
Basic Geriatrics and internal medicine for physiotherapist



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CHAPTER (1): AGEING PROCESS

Definition of Ageing

Types of Ageing

Theories of Ageing

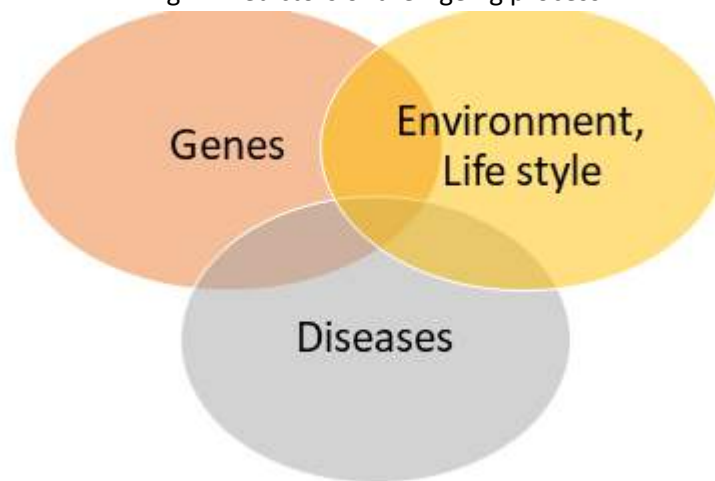
Ageing of different Body systems

Ageing Process

Definition of ageing:

- Physiological ageing (normal ageing): is a complex process of progressive reduction in the function of all body organs. This process may be summarized in the expression “homeostenosis”. It reflects alteration of organ structure and function with time alone and in the absence of supervening disease processes.
- Physiological ageing is an inevitable changes can be explained from both biologic and psychosocial perspectives.
- Processes influencing ageing include gene variations and differences in expression and environmental factors.
- Age and disease are closely associated phenomena. Secondary ageing then refers to those aspects of the aged state that are attributable to disease.

Fig 1: Predictors of the Ageing process



Characters of the ageing process:

Aging is characterized by being Universal, Cumulative, Unidirectional, Heterogeneity, Intrinsic, and Deleterious.

Characters of ageing process	
Universal	All humans age
Cumulative	the effects of aging are irreversible and accumulate over time
Unidirectional	For example, a postmenopausal woman cannot become ovulatory again.
Heterogeneity	occurs at different rates among individuals and within individuals
Intrinsic	Because even under the best environmental conditions an individual ages, aging is intrinsic to the organism.
Deleterious	aging is harmful, resulting in decreased vitality and an increased vulnerability to disease and environmental stresses

Ageing is different from Cellular senescence is the process by which a cell loses its ability to divide, grow, and function, ultimately leading to cell death.

Theories of ageing (biological)

