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“Drug Considerations in Geriatric Patients”

September 2014

Age related disorders are significant in numbers, & they generate considerable drug related challenges. Our goal in this lesson is to re-visit these ever increasing situations. The objectives of this lesson are such that upon completion:



Pharmacists will be able:

1. Define “life expectancy.”
2. Describe metabolic changes that are age related.
3. Name common geriatric disorders.

Technicians will be able to:

1. Understand factors that contribute to a person's longevity.
2. Describe physiological & biological changes that take place during aging.
3. Describe signs & symptoms of age related disorders.

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To obtain continuing education credit for this lesson, you must answer the questions on the quiz (70% correct required), and return the quiz. Should you score less than 70%, you will be asked to repeat the quiz. Computerized records are maintained for each participant.

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INTRODUCTION

Geriatrics is a term used to describe a medical specialty or the study that deals with health care of the elderly, i.e. persons whose age has reached or surpassed the accepted mandatory retirement age or life expectancy. The word geriatrics is derived from the Greek word gere, meaning to grow old, and iatros, meaning healer. A geriatrician is a physician who specializes in treating elderly patients. Gerontology originated from the Greek words geron, meaning old person and -ology, meaning the study of. Gerontology is the study of the aging process and its effects on physical, mental, psychological and social changes as well as the connection between normal aging and age-related disease.

Life expectancy may be defined as the average length of survival from birth. The number of elderly persons has been growing steadily in most countries, thereby increasing the percentage of the elderly in most societies. There are a number of factors that may contribute to a person's longevity. These include:

1. Gender.
2. Genetics (trait inheritance from parents).
3. Adequate health care.
4. Hygiene practices.
5. Sanitation which aims at treatment and disposal of human waste.
6. Diet.
7. Physical exercise that improves fitness and wellness.
8. Lifestyle of persons living in rural areas and those who live in urban environments.
9. Smoking and excessive consumption of alcoholic beverages.
10. Stress of daily live, i.e. financial, occupational and familial.

Life expectancy in the US ranged from 77.4 years in 2002 to 78.24 years in 2010. In Spain, for example, the expectancy was 79.08 years in 2002 and 81.09 in 2010. In the developed countries, life expectancy in 2010 ranged from 77 – 90 years, (Monaco's expectancy was 89.73 years); whereas in the developing countries life expectancy ranged from 32 – 80 years in 2002.

The age at which a person is in need of geriatric care is somewhat arbitrary. There is truth in the saying "age is not how old a person is, it is how you feel". General health and cognition varies from one elderly person to another. One can point to individuals whose intellectual competence and memory sharpness allowed them to hold high positions in the corporate world, politics, education and justice system. However, being mortal, the aging process will take its toll and body organs decrease in function; memory becomes limited; susceptibility to disease increases, and the patient become dependent on others.

In 1990, 10.2% of Americans aged 75 and older lived in nursing homes compared to 8.1% in 2000 and 7.4% in 2006. Currently, some elderly opt to move to assisted facilities, remain at home, or depend on children to take care of them in other ways.

In 2011 the number of individuals 65 years of age and older in the USA was 41.1 million, i.e. 13.3% of the population or approximately one in every 8 Americans. By 2030, it is estimated that this number will reach about 72 million. In 2011 there were 23.4 million elderly women and 17.9 million elderly men, a ratio of 131 women to every 100 men. At age 85 years and older the ratio was 203 women to every 100 men.

AGE-RELATED PHYSIOLOGICAL AND BIOLOGICAL CHANGES

Tissues and cells undergo changes as the patient becomes older. The tissue cells of a healthy young adult consist of mitotic cells that are capable of proliferation. These include the epithelial, fibroblastic and vascular (endothelial) cells. Organ cells such as those of the skin, intestines, liver, kidneys, muscles, and CNS are renewable. However, as we age, the cells become mature and no longer capable of undergoing mitosis or proliferation (post mitosis). Fat deposition increases and takes the place of lost cells. The elasticity that is normally present in young tissue begins to deteriorate, and the normal tissue elasticity is lost. The heart undergoes hypertrophy and fibrosis and the valves become rigid. Responsiveness of the myocardial beta adrenergic receptors and baroreceptors reflect a sensitivity decline. Cardiac rate and output gradually decrease, while blood pressure decreases along with formation of arteriosclerosis. Lung expansion diminishes and gas exchange as well as expiratory flow rate is reduced. Changes in the kidneys may contribute to a decrease in renal blood flow, glomerular filtrates rate, and creatinine clearance. The number of nephrons decreases 30 to 40% between the ages of 25 and 85. Linear decrease in muscle mass and increase in total body fat, especially around the waste and thighs, may cause a decrease in total body water, thereby affecting volume of distribution. The epidermis of the skin atrophies as a result of a decline in collagen and elastin inhibition of locomotion may occur due to degenerative changes in joints and decrease in muscle mass. Eye sight weakens due to diminished transparency in the optical parts of the eye. Hearing may diminish due to changes in the inner ear. Changes in the GI tract may cause a decrease in intestinal motility which may result in constipation. Hepatic flow decreases and a decline in certain hepatic enzymes as well as diminished synthesis of hepatic albumin may occur.

