatremia known to develop within 48-72 hours. It requires urgent and rapid correction. Rapid correction of chronic hyponatremia may cause central pontine myelinolysis, permanent brain damage and death. Therefore, in chronic hyponatremia, an increase of more than 10 mmol/L in the first 24 hours and 8 mmol/L in the other days should be avoided. In mild and asymptomatic chronic hyponatremia, treatment may not be required except for treatment of the etiologic cause. Na

should be measured every 4-6 hours during treatment. The aim is to bring sodium into the safe range, not the normal range (Spasovski et al., 2014). Treatment should be discontinued when symptoms disappear, Na levels fall into the safe range, or total correction is 20 mmol/L. The following formula is used to calculate the patient's Na deficit required for treatment (Kelen, Hsu, 2015);

$$\text{Na deficit} = (\text{Desired Na} - \text{Measured Na}) \times \text{Total body water}$$

1.1.5.3. According to Volume Status

In hypovolemic hyponatremia, isotonic NaCl should be used if the clinical picture is mild, and hypertonic NaCl should be preferred if it is severe. While fluid restriction is sufficient in mild normovolemic cases, isotonic NaCl may be given if no response is obtained. However, hypertonic treatment is required in severe cases. Excess water load can be removed by using loop diuretics during treatment. In IADHS, which is the most common cause of normovolemic hyponatremia, chronic hyponatremia is mostly observed. The primary treatment is fluid restriction. In unresponsive cases, high sodium diet and loop diuretics are used. In resistant cases, agents that suppress ADH response (demeclocycline) may be tried. ADH receptor antagonists are used as targeted treatment options. If hypokalemia accompanies hyponatremia, it should be corrected. This correction will contribute to the treatment of hyponatremia (Eren, 2018).

1.2. Hypernatremia

Serum Na levels above 145 mEq/L. It is a hyperosmolar condition caused by a decrease in total body water or an increase in Na intake.

It may develop iatrogenically (hypertonic solutions, NaHCO₃ treatment, etc.) in hospitalized geriatric patients. This condition has been associated with increased mortality (Arıkan, Özener, 2014). Mortality increases up to 75% in patients with Na levels above 160 mEq/L (Kovesdy, 2012).

With advanced age, renal concentrating ability deteriorates, renal response to ADH weakens and thirst sensation decreases. This increases the susceptibility of the geriatric patient group to hypernatremia. Again, oral intake disorder and inadequate fluid consumption, which are more common in this population, may cause hypernatremia. Another cause is fluid loss. Gastrointestinal losses, diabetes insipidus, skin losses (fever, burns, sweating, etc.) or multiple causes of osmotic diuresis are examples. Some medications may trigger hypernatremia, especially in this population. Hypernatremia is

divided into 3 types according to extracellular fluid volume (Kelen, Hsu, 2015).

1.2.1. Hypovolemic Hyponatremia

Both Na and water loss is present but water loss is prominent. Diuretics, osmotic diuresis or diuresis after obstruction cause renal loss. Urine Na > 20 mEq/L and urine is hypotonic or isotonic. Losses through the skin or gastrointestinal tract are extrarenal losses. Urine Na < 20 mEq/L (Eceder, 2003). Inadequate fluid intake is one of the causes of this type of hyponatremia in elderly patients.

1.2.2. Hypervolemic Hyponatremia

Both total body water and Na are increased, but the increase in Na is significant. It may occur iatrogenically after the use of hypertonic saline or NaHCO₃, especially during hospitalization of elderly patients. This type of hyponatremia may also be observed with excessive oral salt intake.

1.2.3. Isovolemic Hyponatremia

Total body water loss is increased but the amount of Na is unchanged. Diabetes insipidus causes this type of hyponatremia. In its etiology, central or nephrogenic failure in ADH response is involved (Kelen, Hsu, 2015).

1.2.4. Symptoms and Signs of Hyponatremia

Symptoms are mostly of central nervous system origin due to the shrinkage of brain cells as a result of intracellular fluid loss. Patients may experience nausea, vomiting, loss of appetite, irritability, focal neurological deficits, confusion, seizures and even coma. Thrombosis and hemorrhages may occur after ruptures due to contractions in cerebral blood vessels. For this reason, it should be considered in elderly patients, especially in cases of new onset of altered consciousness (Chassagne et al., 2006). While symptoms are prominent in acute hyponatremia above 160 mEq/L, symptoms are much milder in chronic hyponatremia.

1.2.5. Hyponatremia Treatment

The aim of treatment is to reduce water loss and to calculate and replace the missing amount of water.

Water deficit is calculated by the following formula (Gülhan, 2018)

$$\text{Kg} \times \text{Total body water \%} \times [(\text{Measured Na} / 140) - 1]$$

When calculating total body water percentage, it is taken as 0.6 in men, 0.5 in women and elderly men, and 0.4 in elderly women (Gülhan, 2018).

The rate of reduction of plasma Na levels should be 1-2 mmol/L per hour. In elderly patients, this correction can be made more slowly. Half of the fluid deficit should be replaced in the first 12-24 hours and all of it in 48-72 hours. Rapid treatment may cause convulsions and neurologic damage (Eren, 2018). In addition, desmopressin in central diabetes insipidus and salt restriction and diuretic treatments in nephrogenic diabetes insipidus can be applied (Robertson, 2016).

2.POTASSIUM METABOLISM DISORDERS

It is the major intracellular cation of the body and extracellular K levels are within a narrow range of 3.5-5 mmol/L. Passage of potassium across the cell membrane is mediated by the Na-K-ATPase pump and K channels. In this way, many vital physiological processes such as maintenance of resting membrane potential, propagation of action potentials in neuronal, muscular and cardiac tissue, vascular tone, systemic blood pressure control, gastrointestinal motility, acid-base balance, glucose and insulin metabolism, mineralocorticoid activity, renal concentration function are maintained (Gumz, Rabinowitz, Wingo, 2015).

The average daily dietary intake of K is 5-150 mmol. Approximately 90-95% of this is excreted via the renal route and the rest via the intestinal tract (Aygenel, 2018). With aging, the total muscle mass of individuals decreases. With the decrease in this K-rich tissue, the total amount of K also decreases. However, the decrease in aldosterone and plasma renin levels that regulate secretion in distal tubules as a result of aging and the slowing of Na-K-ATPase activity increase the susceptibility to hyperpotassemia in this group (Mulkerrin, Epstein, Clark, 1995).

2.1. Hypopotassemia

Serum K level is below 3.5 mmol/L. This may occur as a result of decreased K intake, increased K loss or intracellular passage of potassium. However, pseudohypopotassemia should be ruled out in patients with low serum K levels.

Pseudohypopotassemia; In cases where the leukocyte count increases, if the blood taken from the patient is kept at room temperature for more than 1 hour, K passes into the leukocyte. Since this transition occurs after the blood is taken from the patient, the low K value detected does not reflect the reality.

Although it can be seen in most conditions leading to leukocytosis, it is observed more frequently in acute leukemias in which the number of active leukocytes increases significantly (Eceder, 2003).

Hypokalemia is seen in the geriatric population with a frequency of up to 5%. Factors such as impaired renal function and polypharmacy, which are more frequently observed in this age group, lead to an increase in this frequency (Lederer, Nayak, 2017).

Reduced K intake is observed especially in eating disorders, prolonged fasting and alcoholism. In addition, the use of K-deficient preparations in parenterally fed patients also causes hypopotassemia in this way.

Increased K excretion occurs in two ways: renal and extrarenal loss. Renal loss is responsible for most cases of chronic hypopotassemia. The most common cause is diuretic use and many other drugs cause hypopotassemia via renal route. In addition, osmotic diuresis seen in diabetic ketoacidosis, conditions with excess of mineralocorticoids and renal tubular acidosis are among the causes. Conditions that cause loss from the gastrointestinal tract such as chronic diarrhea, vomiting, fistulas, and laxative use are causes of extra renal loss.

Intracellular passage of K; although the total body K amount does not change, the intracellular passage of potassium creates a transient hypopotassemia picture. Alkalosis, exogenous insulin intake, increased catecholamine, drugs used in the treatment of megaloblastic anemia, beta agonists, high dose calcium channel blocker intake and some antipsychotic drugs also cause hypopotassemia through this pathway (Öktem, 2019).

2.1.1. Symptoms and Signs of Hypopotassemia

Symptoms depend on the degree and rate of development of hypopotassemia. However, it usually does not cause symptoms unless the K level falls below 3 mmol/L. Fatigue, muscle weakness and muscle cramps are the most common findings. Constipation and ileus may be seen in these patients due to smooth muscle involvement. In more severe hypopotassemia, conditions such as paralysis and rhabdomyolysis may occur. However, the most feared effect of hypopotassemia is cardiac involvement and arrhythmia risk. This condition first manifests on ECG with T wave flattening and u wave formation. In advanced stages, it presents as fatal ventricular arrhythmias.

2.1.2. Hypopotassemia Treatment

The aim of treatment is to prevent the development of life-threatening complications such as severe arrhythmia and respiratory failure, to supplement K deficiency and reduce its loss, and to treat the underlying cause (Aygençel, 2018).

In the presence of hypopotassemia requiring urgent treatment, IV replacement should be preferred. K infusion in isotonic is often used. Dextrose fluids should be avoided as they will deepen hypopotassemia. K administration concentration should not exceed 60 mmol/L, administration rate should not exceed 20 mmol/hour and total dose should not exceed 200 mmol/day. These rates can be lowered in elderly patients. A central vein should be used for high dose administration and the patient should be monitored. Since muscle mass and total body water are reduced and renal-extrarenal K adaptation is impaired in the geriatric group, care should be taken against the risk of hyperpotassemia during treatment (Kim, Han, 2002). In non-emergency cases, treatment with oral replacement and potassium-rich diet may be considered.

2.2. Hyperpotassemia

Serum K levels above 5.0 mmol/L. This may occur as a result of increased K intake, decreased K excretion or excretion of potassium out of the cell. Especially when > 6.0 mmol/L, it is called severe hyperpotassemia. In geriatric patients, underlying comorbid conditions and frequent use of drugs that predispose to hyperpotassemia cause hyperpotassemia to be more common in this group (Robert and others, 2018).

Pseudo-hyperpotassemia is the most common cause. It is usually caused by hemolysis resulting from inappropriate blood collection and intracellular K release. Pseudo-hyperpotassemia should be suspected if the patient has no underlying cause and no symptoms suggestive of hyperpotassemia (Wiederkehr, Moe, 2000).

Increased K intake is more commonly observed in patients with iatrogenic K repletion, in patients receiving K-rich parenteral nutrition and in patients receiving K supplementation in addition to diuretic therapy. Although rare, it may also occur with excessive intake of foods with high K content.

Decrease in K excretion; mostly causes chronic hyperpotassemia. In geriatric patients, conditions such as decreased renal function, renal failure and renal tubular acidosis are the most important factors that increase the tendency to hyperpotassemia. Diseases with cell destruction such as

rhabdomyolysis, tumor lysis syndrome and hemolysis may cause hyperpotassemia because they may cause acute kidney damage.

K out of the cell; although the total body K level remains unchanged, the shift of potassium out of the cell causes hyperpotassemia. Metabolic acidosis, drugs such as succinylcholine, beta blockers and digoxin which are frequently used in elderly patients, insulin deficiency and events leading to cell destruction can be given as examples (Ateş, 2003).

2.2.1. Symptoms and Signs of Hyperpotassemia

Symptoms depend on the degree and rate of development of hyperpotassemia. Fatigue, diarrhea, muscle weakness, paralysis, hypoventilation due to involvement of respiratory muscles and respiratory arrest may develop. Symptoms are more subtle in chronic hyperpotassemia. The most serious side effect in acute and severe hyperpotassemia is cardiac toxicity. The first ECG change is T sharpening. This is accompanied by prolongation of the PR interval and shortening of the QT interval. As hyperpotassemia worsens, the P wave flattens, the QRS widens and eventually turns into a sinusoidal pattern. These patients die with ventricular arrhythmias, heart block or asystole.

2.2.2. Hyperpotassemia Treatment

The aim of treatment is to prevent cardiac toxicity and to achieve membrane stabilization, to prevent potassium from leaving the cell, to increase the excretion of excess K in the body and to treat the underlying cause. Calcium gluconate should be used first to prevent cardiac toxicity by membrane stabilization. It should be administered as 10-20 ml IV slow infusion. The patient should be monitored during treatment and ECG should be monitored after treatment. Treatment should be repeated after 5-10 minutes if necessary. However, care should be taken during calcium gluconate treatment in patients using digitalis. An iatrogenic hypercalcemia condition may cause cardiac toxicity of digitalis (Kelen, Hsu, 2015).

Dextrose-insulin, sodium bicarbonate and β_2 agonists can be used to shift the increased potassium in the extracellular fluid into the cell. However, since these treatments do not change the total body K content, they are temporary treatments.

To reduce total body K, it is necessary to increase K excretion from the body. Loop diuretics can be used for this. However, it should be kept in mind that renal function may be decreased or impaired in geriatric patients and fluid and other electrolytes should be monitored during treatment. Again,

multidrug use should be kept in mind in these patients and K-sparing or K excretion inhibiting drugs should be discontinued.

To increase excretion from the gastrointestinal system, resins that provide Na-K displacement such as kayexalate can be used. If patients have renal failure or treatment-resistant hyperpotassemia, urgent dialysis may be required (Altun, Taktakoğlu, Seyrek, Karayaylalı, 2014).

3. Calcium Metabolism Disorders

The main storage site of calcium, which is abundant in the body, is bone tissue, which accounts for about 99%. Circulating calcium exists in 3 forms: ionized free calcium, albumin-bound calcium and non-ionized calcium (anion complexes). Ionized free calcium is the most physiologically important component of total calcium. However, the measurements indicate total calcium. Conditions such as hypoalbuminemia may cause mismeasurement of total calcium amount independent of ionized calcium. For this reason, albumin values should be checked and corrected calcium should be calculated in patients with hypocalcemia detected in laboratory parameters (Öktem, 2019). In a patient with hypocalcemia, serum albumin is necessary to distinguish true hypocalcemia.

Corrected Ca (mg/dl) = measured total Ca (mg/dl) + 0.8 x (4.0 - serum albumin)

Ionized calcium in plasma is in a narrow range of 2.1-2.6 mEq/L. Three main hormones are involved in maintaining this range; parathyroid hormone, calcitriol and calcitonin. The gastrointestinal tract is primarily responsible for calcium excretion. A small amount is excreted via renal route (Hancı, Özbilgin, 2018). Calcium plays a role in many important events such as cardiac activity, smooth muscle contraction and coagulation.

3.1. Hypocalcemia

Serum calcium level is below 2.0 mEq/L. It is the main electrolyte disorder in patients hospitalized in intensive care unit (Steele, Kolamunnage-Dona, Downey, Toh, Welters, 2013). It is most commonly seen due to chronic renal failure and hypoparathyroidism. In addition, malnutrition, vitamin D deficiency, malabsorption conditions, surgical causes (gastrectomy, short bowel, etc.) that may cause a decrease in calcium absorption may cause hypocalcemia. Sepsis, pancreatitis, rhabdomyolysis, hypomagnesemia, massive transfusions and some drugs are the causes of hypocalcemia (Cho, 2019). Infusion of infusions containing anions that can form complexes with

calcium or infusion of calcium-free albumin are also among the causes (Lederer, Nayak, 2017).

3.1.1. Symptoms and Signs of Hypocalcemia

Symptoms depend on the degree and rate of development of hypocalcemia. It may lead to neurologic, cardiovascular, respiratory and psychiatric signs and symptoms. Patients may develop fatigue, muscle weakness, muscle cramps, tetany and peripheral paresthesia. Chvostek and Trousseau's signs are classic examination findings of hypocalcemia but are not diagnostic. It may cause hypotension, heart failure and bradycardia in patients. QT prolongation is observed on ECG and predisposes to ventricular arrhythmias (Cho, 2019). In chronic hypocalcemia, signs and symptoms such as bone fragility, deformity, rickets, skin and dental disorders, and hair loss may be observed.

3.1.2. Treatment of Hypocalcemia

Treatment depends on the severity and chronicity of hypocalcemia. First, ionized calcium levels should be measured to confirm the diagnosis. Mild hypocalcemia is usually asymptomatic. If symptomatic, oral replacement therapies are preferred. If the ionized serum calcium level decreases to < 1.4 - 1.6 mEq/L, symptoms are markedly observed. Therefore, these patients require IV calcium replacement. 100-200 mg of elemental calcium should be given within 10 minutes, followed by maintenance at a dose of 1-2 mg/kg/hour. Calcium chloride and calcium gluconate preparations are available. Calcium chloride contains higher amounts of elemental calcium than calcium gluconate. However, since it is very irritant, it should be administered via central venous route (Hancı, Özbilgin, 2018).

Patients who use digital during treatment should be closely monitored. An iatrogenic hypercalcemia after replacement may cause cardiac toxicity of digitals.

If the patient has drugs that cause hypocalcemia, they should be discontinued. In case of resistant hypocalcemia, serum magnesium value should be measured and if hypomagnesemia is present, treatment should be given accordingly. When calcium alone is not sufficient, vitamin D metabolites may be added to the treatment (Denker, 2008).

3.2. Hypercalcemia

It is a condition in which the total calcium is above 10.5 mg/dl or ionized calcium is above 2.7 mEq/L. The incidence of hypercalcemia is

increased in the geriatric patient group (Denker, 2008). It is also more common than hypocalcemia in this group. Hyperparathyroidism and malignancies constitute the major causes of hypercalcemia in approximately 90% (Cho, 2019). It may be iatrogenic or caused by drugs (thiazide group diuretics, lithium etc...), some endocrine (adrenal insufficiency, pheochromocytoma, thyrotoxicosis etc...) and granulomatous diseases (sarcoidosis, tuberculosis, etc.), hypervitaminosis A and D.

Primary hyperparathyroidism is the most common single cause of hypercalcemia. It presents as benign adenoma in a single parathyroid gland, especially in elderly female patients (Hancı, Özbilgin, 2018). Malignancies are the second most common cause. It occurs especially in lung, breast, head and neck, renal carcinomas and hematologic malignancies. It is an indicator of poor prognosis.

3.2.1. Symptoms and Signs of Hypercalcemia

It depends on the degree of hypercalcemia and the rate of increase. Mild hypercalcemia is mostly asymptomatic. However, symptoms are evident in acute elevations of calcium or when calcium rises above 12 mg/dl. Neurologic, skeletal, gastrointestinal, renal and cardiovascular systems may be affected. Symptoms may progress from nonspecific findings such as weakness, nausea and vomiting to lethargy and coma (Morley, 2015). Cardiac involvement is reflected on ECG as short QT.

3.2.2. Treatment of Hypercalcemia

The aim is to increase renal calcium excretion, decrease bone resorption and intestinal calcium absorption, and treat the underlying cause. If hypercalcemia is detected, serum parathormone level should be checked first if there is no clearly demonstrable cause (Lederer, Nayak, 2017). In mild and asymptomatic cases, approaches such as limiting calcium intake, eliminating the factors precipitating hypercalcemia and treating the underlying cause can be applied. However, severe and symptomatic cases require urgent treatment. Hydration has a critical role in treatment and IV saline is used. Approximately 4-6 liters of saline should be given in 24 hours. The aim is to increase calciuresis. Furosemide can be used for this. Thiazide group diuretics should not be used because they may increase hypercalcemia. Patients with comorbid conditions such as underlying heart failure should be followed closely and frequently during treatment. Other electrolyte deficiencies that may occur with treatment should be replaced (Öktem, 2019).

The main drugs used to inhibit osteoclastic activity are bisphosphonates. They are especially preferred in the treatment of hypercalcemia due to malignancy. Calcitonin acts by inhibiting bone resorption. 2-8 U/kg can be used subcutaneously. Therapies such as mithramycin, IV phosphate and gallium nitrate are generally not preferred due to their high toxicity and limited effects (Kelen, Hsu, 2015).

4.Disorders Of Magnesium Metabolism

It is the second most abundant cation in the cell. Serum level is between 1.5-2.5 mEq/L. This value indicates the total amount of magnesium. Most of the magnesium in the circulation is in the ionized free state, while the rest is bound to proteins or in non-ionized complexes. Clinical studies have shown a strong correlation between total magnesium and ionized magnesium (Lanzinger et al., 2003). The majority of magnesium is found in bones, with the remainder in muscle, soft tissue, erythrocytes and serum. Magnesium activates many enzymatic reactions. It plays an important role in protein synthesis, coagulation process, smooth muscle tone, calcium balance, glycemic conditions, cardiac and neuromuscular activity (Özcan, Esen, 2011). Excretion is largely via feces and the rest via renal route.

4.1. Hypomagnesemia

Hypomagnesemia has many causes such as distribution disorder, decreased intake, increased excretion, drugs and endocrine diseases. It is an electrolyte disorder with increasing frequency in the community. It has been found that it is observed more frequently in geriatric patient groups and comorbid diseases such as multiple drug use, diabetes and chronic renal failure increase this frequency (Heybeli, Soysal, 2020). Sudden decreases in magnesium levels can be observed especially in patients with malnutrition and those who are fed IV nutrition without adequate magnesium support.