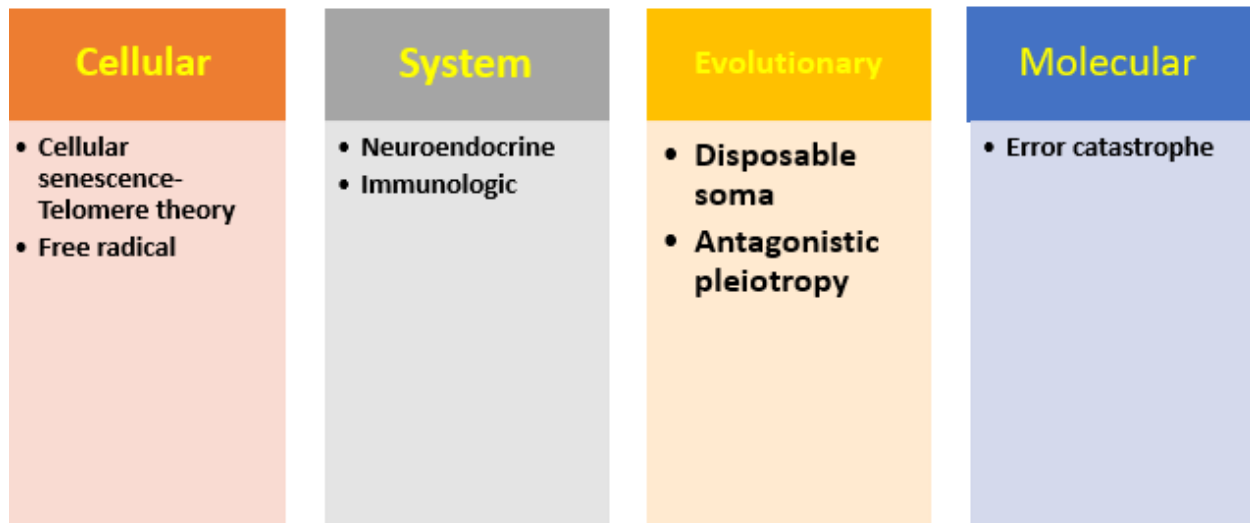


Fig 2: examples of biological theories of ageing

Cellular senescence/ telomere theory:

- Replicative senescence is a specific type of cellular senescence that ultimately results from loss of telomeres (specialized structures composed of a repeating DNA sequence and located at the ends of each linear chromosome). With each cell division, a small amount of DNA is lost at each chromosome end, resulting in shorter telomeres, altered telomere structure, and eventual replicative senescence.
- Activation of the telomerase enzyme will regenerate telomeres, prevent replicative senescence, and immortalize human primary cell cultures

Free Radical theory:

- Free radicals are reactive oxygen species (ROS) are highly reactive molecules that can damage all sorts of cellular components.
- ROS can originate from exogenous sources such as ultraviolet (UV) and ionizing radiations or from several intracellular sources: (phagocytosis, fatty acid degradation, drug detoxification by liver, ATP utilization).
- Toxic accumulation of ROS interfere with cell communication, disturb DNA, RNA and protein synthesis, lower energy levels and generally impede vital chemical processes.
- To protect against oxidation there are many different types of antioxidants, from vitamins C and E selenium, CoQ10 and lipoic acid to enzymes such as superoxide dismutase (SOD), catalase, and glutathione peroxidase. Briefly, antioxidant enzymes are capable of degrading ROS into inert compounds through a series of chemical reactions.

The Neuro-endocrine Theory

- Hypothalamo-pituitary-adrenal (HPA) axis is the master regulator that control the onset and termination of each life stage. It is also responsible for the maintenance of the internal “homeostasis” (steady state) despite the continuing changes in the environment.
- During life span, chronic exposure to severe stress from a multitude of physical, biological, or emotional stimuli may exhaust or weaken the capacity to adapt and lead to the so-called “diseases of adaptation” and death . Aging would then result from “a decreasing ability to survive stress.
- *Evidence to this theory: the cortisol hormone which is considered to be responsible for stress is one of the few hormones that increases with age.*

The immunosenescence theory:

- The immune system must control and eliminate foreign organisms and substances in the host body while at the same time recognizing and therefore sparing from destruction the molecules (cells and tissues) from oneself. In most elderly humans, immunosenescence is characterized by a decreased resistance to infectious diseases, a decreased protection against cancer, and an increased failure to recognize self (hence, autoimmune pathology).

The disposable soma

- The somatic cells are only preserved to maintain reproductive functions. After reproduction somatic cells become disposable.

Antagonistic pleiotropy

- The theory of antagonistic pleiotropy is based on two assumptions. First, it is assumed that a particular gene may have an effect not on one trait only but on several traits of an organism (pleiotropy). The second assumption is that these pleiotropic effects may affect individual fitness in opposite (antagonistic) ways.
- Such genes will be maintained in the population due to their positive effect on reproduction at young ages despite their negative effects at old age (their negative effects in later life will look exactly like the aging process)

Error catastrophe

- Gene expression accuracy diminishes with age. This culminates in a higher proportion of abnormal proteins.
- There is a certain rate of error tolerance of a cell, exceeding which the cell fails in its ability to sustain and function normally.
- Thus, accumulation of errors in the genomic replication machinery beyond a certain threshold might lead to erroneous dysregulation of the protein synthesis, folding and expression mechanisms which ultimately might bring about deterioration in the functionality of the cell.