AGE-RELATED KINETIC CHANGES

Absorption

Although physiologic factors such as gastric pH, gastric emptying rate and intestinal absorption mechanisms may appear to influence the absorption rate from the GI tract, recent reports have not confirmed this. Any impact on absorption would be insignificant. For example, absorption of Vitamin B12, iron and calcium through active transport is reduced, whereas that of levodopa is increased. Due to atrophic changes in the gastric mucosa of the elderly, the secretory capacity of gastric parietal cells diminishes. The results are a decrease in gastric acidity of the stomach. The disintegration, dissolution and subsequent absorption of drugs require certain acidic environment. Thus, the efficiency of absorption of such drugs in the geriatric patient, who lacks the proper gastric pH, is diminished. Gastric emptying rate appears to decline with age, primarily due to weakening of both muscle tone and motor activity.

Since the small intestines are the main absorption site of orally administered drugs, any delay in gastric emptying of a drug into the intestine wall results in the retardation of the absorption process and an increased risk of degradation of acid-sensitive drugs. The GI tract receives about one-third of the heart output. The decrease in cardiac output, that is usually associated with aging, will result in diminished blood flow to the GI tract, resulting in further reduced absorption.

Distribution

Serum albumin levels tend to decrease with age, especially in malnutrition and acute illness. Therefore, concentration of the free form of highly albumin-bound drugs, which determines drug effect, will rise as these drugs will have fewer sites for binding. However, increased levels of unbound drugs will result in an increase in adverse reactions. Reduced albumin protein may also occur due to the presence of renal and hepatic dysfunction. Changes in body composition due to aging can affect drug distribution. The proportions of lean body mass and water content to total body weight decreases with age, whereas that of body fat increases. About 82% of the total body weight of younger adults consists of lean body mass, while in an elderly person, it is 64%. The percentage of fat tissues increases from 18% to 36% in men, and from 36% to 48% in women.

Metabolism

The rate of metabolism depends on hepatic blood flow, the extent of liver impairment, and the magnitude of cytochrome P-450 activity. Age-related reduction in hepatic blood flow falls to a rate from 40 to 50% of that of healthy younger individuals. Consequently, the rate of metabolism in the elderly may be reduced. Oxidative metabolism through the cytochrome P-450 system does decrease with age, and results in a decline in metabolism of the drug.

Renal-Excretion

Some medications are minimally metabolized and are eliminated practically unchanged. A significant decline in glomerular filtration rate and renal blood flow occurs with advancing age. It has been estimated that by age 70, a person may experience a 40 to 50% reduction in renal function. Such declines result in many adverse reactions due to inadequate elimination of drugs.

AGE-RELATED ADVERSE DRUG REACTIONS (ADR)

The chances of having multiple health problems that require the use of multiple medications by the elderly is quite high. In addition to the use of prescription medications, the use of nonprescription drugs is frequent. It has been reported that more than 770,000 cases, including the elderly, of injuries or fatalities have been reported due to ADRs which may cost up to \$5.6 million per hospital. It is estimated that patients 65 years of age and older take an average of 5-6 medications daily. As the patient becomes older, the number of medications used increases. In addition, about 40% of OTC sales in the USA are purchased by patients 65 years of age and older. Due to the intake of multiple drugs, the risk of drug interactions is high. The most commonly encountered ADRs in the elderly include: confusion, drowsiness, memory loss, dizziness, nausea, constipation, incontinence, and extra pyramidal syndromes. Unintentional misuse of medications by the elderly is an important factor in causing ADRs. Compliance errors occur more frequently in elderly patients who suffer from vision, hearing, physical impairments, or from forgetfulness. Some patients may place multiple medications in the same vial.