Serum magnesium levels usually do not cause significant symptoms unless they fall below 1.2 mg/dl (Pham et al., 2014). However, since it acts as a cofactor in many systems in the body, it may be seen with serious outcomes in the geriatric population who are more susceptible (Al Alawi, Majoni, Falhammar, 2018). Hypomagnesemia should be considered in patients with signs and symptoms of hypocalcemia at normal calcium levels. Hypomagnesemia should also be suspected in alcoholic, cirrhotic, IV therapy or long-term use of nutritional fluids (Kelen, Hsu, 2015). In studies, hypomagnesemia was found to be associated with mortality in geriatric patients (Heybeli, Soysal, 2020). Due to its effect on neuromuscular functions,

it may progress with loss of muscle strength, neurologic dysfunction and mood disorder in elderly patients (G.A. Eby, K.L. Eby, 2010). Similar findings are observed on ECG with hypokalemia/hypocalcemia. Hypokalemia/hypocalcemia may be associated with severe hypomagnesemia. Therefore, careful monitoring is required.

While oral magnesium treatments can be used in mild cases, IV replacement may be required in severe cases (Heybeli, Soysal, 2020).

4.2. Hypermagnesemia

It is a rare electrolyte disorder. It usually develops due to IV magnesium therapy in cases of impaired renal function, excessive intake of magnesium-containing drugs, and peritoneal or retroperitoneal leaks due to procedures involving magnesium. Hypermagnesemia may occur in elderly patients even if renal function is normal (Aydın, Berk, Tokdemir, Ergan, 2020).

Hypermagnesemia rarely causes symptoms. In severe cases, it depresses the central nervous system and decreases neuromuscular activity. Serum magnesium level is diagnostic. It should be kept in mind that it may be associated with hyperkalemia/hypercalcemia.

In treatment, magnesium in the intake state should be discontinued. If there is no renal failure, dilution with IV hydration and removal with furosemide can be performed. If the patient does not have accompanying hypercalcemia, the effects of magnesium can be antagonized by giving calcium. Dialysis may be preferred in patients with renal failure (Kelen, Hsu, 2015).

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CHAPTER 10
SEPSIS AND CURRENT APPROACHES TO SEPSIS

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1. INTRODUCTION

Sepsis is still considered a major health problem. Unfortunately, mortality and morbidity are still high. Its incidence is approximately 20 million cases per year and the death rate is 26%. It is known to potentially cause millions of deaths each year (Fleischmann C, et al., 2016). Early detection of sepsis and appropriate management in the first hours improves outcomes (Akin A, et al., 2018).

Fever or hypothermia, leukocytosis or leukopenia, tachypnea and tachycardia are the cardinal signs of the systemic response, and their associations are often referred to as systemic inflammatory response syndrome (SIRS). SIRS may be due to infectious or non-infectious etiology (Braunwald E, 2005). If infection is suspected or proven, a patient with SIRS is now considered to have sepsis. The Surviving Sepsis Campaign has released new updates on sepsis in 2021.

2. DEFINITIONS

2.1. Sepsis and Septic Shock

Sepsis is defined as the presence of systemic inflammation symptoms and organ failure in patients with suspected or proven infection, according to the current 2021 guideline (Surviving sepsis campaign: International guidelines for management of sepsis and septic shock 2021). It is meaningful to get at least 2 points in SOFA (Sequential Organ Failure Assessment) scoring in organ failure.

Septic shock; It is defined as sepsis and lactate elevation requiring vasopressor support despite adequate resuscitation. Mortality rate is higher than sepsis

2.2. Rapid Sequence Evaluation of Organ Failure (qSOFA)

qSOFA (The Quick Sequential Organ Failure Assessment-qSOFA) is a screening tool used to identify patients at higher risk of death. Among the criteria; altered mental status, systolic blood pressure ≤ 100 mmHg, and respiratory rate ≥ 22 /min. A qSOFA score of 2 or more means a high risk for a bad outcome (Tintinalli J, et al., 2020).

2.3. Systemic Inflammatory Response Syndrome (SIRS)

The presence of SIRS criteria does not prove that there is also infection or sepsis. Because these criteria may also exist in other non-infectious conditions such as trauma, pancreatitis and burns. SIRS is not a diagnostic or prognostic marker; It is a simple way of classifying patients with

systemic inflammation. SIRS is mentioned if 2 or more of the criteria are present: (1) fever ($>38^{\circ}\text{C}$) or hypothermia ($<36^{\circ}\text{C}$); (2) tachypnea (> 24 breaths/min); (3) tachycardia (heart rate > 90 beats/min); (4) leukocytosis ($>12,000/\mu\text{L}$), leukopenia ($<4,000 \mu\text{L}$), or $> 10\%$ band neutrophil(4).

Table 1: Definitions Used to Define Septic Patients(Braunwald et al., 2005)

Bacteremia	Positive blood cultures, bacteria in the blood
Septisemi	Systemic inflammatory response syndrome (SIRS)
Systemic inflammatory response syndrome (SIRS)	Two or more of the following situations: (1)Fever (above 38°C) or hypothermia ($<36^{\circ}\text{C}$); (2)Tachypnea (> 24 breaths/min); (3)Tachycardia (heart rate > 90 beats/min); (4) Leukocytosis ($>12,000/\mu\text{L}$), leukopenia ($<4,000 \mu\text{L}$); It can also be caused by noninfectious etiology.
Sepsis	SIRS proven to be due to microbial etiology
Severe Sepsis	Sepsis with one or more organ dysfunction – For example: 1. Arterial blood pressure ≤ 90 mmHg or mean blood pressure ≤ 70 mmHg 2. Despite fluid administration for one hour urine output <0.5 mL/kg/h 3. $\text{PaO}_2/\text{FiO}_2 \leq 250$ 4. Platelet count $<80,000/\mu\text{L}$ 5. Unexplained metabolic acidosis and plasma lactate >1.5 times the upper reference limit of the reporting laboratory 6. Pulmonary artery occluded pressure ≥ 12 mmHg or centralvenous pressure ≥ 8 mm
Septic shock	Hypotension lasting at least one hour despite fluid replacement (arterial blood pressure < 90 mmHg systolic or 40 mmHg lower than the patient's overall blood pressure)or Requirement of vasopressors to maintain systolic blood pressure ≥ 90 mmHg or mean blood pressure ≥ 70 mmHg
Refractory septic shock	Septic shock unresponsive to fluids and vasopressors lasting more than 1 hour

Table 2:Definitions of sepsis and septic shock(Üsküdar Güçlü, 2021)

	Sepsis	Septic Shock
2016 Sepsis-3	Suspected/confirmed infection + SOFA ≥ 2	Sepsis + fluid-resistant hypotension: - Lactate >2 mmol/L - Vasopressor requirement for MAP ≥ 65 mmHg

3. CLINICAL FEATURES

While some presentations can be recognized clinically immediately, sepsis may present as a difficult or obscure picture, especially in the early period. Although vital signs abnormalities especially fever, hypotension, and/or tachycardia can be a clue for sepsis, it should be accepted that patients with these findings may have another underlying cause. In emergency room patients with sepsis, volume loss is usually observed due to decreased intake and increased fluid losses (losses such as vomiting, diarrhea). In more advanced stages, septic cardiomyopathy, characterized by impaired systolic function and diastolic relaxation, develops. cold shock; It is known as impaired peripheral perfusion and cold extremities after the combination of intravascular volume reduction and septic cardiomyopathy (Tintinalli J, et al., 2020).

4. DIAGNOSIS

Sepsis; it is a clinical diagnosis based on evidence of infection, systemic inflammation, and new organ dysfunction and/or tissue hypoperfusion. Septic shock; It is a term used for sepsis patients who need vasopressors and have high lactate levels despite adequate resuscitation.

Other causes of shock are included in the differential diagnosis of sepsis and septic shock. These mimic sepsis; hypovolemic, cardiogenic, anaphylactic, neurogenic, obstructive shock and endocrine disorders such as adrenal insufficiency, thyroid storm (Evans L, et al., 2021). The first step after diagnosis in sepsis is to find the source; however, interventions such as resuscitative measures and antimicrobial therapy should never be delayed. Often the source is clear; there are signs and symptoms of a cause in the pulmonary, genitourinary, soft tissue, or abdomen; however, the source of infection may not be easily seen (Evans L, et al., 2021). Although the most common cause of sepsis is acute bacterial pneumonia, it is difficult to distinguish between viral and bacterial etiologies at the initial stage. Among the intra-abdominal causes, cholecystitis and cholangitis are rare causes. But they are a cause of mortal septic shock and both require emergency surgery. Perforated hollow organs, appendicitis, diffuse colitis, or intra-abdominal abscesses may also be the cause. Acute pancreatitis may result in a clinical presentation similar to that of septic shock due to diffuse inflammation (Evans L, et al., 2021). The most common soft tissue infection that causes sepsis is cellulitis. Necrotizing soft tissue infections are usually seen in patients with immunosuppression, diabetes, or a history of circulatory disorders. Acute

bacterial meningitis is also a rare cause of septic shock. Community-acquired meningitis can also progress to septic shock (Evans L, et al., 2021).

5. LABORATORY TESTS AND IMAGING

In the diagnosis of sepsis, laboratory imaging and tests help detect occult bacterial infection, reveal a specific cause of microbial infection, and identify occult severe sepsis. Commonly used laboratory tests include; a CBC including platelet count, serum electrolytes, kidney function tests, lactic acid level, liver function tests and urinalysis. Arterial blood gas assists in the evaluation of metabolic status and ventilation and oxygenation in selected patients. In case of active bleeding or suspected disseminated intravascular coagulation, fibrinogen, prothrombin time, aPTT and D-dimer should be measured.

Considering the frequency of pneumonia or accompanying acute respiratory distress syndrome, chest radiography evaluation would be appropriate. Plain abdominal radiographs or CT scan are recommended in patients with suspected perforation or diffuse inflammation. Conditions originating from the biliary system can be determined with the help of USG. Soft tissue CT scans used to diagnose intra-tissue free air or deep tissue abscesses may also be helpful in diagnosing necrotizing skin and soft tissue infections. Brain CT and lumbar puncture are recommended in any patient with potential meningitis, but antibiotherapy should always be started before these tests are completed. If possible, MRI evaluation should be requested in the presence of suspected spinal epidural abscess.

It is recommended to take at least two separate blood culture sets from different vein sites in adults with sepsis. If possible, Gram staining and secretion culture should be obtained from the area thought to be a potential source of infection. Other tests for sepsis assessment include C-reactive protein (CRP) and procalcitonin. It should be noted that neither test can exclude sepsis. Both of these tests can be used to manage the need to initiate or continue antimicrobial therapy, with the exception of sepsis (Evans L, et al., 2021).

6. TREATMENT

In patients with sepsis-induced hypoperfusion or septic shock, a minimum of 30 mL/kg intravenous (IV) crystalloid fluid support is recommended in the first 3 hours of resuscitation. The use of dynamic measurements rather than physical examination or static parameters will be more likely to guide fluid resuscitation (Evans L, 2021). Dynamic parameters;

includes assessment of systolic volume (SV), systolic volume variation (SVV), pulse pressure variation (PPV), and response to fluid bolus by echocardiography. In patients with increased serum lactate, resuscitation should be directed to reduce lactate. Capillary refill time for adults with septic shock can also be used in resuscitation assessment. For adults in septic shock who need vasopressors, the initial target mean arterial pressure (MAP) is 65 mmHg. If patients need to be followed clinically in intensive care units, it is recommended that they be hospitalized within 6 hours. In cases of possible septic shock or sepsis, it is recommended to apply antimicrobials without delay (Evans L, et al., 2021).

In the last guideline, it was emphasized that surgical procedures should be avoided as much as possible, and it would be more appropriate to prefer percutaneous methods such as abscess drainage.

6.1. Antibiotic Selection

In patients with sepsis or septic shock at high risk for multidrug-resistant organisms, the use of two different antimicrobials with gram-negative coverage is recommended for empirical therapy. If the causative pathogen is known, agent-directed treatment is recommended and empirical dual antimicrobial use is not appropriate in this case (Evans L, et al., 2021). If a fungal etiology is suspected, it would be appropriate to use empirical antifungal therapy. Long-term beta-lactam infusion is recommended instead of traditional bolus infusion for maintenance in patients with sepsis or septic shock. For adults with sepsis or septic shock, if the possible source is intravascular catheters, it is recommended that these catheters be removed as soon as an alternative route for vascular access is provided (Ferrer R, et al., 2009).

For these patients whose optimal duration of treatment is uncertain, it is more appropriate to use procalcitonin and clinical evaluation together to decide when to discontinue antimicrobial therapy (Wacker C, 2013).

6.2. Hemodynamic Management

6.2.1. Liquid Management

In sepsis or septic shock, the use of crystalloid as the first-line fluid for resuscitation is recommended. In patients who need large volumes of crystalloids, it would be appropriate to administer albumin instead of crystalloids alone (Evans L, et al., 2021).

6.2.2. Vasoactive Agents

For adults with septic shock, the use of norepinephrine as a first-line agent is recommended compared to other vasopressors. Dopamine, Vasopressin, Epinephrine, Celepressin, and Angiotensin II are other options. If adequate MAP levels have not been achieved in patients on norepinephrine therapy, it would be appropriate to add vasopressin to the treatment instead of increasing the norepinephrine dose. Vasopressin usually; It is added to the treatment when the norepinephrine dose is in the range of 0.25-0.5 $\mu\text{g}/\text{kg}/\text{min}$ and is insufficient. When MAP levels are insufficient despite norepinephrine and vasopressin, it would be appropriate to add epinephrine to the treatment. In patients with persistent hypoperfusion and cardiac dysfunction despite adequate volume status and arterial blood pressure, dobutamine can be added to norepinephrine(Evans L, et al., 2021).

6.3. Follow-up and Intravenous Route

In adults with septic shock, the use of invasive monitoring for rapid arterial blood pressure monitoring is recommended. For adults with hypoxemic respiratory failure due to sepsis, it would be more appropriate to prefer high-flow nasal oxygen to non-invasive ventilation (Evans L, et al.,2021).

In patients who develop sepsis-induced ARDS, it is recommended to use a low tidal volume (6 mL/kg) ventilation instead of a high tidal volume preference (>10 mL/kg). For adults who develop severe ARDS from sepsis, an upper limit of 30 cmH₂O should be preferred over higher plateau pressures. In adult patients with moderate to severe sepsis-induced ARDS, it would be appropriate to use higher PEEP values instead of lower PEEP. In adults with respiratory failure due to sepsis but not ARDS, it is appropriate to use low tidal volume instead of high tidal volume ventilation. It is recommended to use prone ventilation lasting longer than 12 hours a day for adults with moderate to severe ARDS caused by sepsis(Evans L, et al., 2021).

For adult patients with severe ARDS due to sepsis, when mechanical ventilation fails, the use of veno-venous (VV) Extracorporeal Membrane Oxygenation (ECMO) in experienced centers with the infrastructure would be an appropriate approach(Evans L, et al.,2021).

6.4. Additional Treatments

Intravenous corticosteroid use is appropriate in adult patients with septic shock who need to continue vasopressor therapy. The preferred corticosteroid for adults with septic shock is IV hydrocortisone at a dose of 50

mg every 6 hours or 200 mg/day given as a continuous infusion. It is recommended that this treatment be administered in the first 4 hours after the initiation of sepsis treatment, when the dose of norepinephrine or epinephrine is ≥ 0.25 mcg/kg/min (Evans L, et al., 2021).

In sepsis or septic shock, a restrictive transfusion strategy for red blood cell (RBC) transfusion is recommended. Typically, a hemoglobin concentration of 70 g/L is an indication for transfusion; however, RBC transfusion should not be guided by hemoglobin concentration alone. Stress ulcer prophylaxis is appropriate for those with risk factors for gastrointestinal bleeding. It is recommended to use low molecular weight heparin (LMWH) instead of unfractionated heparin (UFH) in the prophylaxis of venous thromboembolism (VTE). In adult patients with sepsis or septic shock, it is recommended to initiate insulin therapy when the glucose level is ≥ 180 mg/dL (10 mmol/L). Sodium bicarbonate therapy is appropriate for adults with septic shock, severe metabolic acidemia ($\text{pH} \leq 7.2$), and acute kidney injury (Evans L, et al., 2021).

7. CONCLUSION

The presence of sepsis should be recognized early, especially in emergency admissions. Fluid support and antibiotics appropriate for the focus of infection should be started immediately. The agents we use to correct hemodynamics are not always innocent, sometimes they can have negative effects on mortality.

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CHAPTER 11
DERMATOLOGICAL DISEASES IN THE GERIATRIC
PATIENT

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INTRODUCTION

According to the World Health Organization, the definition of the geriatric population includes people over 60. The aging rate of the population is much faster than in the past, and in 2020, the population aged 60 and over has outstripped children under the age of 5 (WHO, 2022).

People older than 60 years are increasing in number in the United States, and the ratio of people older than 65 years will be approximately %20 in 2030 and 2050; all over the World, the proportion of over 60 years will nearly double from 12% to 22% (RuiP, 2014).

Due to the growth in the elderly population in recent years, the frequency of dermatological diseases related to old age has been increasing.

With aging, our skin is aging too. Skin aging consists of intrinsic and extrinsic aging processes. Intrinsic aging is an unavoidable change due to the passage of time. Intrinsic aging includes decreasing cell renewal capacity, DNA repair capacity, chemical clearance capacity, barrier function, mechanical protection, sensory perception, immunity responsiveness, thermoregulation, sweat and sebum production, etc., and is seen in all individuals. On the other hand, extrinsic aging is chronic environmental influences such as sun exposure, air pollution, smoking, etc., and can be modifiable. (Yaar, 2012)

Factors such as chronic diseases and increased drug use for chronic diseases, added to the external and internal aging process, such as long-term ultraviolet exposure, immunodeficiency, circulatory disorders, and immobility, affect the incidence and course of dermatoses in elderly patients. At the same time, with aging, various histological changes begin to appear too. Examples of histological changes are decreasing melanocytes and Langerhans cells, lacking elastic tissue function, less vascular and dense dermis, and decreasing sweat glands, nerves, and circulations. (Norman, 2003) At the end of all these processes, the primary physiological changes that occur with aging in the skin are as follows: atrophy, xerosis, relaxation, wrinkles, and sagging because of decreased skin elasticity. In addition, the incidence of ephelides and lentigos, thinned and gray hair, and benign and malignant skin tumors is increasing. (Yaar, 2012)

Skin diseases that are urgent and common in the elderly are briefly discussed in the following sections by referring to their pathogenesis and clinical manifestations in this population.

1. DERMATOLOGIC EMERGENCIES IN GERIATRIC PATIENTS

1.1. Urticaria and Angioedema

The geriatric population consumes more medications than younger age groups and has more medical conditions, such as hepatic, renal, or cardiac dysfunction, that can change drug metabolism or excretion. That's why all kinds of adverse drug reactions increase with age. The most seen cutaneous drug reactions are pruritus, exanthems, and urticaria (Yaar, 2012).

In the general population, urticaria, often known as hives or welts, affects about 20% of people (Kaplan, 1979). Typically, urticarial lesions are erythematous plaques of circumscribed, round, oval, or serpiginous shape, varying in size, often with central pallor. The lesions can be quite itchy and tend to resolve within 24 hours. Angioedema, which swells deeper in the skin and gives a burning sensation, may sometimes accompany urticaria. Although a definitive cause cannot always be identified, patients with new onset urticaria may identify a putative trigger such as medication, food, insect bites, or infection, especially when the illness lasts for weeks or months.

To make an accurate diagnosis and provide the best care possible, questioning patient history, including any prescription and over-the-counter medications is essential.

The first-line treatment approach should focus on short-term relief because most urticaria cases are self-limited and resolve spontaneously.

As a first-line therapy, second-generation H1 antihistamines are recommended (Zuberbier et al., 2009). These drugs do not have anticholinergic effects in contrast to first-generation agents. Because of that, they have less significant drug-drug interactions than first-generation agents.

Adding a brief course of oral glucocorticoids can be utilized for patients who still experience symptoms after taking an H1 antihistamine or who have noticeable angioedema. Prednisone is commonly administered in 30 to 60 mg daily and tapered over five to seven days (Zuberbier et al., 2022).

1.2. Stevens-Johnson Syndrome (SJS) and toxic epidermal necrolysis (TEN)

SJS and TEN are the most severe drug reactions of the skin. They occur 1-45 days after drug use and 14 days on average. Generally, erythematous macules and bullous lesions are observed on the trunk (Schwartz et al., 2013). If bullous lesions occupy more than 30% of the body surface area, it is called TEN; if seen in less than 10 percent of the skin, it is

called SJS. Mucous membranes are frequently involved. Usually, the prognosis is poor. Advanced age is typical, and 75% of the patients are over 40 years old (Sawicki & Ellis, 2013; Schwartz et al., 2013). The cause is usually drugs. Sulfonamides, antiepileptic, nonsteroidal anti-inflammatory drugs, and allopurinol mainly cause it.

Patients with suspected SJS and TEN should be hospitalized immediately. Disease severity and prognosis should be quickly defined utilizing the Toxic Epidermal Necrosis Score (SCORTEN) to determine an appropriate treatment option. Patients with body surface abrasion (BSA) >10%, rapidly progressing disease, or abnormality in biochemical/organ function should be referred to a specialty center such as an intensive care unit.

As soon as possible, discontinuation of interfering drugs may improve prognosis. At the same time, fluid and electrolyte balance, nutritional support, temperature management, pain control, prevention and treatment of infection, and wound/ocular care should be considered and applied (Schwartz et al., 2013).