Types of Ageing:

Chronological	The number of years a person has lived since birth.
Biological	age changes in physical structures and functions that affect either ability to survive or appearance
Social	How a person perceives the aging process and how it relates to the society in which they live
Psychological	age changes in mental processes and behavior

The elderly are special population with special needs:

- **Physiological Changes in the Elderly** (Normal Aging is not a disease)
- **Multiple comorbidities and multiple medications:** The incidence of chronic diseases increases with ageing e.g. dementia, Parkinsonism, stroke, heart diseases leading to polypharmacy.
- **Overlapping Variables** (physiological, social, psychological, environmental variables) & multiple diseases): heterogeneous Population: Need for Individualized Treatment:
- **Atypical presentations of diseases**
- **They need different assessment approach** (see comprehensive geriatric assessment) through Multidimensional, Interdisciplinary, Geriatric team
- **The goal of elderly care is maintaining function & quality of life:" To add life to years NOT only years to life**

Age related physiological changes:

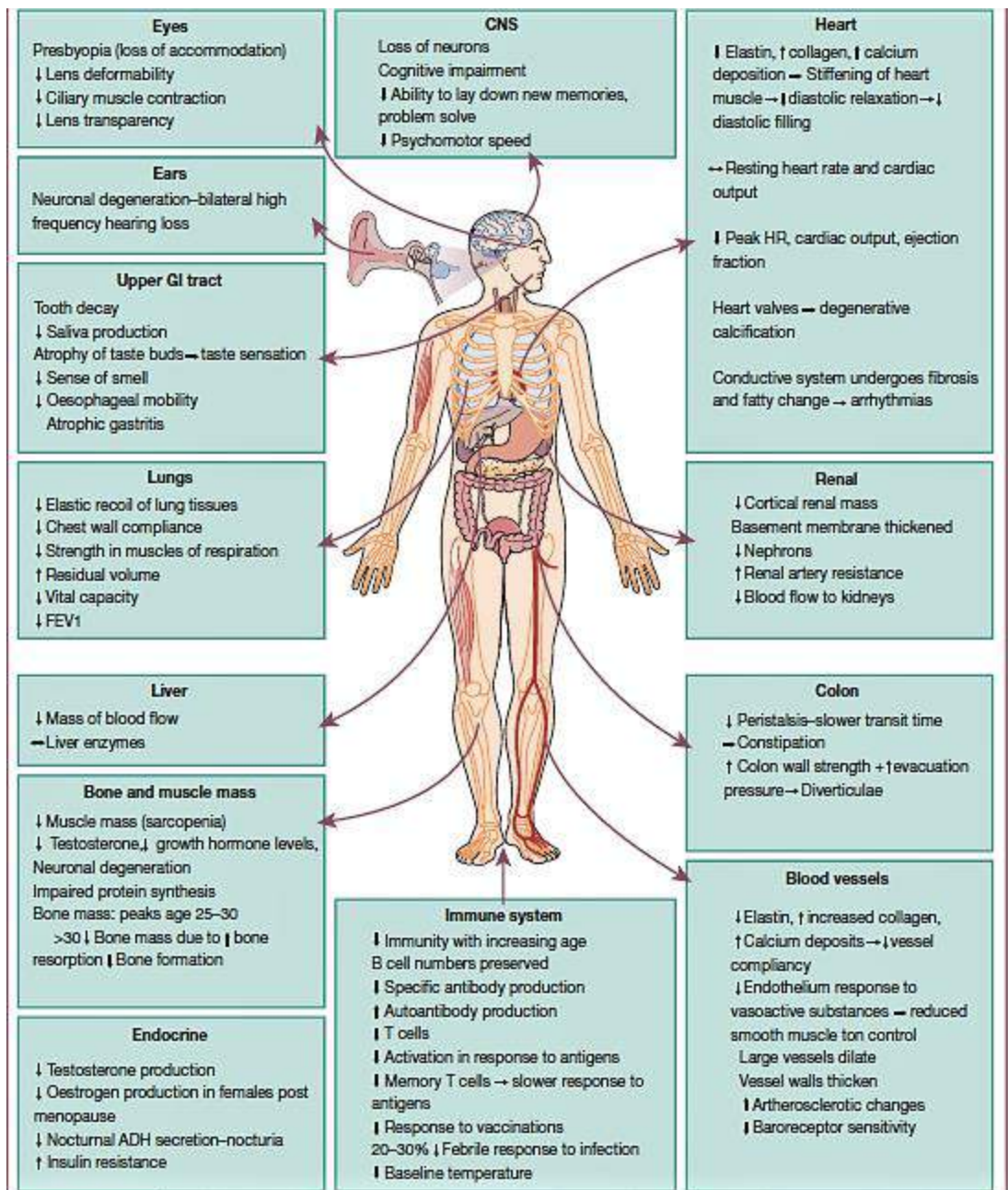
- Aging and disease are not synonymous. Although the aging process makes individuals more vulnerable to illness and disease, pathology is not inevitable with age. Aging alone generally does not cause symptoms.
- The major age-related biologic change is a diminished reserve capacity and the inability to maintain homeostasis in the face of stressors such as a disease or adverse environmental factors such as excessive heat.