COMMON GERIATRIC CONDITIONS

Other than chronic diseases encountered in the general population such as hypertension, diabetes, and asthma, there are specific geriatric conditions that may lead to disability and incapacity to perform daily living tasks such as bathing, changing clothes, eating, shaving,

using the toilet and getting into a car. In a study conducted in 2011 on 11,000 persons aged 65 years and older who reside in nursing homes or at home, it was found that 50% of them had suffered from geriatric conditions such as Alzheimer's disease, dementia, incontinence, Parkinson's disease, osteoarthritis, strokes, tremors, syncope, cancer, benign prostatic hypertrophy and accidental falls.

Alzheimer's Disease is a degenerative progressive form of dementia characterized by failing general health and memory loss due to deterioration of brain function. It begins its gradual course in a normal person with normal cognition as encountering difficulty in remembering familiar names, places and words. As the disease progresses more memory lapses are experienced. The person may have difficulty in performing daily living tasks, forgetting events they just read in the newspaper, coming up with the correct word or expression during conversation, and misplacing objects. Later on, there is a great deal or complete cognition decline and noticeable change in behavior, followed by deterioration in general health. Physiologically, the disease is characterized by loss of neurons and synapses in the cerebral cortex and some cortical regions. There is no cure for Alzheimer's disease, but drugs such as acetylcholinesterase inhibitors and N-methyl-D-Aspartate Receptor (NMDAR) inhibitors are used.

Urinary Incontinence (UI) occurs when a person experiences a strong urge to urinate immediately or to urinate more frequently than normal with or without leakage. More often the person loses control of the urinary bladder. It occurs in men and women. UI causes a great deal of distress to the patient, families and friends. One in 5 persons over 40 suffers from over active bladder or urge for frequent urination. However, such combination is more common among persons 65 years of age and older. It can be physically and emotionally draining. Causes of UI include inflamed bladder wall, multiple sclerosis, Alzheimer's disease, dementia, and strokes. UI can occur occasionally as constant dribble, or complete lack of bladder control. UI can be categorized as urge or stress incontinence. Urge UI is exhibited as urgent and sudden urge to urinate due to bladder muscle contraction resulting in accidental urination. Stress UI, which is not related to psychological stress, occurs when stress or pressure caused by the abdominal muscles is stronger than the closing pressure of the bladder muscle, leading to leakage. This may happen during coughing, sneezing, running, jumping, lifting heaving objects, getting out of a chair, or climbing stairs. In men it may occur in those with prostate enlargement, or in those who had prostate treatment or surgery. Incomplete bladder evacuation could lead to leakage in both men and women. UI can be treated behaviorally by timed bathroom use, pelvic muscle exercise, management of fluid and food intake, and double voiding, i.e. waiting a few minutes between the first and second urinations. Drugs such as cholinergic agents are helpful in reducing the signs of UI.

Dementia is a progressive condition that describes a variety of symptoms associated with memory loss and decline in mental functions of the patient. It also can cause changes in the person's mood and behavior. Dementia can be due to degeneration of brain cells as in Alzheimer's disease, Parkinson's disease, Huntington's disease (a hereditary and progressive brain disease that results in permanent damage to nerve cells) and diseases that cause damage to blood vessels in the brain as in strokes, excessive alcohol or drug use, accumulation of fluids in the brain, or head injuries. Even though many people use the words dementia and Alzheimer's disease interchangeably, they are not the same. Indeed, Alzheimer's disease is a form of dementia.

Parkinson's Disease is a progressive, degenerative disease of the CNS. The degeneration of the nerve cells is slow and gradual thus during the course of the disease the symptoms intensify and new ones may appear. The hallmark of the disease is the presence of tremor which is noticeable even when the patient is resting. Other symptoms include difficulty in maintaining balance, rigidity, drooling, stiffness of limb movements, speech difficulty, mood changes such as depression and anxiety, and stooped posture.

Osteoarthritis (OS) impacts on joints, including articular cartilage and subchondral bone. It is the most common joint disease caused by the aging process. As the person becomes older, the cartilage, which serves as a cushion for the joint, will undergo degeneration allowing the bones to rub together causing pain, stiffness and swelling. It is more common in women after the age of 55, but occurs equally in both sexes before that age. Contributing factors include familial traits, obesity, occupation and running.

Stroke, Cerebrovascular Accident (CVA) is a condition that results from blood supply impairment in the brain due to hemorrhage or lack of blood flow (ischemia) due to a blockage of a blood vessel as a result of thrombosis or embolism. Deprivation of oxygen to the brain for a few seconds could lead to death of brain cells. Depending on the involved area of the brain, a stroke may result in memory loss, immobility, imbalance and inability to speak.