Treatment options are cyclosporin, intravenous immune globulin, and tumor necrosis factor (TNF) inhibitors.

1.3. Erythroderma (exfoliative dermatitis)

Erythroderma is a severe and life-threatening condition manifested by erythema and scaling covering ≥ 90 percent of the skin surface area, which may include fever or hypothermia, peripheral edema, and tachycardia. Although the cause of erythroderma cannot be determined in approximately one-third of patients (idiopathic erythroderma), exacerbation of a pre-existing inflammatory dermatosis, cutaneous drug reactions, and cutaneous T-cell lymphomas are among the most common causes (Pal & Haroon, 1998)(Cuellar-Barboza et al., 2018).

Complications such as heart failure, fluid and electrolyte imbalance, hypothermia, compensatory hypermetabolism, hypoalbuminemia, edema, and muscle wasting can be seen in the elderly and patients with comorbidities. The primary treatment of the disease is independent of the underlying condition and should consist of nutrition, fluid, electrolyte replacement, and skin care approaches.(Cuellar-Barboza et al., 2018)

2. OTHER COMMON DERMATOLOGICAL DISEASES IN THE GERIATRIC POPULATION

2.1 Tumors

Benign tumors are characteristics of aged skin. Sebaceous hyperplasia, seborrheic keratoses, and cherry angiomas can appear in nearly all people who are a member of the geriatric group. In addition, malignant tumors may occur with increasing frequency in aged skin. Common malignant neoplasms are basal cell carcinoma, squamous cell carcinoma, and melanoma. (Yaar, 2012)

2.1.1. Benign- premalignant skin lesions

Sebaceous hyperplasia is a typical benign skin lesion that generally affects elderly individuals. It is usually seen as a solitary small, yellow, lobulated papule and is seen in the forehead and cheeks areas (Alsaad et al., 2006).

Seborrheic keratosis is a prevalent benign lesion that increases with age, especially on the face, trunk, and proximal extremities. It presents as well-circumscribed, dark brown or black papules with comedo-like openings and rough surfaces. Treatment options are electrosurgery and cryosurgery. If there is any doubt, a shave biopsy should be considered to rule out the possibility of melanoma or other non-melanoma skin cancer (Yaar, 2012).

Actinic keratosis is one of the premalignant skin lesions with an irregular surface, 3-6 mm, red or brown, with a risk of transformation into squamous cell carcinoma, seen in sun-exposed areas. The form of actinic keratosis seen on the lips is called Actinic cheilitis. To reduce the development of actinic keratosis, sun protection (sunscreen, clothing) is mandatory. Superficial lesions can be treated with cryosurgery, electrosurgery, and/or topical 5-fluorouracil (Norman, 2003)(Dianzani et al., 2020).

2.1.2. Malignant tumors

The most common malignant tumor is basal cell carcinoma (BCC). BCC usually presents as a pearly papule with branching vascular telangiectasias on sun-exposed areas but can also be seen as an erythematous plaque or nodule with central necrosis, crusty ulceration, or pigmentation may occur (Rubin et al., 2005). Mohs surgery is the best strategy for such cases. Topical imiquimod, 5-fluorouracil, electrosurgery, cryotherapy, excision, or photodynamic therapy may be a treatment option for small lesions in low-risk areas or people who are unsuitable for surgery (Kim et al., 2018).

2.2. VASCULAR DISORDERS

With aging, vascular density, cutaneous blood flow, endothelial cell permeability, and elasticity decrease, skin rigidity increases, and immune responses begin to deteriorate; As a result, aging skin becomes more susceptible to injury, and its ability to repair after an injury is reduced (Wey & Chen, 2010).

2.2.1. Stasis dermatitis and ulceration

It is caused by venous hypertension secondary to heart failure or peripheral venous valve insufficiency. Venous insufficiency can cause edema, varicose veins, discoloration, even dermatitis, and venous ulcers (most commonly on the inside of the lower leg). General measures are leg elevation, exercise, and bandage application. Mild-potent corticosteroids are recommended if stasis dermatitis has developed. Surgery may be an option in more severe cases, but oral antibiotics may be added to the treatment if there is a secondary infection (Norman, 2003).

2.2.2. Pressure ulcers

It is tissue damage secondary to ischemia caused by prolonged pressure on the tissue, especially preferring bony prominences in the lower part of the body. It is more common in the elderly due to frequent inactivity, sensory disorders, malnutrition, and sensory and circulatory disorders.

Since tissue damage may be more profound than it appears, a detailed evaluation should be made with palpation. Management of pressure ulcers includes relieving pressure or friction (repositioning at least per two hours, air flow mattresses), wound care (debridement, dressing, and treatment of secondary bacterial infection), and controlling comorbidities (Norman, 2020).

2.2.3. Purpura

Actinic/Senile purpura presents in the elderly as purpuric macules and patches on the sun-exposed areas. Physiological changes that occur as people age cause thinning of the skin and reduced protection from external trauma. In addition, increased use of drugs that cause thrombocytopenia (platelet count below 100,000/mm³) in the geriatric group also causes an increase in the incidence of purpura (Chung et al., 2014; Shuster, 1965).

Protection from purpura includes skin protectors and environmental regulations to minimize the risk of injury. Treatment should focus on the underlying cause. If the platelet count is meager (<10,000/mm³), a platelet transfusion may be required (Norman, 2003).

2.3 INFLAMMATUAR DERMATOSIS

2.3.1. Pruritus

Itching is the most common symptom in dermatology and is an unpleasant sensation leading to scratching. It is generally accepted that older people often suffer from itching (Reich et al., 2011).

In elderly patients, itching may be caused by various systemic diseases such as underlying diabetes, iron deficiency, liver and kidney function disorders, skin diseases, especially xerosis, or multiple drugs. Emotional or psychological stresses also contribute to itching. A careful dermatological and psychological examination should be performed, and drug use and underlying diseases should be questioned. Emollients, oral antihistamines, and short-term use of topical or systemic corticosteroids are among the treatments applied.

2.3.2. Xerosis and asteatotic eczema

Xerosis is the most common skin disorder in the elderly (Beauregard&Gilchrest, 1987). Usually, effect the lower legs and includes severe itching and excoriation. Asteatotic eczema can be defined as xerosis with inflammatory changes. Factors that cause and exacerbate skin dryness include a dry environment, harmful bathing habits (especially harsh soaps or detergents), irritating and tight clothing, diuretic drugs, and cholesterol-lowering agents (Wey& Chen, 2010). Treatment of xerosis consists of avoiding aggravating factors and moisturizing the skin. Corticosteroids may be utilized for a short time if inflammation or itching is resistant.

2.3.3. Seborrheic dermatitis

It is manifested by erythema, scaling, and pruritus in the paranasal fold, glabella postauricular area, and intertriginous areas. This disease is commonly seen in the elderly with Parkinson's disease and emotional stress. Shampoos containing zinc pyrithione, selenium sulfide, keratolytic, topical corticosteroids, and antifungal creams calcineurin inhibitors can be used in treatment (Mastrolonardo et al., 2003).

2.4. CUTANEOUS INFECTION

Varicella zoster reappears in the elderly as herpes zoster, known as shingles. This herpes virus may remain dormant in cutaneous neurons for years and often presents as grouped, painful pruritic vesicles on an erythematous background containing a single dermatome, usually following a prodrome such as pain pruritus in the elderly during times of stress or

immunosuppression. Lymphadenopathy and systemic symptoms such as headache, weakness, or fever may present. After 3-5 days, the vesicles begin to crust. Antiviral treatments such as acyclovir, valacyclovir, and brivudine should start within 72 hours.

Common fungal infections in the elderly are candidiasis, tinea pedis, tinea cruris, and onychomycosis. Candida occurs as pustules and satellite pustules on an erythematous moist surface in intertriginous areas, including the inguinal, anogenital, flexural, submammary, and perioral regions, especially in people who have diabetes and/or are under antibiotic therapy. Keeping the folds dry and antifungal creams are the things that should be done in the treatment.

Tinea pedis (athlete's foot) is a dermatophyte infection that presents as scaling, fissuring, maceration of the foot, and occasionally crusting that covers the entire sole.

Tinea cruris (jock itch) is a dermatophyte infection with itching and a scaly tongue in the groin area.

Onychomycosis is a nail infection often caused by a dermatophyte (tinea unguium), less often by Candida species. About half of patients over 70 are affected by this disease. In the most common form, distal and lateral subungual onychomycosis (DLSO), the disease initially presents as a white spot on the nail and over time becomes yellow, dull, thickened, and then begins to crack. Topical and systemic antifungals and compliance with general hygiene rules are among the treatment stages. (Norman, 2003)

CONCLUSION

In addition to the physiological changes that occur with aging in the geriatric group, the increase in the frequency of drug use and comorbidities causes an increase in the incidence of adverse skin drug reactions, inflammatory dermatoses, benign premalignant and malignant tumors, and viral and fungal infections. For this reason, it is essential to be familiar with the dermatological diseases seen in the elderly, to make emergent treatments in emergencies, and then to refer them to a dermatologist to increase the quality of life and life span of the patients.

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CHAPTER 12
THE OCULAR EMERGENCIES IN GERIATRICS

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INTRODUCTION

The earliest organ affected by aging is the eye. Vision is affected both physiologically by age and pathologically by additional diseases and multidrug using in elderly.

Physiologically, the pupil shrinks and the response to light decreases, the eye lens loses its flexibility, the transparent eye lens becomes dull, and visual acuity decreases by aging (Altnel et al., 2013).

Chronic diseases increase pathologically with age, impaired vascular flexibility and additional multidrug using also cause visual loss to deteriorate indirectly.

Age-related eye diseases affect millions of people worldwide. Apart from visual loss, it can also cause blindness (Lorenzo-Veiga et al., 2021).

Dry eye, cataract, age-related macular degenerations, neovascular age-related macular degenerations, glaucoma are most common eye diseases that increase with age. In a study (Laey et al., 2004) macular degenerations (26%), glaucoma (20.5%), diabetic retinopathy (8.9%) and ischemic optic neuropathy (4%) were shown among the causes of blindness in western countries.

Geriatric patients admit to emergency departments both in terms of emergencies of age-related eye changes and eye emergencies seen in all age groups. Some chronic eye diseases may present to emergency department with acute attacks. Rapid diagnosis and early treatment of eye emergencies are very important, especially in terms of not losing vision.

1.Red Eye Emergencies

1.1.Ocular infections

- Conjunctivitis
- Episcleritis
- Bacterial, viral and fungal keratitis/corneal ulcer
- Endophthalmitis

1.2. Subconjunctival hemorrhage

1.3. Uvetitis/iritis

1.4. Ocular trauma

1.1. Ocular Infections

Preseptal cellulitis (figure 1 is below, Veraldi et al., 2021) is associated with paranasal sinusitis. Patient does not have visual loss or

patients' eye movements are painless. Patients with moderate preseptal cellulitis can be discharged from ER with 24-48 hours of follow-up with empirical antibiotics. Intravenous (IV) antibiotics or alternative antibiotic therapy could be considered for severe and unresponsive cases to drugs (Gordon et al., 2020).



Figure 1. Periorbital cellulitis

Postseptal cellulitis is connected with paranasal sinüs. Most commonly seen in immunosuppressed patients, trauma, foreign body in the globe or having eye surgery. Mucormycosis should also be considered in diabetes mellitus.

In orbital cellulitis, visual acuity is reduced and eye movement is painful (figure 2 is below, pictured by Azzam et al., 2021). Patients say they have fever and headache. Mortality and morbidity can be prevented with rapid initial therapy strategies. Imaging should be performed and ophthalmology consultation should be requested as surgical intervention may be required. In the treatment vancomycin use together with third generation cephalosporin, piperacilin-tazobactam, ticarcilin-clavulanate, imipenem or meropenem. Metronidazole or clindamycin should be added as anaerobic agent to therapy (Gordon et al., 2020). If glaucoma or optic neuropathy occur, lateral canthotomy should be performed by ophthalmologist.



Figure 2. Orbital infection in the right eye

Chelation is painless swelling of the eyelid. Recurrent cases can be treated with corticosteroid or excretion with incision.

Blepharitis is an inflammation of the eyelash. Daily eyelid cleaning (Bernardes et al., 2010) and, in severe cases, topical antibiotics at night recommended.

Conjunctivitis (figure 3 is below, pictured by Khan J et al., 2020) is the most common cause of red eye diseases. The symptom of bacterial conjunctivitis is painless mucopurulent excretion. Chlamydia and gonococ infections can transmitted sexually (Azari et al., 2013). Examination with a biomicroscope by staining with immunofluorescein is verr important not to miss the diagnosis of corneal abrasion, ulcer and herpetic dendrite. Its treatment is topical antibiotics. The most common cause of viral conjunctivitis is adenovirus. It is extremely contagious anf painful. Treatment of viral eye disease symptomatic. In severe cases of viral conjunctivitis topical antibiotics should be added to prevent secondary infection.

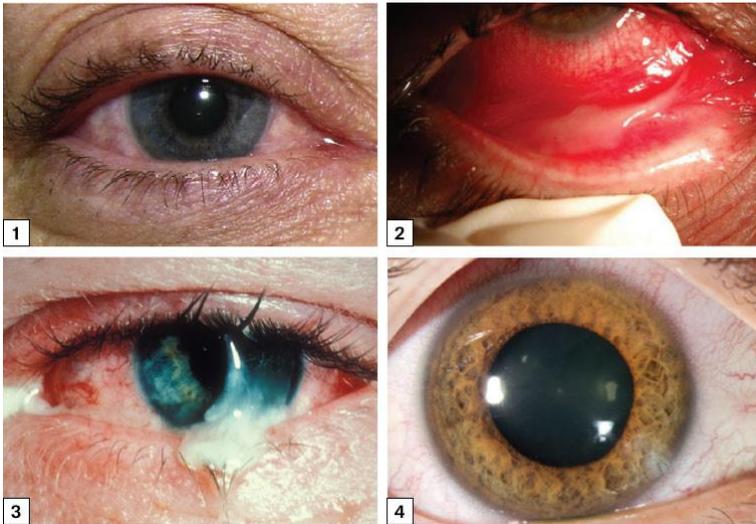


Figure 3: 1. Adenoviral conjunctivitis, number 2. Viral conjunctivitis, number 3. Bacterial conjunctivitis, number 4. İritis

Herpes simplex virüs (HSV) can cause keratoconjunctivitis, photophobia, pain, tearing and redness of eyes, and decreases vision acuity. In slit-lamp examination, geographic ulcers are observed with dendrites stained with immunofluorescein. HSV could cause permanent damage to the cornea. Topical steroids and oral antivirals must use in combination (Azari et al., 2013).

A corneal ulcer is a serious condition involving multiple layers of the cornea. Infections, eyelid abnormalities, and trauma can cause ulcer. We see vision loss of the patients. In severe cases, surgical therapy may be required (Hartley et al., 2010).

1.2. Subconjunctival hemorrhage

Hemorrhage may occur with trauma, Valsalva maneuver, hypertension. It usually regresses within 2 weeks. Symptomatic treatment is sufficient (figure 4 is below, pictured by Stephan Moll)



Figure 4. Subconjunctival hemorrhage in anticoagulated patient

1.3.Uveitis/iritis

Uveitis (figure 5 is below, pictured by Jonathan Trobe) is inflammation of the iris, ciliary body and choroid tissue. Its incidence is low. The visual and therapeutic consequences are serious. Etiological research is very important. Systemic inflammatory diseases, infections, malignancy and trauma cause uveitis (Tintinalli et al.,2020). Ocular pain, conjunctival redness, photophobia and vision loss most common complaints. Photophobia is a sign of iritis. Treatment is the treatment of etiological cause. Ophthalmology consultation should be requested.

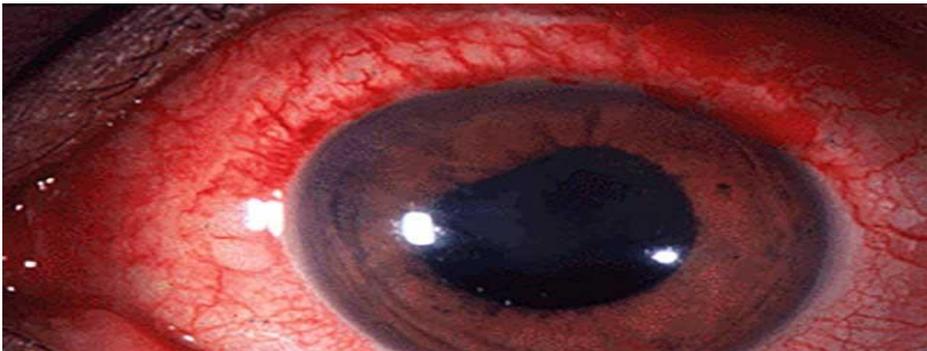


Figure 5. Anterior uveitis

1.4. Ocular trauma

Corneal abrasion (figure 6 is below, pictured by Steven Harsun) and corneal foreign bodies are frequently diagnosed by primary care physicians and emergency physicians. The clinical course of a corneal epithelial defect can range from relatively benign self-healing abrasions to potentially sight-threatening complications such as corneal ulcer, recurrent erosion or traumatic iritis (Ahmed et al., 2015). Penetrating globe injury should be excluded by biomicroscopic evaluation with immunofluorescent staining.



Figure 6. Corneal abrasion after trauma at biomicroscop examination

Corneal foreign bodies (figure 7 is below, pictured by Chris Nickson) are usually superficial and have a good prognosis.

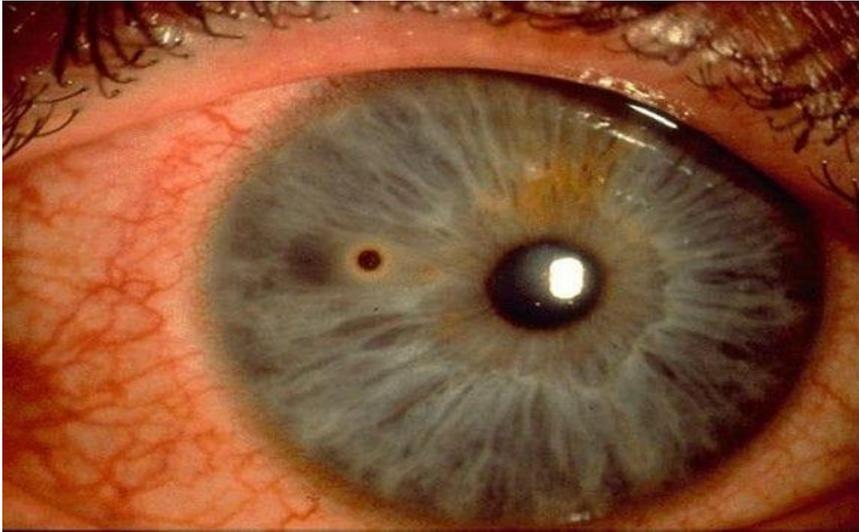


Figure 7. Corneal superficial foreign body

Foreign body penetration (figure 8 is below, photo by Shivam Mini) into the globe can cause vision loss or blindness. The patient feels the foreign body. A white neutrophil ring may be seen around foreign body that remain for more than 24 hours. Before the foreign body removed from the eye with biomicroscope, anesthetic should be put in the eye and ocular irrigation with saline or clean water must be done. If foreign body deeper of layers, it should be removed by ophthalmologist (Tintinalli et al., 2020). After removal of superficial foreign bodies, topical antibiotics, cycloplegics and oral analgesics should be prescribed. Patient vaccinate against tetanus if necessary.

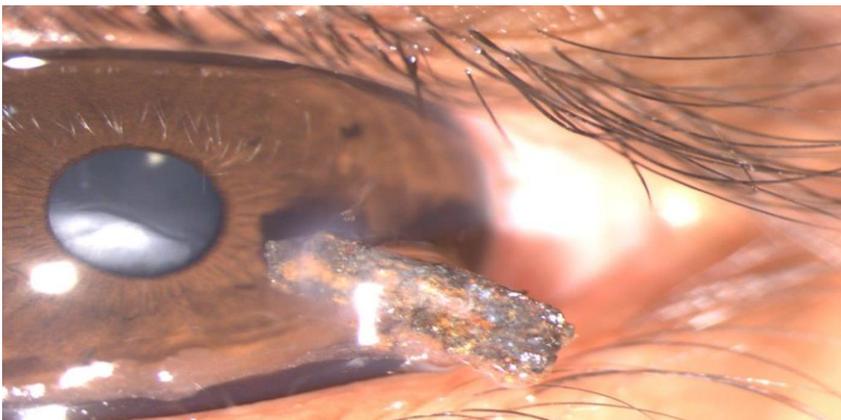


Figure 8. Corneal foreign body and perforation

Eyelid lacerations (figure 9 is below, pictured by A. K. Grover et al.) involving the margin of the lid, those within 6-8 mm of the medial canthus or those involving the lacrimal duct or sac, those involving the inner surface of the lid, concomitant ptosis, tarsal plate, and levator palpebrae muscle should be repaired by an ophthalmologist (Tintinalli et al., 2020).



Figure 9. Eyelid laceration

The first step in blunt ocular trauma is the examination of globe integrity, anterior chamber and ocular movements. It may be difficult to open the patients' eyes. During follow-up, edema may increase and eyelid may not open due to edema (figure 10 is below, pictured by emra.org). Therefore, the emergency physician should make the first examination quickly. If the anterior chamber is straight, that means rupture of globe. Limitation of ocular movements should suggest blow-out fracture. The blunt trauma also must be examined with biomicroscop.