Body system	Physiological change	Clinical implications
General body composition	The percent of body water (TBW) decreases with aging	↑risk of dehydration Pharmacokinetic effect
	Lean body mass decreases because of muscle loss	Slower gait speed, weaker hand grip Pharmacokinetic effect
	Increased percent of body fat (until around 70, then decreases)	Pharmacokinetic effect
	Decreased bone mass	
Changes in Resting Energy Rate	Decreased Basal Metabolic Rate	
Vision	loss of rods and cones	↓ light sensitivity, color perception, dark adaptation, night vision (stressor)

	The lens becomes denser, thicker, and less elastic.	↑ risk of cataract
Hearing	loss of hair cells in the organ of Corti and loss of cochlear nerve cells	Difficulty in speech discrimination esp. in noisy environments (stressor). ↑ difficulty to determine the source of sound
Smell and taste	↓ the number of taste buds and olfactory receptors. Smell is more affected than taste with age and declines rapidly after age 50	↑ risk of malnutrition ↓ quality of life Difficult compliance on therapeutic diets
Immunity	Thymic involution and attenuated T-cell-mediated Immunity, ↓ T cells	lead to reactivation of quiescent infections, such as TB and varicella. decline in delayed-type skin-hypersensitivity reactions to injected antigens (anergy) in many frail aged subjects
	↓ production of antibody by B cells	↑ risk of infection. ↓ efficacy of vaccination
	Autoantibodies occur more frequently (e.g. antiphospholipid antibodies) and are associated with vascular disease	Their significance in older people is uncertain.
Cardiovascular system	Loss of cardiac myocytes secondary to apoptosis, with compensatory hypertrophy of remaining cells.	Changes in stroke volume and diastolic function
	Accumulation of intracellular lipofuscin and extracellular amyloid. Increased intercellular collagen.	leading to reduced LV diastolic compliance
	Loss of pacemaker cells	Increase risk of sick sinus syndrome
	Patchy fibrosis of the conduction system	Increase risk of heart block
	Reduced baroreceptor sensitivity	Increased risk of orthostatic hypotension.
	↓ β-adrenergic receptors number & sensitivity	Lead to altered response to beta blockers Beta-adrenergic-mediated vasodilatation decreased while Alpha-adrenergic-mediated vasoconstriction unchanged leading to hypertension
	Increased vascular stiffness	Increases risk of systemic hypertension
Respiratory system	Calcification of the intercostal cartilages; arthritis of the costo-vertebral joints	Rigidity and stiffness of the wall increases and chest wall compliance decreases
	Gradual atrophy of intercostal muscles (loss of muscle mass)	Greater contribution from diaphragmatic and abdominal muscles and may lead to diaphragmatic fatigue
	The cilia beat decreases with age and there is a reduction in number of cilia	Reduces clearance of debris and pathogens Increases chance of infection