Tremor is a type of involuntary, often rhythmic, movement caused by muscular contraction followed by relaxation of a body part(s) such as hands, arms, eyes, face and trunk. It is usually a symptom of underlying disease such as Parkinson's disease, multiple sclerosis, strokes, brain injury, neurodegenerative diseases, withdrawal of abused drugs and alcohol.

Syncope, also known as fainting, is a temporary loss of consciousness which usually occurs swiftly followed by a quick recovery. A number of forms of syncope are preceded by dizziness, temporary loss of vision and hearing, weakness, nausea, sweating and palpitation. This condition is common among the elderly and mostly caused by insufficient blood flow to the brain as the case in hypotension when the heart does not pump enough oxygenated blood to the brain. Emotional stress, dehydration, pooling of blood in the legs as a result of body posture changes may all cause sudden drop in blood pressure. Syncope is often due to underlying disorders of the heart, nervous system or blood flow in the brain.

Cancer can be defined as uncontrolled and unregulated cell growth forming a malignant tumor that can strike any body part and at any age. It can metastasize to adjacent and non-adjacent parts of the body through the lymphatic system or blood stream. Normally, the risk of developing cancer increases as the person becomes older. Incidence of cancer is on the rise as life expectancy increases.

Benign Prostatic Hypertrophy (BPH) refers to an increase in size of the prostate as a result of proliferation of the stromal and epithelial cells manifested in the formation of nodules. The swelling compresses the urethral canal, resulting in difficulty in urination. BPH develops around the age 40, but becomes more prominent with advancing age. Practically all men will experience this condition, if they reach the age of 80. Prostate cancer may occur concurrently with BPH. However, there are no indications that BPH will trigger the development of prostate cancer.

Accidental Falls occurs as a result of changes in the musculoskeletal system due to aging. Restricted mobility, weaker muscles as well as the presence of osteoarthritis and visual and auditory impairment can increase the risk of accidents and falls. Nearly 50% of accidental deaths in patients over 65 are from falls which often result in hip fractures. About 50% of the falls occur at home.

SUMMARY

The number of elderly persons in most societies of the world is on the rise. In 2011 the number of people 65 years of age and older in the USA was 41.4 million. By 2030, it is estimated that this number will reach 72 million. As the individuals become older, physiological, biological and kinetic changes take place. Thus, elderly persons need special care.

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1. Does the program meet the learning objectives?

Define "life expectancy" YES NO

Describe age related metabolic changes YES NO

Name common geriatric disorders YES NO

2. Was the program independent & non-commercial YES NO

Low Relevance Very Relevant

3. Relevance of topic 1 2 3 4 5 6 7

4. What did you like most about this lesson? _____

5. What did you like least about this lesson? _____

Please Mark the Correct Answer(s)

1. Which of these factors does NOT contribute to longevity?

- A. Genetics B. Gender
C. Lifestyle D. Height of patient

2. It is estimated that the number of people 65 years of age & older in the US by the year 2030 will be:

- A. 100 million B. 72 million
C. 36 million D. 120 million

3. Which of these statements is FALSE regarding the aging process?

- A. Contributes to rigidity of heart valves
B. Results in decreased gastric acidity
C. Results in an increase in cardiac rate & output
D. A significant decline in glomerular filtration rate occurs

4. The average number of medications that patients 65 years of age & older take is:

- A. 5 – 6
B. 2 – 3
C. 10
D. 12

5. Osteoarthritis is less common among women than men after age 55.

- A. True B. False

6. Stress urinary incontinence is due to:

- A. Under sized urinary bladder
B. Sudden urge to urinate as a result of bladder muscle contraction
C. Abdominal muscle pressure is stronger than the closing strength of the bladder muscle
D. Gender

7. Which of these is NOT a symptom of Parkinson's Disease?

- A. Tremor
B. Sight & hearing loss
C. Speech difficulty
D. Difficulty in maintaining balance

8. Lack of blood flow due to blockage of a blood vessel as a result of a blood clot is:

- A. Atherosclerosis B. Embolus
C. Thrombus D. Ischemia

9. Alzheimer's Disease is characterized by:

- A. Loss of neurons & synapses in the cerebral cortex
B. Nausea & vomiting
C. Migraine headache
D. Regular loss of consciousness

10. Which statement is FALSE about BPH?

- A. BPH refers to prostate enlargement
B. Develops around age 40
C. Refers to presence of cancer
D. Practically all men will experience BPH by age 80

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