Figure 10. Edema after ocular blunt injury

A ruptured globe (figure 11 is below, pictured by Kristen Walton) is an ophthalmologic emergency. It can cause visual disturbances even blindness. Previous eye surgery, myopia, advanced age, female gender, sudden falls are risk factors (Viestenz, et al., 2008). The patient complaint eye pain. Immediate and watertight wound closure is essential to avoid expulsive choroidal hemorrhage, persisting ocular hypotony or epithelial ingrowth (Viestenz et al., 2008). The closure material should not contact with the superficial surface of the eye. Immediate consultant of ophthalmologist necessary.



Figure 11. A full thickness corneal laceration with iris prolapse after trauma

Chemical trauma incidence is 11.5%-22.1% among ocular injuries (Kwok et al., 2019). Generally they are industrial and agricultural injuries.

The patients' eye should irrigate with saline or clean tap water both before hospital and in the hospital. The pH of the patients' eye must be brought to the level of 7 (Kwok et al., 2019). The eye should be evaluated for foreign body, including under the eyelid. Alkaline agents are more dangerous in terms of the risk of perforation (Wagoner et al., 1997). Potential alkaline agents can perforate the eye in 15 seconds (Wagoner et al., 1997). Severe eye injuries result in corneal opacity (figure 12 is below, pictured by Jason M et al.)



Figure 12. Corneal opacity after chemical injury

2.Acute Visual Losses And Blindness

- 2.1. Acute angle-closure glaucoma
- 2.2. Optic neuritis
- 2.3. Central retinal artery and central vein occlusion
- 2.4. Retinal detachment
- 2.5. Temporal arteritis
- 2.6 Cranial nerve palsy
 - Diabetic/hypertensive cranial nerve palsy
 - Posterior communicating artery aneurysm
 - Horner's syndrome
 - Pseudotumor cerebri

2.1. Acute angle-closure glaucoma

Acute glaucoma crisis is an ophthalmologic emergency. Having small eyes and large lenses are risk factors. The main triggering factors are stress, sympathomimetics, parasympathetic drug used (Collignon-Brach et al., 2004). It is the inability of the humor aqueous fluid to flow out of the eye. If it doesn't treated, it cause optic neuropathy and vision loss. Pupillary dilation accelerates in acute attack (figure 13 is below, pictured by Heiko Pohl et al.). The already narrow iris closes the angle between the lens, making the lens even thicker. Elderly, the elasticity of the lens decreases and therefore the risk of glaucoma increases. Hyperopia also increases the risk. Itranasal cocaine use is also a risk factor due to pupil dilatation (Tintinalli et al., 2020).



Figure 13. Acute angle closure glaucoma with red eye and midriasis in the left

The patient complains sudden onset severe eye pain and accompanying ipsilateral headache. On examination, more prominent redness is observed in the limbus and conjunctiva on the affected eye. Intraocular pressure (IOP) is measured at 60-80 mmHg, with a normal of 10-20 mmHg. The initial treatment for a glaucoma crisis is to lower the intraocular pressure. Acetazolamide, topical alpha₂-agonist, topical beta-blocking agents and IV mannitol treatment are recommended to lower IOP. If IOP is high despite these treatments, surgical treatment is recommended (Chan et al., 2019).

2.2. Optic Neuritis

It can progress from a slight decrease in vision to light level vision. Color vision is more affected by visual acuity. Rapid and accurate diagnosis is critical to limit vision loss, future neurological disability and organ damage. The risk factors are autoimmune, infections, granulomatous diseases, paraneoplastic disorders and myelination. MRI imaging is important in

diagnosis. In the treatment, high-dose IV treatment of methylprednisone 3 days and 1 mg/kg for 11 days after iv therapy is recommended (Bennett et al., 2019). Ophthalmology and neurology consultations should definitely be requested.

2.3. Central retinal artery and central retinal vein occlusion

Central retinal artery occlusion (CRAO) is an ophthalmologic emergency. It is the cause of massive visual loss. Vision is irreversibly lost after 240 minutes (Hayreh et al., 2018). This 4 hours very critic for both morbidity. At examination central cherry spot with retinal pallor at CRAO (figure 14 is below, pictured by Mehul A. Shah) . In a study (Hayreh et al., 2018) it CRAO seperated 3 groups. Type 1 CRAO is also called classic. In type 1 retinal artery occlusion due to embolism. Type 2 transient CRAO is a temporary occlusion of the artery. Type 3 CRAO is associated with giant cell arteritis. Fundus examination reveals macular cherry red and retinal pallor. If acute ischemic retinopathy is suspected in patients, ophthalmology and neurology consultations should be promptly requested within the first 4 hours.



Figure 14. Central cherry spot with retinal pallor at CRA

Central retinal vein occlusion (CRVO) is a common vascular cause of vision loss. It is divided into ischemic and nonischemic retinal vein thrombosis (Khayat et al., 2018). Its prevalence is 0.1%-0.5% among middle-age and elderly people. After diabetic retinopathy, both main vein and branch occlusion is the second common cause of retinal vascular injury (McAllister et al., 2012). In fundus examination, macular edema, optic disc swelling is characterized by hemorrhage in all retinal quadrants (figure 15 is below, pictured by Jeffrey G. Gross). Antithrombotic agents, thrombolytics, intravitreal anti-VEGF agents, corticosteroid intravitreal implants and surgical

interventions are recommended for treatment (McAllister et al., 2012). Ophthalmology and neurology consultations should be requested immediately.

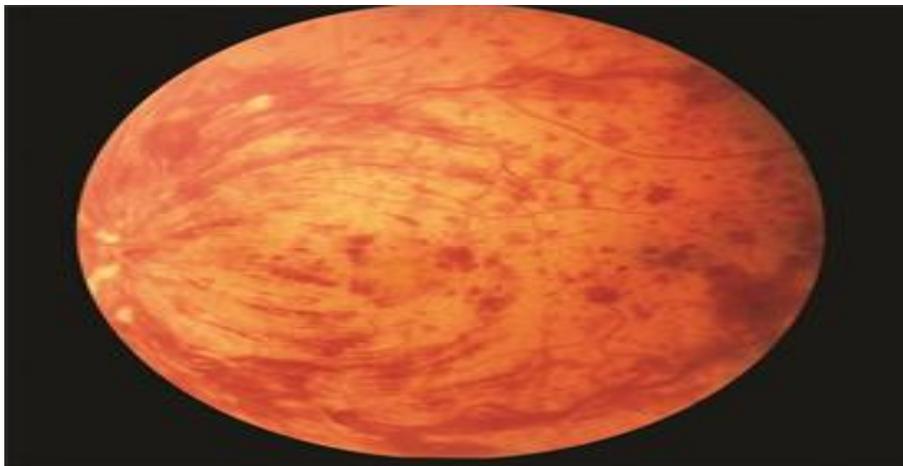


Figure 15. CRVO with flame hemorrhages

2.4. Retinal detachment

Retinal detachment should be considered when the patient complains of new onset flashes of light and floating objects. The lifetime risk of retinal detachment is 0.1% (Kwok et al., 2020). Risk factors are advanced age, high myopia, ocular trauma, prior ocular surgery and familial history. While ipsilateral complaints are almost always related to the eye, bilateral complaints are related to central nervous system. At biomicroscop examination retinal detachment can be seen (figure 16 is below, pictured by Elad Moisseiev et al.).

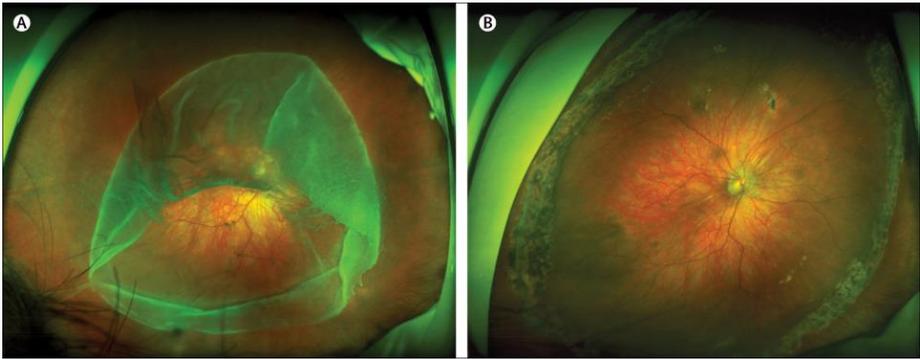


Figure 16. Retinal detachments in severe myopia

In Emergency room ultrasound also can use to see retinal detachment (figure 16 is below, by Arun Nagdev)

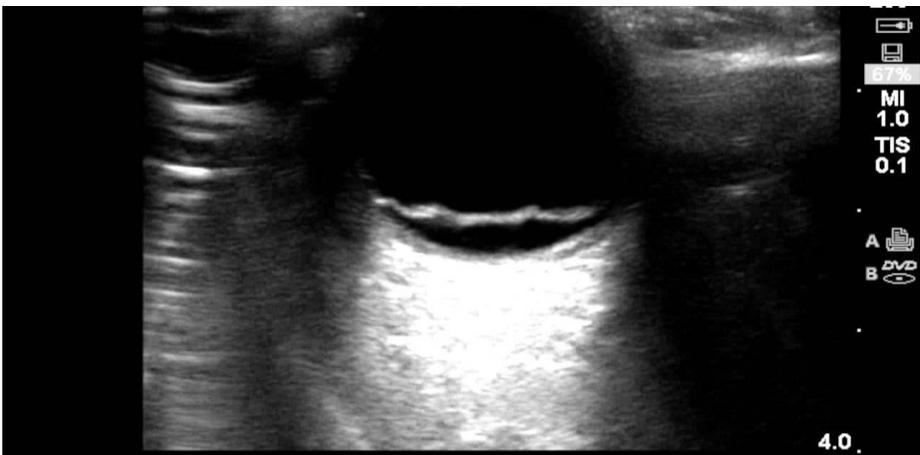


Figure 16. Retinal detachment in ocular USG

In its treatment, laser or intraocular gas balloon is applied. It is not recommended for patients undergoing air shanges and travel after gas balloon therapy. Ophthalmology consultation should be requested in cases of suspicion of retinal detachment.

2.5. Temporal arteritis giant cell arteritis

Temporal areteritis is a systemic autoimmune vasculitis that affects patients aged 50 and over (Ling et al., 2020). It is a vasculitis that affect large and medium cesselss and especially extracranial branches (Ciofalo et al., 2019). It is an ophthalmologic emergency that can cause rapid irreversible vision loss. Patients may have headache, vision loss, pain with chewing,

difficulty in swallowing, absence of pulse on the temporal artery, anomalies of heraing and ischemic findings of tongue and neck (Ciofalo et al., 2019) for the diagnosis sedim and C-Reactive Protein (CRP) can be used and definitive diagnosis can be done by biopsy. Vision loss is important in its treatment. Patients with vision loss require high-dose steroids/3 days and hospitalization. All cases with suspected temporal arteritis should be consulted to ophthalmology.

2.6. Cranial nerve palsies

Diabetic oculomotor palsy is the most common complication of diabetes (Lajmi et al., 2018). Pupil is normal. In acute stage, movement restriciton is ocur in the upward gaze and medial gaze. Upward gaze limitation associated with 4th cranial nerve palsy. Neuroimaging of the patient should be performed in terms of Central Nerve System (CNS) pathology. Ophthalmology and neurology should be consulted.

Acute palsy of the 3th cranial nerve with ipsilateral pupillary dilation should be considered a posterior communican artery aneurysm until proven otherwise (figure 17 is below, pictured by Dalia Nelson). Central neuroimaging of the patients should be done and neurochirurgy colnsultation should be done. Its treatment is surgical clipping or endovascular coiling. Endovascular coiling is more beneficial in elderly patients. However, surgical clipping superior in other groups (Nikova et al., 2022).



Figure 17. Left 3th nerve palsy

Ipsilateral ptosis, myosis and anhidrosis should suggest Horner's syndrome (figure 18 is below, pictured by Mike Cadogan). Neck and chest

tumors, neck and thoracic surgery are among risk factors (Sabbagh et al., 2020). Carotid aortic dissection should also be considered in Horner's syndrome with neck pain. Head and neck CT angiography and MRI imaging are required.



Figure 18. Horner syndrome

Pseudotumor cerebri (Idiopathic intracranial hypertension (IIH)) is the name given the headache and vision loss with rising intracranial pressure without mass compression. First-line therapy is acetazolamide (Burkett et al., 2018). Surgery may be considered in severe cases. Risk factors include hormones, natriuretic peptides, female gender and obesity. Patients should be consulted to neurolog, neurochirurgy and ophthalmology.

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- <https://www.reviewofoptometry.com/article/safety-first1> pictured by Kristen
 Walton
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 6736%2816%2931407-6/fulltext](https://www.thelancet.com/journals/lancet/article/PIIS0140-6736%2816%2931407-6/fulltext) pictured by Elad Moisseiev et al.
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CHAPTER 13
NEUROLOGICAL EMERGENCIES IN
GERIATRIC PATIENTS

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1-INTRODUCTION

Today, due to the development of diagnostic methods and the increase in treatment strategies, there is an increase in life expectancy. As a result, there is a rapid increase in the number of geriatric patients admitted to the emergency department. Neurological emergencies are common in the elderly due to changes in the central nervous system. The resulting neurological diseases affect the daily life, survival and mortality of the geriatric patient population (Hu SC et al, 1999).

2- Neurological Emergencies In Geriatric Patients

With aging, the frequency of some neurological diseases increases. Age is an important risk factor for neurological diseases. Neurological emergencies that are the frequent causes of emergency room admission in the geriatric patient population can be counted as ischemic stroke, hemorrhagic stroke, epilepsy, and dementia (Table 1) (Nentwich, L. M., & Grimmnitz, B. (2016).

Table 1. Common neurological emergencies in the geriatric patient population

2.1-Ischemic Stroke
2.2-Hemorrhagic Stroke
2.3-Epilepsy
2.4-Dementia
2.4.1 Alzheimer

2.1 Acute Ischemic Stroke

Stroke is responsible for 10% of all deaths in the world and is a serious cause of morbidity in societies. The frequency of stroke is 30% over the age of 80. (Lopez AD, et al, 2016). Aging increases the risk of stroke. Acute ischemic stroke (AIS) in elderly patients has been reported to produce more dangerous outcomes than younger patients. Ischemic stroke, which also plays an important role in mortality and morbidity in geriatric patients, should be diagnosed and treated quickly (Howard G, et al, 2012).

A detailed anamnesis, physical examination, and rapid imaging methods should be used in patients with suspected AIS. Neurological symptoms are more difficult to diagnose in the elderly, as they may present with atypical signs and symptoms. In order of frequency, symptoms such as loss of motor power, sensory deficit, aphasia, dysarthria, dizziness, altered consciousness, and decreased mobility are observed. Elderly patients do not

take their symptoms into account, so the time to reach the hospital is late (Vellas B, et al, 1999).

The first examination of elderly patients who apply with the suspicion of AIS should be done quickly and further examinations should be performed. Hypoglycemia in geriatric patients can often be confused with the atypical symptoms seen in AIS. Differential diagnosis of AIS and hypoglycemia should be made with fingertip blood sugar, which can result quickly. A rapid anamnesis should be taken from the patient and his/her relatives and learned when the symptoms begin. The period when the patient's last state of well-being and symptom started should be learned in detail and a history should be taken (Weir CJ, et al, 1997).

A prompt physical and neurological examination should be performed, while the neurological examination should be noted using an official stroke score, such as the National Institutes of Health Stroke Scale (NIHSS) (Kwah, L. K., & Diong, J. 2014).

Coagulation, thrombocyte, urea creatinine and cardiac enzyme values should be checked in the emergency department. In addition, patients should be followed in monitored observation, an electrocardiogram should be recorded (Kim YH, et al, 2016).

Patients admitted to the emergency department with AIS, emergency brain imaging is performed with computed tomography (CT) in the emergency room. CT is the best imaging modality to detect bleeding. MRI imaging is more specific for suspected patients. However, the duration of MRI imaging should not delay diagnosis and treatment. (Beauchamp NJ, et al, 1999).

In 1996, the Food and Drug Administration (FDA) approved the use of Recombinant tissue plasminogen activator (rt-PA) in patients with AIS. Intravenous thrombolytic therapy with recombinant tissue plasminogen activator (rt-PA) is the recommended treatment method with proven efficacy in the first three hours (Demchuk, A. M. et al, 2001).

2.2 Hemorrhagic Stroke

Bleeding that occurs non-trauma is called a hemorrhagic stroke. 10% of all strokes are hemorrhagic strokes. Hemorrhagic stroke is a cause of high mortality and morbidity due to its high 30-day mortality rate. (CAPLAN, et al, 2014)

The incidence of hemorrhagic stroke increases with age and is a significant geriatric emergency that doubles with each decade after the age of

35. Risk factors include advanced age, previous stroke, hypertension, and the use of oral anticoagulation (Lewandowski C, et al, 2001). Clinic in hemorrhagic stroke; varies depending on the location of the bleeding, the speed of its development, its size. Hemorrhagic stroke presents similar clinical findings to acute ischemic stroke. The definitive method of diagnosis is made using intracranial imaging.

Because of the high prevalence of oral anticoagulation use and hypertension in geriatric patients, coagulation factors and blood pressure should be considered in patients who come to the emergency department. Non-contrast CT imaging should be performed promptly in patients presenting with suspected hemorrhagic stroke. (Chalela, J. et al, 2007).

Sudden elevated blood pressure is common in elderly patients with hemorrhagic stroke and can lead to negative consequences through increased hematoma spaciousness and the formation of edema around the hematoma (Kazui S, et al, 1997).

Geriatric patients should be questioned in detail whether they use anticoagulants. The rate of use of anticoagulant therapy in elderly patients is higher than in other age groups. (Özgüncü, C., & Eren, F. 2022).

Anticoagulant drugs of patients presenting to the emergency department with hemorrhagic stroke should be discontinued and the effect of the anticoagulant drug should be reversed. The antidote of anticoagulants is given in the table below (Table 2) (Yates S, et al, 2015-Abo-Salem E, et al, 2016)

Table 2 Pharmacokinetics and reversal of anticoagulants

Anticoagulant	Mechanism	Antidote
Warfarin	Vitamin K antagonist	Vitamin K, PCCs
LMWH (enoxaparin)	Factor Xa inhibitor	Protamine, Andexanet
Rivaroxaban	Direct Factor Xa inhibitor	Andexanet Plasma exchange, PCC
Dabigatran	Direct Factor IIa inhibitor	Idaricizumab plasma exchange, PCCsc
Edoxaban	Direct Factor Xa inhibitor	Andexanet plasma exchange, PCCsc
Apixaban	Direct Factor Xa inhibitor	Andexanet plasma exchange, PCCsc

Abbreviations: FFP, fresh frozen plasma; IV, intravenous; LMWH, low molecular weight heparin; PCCs, prothrombin complex concentrates

2.3 Epilepsy

Compared to other age groups, the incidence of newly onset seizures, epilepsy and status epilepticus is high in elderly patients. As the age increases, epilepsy incidence gradually increases. Epilepsy is the third most common neurological disease after dementia and stroke in geriatric diseases. Although common in geriatric patient, the diagnosis and treatment of seizures is complicated due to age, comorbid conditions and drug side effects. Seizures in geriatric patients increase mortality and morbidity (Faight E, et al, 2012).

Examination of seizures in geriatric patients can be difficult and time-consuming. Many other medical disorders can mimic and coexist with seizure activity, and the differential diagnosis for an elderly patient presenting with a newly onset seizure is wide-ranging. Infective and metabolic causes should be investigated in geriatric patients presenting with seizures and electrocardiogram, cardiac monitoring, laboratory tests and brain imaging should be performed. Electroencephalography (EEG) is an important diagnostic test in assessing a patient with possible epilepsy, but EEG findings do not always lead to a definitive conclusion in geriatric patients. As a result of physiological changes caused by aging, EEG abnormalities can be seen on EEG imaging without seizures (Nentwich, L. M., & Grimmnitz, B. (2016).

In the differential diagnosis of patients presenting with seizures, it is often necessary to consider the following diagnoses (Berg, A, et al, 1996).

- 1-Cardiac arrhythmia
- 2- Transient ischemic attacks (TIA)
- 3-Stroke
- 4- Migraine
- 5-Hypoglycemia
- 6- hyponatremia
- 7- hyperthyroidism
- 8- Infection
- 9- Carotid sinus sensitivity

Non-convulsive SE (NCSE) is a clinically minimal seizure activity, but the EEG has a pattern of seizure activity. NCSE is more common in elderly patients and due to the minimal clinical presentation, many patients with NCSE present with a delayed or missed diagnosis. The NCSE can last for hours to days, and patients present with mild confusion to delirium and altered mental state with changing clinical features (Maganti, R., et al, 2008).

2.4 Dementia

It is a neuropsychiatric syndrome that occurs due to many causes of deterioration in cognitive functions, including memory, language and executive functions.

It is known that with the prolongation of life expectancy, the proportion of the elderly population in the general population has increased in the world. With the increase in the elderly population; There is an increase in the incidence of various diseases. It is known that the most important disease affecting this population is dementia. The prevalence of dementia increases rapidly with the aging of the population (McKhann GM, et al, 2011).