	Thickening of the alveolar basement membrane	Decrease gas-diffusing capabilities, increase in ventilation/perfusion heterogeneity. Arterial oxygenation declines.
	Ventilation control Diminishes	Diminishes response to hypercapnia and hypoxia
Endocrine system	Marked decrease in dehydroepiandrosterone (DHEA) Decreased free and bioavailable testosterone Decreased production of vitamin D by skin and activation in kidney Decreased GH, IGF1 Increased cortisol level	Increased risk of frailty, sarcopenia, and osteoporosis.
	↓ Aldosterone secretion	Increased risk of Orthostatic hypotension
Musculo-skeletal system	<p>Muscle</p> <p>Marked decrease in muscle mass (sarcopenia) due to loss of muscle fibers</p> <p>Decreased myosin heavy chain synthesis</p> <p>Decreased innervation, increased number of myofibrils per motor unit</p> <p>Infiltration of fat into muscle bundles</p> <p>Bone</p> <p>Slower healing of fractures</p> <p>Decreasing bone mass in men and women, both trabecular and cortical bone</p> <p>Decreased osteoblast bone formation</p> <p>Joints</p> <p>Disordered cartilage matrix</p> <p>Modified proteoglycans and glycosaminoglycans</p>	
Gastrointestinal	↓ Saliva production	↑ Oral infections, ↑ Gum disease
	Decreased liver size and blood flow Hepatocytes accumulate secondary lysosomes, residual bodies, and lipofuscin	Impaired clearance by liver of drugs that require extensive phase I metabolism Reduced inducibility of liver mixed-function oxidase enzymes Mild decrease in bilirubin
	Mild decrease in stomach acid production, probably due to nonautoimmune loss of parietal cells Impaired response to gastric mucosal injury Decreased mucus secreting cells	
	Slowed gastric emptying	Prolonged gastric distention, ↑ Postprandial satiety
	Decreased pancreatic mass and enzymatic reserves	Insulin resistance
	Decrease in effective colonic contractions	Increased risk of constipation

	↓ Calcium absorption	↑ Bone loss
Skin	Epidermal turnover rates decrease by 30% to 50% by the age of 70	Rougher skin with decreased barrier function, delayed wound healing.
	The dermal- epidermal junction fattens	Resulting in decreased contact between the two layers. As a result the two layers may easily separate, making older skin more likely to tear and blister.
	Basal and peak levels of cutaneous blood flow are reduced by about 60%	compromised vascular responsiveness during injury or infection
	Collagen synthesis decreases and degradation increases	Loss of the connective tissue matrix and impaired wound healing.
	Elastic fibers decrease in number and size	decreased skin elasticity
	Subcutaneous fat decreases with age	Decreasing its ability to protect deeper structures from injury.
	Decreased Langerhans cells	Increased risk of infections
Hematologic	Bone marrow reserves decreased	Failure to response to high demand e.g infections , hemorrhage, hemolysis
Kidney	↓ Kidney size, mass, and number of functional glomeruli	Decreased creatinine clearance and GFR 10 ml/decade affecting drug excretion
	↓ Number/length of functional renal tubules	↓ Concentrating/diluting capacity, ↑ Fluid and electrolyte abnormalities
	↓ Renal blood vessel elasticity	↓ Renal blood flow
	↓ Vitamin D activation	Vitamin D deficiency
	Decreased serum renin and aldosterone	Increased risk of Volume depletion and hypokalemia
Peripheral nervous system	Loss of spinal motor neurons Decreased size of large myelinated fibers Increased heterogeneity of axon myelin sheaths	Decreased vibratory sensation, especially in feet Decreased thermal sensitivity (warm–cool) Decreased sensory nerve action potential amplitude
Central nervous system	<ol style="list-style-type: none"> 1. Small decrease in brain mass, Nonrandom loss of neurons to modest extents 2. Decreased brain blood flow and impaired autoregulation of perfusion 3. Decreased density of dendritic connections, synapses. 4. Increased numbers of scattered neurofibrillary tangles and senile plaques 5. Decreased myelin and total brain lipid 6. Altered neurotransmitters, including dopamine and serotonin 	Decline in fluid intelligence Slowed central processing and reaction time Affected working memory, divided attention