Determining the etiological cause of dementia is important for the treatment approach. Etiologically, dementia; is divided into primary (degenerative) and secondary (nondegenerative). Common types of degenerative dementia are;

- 1-Alzheimer's disease
- 2-Dementia with Lewy bodies
- 3-Degeneration of the frontotemporal lobar
- 4-Dementia due to Parkinson's disease (Vitali P, et al, 2008).

Common causes of non-degenerative dementia include vascular dementia, vitamin deficiencies (e.g., B12, thiamine), hypothyroidism, normal-pressure hydrocephalus, chronic alcohol abuse, chemotherapy-related cognitive dysfunction, infections (e.g., HIV), intracranial masses, traumatic brain injury, and psychiatric illnesses (depression/anxiety). The diagnosis of dementia is made by clinical evaluation. The main component in the diagnostic process is history taking and clinical examination. In determining the etiological cause of dementia, the initial symptoms and the course of the disease have a very important place. Neurodegenerative dementias begin at an advanced age. These dementias, which develop due to degenerative processes, have a slow course. Dementia, which develops due to organic causes such as infection, autoimmune, metabolic/toxic or endocrine causes, can be seen at an earlier age and may also progress more rapidly (Vitali P, et al, 2008).

2.4.1 Alzheimer's disease.

Alzheimer's disease (AD) is the most common cause of dementia, with its prevalence and incidence increasing in proportion to age. In the age range of 65-69 years, the incidence is 0.4% and the prevalence is 2%. It is reported that the incidence of AD doubles every 5 years in people over 65 years of age at the age of 90 (Fiest, K.M., et al, 2016).

3-CONCLUSION

The world's population is aging rapidly. The number of elderly patients admitted to the emergency department is increasing. Neurological emergencies are frequently encountered in the geriatric patient population in the emergency department and mortality rates are high in this population. Comorbidities are higher in elderly patients. Physiological changes occur with aging and the care of geriatric patients is difficult and complex. With rapid and early intervention in the emergency department, the quality of life of elderly patients who present with a neurological emergency can be improved.

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CHAPTER 14
PSYCHIATRIC DISEASES
IN THE GERIATRIC PATIENT

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INTRODUCTION

The increase in the elderly population leads to an increase in the incidence of organic brain diseases and depression symptoms. Accordingly, acute hospitalization and emergency room visits are also increasing (Kocyigit et al., 2019). The fact that psychiatric diseases in the elderly have different clinical findings than adults, that clinical symptoms of diseases such as dementia and depression are perceived as 'normal' in the natural course of old age, and the insufficiency of epidemiological studies, especially including the elderly population, are factors that make it difficult to make a diagnosis in elderly patients (Aslan et al., 2017). Geriatric patients presenting to the emergency department for psychiatric reasons have important characteristics. The first is that the patients have multiple comorbidities and the clinic presents with psychiatric symptoms with an underlying acute disease picture. Secondly, they are sensitive to drug interactions and drug side effects due to multiple drug use (Thienhaus et al., 2004). Therefore, geriatric psychiatric emergencies are among emergency internal clinics in terms of underlying causes. Although geriatric psychiatric diseases are a broad topic, delirium, dementia, suicide, depression, abuse and neglect of elderly patients will be discussed as geropsychiatric emergencies (Kocyigit et al., 2019).

1. Delirium

Delirium is an acute-onset clinical condition characterized by fluctuations in attention and orientation and accompanied by cognitive deficits such as memory, language and impaired consciousness (Neufelt et al., 2013). It is a common cause of acute mental changes in the elderly (Carthy et al., 2017). Delirium is the most common psychiatric emergency in geriatric patients followed up in internal and surgical inpatient services (Eker et al., 2019). It is seen in 8-10% of all elderly patients admitted to the emergency department and 40% of nursing home patients (Inouye et al., 2014).

1.1 Clinical Features

Differential diagnoses of delirium include dementia, depression or other underlying psychiatric disorders. The main symptoms are confusion, difficulty maintaining attention and disorientation. Blurred consciousness is the main symptom; alertness is decreased or excessively increased. Maintenance of attention is impaired; information retrieval, processing, storage, recall and utilization are disrupted. Disorientation to time and person is very useful for diagnosis. Symptoms fluctuate during the day, with some improvement during the day and worsening at night (Kirpinar & Isik, 2014).

The delirium clinic is characterized as hypoactive, hyperactive or mixed according to psychomotor activity. Hyperactive delirium is characterized by increased psychomotor activity. Characteristically, patients show agitation, restlessness, psychosis, sudden changes in mood and aggression. They may harm themselves and their surroundings with behaviors such as refusing medical treatment, pulling intravenous lines and catheters, screaming, and trying to escape from their surroundings. In hypoactive delirium, there is decreased psychomotor activity. Infections, metabolic disorders, hypoxia, renal and hepatic insufficiencies mostly cause hypoactive delirium (Dokuzlar et al., 2018). Lethargy, lethargy, apathy and confusion are observed in patients. Confusion can be overlooked in superficial communication with patients and although it is common in the elderly, its diagnosis is often overlooked due to its subtle clinic and confused with depression (Saxena & Lawley, 2009).

1.2 Risk Factors

The goal of diagnosis and treatment in patients with delirium is to find and correct the underlying cause. Approximately 95% of elderly people diagnosed with delirium have organic etiologic factors (LaMantia et al., 2014). In addition, grief reaction, change of environment, lack of sensory stimuli, insomnia and fatigue contribute to the occurrence of delirium (Inouye et al., 1993). Emergency practitioners should question the predisposing risk factors for the development of delirium when taking anamnesis from an elderly patient (Table 1) (Emektar & Demircan, 2019). The presence of triggering factors in elderly patients with predisposing risk factors facilitates the diagnosis of delirium (Table 2) (Emektar & Demircan, 2019).

Table 1: Predisposing conditions for delirium.

Demographic	Concomitant diseases	Medicines
Advanced age Male Gender	Number of concomitant diseases Concomitant disease severity Visual impairment Hearing impairment Dementia Depression History of delirium	Multiple medication use Existing psychiatric medications Alcohol abuse Substance addiction

	Cerebrovascular disorders Functional disorders Falling Malnutrition	
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Table 2: Conditions triggering delirium.

Systematic diseases	Primary brain diseases	Medicines	Environmental/Iatrogenic factors
Infection/sepsis	Stroke	Polypharmacy	Prolonged length of stay in the emergency department
Dehydration	Intracerebral hemorrhage	Alcohol or sedative drug withdrawal	Insomnia
Hypoxia/Hypercarbia	Meningitis	Substance or alcohol use	Application of physical restraint
Shock	Encephalitis	Anticholinergic medicines	Permanent urinary catheter
Electrolyte disorders	Seizures or postictal states	Sedative-hypnotics	Pain
Hypo/Hyperglycemia	Subdural hemorrhage	Opiates	Surgical interventions
Hypo/hyperthermia	Epidural hemorrhage		
Trauma			
Acute MI			

1.3 Physical Examination

Patients may not remember falling or injuring themselves, so signs of trauma should be sought. Even the patient's back and heels should be examined for decubitus ulcers. Abnormal postures, gait, coordination, difficulty in vision should be checked and a complete neurological examination should be performed. It should be kept in mind that a normal physical examination does not exclude the diagnosis of delirium (Grover et al., 2012).

1.4 Mental Status Examination

Although there are many tests developed to measure the severity of delirium, CAM (Confusion Assessment Method), which includes a short, standardized diagnostic algorithm in emergency departments, KDM (Confusion Assessment Method) and MDA (Memorial Delirium Assessment) scale, which measures the severity of delirium, are frequently used scales (Table 3) (Emektar, 2019). CAM consists of two parts. While cognitive

disorders are evaluated in the first part, the second part includes parameters that distinguish the causes of delirium and reversible confusion from other cognitive disorders. The two parts of CAM can be administered in emergency departments in less than 5 minutes (Marcantonio et al., 2010).

Table 3: CAM Part 2 diagnostic algorithm.

1. Acute onset with fluctuations during the day.
2. Decreased attention (Can they remember what is said? Can they focus their attention?)
3. Decreased ability to think in an organized manner (meaningless conversations, illogical thoughts, jumping to unrelated topics)
4. Altered consciousness.
<i>In order to diagnose delirium, Criteria 1 and 2 must be present and in addition, at least one of Criteria 3 and 4 must be present.</i>

1.5 Laboratory Testing and Imaging

Fingertip blood glucose, complete blood count, electrolyte levels, renal and liver function tests, urine analysis should be ordered in patients with suspected delirium in the emergency department. ECG (electrocardiogram) should be performed for cardiac pathologies and cardiac markers should be studied. In patients with pulmonary pathologies, blood gas analysis should be requested to rule out hypercarbia. If the level of drugs used by the patient can be measured (such as lithium, anticonvulsants, theophylline, digoxin and aspirin), drug levels may be requested. Lumbar puncture should be considered in patients with fever, leukocytosis and no focus can be detected. Investigations should be detailed according to the clinical and medical conditions of the patients (Marcantonio et al., 2014). If patient history and laboratory findings do not give a clear idea, brain tomography should be considered if the underlying cause is elucidated, if trauma is suspected or if there are focal neurologic findings (Han et al., 2013).

1.6 Treatment

When non-pharmacologic approaches are not sufficient in the treatment of delirium, pharmacologic treatment methods should be used if the patient prevents the treatment process and harms himself/herself or his/her environment (Flaherty et al., 2011). Pharmacotherapy of delirium is determined according to the underlying cause. Antipsychotics are still the first choice due to their efficacy, safety and applicability in different forms.

Haloperidol is one of the most widely used antipsychotic drugs since it can be administered orally, intramuscularly or intravenously and does not have anticholinergic properties. In the treatment of agitated patients, 0.5-1.0 mg parenteral haloperidol can be given every 30-60 minutes (Clevenger et al., 2012). When haloperidol is administered intravenously, care should be taken in terms of torsades des pointes. Benzodiazepines should not be the first choice because of their high side effect profile and aggravation of delirium. However, they may be preferred in the presence of withdrawal syndrome and seizure-related delirium (Breitbart et al., 1996).

2. Dementation

Dementia is the decline in mental and social abilities, especially memory, in a conscious patient to the extent that it affects daily life. Its incidence and prevalence increase with aging. Symptoms of dementia typically start insidiously and progress slowly. In the presence of severe or rapidly progressing symptoms, other causes should be investigated (The IPA Complete Guides to Behavioural and Psychological Symptoms of Dementia-Specialists Guide, 2012).

2.1 Pathophysiology

The most common cause of dementia is Alzheimer's dementia, a neurodegenerative disease affecting approximately 5 million people in the United States (Barton et al., 2010). Its pathophysiology involves a decrease in neurons in the cerebral cortex, increased amyloid deposition and the production of neurofibrillary plaques. The etiology is not clearly known (Carpenter et al., 2011). The prevalence of Alzheimer's dementia is 6% to 8% at ages >65 years and $\geq 30\%$ at ages >85 years. Other common types of dementia include vascular dementia, dementia with Lewy bodies, frontotemporal dementia, Parkinson's disease-related dementia and mixed dementia (Heber et al., 2003). Table 4 shows the types of dementia (Emektar & Demircan, 2019)

Table:4 Classification of dementia by cause

Degenerative diseases	Neoplastic
Alzheimer's disease	Primary tumors and metastatic diseases
Huntingon disease	Carcinomatous meningitis
Parkinson disease	Paraneoplastic syndromes

Vascular diseases Multiple infarcts Hypoperfusion Subdural hematoma Subarachnoid hemorrhage	Traumatic Traumatic brain injury Subdural hematoma
Infectious causes Meningitis (bacterial, fungal or tuberculosis) Neurosyphilis Viral encephalitis (herpes virus, human immunodeficiency virus) Creutzfeldt-Jakob disease	Metabolic causes Vitamin B-12 or Folate deficiency Thyroid diseases Uremia
Inflammatory causes Systemic lupus erythematosus Demyelinating diseases	Hydrocephalus Normal pressure hydrocephalus Noncommunicating hydrocephalus
Toxic Alcohol Medications (anticholinergics, polypharmacy)	Psychiatric Depression (pseudodementia)

2.2 Clinical Findings

Behavioral problems are common in dementia and usually begin to occur in advanced stages. Behavioral symptoms of dementia include physical/verbal violence, agitation, disinhibition, constant wandering and inappropriate behaviors. Psychological symptoms include anxiety, depression, hallucinations, delusions, apathy and misidentification syndromes (Ipekcioglu et al., 2009). As a result of visual and spatial disturbances, getting lost in the outdoors is a common emergency in dementia practice. In the presence of new or worsening behavioral symptoms, medical problems, treatment side effects, constipation, undiagnosed or inadequately treated pain, nutritional deficiencies or sleep problems should be considered as underlying causes (Soysal et al., 2015).

2.3 Physical Examination

Physical examination cannot elucidate the etiology of dementia, but it is instructive in terms of differential diagnosis. The presence of focal neurologic findings may indicate vascular dementia or intracranial mass. Extrapyramidal findings such as increased motor tone, rigidity or movement

disorder in the extremities suggest Parkinson's disease (Emektar & Demircan, 2019).

2.4 Mental Status Examination

Mental status tests should be performed in patients diagnosed with or thought to have dementia in the emergency department. For this, the Mini-Cog test provides ease of application in the emergency department. The patient is told three words (e.g. apple, table, penny), then asked to remember the words and repeat them immediately. Three minutes later, the patient is asked to repeat the three words. If the patient can remember all three words, there are no signs of cognitive impairment. If he/she cannot remember any words, it is considered as the presence of cognitive impairment. If the patient remembers one or two words, they are asked to perform a clock drawing test. The patient is asked to draw a specific time showing hours and minutes. The test result is assessed as normal (negative for cognitive impairment) or abnormal (positive for cognitive impairment) (Heber et al., 2000)

2.5 Laboratory Testing and Imaging

Laboratory tests should be selected according to the clinical condition of the patient. Complete blood count, liver-kidney function tests, urinalysis, thyroid function tests, erythrocyte sedimentation rate, etc. can be performed. Brain tomography or magnetic resonance imaging should be requested when necessary (Emektar & Demircan, 2019).

2.6 Emergency Department Management

Patients presenting with acute mental changes or rapid onset of symptoms should be consulted to the relevant departments for detailed evaluation (Carpenter et al., 2011). In the presence of new or worsening behavioral symptoms, medical problems, treatment side effects, constipation, undiagnosed or inadequately treated pain, nutritional deficiencies or sleep problems should be considered as underlying causes. Comorbid diseases such as urinary tract infection, congestive heart failure and hypothyroidism may lead to sudden deterioration in cognitive functions (Soysal et al., 2015). Therefore, dementia and conditions that worsen dementia should be recognized early and the underlying causes should be corrected in the

emergency department. Table 5 shows the similarities and differences between delirium and dementia (Lamantia et al., 2016).

Table 5: Clinical distinction between delirium and dementia.

Specification	Delirium	Dementia
Beginning	Acute (hour-day)	Insidious (month-year)
Progress	Floating	Continuous
Attention	Distorted	Normal except in severe cases
Disorder of Consciousness	Distorted	Generally preserved
Hallucinations	Frequently Available (audio/visual)	Generally preserved
Psychiatric findings	None	Often associated with depression
Course in 24 hours	Fast floating	Fast floating
Orientation	Distorted	Distorted
Concentration	Distorted	Distorted
Speaking	Inconsistent, disorganized	Anonymous/aphasic
Movements	Asterix, tremor	Often absent
Treatment	Typical feedback	Does not respond

3. Depression

The term geriatric depression refers to both patients who were depressed at an earlier age and relapsed in old age and patients whose depression first appeared in old age (Eren et al., 2020). Geriatric depression is a serious health problem in society and should be considered as a progressive and chronic disease. It is an important cause of mortality and morbidity (Eker et al., 2018).

3.1 Epidemiology

Major depression is a chronic and episodic form of severe depression and is commonly observed in the elderly (Blazer et al., 2003). Major depression is seen in 0.7-1.4% of the elderly in the community and this rate increases in hospitals and nursing homes (Vieira et al., 2014).

3.2 Risk factors

The main risk factors for depression are genetics, medical conditions, functional disability, disability, social isolation and psychological stressors. Most of these factors are common in the elderly (Blazer et al., 2003). Other important risk factors include lack of social support, living alone, being unmarried, cognitive impairment, grief and low socioeconomic status (Barua et al., 2010).

3.3 Clinical findings

Depression may be overlooked in elderly patients and other serious clinical conditions may also be defined as depression. In patients presenting with depression clinic, organic causes should be ruled out first (Seyhan et al., 2020). Depression manifests differently in older adults compared to younger age groups. Instead of crying spells, feeling sad or feeling that life is a failure, loss of appetite or loss of sexual interest is often reported. They are more likely to be irritable and withdrawn than sad. Older patients may also present with somatic or cognitive complaints when suffering from depression, which can make diagnosis difficult (Kroenke et al., 2003). Anxiety disorders are common with depression in the elderly, with a lifetime incidence of 15% (Beaudrea et al., 2008).

3.4 Screening tests

Although there are many depression screening tests, most of them have low applicability in the emergency department. The Patient Health Questionnaire-9 provides a nine-question assessment of depression in a short period of time. It questions nine features of depression, including anhedonia, depressed mood, sleep problems, feeling tired, changes in appetite, guilt or worthlessness, difficulty concentrating, feeling slowed down or restless, and suicidal thoughts (Gilbody et al., 2007).

3.5 Treatment

Hospitalization is often recommended for major depression in the elderly. Hospitalization is recommended especially if the risk of suicide is high, the patient has delusions, is not compliant with treatment, cognitive functions are not good and there is no social support (Eker et al., 2018). Depression should be evaluated in terms of comorbidities, drug history and suicide risk. Treatment includes both non-pharmacologic and pharmacologic interventions. Favorable results can be obtained in 50-65% of elderly people treated with antidepressants. Patients also present to the emergency

department with side effects of antidepressant treatment and drug interactions. Selective serotonin reuptake inhibitors and selective norepinephrine reuptake inhibitors are the most commonly prescribed and effective antidepressants (Mottam et al., 2009). As with all treatments in the elderly, Selective Serotonin Reuptake Inhibitors (SSRIs) should be started at the lowest dose and dose titration should be done slowly and carefully by observing for side effects and potential drug interactions (Downing et al., 2013).

4. Suicide

Depression, chronic physical pain, loss, abandonment, loneliness and family conflicts are the most important causes of suicide. Degenerative and chronic diseases, physical dependence, mental disorders and severe depression are among the reasons leading to suicide attempts in the elderly (Minayo et al., 2015).

4.1 Epidemiology

Although suicidal ideation is low in the elderly, the rate of suicide that results in action and death is high (Ipekcioglu et al., 2009). In addition, elderly patients give fewer signs of suicidal ideation to their environment (Tintinalli et al., 2021). In the United States of America, approximately 32000 people commit suicide each year, and 5000 of these suicides occur in the elderly over the age of 65 (Ipekcioglu et al., 2009).

4.2 Risk factors

Depression is the biggest risk factor for suicide. Other risk factors include poor health status, poor sleep quality, alcohol dependence, asociality, physical illness, loss of function and presence of firearms (Turvey et al., 2002). Focusing on the impact of emotional state, suicidal decision-making and cognitive state on suicide in the elderly will help to identify risk factors (Kosses et al., 2014).

4.3 Intervention and measures

A community-based and multidisciplinary approach is important in preventing suicide in the elderly. Measures taken for prevention can be categorized under three headings:

1-Primary prevention: It includes protective measures. These are efforts to prevent the occurrence of risk factors that cause suicide. For example, regulating socio-economic factors, increasing social support, facilitating access to the health system.

2-Secondary Prevention: Treatment of psychiatric disorders and monitoring of suicidal thoughts.

3-Tertiary prevention: Arrangements such as psychotherapy programs, crisis interventions, training programs, and participation in self-help programs (Cicek et al., 2020).

5. Elder Abuse

Although it has probably existed since antiquity, elder abuse was first described in the medical literature in the 1970s. (Dong&Simon, 2013) The definition produced by the World Health Organization is as follows: "A single or repeated act or lack of appropriate action that causes harm or distress to an older person in any relationship where there is an expectation of trust" (Dong&Simon, 2012).

5.1 Epidemiology

Elder abuse is a global public health, human rights, and criminal justice problem. Over the last century, with the growth and development of aging population, the number of older people is increasing daily in developing countries. An estimated 3 million individuals in the United States are affected by elder abuse annually. (Cooper et al., 2008). Turkey does not have a national database on elder abuse. Limited data are available, and in a few studies conducted in the west of the country, the rates of elder abuse have been determined as 13.3-14.2%. (Sener&Demircan, 2019). Available evidence suggests that elder abuse is prevalent, predictable, costly, and sometimes fatal. (Lahs et al., 2015). The emergency department (ED) visit provides a valuable opportunity to screen for elder abuse, as people who experience elder abuse are twice as likely to visit the ED compared to nonabused older adults. (Kotze, 2018).

5.2 Categorization

Elder abuse is examined under five main headings: physical abuse, psychological or verbal abuse, sexual abuse, financial exploitation and neglect (Table 6) (Lahs et al., 2015). Physical abuse is the most easily recognizable form of elder abuse. It can be defined as the application of force that may result in bodily injury, physical pain or impairment. Pushing, slapping, burning, hitting with objects and inappropriate use of restraint are examples of physical abuse. Pathologies that can be detected include abrasions, lacerations, bruises, fractures, use of restrictive medication or equipment. Verbal or psychological abuse is defined as causing emotional pain or distress

or discomfort. Verbal threats (such as threats of violence, threats of abandonment or deprivation of needs), humiliation, intimidation are examples of verbal/psychological abuse. Verbal/psychological abuse contributes to the development and worsening of mental problems such as depression, which is common in many elderly victims (Laumann et al., 2008). Sexual abuse is generally defined as any type of non-consensual sexual contact with an older person. The spectrum of sexual abuse ranges from unwanted touching to inappropriate interventions, from unwanted innuendo to rape (Lahs et al., 2015). Financial abuse is considered to be the second most common form of abuse. It corresponds to approximately 20-30% of all abuse cases. In various studies, the 1-year prevalence is seen between 1.0-9.2%. Financial or material abuse is defined as the illegal or inappropriate use of funds or property of the elderly. Financial exploitation occurs when family members, caregivers or friends control the resources of older persons (Lahs et al., 2015). The most common form of elder abuse is elder neglect. It accounts for more than half of all elder maltreatment cases reported to adult protective services each year. Elder neglect is defined as a caregiver's failure to provide basic care to the patient and failure to provide the necessary supplies and services to prevent physical/emotional discomfort (Kocyigit et al, 2019).

Table 6: Types of Elder Abuse.

Physical
Verbal or psychological abuse
Sexual abuse
Financial abuse
Negligence

5.3 Risk Factors

Studies show that older women are more frequently exposed to abuse than older men. Among older adults, younger older adults are associated with a higher risk of abuse, including emotional, physical and financial abuse and neglect. It is also shown that isolation and lack of social support are important risk factors for elder abuse (Table 7) (Lahs et al., 2015).

Table7: Risk factors for elder abuse (for the elderly).

Female gender
Young elderly group
Large group of joint elderly

Lack of social support
Alcohol addiction
A story of domestic violence
Cognitive Disorder
Physical dependence
Developmental disability
Special medical or psychiatric needs
Difficult behavior (such as aggression or verbal outbursts)
Limited experience in financial management
Nursing Home

5.4 Intervention and Precautions

Many studies have been conducted on the prevention and protection from abuse. Some of these studies have investigated the effectiveness of interventions aimed at reducing the occurrence or recurrence of elder abuse through mechanisms believed to regulate long-term outcomes (Sener et al., 2019). It is stated that the most effective method to prevent abuse is education. Interventions such as programs targeting risk factors for elder abuse, home visits, home-based geriatric assessment and help hotlines are some other measures. However, there is insufficient evidence that all these measures reduce abuse and neglect. Adult protection services that ensure mandatory reporting of cases, home health care services and staff that increase reporting, police as the first response unit in elder abuse, prosecutors' offices that conduct forensic follow-up, lawyers/legal services that follow up on will issues, clinicians who are in a critical position for recognition and appropriate reporting, hospital staff who can increase the likelihood of recognition of abuse, nursing homes that can be used if abuse is suspected in home care patients, and banks that can detect misuse of financial resources should work in an integrated way to detect, report and prevent abuse (Lachs et al. , 2015)

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CHAPTER 15

**METHODS OF SEDOANALGESIA
IN THE GERIATRIC PATIENT**

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1.INTRODUCTION

Aging is a physiological process that reduces some of the physical and mental abilities of people over time. The World Health Organization (WHO) has determined the onset of old age as 65 years; also classified old age as young old (65-74), old (75-84) and advanced old (85+) According to the data of the World Health Organization, life expectancy at birth increased from 46.5 between 1950-55 to 71.4 in 2015 (Anon. n.d.-a.).

In Turkey; While the population aged 65 and over, which is considered as the elderly population, was 6 million 651 thousand 503 people in 2016, it increased by 24.0% in the last five years and became 8 million 245 thousand 124 people in 2021. According to the “Global Strategy and Action Plan on Aging and Health” report published by the World Health Organization in 2015, the number of people aged 60 and over, which was 600 million in 2000, will increase to 1.2 billion in 2025 and is expected to reach two billion in 2050. This information indicates that the number of elderly individuals in societies is increasing and will increase over time (Anon. n.d.-b.).

Procedural sedoanalgesia (PSA); It is the use of anxiolytic, sedative, hypnotic, analgesic and dissociative drugs alone or in combination to reduce anxiety, pain and movement. Many interventional procedures, especially in the emergency department or local intervention departments, are painful and cause anxiety in the patient. These agents are medical procedures applied to increase patient comfort and safety by reducing pain and anxiety during diagnostic or therapeutic procedures. In other words, sedation and analgesia are needed to ensure patient cooperation and increase the success of the procedure (Frank 2022).

1.1.Psa indications

Procedures that require PSA are often those that require minor intervention. These can sometimes be applied in the local intervention room of the polyclinics and sometimes in the emergency services. Some of the most common of these processes are as follows (Ozcengiz and Birbicerler 2018);

- Acute painful conditions (renal colic, malignancy pains, trauma, headaches, acute inflammatory events)
- Orthopedic interventions
- Some dressings and wound debridement
- During magnetic resonance imaging and computed tomography procedures

- Calming patients who are agitated due to psychotic illnesses or traumatic situations
- Central venous catheter insertion procedure
 - Endotracheal intubation procedure
 - Thoracentesis procedure
 - Tube thoracostomy procedure
 - Pericardiocentesis procedure
 - Diagnostic peritoneal lavage procedure
 - Lumbar puncture procedure
 - Suturing procedure
 - Cardioversion procedure

1.2.Preparation for procedural sedoanalgesia

Before starting procedural sedoanalgesia, there are some preparatory procedures that must be done (Balçı 2020)

An informed consent form should be obtained from the patient; This consent form should inform the patient about the risks, benefits, alternatives and planned sedation of the procedure and should answer all questions. In some cases where the patient's consent cannot be obtained because of severe pain or a change in consciousness; If the procedure to be done is important for the patient's life; can be considered as if the patient consented.

Necessary equipment should be available in the intervention room before starting the procedure. These equipments are (Frank 2022).

- Aspirator
- Bag valve mask
- Airway attachments such as oral and nasal airways
- Endotracheal intubation equipment
- Oxygen
- Intravenous line equipment
- Medications for advanced cardiac life support requirement
- Antidotes (naloxane, flumazenil)
- Monitor suitable for monitoring

After the necessary equipment is ready, the patient's vital signs should be monitored and preoxygenation should be started before the procedure. Supplemental oxygen is often recommended during and before PSA to

preserve patients' existing oxygen reserves and to prevent hypoxemia caused by hypoventilation (Balci 2020).

1.3.Sedation levels

Drugs used in procedural sedoanalgesia (except ketamine) can cause sedation at different depths, from minimal sedation to general anesthesia, depending on the dose and patient response(Balci 2020).

The effects, pharmacological properties and side effects of the drugs used should be well known and the appropriate sedation level should be selected accordingly. Considering the adequacy of the patient's ventilation, the doctor should choose the most comfortable and appropriate drug for the patient (Ozcengiz 2018). The sedation scale of the patients is shown in Table 1 (Höhener,2008);

Table 1. The Levels of Sedation

	Minimal Sedation	Moderate Sedation	Deep Sedation	General Anesthesia
Response	Normal response to verbal stimulus	Respond to a verbal warning or tactile stimulus	Response to repetitive or painful stimulus	No response even to painful stimulus
Airway	Protected	No intervention required No intervention required	Intervention may be required	Intervention is often necessary
Spontaneous Breathing	Protected	sufficient	may be insufficient	often insufficient
Cardiovascular Function	protected	Usually protected	Usually protected	May impaired

1.3.1. Minimal sedation

The patient is almost awake and responds normally to verbal stimulation, obeying orders. The cardiovascular and respiratory functions of the patients are preserved. This type of sedation is characterized only by anxiolytic effect. It can be preferred if the patient's cooperation with the physician is necessary. With this procedure, pain control is provided with local or regional anesthesia. It is suitable to be preferred in minor procedures such as lumbar puncture, small joint and simple fracture reductions, and abscess drainage. Commonly used drugs are nitrous oxide, fentanyl, midazolam, and low-dose ketamine (Ozcengiz 2018)

1.3.2. Moderate sedation

The patient's level of consciousness is depressed. There is a slow but positive motor response to simple verbal or tactile stimulation. The eyes close, the conversation goes away, and it's like being drunk. It is used in procedures where detailed patient cooperation is not required, muscle relaxation and pain reduction is desired. Many agents used to produce this level of sedation produce amnesia. It can be preferred in procedures such as shoulder dislocation reduction, thoracostomy tube placement, synchronized cardioversion. Agents commonly used for moderate sedation in adults; It is a combination of Propofol, Etomidate, Ketamine (ketamine), Methohexital (methohexital) and Fentanyl (fentanyl) and Midazolam (Frank 2022).

1.3.3. Deep sedation

Patients do not respond to verbal stimulation but they respond to painful stimulation. Airway reflexes are protected. The drugs used in this type of sedation are the same as for moderate sedation, but the application doses have increased (Bqalcı 2020).

1.3.4. General anesthesia

There is no response to verbal or painful stimulation, and the patient's airway reflexes are also lost. It should be preferred in operating room conditions (Höhener 2008).

1.4. Drugs used in PSA

The selection of sedative and analgesic agents to be used varies according to the procedure to be performed, the duration of the procedure, the age of the patient, the physical condition of the patient, the experience of the physician and the current conditions (Deitch 2010),

1.4.1. Drugs with analgesic effect

The most commonly used drugs in analgesics are opiates. There are synthetic (morphine) and semi-synthetic (meperidine, fentanyl) forms (Deitch 2010),

1.4.1.1. Morphine

It produces analgesia, sedation and euphoria. The peak effect occurs 15-30 minutes after it is given. The half-life is 2-3 hours. It is metabolized hepatically and its metabolites are excreted by the kidneys. It is started with a dose of 0.05-0.1 mg/kg and repeated every 0-15 minutes if necessary. If long-acting analgesia is desired, an effect of 4-6 hours can be achieved with a dose of 0.2 mg/kg. It should be administered as a very slow intravenous infusion. Respiratory depression, hypotension, nausea, vomiting, constipation, pruritus,

biliary spasm and urinary retention are expected complications and care should be taken in this respect (Godwin 2014).

1.4.1.2.Meperidine (Dolantin)

The peak effect starts in 10-20 minutes. It is 10 times less potent than morphine. The half-life is 3-4.5 hours. The duration of action is shorter. It is eliminated from the liver and its metabolite normeperidine is excreted by the kidneys, but is also toxic to the central nervous system. This metabolite may cause prolonged sedation and convulsions. There is an initial dose of 1-1.5 mg/kg iv dose, which can be repeated with 5-10 minutes intervals. The total dose should not exceed 1-3mg/kg. Myocardial depression, respiratory depression, euphoria, nausea and vomiting are expected complications. It should not be used together with MAO inhibitors as its use can lead to fatal effects (Godwin 2014).

1.4.1.3.Fentanyl

It is much more potent than morphine, but does not have anxiolytic and amnesic effects. Its effect starts very quickly. It reaches its peak effect in 2.5-10 minutes. The duration of action is 20-40 minutes and the half-life is 3-3.5 hours. Initial dose is 1-2 mcg/kg. Nausea, vomiting, hypotension, bradycardia, chest wall rigidity are expected complications (Unscheduled Procedural Sedation 2019, Messenger 2008).

1.4.2.Anesthetic drugs

Midazolam, Propofol, Etomidate, Ketamine, Thiopental and Methohexital

1.4.2.1.Midazolam

It is anxiolytic, amnesic, sedative, hypnotic, muscle relaxant and anticonvulsant. It shows its peak effect in 1-2 minutes, the effect lasts for 60 minutes. Initial dose; 0.01 mg/kg is in the form of intravenous (IV) infusion in 30 seconds, it can be repeated every 3-5 minutes if necessary. The total dose is between 5-7mg. It can cause hypotension and respiratory depression at 0.25-0.5 mg doses. Flumazenil is used as the antagonist; 0.1-0.2 mg IV should be administered in repeated doses until the desired effect (Godwin 2014).

1.4.2.2.Propofol

It causes deep sedation, hypnosis, amnesia, but has no analgesic effect. It is administered as 0.2 mg/kg/min infusion, and the patient wakes up 2-2.5 minutes after the infusion is stopped. It can cause respiratory and cardiac depression and sudden hypotension (Deitch 2010).

1.4.2.3.Ketamine

It has analgesic, mild sedation, antegrade amnesia and deep sedation and dissociative anesthesia effects. It is administered as 1-2 mg/kg IV or 2-4 mg/kg IM, and its effect starts in 1-2 minutes. If the patient has active pulmonary infection, severe head trauma, coronary artery disease, heart failure, uncontrolled hypertension, aneurysm, mass in the central nervous system, hydrocephalus, increased intracranial pressure, altered consciousness, focal neurological deficit, glaucoma or eyeball injury It is absolutely contraindicated. It should not be used in posterior pharyngeal interventions in children under 3 months of age, during pregnancy and lactation, if the patient has porphyria, psychosis, and hyperthyroidism. Nausea and vomiting, nystagmus, excessive secretion, mild myoclonic convulsions, hallucinations, nightmares and dreams, and sympathomimetic effects (hypertension, tachycardia, rhythm disturbances) are the expected side effects of ketamine (Messenger 2008).

1.4.2.4.Etomidate;

It has sedation, amnesia and hypnotic effects but not analgesic effects. It is used by titration of 0.1mg/kg IV, its effect starts in 20-30 seconds. It can cause nausea, vomiting, myoclonus, and adrenal suppression, but it has almost no hemodynamic, respiratory, central nervous system and cardiac side effects. It is the drug that provides the best hemodynamic profile. Lowers intraocular pressure (Godwin 2014)

1.4.2.5.Thiopental

The starting dose is 3-5 mg/kg/IV. The peak effect of the drug occurs in 30-40 seconds and the effect lasts for 10-30 minutes. Thiopental decreases cerebral blood flow and may cause myocardial depression and vasodilation. It should be used with caution in hypovolemic patients due to its hypotension side effects (Godwin 2014)

1.4.3.Recommended sedoanalgesic drug combinations

- Midazolam + Fentanyl
- Midazolam + Meperidine
- Midazolam + Morphine
- Midazolam + Ketamine
- Propofol + Fentanyl
- Thiopental + Fentanyl
- Etomidate + Fentanyl

1.5.How should Sedoanalgesia Termination be done?

After sedation and completion of the procedure, drug therapy is discontinued and patients continue to be monitored until they have fully returned to their baseline mental state and cardiopulmonary function (Balci 2020, Frank 2022)..

1.6.Discharge

The patient can be discharged if the procedure is at such a low risk that the procedure does not require follow-up in terms of complications, if the patient does not have complaints of pain, dizziness, nausea, is stable in respiratory and cardiac terms, can do his work without any assistance and can be accompanied by someone for at least a few hours (Balci 2020, Frank 2022)

2.Sedoanalgesia in geriatric patient

2.1.Physiological changes due to aging

2.1.1.Central nervous system

With age, there is an increase in the threshold value of all stimuli such as vision, hearing, touch, taste, pain and temperature. The reason for this increase is due to various reasons such as decrease in the number of receptors and afferent conduction pathways, slowdown in neurotransmission, shrinkage in brain cells and axons. After the age of 80, the loss of neurons in the brain is evident in the cerebral cortex, especially in the frontal lobe. For these reasons, dose requirements for local and general anesthetics are reduced in geriatric patients (Aydoğan 2011).

2.1.2. Cardiovascular system

The decrease in parasympathetic tone, beta-receptor sensitivity and cardiovascular elasticity with aging is one of the main changes seen in the cardiovascular system. Since cardiac reserve decreases in most elderly patients, a significant decrease in blood pressure can be observed during anesthesia applications. Elderly patients have poor ability to respond to hypovolemia, hypotension or hypoxia with an increased heart rate (Rooke 2020).

2.1.3. The respiratory system

Decreased flexibility of lung tissue causes distention and collapse of small airways. As the alveolar surface area decreases, gas exchange also decreases. This leads to disruption of the ventilation-perfusion mechanism. With these emphysema-like changes, arterial oxygen pressure is said to decrease by an average of 0.35 mmHg per year (Aydoğan 2011).

2.1.4. Kidney Function

Renal blood flow and kidney mass decrease with age. the ability of the kidneys to concentrate and dilute urine is reduced. For this reason tendency to dehydration or fluid overload in elderly patients increases (Aydogan 2011).

2.1.5. Gastrointestinal tract

The rate of liver biotransformation is reduced in the elderly(Aydogan 2011).

2.1.6. Musculoskeletal system

Bone and muscle mass decrease with age (Aydogan 2011).

2.2. Drugs of choice for geriatric sedoanalgesia

It has been shown that many IV agents used in anesthesia are metabolized in the liver, and hepatic changes accompanying age lead to a decrease in the clearance of anesthetics. Renal clearance declines with advancing age. Many agents that are eliminated via the kidney are affected by this condition. It is observed that the sensitivity to anesthetic agents increases with increasing age in geriatric patients, but the mechanism playing a role in this has not been determined yet. However, this problem experienced with agents with quite different chemical properties is associated with a basic neurophysiological process such as neuronal mass or loss of cerebral blood flow (Höhener 2008 , Muravchick 2006).

2.2.1. Anesthetic drugs in geriatric patients

Because of these physiological changes, elderly patients usually require lower doses of premedication. Currently, the most commonly used sedative drugs in the elderly are benzodiazepines. Among these, the first drug to be chosen is midazolam, which has a short half-life, minimal active metabolite and few side effects. Although oral use is effective, IM or IV is usually used. The IV dose is 0.05-0.07 mg kg in elderly patients. IM dose Midazolam administered IM at a dose of 2-3 mg in the 60-69 age group provides an effective premedication without causing excessive drowsiness. In patients aged 70 years and older, IV titration is more appropriate under careful and continuous observation, since IM midazolam premedication causes excessive sleepiness (Höhener 2008 , Muravchick 2006)

Another benzodiazepine commonly used in the geriatric patient population for sedation is Diazepam. After IV or PO administration, the elimination half-life is 20 hours at age 20 and reaches 90 hours at age 80 (Wong 1991,Lim 2020)

It was observed that Thiopental caused more cardiovascular depression in geriatric patients. therefore, the dose should be reduced and repeated bolus or infusion administrations should be avoided (Rooke 2000)

Disadvantages of Etomidate are postoperative nausea and vomiting and adrenocortical suppression in its infusion (Griffiths 2014)

Ketamine is a potent sedative, hypnotic, amnestic and analgesic agent that can be administered IV and IM. It stimulates the cardiovascular system. While this event is beneficial for hypovolemic patients, it is disadvantageous in patients with ischemic heart disease as it increases myocardial oxygen demand. Ketamine increases airway secretions, decreases airway resistance, and increases intracranial pressure. Therefore, it is a drug that should be used with caution in geriatric patients(Griffiths 2014).

2.2.2. Drugs with analgesic effect in geriatric patients

Opioid Analgesics Weak Opioids (Tramadol, Codeine) Tramadol; It is a centrally acting analgesic in synthetic structure with both opioid and nonopioid properties. 30% of its analgesic effect can be antagonized by naloxane. It can be preferred in geriatric patients for its analgesic effect. The elimination half-life of tramadol is slightly prolonged. The dose should be reduced. While tramadol provides analgesia by central inhibition, it also causes CNS excitation. The most common of these effects are nausea and vomiting. Convulsions have been reported at high doses. Infrequently, tremor may occur. Care should be taken in elderly patients with Parkinson's as it may increase tremor. It is especially preferred in geriatric cases because its effect on respiratory depression is very rare (Höhener 2008 , Griffiths 2014)

Strong Opioids (Meperidine, Morphine, Fentanil, Alfentanil, Sufentanil) They are the first choice for pain control, especially during major interventions (Steven 2008)

The main mechanism of increased sensitivity to opioids in the elderly is increased brain sensitivity. In general, the need for opioids in the elderly is 25-50% lower than in the young. Age is an important factor in determining opioid dose. Opioids do not affect platelets, they do not have renal and hepatic toxic effects. They do not irritate the GI mucosa. Respiratory depression is the most feared side effect. Respiratory depression always occurs after sedation. Sedation level, respiratory rate depth and rhythm should be monitored. Naloxane is administered as an antidote in patients with respiratory depression. Potent and fast-acting opioids (fentanyl, sufentanil, alfentanil)

can be used alone for induction in patients with critical hemodynamic stability(Bansal 2012, Steven 2008)

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CHAPTER 16
GERIATRIC PATIENTS AND POLYPHARMACY

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INTRODUCTION

An important part of elderly patient care is optimizing drug therapy. Before using the drug, the clinician should think multifactorial about the drug to be prescribed. It is a difficult process that includes choosing the best active ingredient in the appropriate indication, adjusting the dose according to the patient's current condition and physiological characteristics, monitoring the effectiveness and drug side effects, informing the patient about expected or unexpected side effects, and exchanging information from different branches when necessary (Rochon and Schmader 2019).

It is reported that the world population is aging compared to the past, and when we look at the common predictions of the regional and countries' own research companies, especially the World Health Organization (WHO), the ratio of the elderly population to the total population will increase day by day. According to the data of the World Health Organization, while people aged 60 and over constituted 12% of the population in 2015, it is estimated that this rate may increase to 22% in 2050 (Anon n.d.-a). When the United States of America (USA) data is analyzed, while the population over 65 was 35 million in total at the beginning of the 2000s, it is estimated that this number will double to 70 million in 2030 (Fulton and Riley Allen 2005). In Turkey, when the data for the year 2020 are examined, it is estimated that while the elderly population constitutes 9.5% of the total population, this rate will be 12.9% in 2030 and 25.9% in 2080 with an increase of approximately two and a half times (Anon n.d.-b).

As a result of many changes that occur in our body with aging, there are changes in the pharmacokinetic and pharmacodynamic effects of drugs. Approved doses may not be appropriate for elderly patients, as drug dose studies generally do not cover elderly patients (Cho et al. 2011). The increase in the volume of drug distribution cannot be prevented due to the increasing fat mass and relatively decreasing muscle mass with aging. Even in the absence of kidney disease, a decrease in drug clearance occurs as a result of decreased renal functions with aging (Rowe et al. 1976). Decreased hepatic functions with increasing age may explain the significant differences in drug metabolism with young people (Tan et al. 2015).

1. Definition

Polypharmacy can be simply defined as the use of two or more drugs for different reasons. Although the minimum number of drugs varies in different sources to define polypharmacy, numbers ranging from 5-10 are also

used (Ferner and Aronson 2006). Again, according to the National Service Framework (NFS), the number 4 is specified as the minimum number (Britain 2001). Although the issue of polypharmacy is most often attributed to prescription drugs, the number of over-the-counter drugs and herbal products used for vitamin and energy supplementation should not be ignored.

2. Epidemiology

In the literature reviews, it is observed that the prevalence of polypharmacy varies (Pazan and Wehling 2021). It is seen from the Cross-sectional analyzes of the Survey of Health, Aging, and Retirement in Europe (SHARE) 6th Wave that polypharmacy was defined as the use of 5 or more drugs in individuals aged 65 and over in 17 European countries and Israel. It varies between 26,3-39.9% (Midão et al. 2018). Again, in a cross-sectional study conducted in Scotland, polypharmacy was defined as 4-9 drug use and it was found to be 28.6% in people aged 60-69 and 51.8% in people aged ≥ 80 years (Payne et al. 2014). Again, in a study conducted in Switzerland, it was determined that 41.2% of the elderly individuals used 5 or more drugs (Blozik et al. 2013).

When the United States of America data is examined; According to the National Health and Nutrition Examination Survey (NHANES) data, the use of 5 or more drugs between 1999/2000-2011/2012 was compared and it was found that the prevalence increased from 24% to 39% (Kantor et al. 2015). Again, in a study conducted in Korea in 2010-2011, 86.4% of the elderly population was using 6 or more drugs (Kim et al. 2014). In a study conducted in Turkey, it was determined that 38.2% of individuals over the age of 65 use 4 or more drugs (Kutsal 2006).

3. Etiology

The causes of polypharmacy can be examined under 4 main headings. First; patient-related factors such as increasing age, gender, ethnicity, smoking, education level. Latter; disease-related factors such as cardiovascular, endocrinological, and respiratory diseases. Third; Factors originating from health professionals, such as prescribing drugs for which there is no indication, and finally, factors related to accessibility to health services (Guillot, Maumus-Robert, and Bezin 2020).

When the etiology of polypharmacy is examined, the issue that should be emphasized and the most preventable is; professional health practitioner-driven factors. When these factors are examined; The lack of communication between specialists and general practitioners, the demand for reorganization

of the prescription, personal preferences, beliefs, many guides-information sources, and lastly, the lack of up-to-date education can be counted (Clerc et al. n.d.; Davis et al. 1999). In addition, drugs used off-label such as laxatives, sedatives/hypnotics, antidepressants and analgesics are the precursors of polypharmacy (Veehof et al. 2000). In line with these clinician-derived factors, the susceptibility of patients to polypharmacy increases.

CLINICAL CONSEQUENCES OF POLYPHARMACY

Polypharmacy causes many problems, especially drug-related adverse events, treatment non-compliance, and drug interactions. In addition to all these problems, increasing costs is another issue that has been emphasized in many studies (Shah and Hajjar 2012).

Studies have shown that while the adverse drug reaction rates are 13% in the use of two drugs, the risk increases to 58% when this number increases to five drugs, and this rate is 82% in the use of seven or more drugs (Prybys 2002). The drugs that cause the most common adverse events include diuretics, nonsteroidal anti-inflammatory drugs, anticoagulants, antibiotics, antidiabetics, and cardiovascular drugs (Gurwitz et al. 2003; Hohl et al. 2001). Pharmacodynamic and pharmacokinetic changes occur in geriatric patients as a result of increasing age, deteriorating nutritional habits and increasing comorbidities (Mallet, Spinewine, and Huang 2007). In a multicenter randomized controlled study conducted in Europe and including 1601 patients, the rate of drug-drug interaction was found to be as high as 46% (Bjorkman et al. n.d.). Ignoring the interactions of prescribed drugs in the geriatric patient population has a direct impact on adverse drug reactions and increased hospitalizations due to drug toxicity (Gurwitz et al. 2003; Juurlink et al. 2003). In studies conducted, treatment compliance rate in geriatric patients varies between 43% and 95% (Vik, Maxwell, and Hogan 2004). In addition to the increase in the number of drugs, it was stated that the non-compliance increased in direct proportion to the increasing age (Colley and Lucas 1993; Salazar, Poon, and Nair 2007). Treatment failure rates increase in direct proportion with increasing non-compliance, and hospitalization rates increase as an inevitable result (Salazar et al. 2007). Many studies have shown that there is a link between polypharmacy and hospitalization in the geriatric patient population (Beer et al. 2011; Khezrian et al. 2020; Lalic et al. 2016; Wastesson et al. 2018). Again, in hospital-based studies, its relationship with rehospitalization was also determined (Wastesson et al. 2018). In a meta-analysis, a significant relationship was found between polypharmacy and

mortality(Leelakanok et al. 2017).The presence of a high number of comorbidities and the association of polypharmacy in geriatric patients may increase mortality(Pazan and Wehling 2021). The relationship between polypharmacy and falling has been shown in many studies. In a study, the rate of falling in the geriatric age group using five or more drugs was 21% higher than the group not using drugs(Dhalwani et al. 2017). A study conducted in England shows the relationship between the fall rate and polypharmacy in nursing home patients(Izza et al. 2020).

The relationship between polypharmacy and cognitive impairment has been found in many studies. This rate is higher especially in polypharmacy, which includes psychotropics and anticholinergic drugs(Niikawa et al. 2017; Wastesson et al. 2018). In a study conducted with newly diagnosed Parkinson's patients, mini-mental state examination scores were found to be significantly lower in patients with polypharmacy(Ishii et al. 2019). It has not been clearly proven that polypharmacy causes deterioration in physical functions as well as cognitive disorders. In some studies, no relationship was found between decline in functional status and polypharmacy(Vetrano et al. 2018). However, there are studies showing that disability rates in falling patients are higher in polypharmacy patients(Bonaga et al. 2018; Wang et al. 2015).

POLYPHARMACY PREVENTION

Specific to geriatric patients, the drug histories of the patients should be taken comprehensively at the time of first application and should be updated at each application. While drug history is being investigated, prescription drugs should be added to the list as well as over-the-counter drugs. The patient or caregiver should be informed and encouraged to bring the medicines used by the patient at every hospital application. Medicine groups such as supplements and antacids used for support purposes, especially vitamins, are ignored by clinicians. All drugs used by patients should be reviewed whether they are used in appropriate indications. It should not be forgotten that the drugs used to eliminate the side effects of the drugs used cause an unnecessary risk increase to the patients. Patients should be directed to non-pharmacological treatments such as diet and exercise whenever possible(Shah and Hajjar 2012).

Clinicians should regulate the treatment by taking into account the pharmacokinetic and pharmacodynamic properties of the drug to be used in the appropriate indication, especially the kidney and liver functions, drug

interaction and side effect profile of the patient(Shah and Hajjar 2012)(Shah and Hajjar 2012). Medication compliance of patients can be achieved with the use of generic drugs, specially designed medication boxes, other compliance tools, and caregiver training(Shah and Hajjar 2012).

In addition, two abbreviations using the initials SAIL and TIDE can help the clinician to prevent polypharmacy(Werder and Preskorn 2003).

Technique	Description
SAIL	
Simplify	Simplify drug regimens to reduce pill burden. Use medications that can be dosed once or twice daily. Use medications that can treat multiple conditions.
Adverse effects	Be familiar with adverse effects of medications. Choose medications that have broad therapeutic indices when possible. Discontinue a medication that is causing an adverse effect when possible.
Indication	Ensure each medication has an indication and a defined, realistic therapeutic goal.
List	List the name and dose of each medication in the chart and share it with the patient and/or caregiver.
TIDE	
Time	Allow sufficient time to address and discuss medication issues during each encounter.
Individualize	Apply pharmacokinetic and pharmacodynamic principles to individualize medication regimens. Consider dose adjustments for renal and/or hepatic impairment. Start medications at lower doses than usual and titrate slowly.
Drug interactions	Consider potential drug-drug and drug-disease interactions. Avoid potentially dangerous interactions, such as those that can increase the risk for torsades de pointes.
Educate	Educate the patient and caregiver regarding pharmacologic and nonpharmacologic treatments. Discuss expected medication effects, potential adverse effects, and monitoring parameters.

Figure 1: SAIL and TIDE techniques

CONCLUSION

Polypharmacy has taken its place among the causes of increasing morbidity and mortality. Considering all these, it is an issue that should be kept in mind especially in the geriatric patient group. At the end of a careful and comprehensive history at the time of admission to the hospital, a detailed drug inquiry should be made by the clinician, and all substances that patients do not see as herbal or medicine, especially vitamins they use without a prescription, should be questioned and recorded. During the treatment of all patients, the drugs used should be taken into consideration, and dose adjustments should be made according to the functional status of the patient and the side-effect profile of the drugs to be administered, adverse drug interaction, pharmacokinetic and pharmacodynamic properties. Before prescribing to patients, ways to treat the present condition should be sought, particularly through non-pharmacological means such as diet or exercise.

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CHAPTER 17
NEGLECT AND ABUSE SITUATIONS
IN THE GERIATRIC PATIENTS

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1. INTRODUCTION

Everyone deserves to live in safety and prosperity, healthy, honorable, and respectful.

Abuse is the misuse of someone's goodwill. Negligence, on the other hand, means not showing the necessary attention, neglecting, ignoring, and not giving importance (TDK dictionary, 2014). Old age indicates a period in which physical and cognitive activities decline and emotional intensity and dependence increase (Taşkesen, 2017). The elder abuse (EA) situation, which has increased with the increase in the elderly population, has become a global problem (Storey, 2020). EA poses a serious threat to public health and increases the risk factors that impair the health of elderly individuals (Koga, Tsuji, Hanazato, Suzuki & Kondo, 2020). In addition, the World Health Organization (WHO) has given priority to this issue in recent years (Burnett, Achenbaum & Murphy, 2014). WHO defines elder abuse as a human rights violation and an act of violence (Yon, Ramiro-Gonzalez, Mikton, Huber & Sethi, 2019).

EA can occur especially in those who stay in long-term care facilities. Although nursing homes are the first places that come to mind when it comes to EA and its neglect, it is known that many cases occur in homes. Domestic abusers are usually children, grandchildren, or their partners. EA has an important place in domestic violence and is more common in situations where the trust relationship is damaged (Phelan, 2012).

2. Incidence Prevalence

The increase in the elderly population both in the world and in our country has brought many problems in the field of economics, social, and health. As it is understood that the elderly population will increase gradually in the coming years, the subject of EA will be discussed more. It is estimated that individuals over the age of 65 will constitute approximately 25% of the US population in 2050 (Roberts, Ogunwole, Blakeslee & Rabe, 2018). Compared to 2010 data, it is estimated that the population over 65 years old will increase by 188%, the population over 85 years old by 351%, and the population over 100 years old by 1004% in 2050 all over the world (Global Health and Aging, 2014).

Unfortunately, the data in the literature on EA statistics cannot completely reflect the truth. Because most cases are either unreported or hidden. It is known that approximately 80% of EA cases are not reported to the authorities (National Center, 2014). The reasons for this include the

victims' isolation, cultural beliefs, fear of hospitalization, serious illness or fear of retaliation, refrain from the judicial process, guilt, and the desire to protect the abuser (LoFaso & Rosen, 2014). In 2021 WHO report, it was shown that one out of every six elderly individuals experienced abuse (WHO, 2021). A study conducted in the USA found that approximately 11% of the elderly living in the community were exposed to at least one type of abuse within a year (Acierno et al., 2010). Unfortunately, sometimes these abuses can lead to the death of the elderly individual. For example, in a study conducted between 2002 and 2016, it was revealed that more than 19,000 elderly people were killed (Logan, Haileyesus, Ertl, Rostad & Herbst, 2019). It is seen that the majority of the elderly victims are men and the murder is mostly committed in the home of the elderly individual. It is often seen that the perpetrator is someone from a close circle or one of his relatives (Shawon, Adhia, DeCou & Rowhani-Rahbar).

The prevalence rate of elder abuse varies widely between countries. Among the European countries, it was found that Ireland had the lowest EV rate at 2.2% (Naughton et al., 2012), while Croatia had the highest EA rate at 61.1% (Ajdukovic, Ogresta & Rusac, 2009). Living in the city or in the countryside can also make a difference in the abuse of elderly individuals. In a recent study, it was found that approximately 40% of the elderly living in rural areas have EA (Kolodziejczak, Terelak & Bulsa, 2019).

2. Classification

Types of abuse; physical, financial, psychological, and sexual abuse. Apart from these types of abuse, there is also the neglect of the elderly. In the elderly, many types of abuse can be seen at the same time (Rosen, Elman, Mulcare & Stern, 2017). While psychological abuse, financial abuse, and neglect are more common in society, sexual and physical abuse is less common (Amstadter et al., 2011).

2.1. Physical Abuse

They are actions such as harming the body (slapping, pushing, burning, hitting), physically obstructing, keeping in bed forcibly, and using physical force, by people who are trusted or cared for by elderly individuals (Kılıç & Şelimen, 2017). Injuries, bruises, bite marks, fractures, beating marks (chain, stick), burnt areas on the body, bleeding on the scalp or lack of hair in one area are indicators of this type of abuse (Kıssal & Beşer, 2009).

2.2. Financial/Material Abuse (=Financial Exploitation)

It is the most common among the species that cause EA (Weissberger et al., 2019). Uncertain decrease in the assets of the elderly person, irregular withdrawal of money from the bank account, issuance of checks with forged signatures, and loss of valuables with high monetary value are examples of this type of abuse (Erden & Boz, 2018). Demographic factors (such as low income), cognitive impairments, and psychosocial problems are risk factors for financial abuse (Sprenge, Ebner, Levin & Turner, 2021).

2.2.1. Abuse in the Health System

It is carried out by unethical health personnel. For example, it does not provide the necessary health service to the elderly individual, but bills it and receives its fee. It imposes over- or duplicate charges for medical services. Prepares medical supplies or medication reports on behalf of the elderly patient.

2.3. Emotional/Psychological Abuse

Most of the time, it is psychological abuse when elderly people experience mental pain from someone they trust, verbally or non-verbally (Ertin & Bad, 2016). Examples of this type of abuse include verbal attack, humiliation, belittlement, threatening, intimidation, embarrassment, criticism, intimidation, mobbing, nickname-taking, and forced separation (Yeşil, Taşci & Öztunç, 2016). In elderly individuals who are victims of psychological abuse, shyness, not answering questions, and not wanting to communicate with other people can be seen (Akdemir, 2008). This type of abuse is also common in people who are subjected to sexual and physical abuse (Erden & Boz, 2018).

2.4. Sexual Abuse

It is forcing the elderly to any sexual activity against their will. It is the most concealed type of abuse by the elderly. Because the elderly victims are very ashamed of this situation and think that the person who takes care of them will punish them. Sleep disorders, aggressive behaviors, and depression can be seen in these victims, most of whom are women (Fadıloğlu, 2012). The perpetrators of sexual abuse are usually acquaintances or relatives of the elderly. Among the indicators of this abuse are; bleeding from the vagina, pain in the genital area, torn and bloody underwear, bruises on the breasts, and difficulty in walking and sitting. In addition, involuntary touching, forcible

undressing, and taking openly sexual photographs are also included in this abuse.

2.5. Negligence

Negligence cases are more common in older individuals than abusers. Family members are often unaware that they neglect the elderly. It should be evaluated as three subtypes.

a) Active negligence: failure of the caregiver to fulfill their caregiving responsibilities.

b) Passive negligence: The caregiver's unintentional failure to fulfill their caregiving responsibilities. Not fulfilling the needs of the elderly such as food, clothing, shelter, heating, medical treatment, and hygiene, or acting unwillingly (Uysal, 2017).

c) Self-neglect: Inability to meet one's own basic needs. The elderly may neglect themselves due to their poor income. This neglect may also be due to an underlying neuropsychiatric disease. It is more common in patients with dementia. In addition, self-neglect can be seen in the elderly with some substance addictions. In the medical treatment of the elderly, it can be counted as insufficient or insufficient use of medication, safety measures, and inadequacy in meeting their needs such as personal care, shelter, clothing, and nutrition (Kalaycı, Yazıcı & Şenkaynağı, 2015). Situations such as the bad smell of the elderly due to not paying attention to their personal hygiene, having scaly rashes and wounds on their skin, being very weak or obese, having dirty clothes, and dressing inappropriately are indicators of elderly neglect (Akdemir et al., 2008).

Table 1: Classification, typical examples and indicators

Type	Typical Examples	Indicators
Physical Abuse	Pushing, slapping, hitting, kicking, pulling hair Starvation or force feeding Burning your house, using firearms or knives Abuse of drugs	Wound, bruise Bite Burn Dry skin due to dehydration Broken glasses

Financial/Material abuse	Stealing money or belongings Cashing checks or forging his signature Signing fake contracts, changing a will, giving power of attorney Stealing their ID or password	Living an unsuitable life Continuous debt payment
Emotional/psychological abuse	Verbal scolding, humiliation Blame, mock Threats of punishment/deprivation Act like a baby Isolating the person from society	Fear Anxiety Startle Depression Keep quiet
Sexual Abuse	Sexual molestation, rape Forced nudity Taking obscene photos Unwanted touching, verbal sexual approaches Inappropriate display	Bleeding from the vagina Pain in the genital area Torn and bloody underwear Bruises on the breasts
Negligence	Seizure of food, water, clothing, shelter and medicines Lack of personal hygiene Deprivation of walkers, canes, glasses, hearing aids or dentures Failure to provide personal safety or medical care	Inappropriate and dirty clothing A neglected body Sunken eyes Bed sores

1. Physical Examination

Signs of physical injury such as bruising, cuts, fractures, and burns may be seen in patients suspected of maltreatment. There may also be some indications that support this suspicion of abuse or neglect. In particular, it includes changes due to malnutrition and dehydration. Dehydration, which is common in the entire elderly population with a decrease in the feeling of thirst, can become life-threatening in the neglected elderly group. Sometimes

the caregivers and sometimes the household may not care or neglect the water needs of the elderly person. Serious fluid losses can be fatal (Lachs, 2000). Malnutrition, weight loss, and related infections may impair the immune system of the elderly (Dyer, Connolly & McFeeley, 2003). Many older individuals have difficulty coping with stressful situations because they have low physiological and psychological capacities. This risk increases exponentially in the case of EA and negligence (Dong et al., 2011).

2. Who is at Risk

Risk factors of the victim: Over 75 years old, female gender, being widowed or divorced, low-income level, low education level, presence of depression, dependency and inadequacy due to health and economic problems, loss of status and power, living alone, dementia, low mental capacity, and physical disability

Risk factors for the abuser: Being a family member, having psychiatric problems, unemployment or economic problems, not accepting or compelling the role of care, not getting along with the caregiver, having familial problems, being addicted to drugs, alcohol, or substance

Risk factors belonging to institutions: Low wages to employees, insufficient or too intense work of personnel, insensitivity of employees to this issue, and lack of information about reporting abuse (Erden & Boz, 2018).

3. Neglect and Abuse in the Covid-19 Pandemic

Elderly individuals had to live in home isolation for a long time during the pandemic period, due to their high risk of contracting Covid-19 disease. In this process, psychological problems such as depression and anxiety began to increase both in the elderly and in the households or caregivers who took care of them. Isolation and social distance increase stress among people, resulting in an increase in elder abuse (Elman et al., 2020). Along with these risk factors, which increased during the pandemic period, there was an increase in EA cases (Filipska et al., 2021). The fact that elderly care is more difficult, tiring, and stressful, especially in this period, was considered as the most important reason (Schulz, Beach, Czaja, Martire & Monin 2020). In a recent study, it was seen that the elderly who need long-term care experienced an increase in their exposure to violence (Chang & Levy, 2021). A study conducted in Poland during the pandemic period showed that approximately 45% of hospitalized elderly were victims of EA (Filipska et al., 2021). It has been shown that there is an 84% increase in the

rate of EA seen during the pandemic compared to the periods before the pandemic (Chang & Levy, 2021). In a large-scale study conducted in some European countries, within a year before the pandemic, 19.4% of the participants were subjected to psychological abuse, 3.8% to financial abuse, 2.7% to physical and 0.7% to sexual abuse. (Fraga et al., 2014).

As the elderly group carries a greater risk of complications after contracting Covid-19, their need for care increases. This result has become an important risk factor for elder abuse (Arthur-Holmes & Gyasi, 2021). In addition, the serious economic difficulties and stress that emerged in the families of elderly people during the pandemic were considered the important cause of EA (Du & Chen, 2021).

4. Precautions and Recommendations

The risks that will cause EA need to be tackled. It is necessary to deal with the risks that will cause it. First of all, it is necessary to inform, train or warn communities and organizations, especially family members, about EA. Conditions that create abuse and neglect must be improved and corrected. With the support of the media, training should be organized to raise awareness of love and respect for the elderly.

Not recognizing or knowingly reporting cases of elder abuse and neglect holds healthcare professionals responsible. Health professionals who have a role in the care of elderly patients should also be subject to training and inspections on the subject. Most healthcare professionals are hesitant to ask patients about abuse and neglect. It has been observed that healthcare professionals do not have sufficient knowledge about the binding laws on EA and negligence (Almogues, Weiss, Marcus, & Beloosesky, 2010). With the more frequent and widespread use of home care services implemented by our Ministry of Health, EA and negligence can be detected more.

Abuse and neglect of the elderly in our country have reached such dimensions as attracting the attention of researchers, non-governmental organizations, and law enforcement officers (Erden & Boz, 2018). In Articles 97, 98, 279, and 280 of the Turkish Penal Code; There are penalties to be given to responsible persons in cases of EA and negligence, and to health personnel who do not report this situation to the competent authorities or show delay (TCK, 2004).

The elderly should be informed that when they encounter a situation of abuse, they should report it to the necessary places. The availability of shelters and nursing homes where they can stay when they have to leave their

place of residence may prevent them from being abused again. Policies on the aging need to be updated and improved. In addition, easier and safer bank access can be provided for the elderly on devices such as smartphones and computers with internet connection.

Calling and visiting family elders frequently will increase their trust in us. It may be necessary to stay with the elder from time to time so that the caregiver who lives at home can take a break. The "15 June World Adult Abuse Awareness Day", which is not well-known throughout society, should be brought to the fore more. It is necessary to provide training on the subject and increase the level of knowledge and awareness.

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- visit may offer the only opportunity to identify victims of elder abuse. Addressing elder mistreatment may dramatically improve quality of life or save the lives of these vulnerable patients. *Emergency Medicine*, 49(5), 200-207.
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CHAPTER 18
ASTHMA IN GERIATRIC PATIENT

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INTRODUCTION

Asthma is chronic inflammatory disease of the respiratory tract, multiple factors play a role in its development. Asthma is one of the most important causes of morbidity and mortality in the world and in Turkey, main symptoms respiratory distress, cough, wheezing and pressure in the chest. It usually progresses in attacks and treated according to the degree of airway obstruction. Attacks occur in the morning or at night and triggered by exposure to an allergen. Asthma has become common in adult and children in recent years. Worldwide prevalence of asthma is associated with increased atopic susceptibility. and asthma incidence parallel the in other all rate of increase diseases such as allergic rhinitis and eczema (Kılınç et al., 2016) Reducing/preventing attacks within the scope of protection from future risks in treatment, recommended to prevent persistent airflow limitation and to keep the drugs used within safe limits in terms of side effects (Çelik, 2022).

THE EFFECT OF AGING ON THE RESPIRATORY SYSTEM

According to the World Health Organization, aging is defined as a decrease in the ability to adapt to environmental factors. Although aging shows individual differences, genetic, environmental factors, lifestyle, chronic diseases and their use of physiological coping ways (Coşkun, 2015). The World Health Organization (WHO) defines geriatric old age as 65 years and older, those aged 85 and over were defined as very old. Although the increase in life expectancy at birth is an indicator of the welfare level of countries, Health problems that increase in number and severity with the increase in the old population, diminished functional abilities, economic difficulties, changes in social status, many problems such as loss of spouse and friends are encountered (Üzer et al., 2019). Decrease in elastic recoil with aging, due to calcification in costochondral components and costal cartilage, increased chest wall rigidity, with (decreased compliance) Diaphragmatic weakness and decrease in respiratory muscle strength are observed (Kalpaklıoğlu et al.) At the cellular level, as a result of changes in immune responses with age, the susceptibility to airway infections increases and the elderly have more frequent respiratory tract infections. Differential diagnosis of dyspnea, which is the main symptom in asthma, can be difficult in the elderly due to other comorbidities. The causes of dyspnea in the elderly are given in Table 1(Kalpaklıoğlu et al). Especially Chronic Obstructive Pulmonary Disease (COPD) and heart failure are diseases that are clinically similar and can mask each other .

Aging is a very complex process where functions gradually decrease in all structures from cells to organs, in the growth and development of a living organism. Aging is a process, it starts with birth and never stops (Coşkun, 2015)

Table 1. Causes Of Dyspnea In Geriatric Patients

• Chronic obstructive pulmonary disease
• Cardiac diseases (heart failure etc.)
• Respiratory infections
• Gastroesophageal reflux
• Tracheobronchial tumors
• Foreign body aspiration and chronic aspiration
• Bronchiectasis
• Obesity
• Interstitial lung diseases
• Pulmonary embolism
• Vocal cord dysfunction
• Thyrotoxicosis
• Allergic Bronchopulmonary Aspergillosis (ABPA)
• Churg-Strauss syndrome
• Hyperventilation
• Drugs (Beta-blockers, Nonsteroidal anti-inflammatory drugs (NSAID), acetylsalicylic acid (ASA), cholinergic drugs, ACE inh)
• Geriatric syndromes

DIAGNOSIS

Pulmonary function tests (Spirometry), bronchial provocation tests (Methocholine, Exercise, Other) identifying triggers (Skin prick tests, Intradermal tests) are the main tests and the most important are pulmonary function tests. Performed by experienced personnel in appropriate environments must. After taking a deep breath, it is quickly blown into the device. With this test, the air in our lungs the amount of output (FEV1) in the 1st second is expected to be >80%. According to the severity of asthma, these values low can be observed. However, even if the pulmonary function tests are normal, the procedure is repeated by administering a short-acting β_2 agonist (salbutamol) to show whether there is a narrowing of the bronchi in asthmatic patients. If a certain increase is observed compared to the initial

value of the patient, this is a very valuable finding for diagnosis. (Coşkun 2015). Sometimes breathing tests can give normal results, even if the symptoms suggest asthma. Like this cases, provocation tests are applied. Preventing or reducing the frequency of attacks after diagnosis in terms of allergen tests, prevention methods are recommended for the patient.

Diagnostic stages in geriatric patients are not much different from adults. However, comorbid diseases, multiple It can be a bit challenging due to situations such as drug use. Other diagnoses, especially COPD should be excluded and a treatment plan should be made.

Table 2. Asthma attack severity (Tintinalli, Seventh Edition,part 8,chapter72)

	Light-Medium Attack	Heavy Attack	Life-threatening Attack	
Patient Position	Prefers sitting rather than lying down	Prefers to sit leaning forward	Prefers to sit leaning forward	
	Not agitated	Agitated	Sleepiness, confusion	
Speech	Can make short sentences	Speaks word by word	Can't speak	
Respiration Rate	Respiratory rate increased (But <30/min)	> 30/min	> 30/min	Insufficient effort for breathing, fatigue and transition to respiratory failure
Heart Rate	100-120 beats/min	> 120 beats/min	> 120 beats/min	Hypotension, arrhythmia, bradycardia
Oxygen Saturation	%90- 95	< %90	<%90	Cyanosis
Auscultation	Wheezing	Wheezing		
PEF	PEF (Expected/ personal best value) > 50%	PEF (expected/ personal best value) < 50%	Silent lung Doesn't have the performance to do PEF	

TREATMENT

Treatment is run with lifestyle changes according to the patient's allergen status. Medications are used to control the disease and reduce the frequency of attacks. Since asthma medications are generally used for a long time, the side effect profile should also be considered. Patient-doctor compliance also ensures a successful treatment process. The drug groups used in general are listed in Table 3.

Table 3. Drugs used in the treatment of asthma and mechanism of effect

Systemic corticosteroids	They inhibit the release of mediators by suppressing inflammation in the airways.
B adrenergic agonists	It causes relaxation and bronchodilation in bronchial smooth muscles.
Inhaled steroids	It suppresses inflammation locally in the bronchi and alveoli.
Anticholinergics	Vagal bronchodilation
Leukotriene Receptor Antagonists	Receptor blockade of bronchial mucosa-derived mediators called leukotrienes
Other treatments	Anti Ig E, immunotherapy...

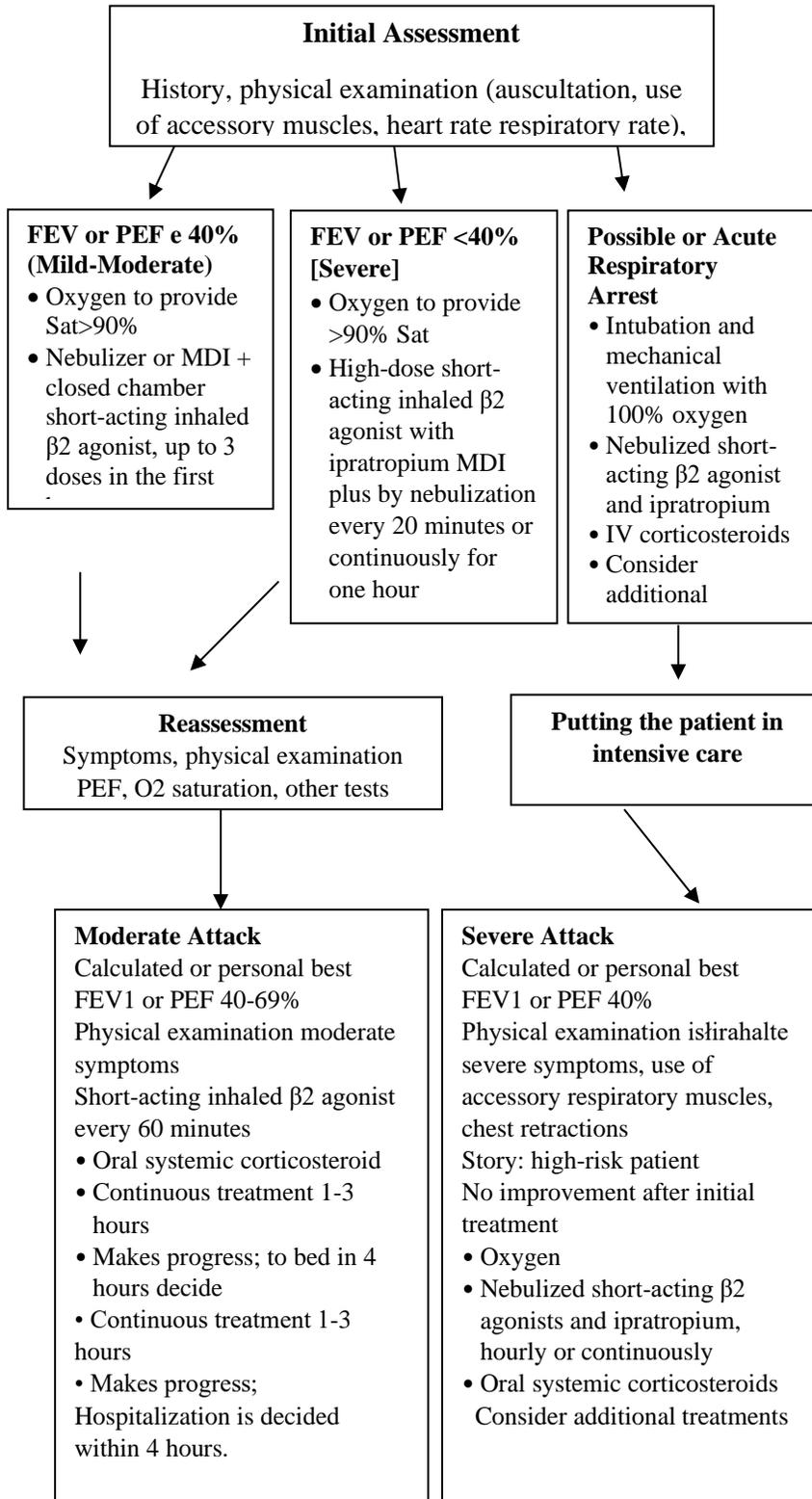
The drugs in the table can be used alone or in combination preparations. Asthma is a disease that progresses in attacks and patients apply to the emergency room if they cannot get relief despite using their own inhaler drugs at home.

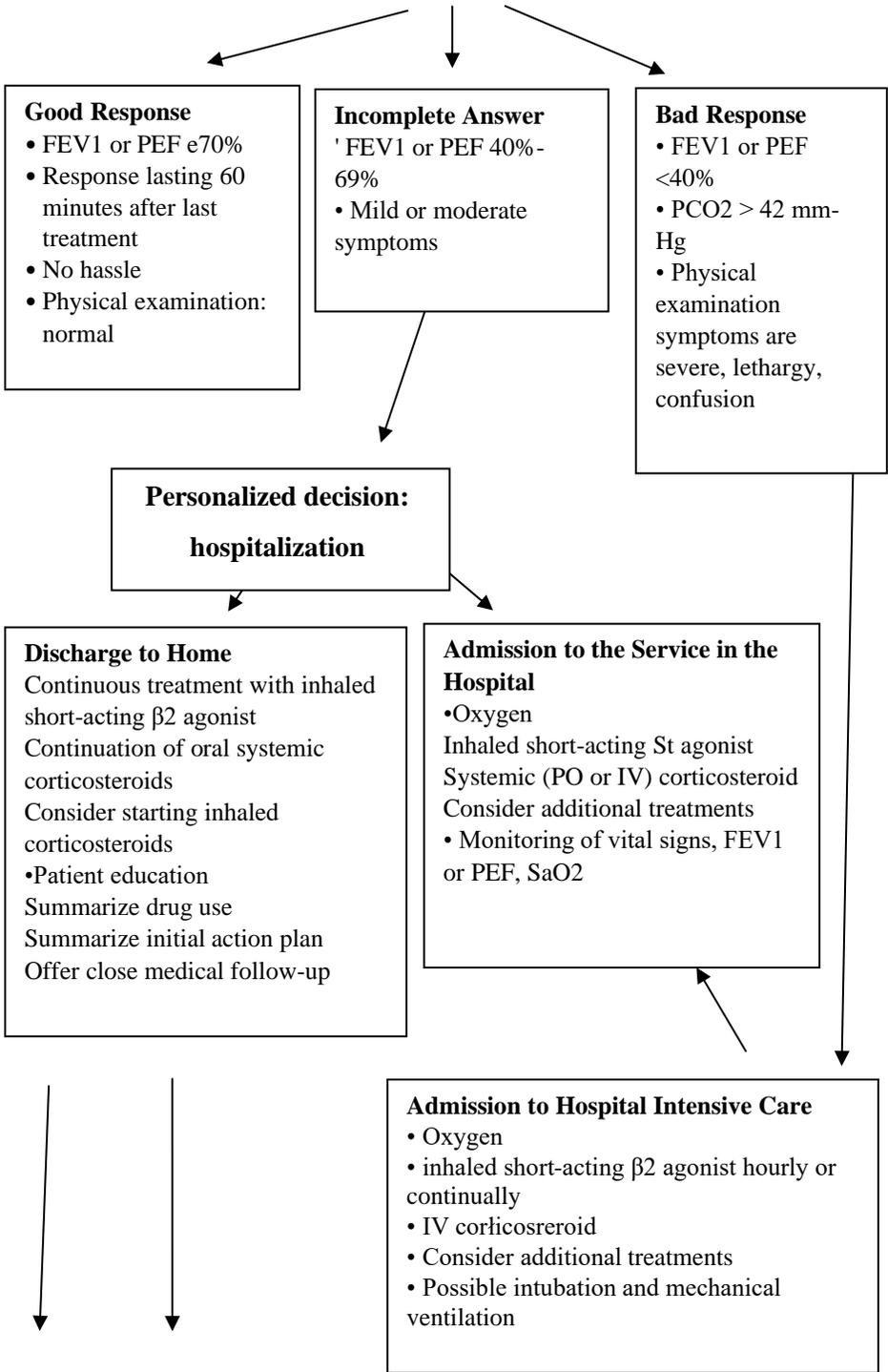
The use of bedside spirometry provides rapid and objective evaluation of patients and also serves as a guide for the benefit of treatment. Forced expiratory volume (FEV1) and peak expiratory flow (PEF) values at 1 second directly measure the degree of obstruction in the large airways. Sequential measurements serve to assess disease severity and response to treatment. Physical examination findings and assessments of the patient's symptoms do not necessarily correlate well with the severity of airflow obstruction. If possible, management decisions should be made based on the patient's best FEV1 or PEF values, and if these are not known, other physiological and historical causes should be evaluated and the patient's expected spirometric values should be used accordingly. Since the reliability of these tests depends

on patient cooperation, the use of spirometry is limited in the evaluation of very serious attacks (GINA 2021).

The emergency physician should first evaluate the severity of the attack and start treatment. The patient is monitored and vital signs are recorded. A short history of the disease is taken from the patient or his relatives, and a physical examination is performed. In general, the patient's ability to form sentences, not be agitated, and not use the auxiliary respiratory muscles are seen in mild attacks, while interrupted speech, agitation, use of auxiliary respiratory muscles indicate severe attacks. There is also an increase in respiratory rate and heart rate. The patient's inhaler treatment is started. In mild attacks, blood tests may not be requested, but in severe attacks, hemogram and arterial blood gas are taken. While evaluating the degree of hypoxia in arterial blood gas, it also allows us to measure the response to the treatment given. Pulmonary imaging is not required during an attack, but may be requested if complications such as pneumothorax or pneumonia are suspected.

Oxygen is given with a nasal mask so that the oxygen level is above 90% and simultaneous inhaler bronchodilator therapy is started. The patient who is given oral or IV steroids is evaluated for treatment response 1 hour later. If the patient does not find clinical relief, high-dose inhaler steroids are tried. If the patient still does not feel relief, IV magnesium, which has a known relaxation effect on bronchial smooth muscles, can be administered. Another treatment option is heliox, which consists of a mixture of helium and oxygen, and it can be tried in patients who do not show sufficient improvement. (Kalpaklıoğlu et al.) Although some researchers have shown that ketamine and halothane show success in patients in whom all other treatments have failed, there are no controlled studies supporting this issue. (GINA 2021). If the patient still does not respond to the treatment, he should be intubated and transferred to the intensive care unit. (Table 4) (Kalpaklıoğlu et al).





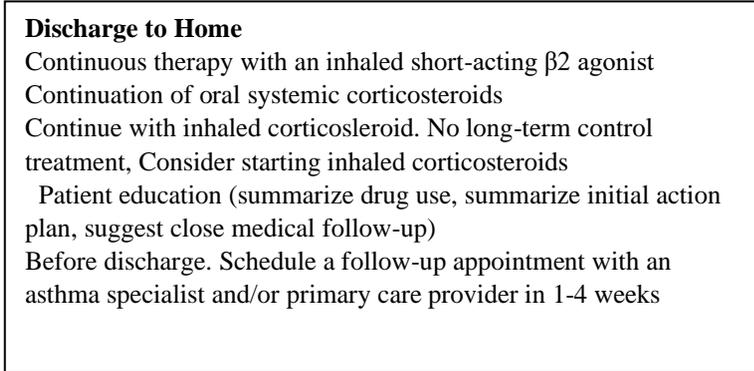


Figure 1. Asthmatic patient management (Tintinalli, Seventh Edition, part 8, chapter 72)

DISCHARGE FROM EMERGENCY DEPARTMENT

Discharge of patients should be decided by combining subjective parameters such as resolution of wheezing, improvement in clinical aeration in evaluation with auscultation, and objective measures such as normalization of FEV1 or PEF values, as well as factors in the history such as patient compliance, emergency service and hospitalization. The ideal elements required for successful discharge without the risk of early relapse have not yet been established. After treatment and emergency room discharge, varying degrees of residual airflow obstruction, airway lability, and inflammation persist.

Table 4. Problems encountered in elderly asthmatics

Pharmacological	Comorbidities	Physiological
<ul style="list-style-type: none"> ➤ Inappropriate drug use ➤ drug-drug interaction ➤ Increased risk of side-effects ➤ Decreased effectiveness ➤ Limited data with new biologic therapies 	<ul style="list-style-type: none"> ➤ COPD ➤ cognitive impairment ➤ Cigaret ➤ Obesity 	<ul style="list-style-type: none"> ➤ Fix airway obstruction ➤ Increased small airway disease ➤ Disruption of dyspnea ➤ susceptibility to infections ➤ Increased deterioration in respiratory functions

Asthma treatment and education of the geriatric patient group includes difficulties compared to younger individuals. With aging, cognitive dysfunction, forgetfulness, and regression in fine motor skills occur. An elderly patient's forgetting to take their medication or not using their inhaler effectively affects the treatment compliance process negatively. As a result, he has more frequent attacks and needs to go to the hospital more often. Accompanying chronic diseases aggravate the picture a little more, leading to a more difficult treatment process. However, due to aging-related liver and kidney function disorders, the metabolism of drugs used also changes. As a result, social and psychological support is important in addition to medical treatment in elderly individuals. A quality treatment process can be experienced by providing patient education and more frequent control examination appointments with home care services.

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