QUIZ 1:

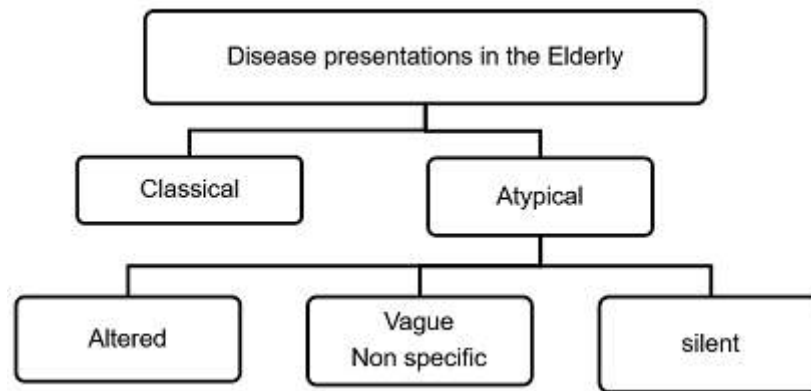
1. **Age-related changes in the cardiovascular system among older adults include:**
 - A. Adrenergic receptors number-Decreased β A.
 - B. Decreased systolic blood pressure
 - C. Increased maximal heart rate during exercise
 - D. Increased β -adrenergic receptors sensitivity
 - E. Increased cardiac output under stress
2. **Age related changes in vision include**
 - A. Increase color Sensitivity
 - B. Decrease dark Adaptation
 - C. Decrease intraocular pressure
 - D. Increase risk of iridocyclitis
 - E. Decreased risk of cataract
3. **The following can cause decrease appetite among elderly**
 - A. Decrease taste sensation
 - B. Decrease intestinal motility
 - C. Loss of teeth
 - D. Cognitive impairment
4. **Elderly are more prone to develop infections because**
 - A. Decrease T cell immunity
 - B. Increased environmental factors
 - C. Cognitive impairment
 - D. Iron deficiency Anemia
5. **Elderly develop sarcopenia due to all of the following except**
 - A. Decreased myosin heavy chain synthesis
 - B. Decreased innervation, increased number of myofibrils per motor unit
 - C. Infiltration of fat into muscle bundles
 - D. Excess mitochondrial ATP production

A blue geometric graphic consisting of several overlapping triangles and quadrilaterals, creating a dynamic, abstract shape. The colors range from a deep blue to a lighter, almost white blue.

CHAPTER (2): GERIATRIC MEDICINE

Disease presentations in Elderly
Comprehensive Geriatric Assessment
Delirium, Dementia, Depression
Health promotion in elderly
Geriatric pharmacology
Sarcopenia
Frailty
Osteoporosis
Sleep disorders

Disease Presentation in Elderly



The definition of an atypical presentation of illness is: when an older adult presents with a disease state that is missing some of the traditional core features of the illness usually seen in younger patients.

1. Examples for altered presentations of diseases

- Dwindles (Functional decline)
- Weakness
- Falls
- Immobility
- Incontinence
- Cognitive Change
- Mood Change

2. Examples for non-specific presentations of diseases: e.g. Fatigue which can be a presentation of any of the following:

Organic conditions Cardiopulmonary (heart failure, COPD, IPF) Neurological (MS, Parkinsonism) metabolic/ (DM, hypothyroidism toxic (chronic lead exposure) infections (HCV, HBV, HIV) Deficiency states (Vitamin D deficiency) neoplasm	<u>Psychogenic: depression</u> <u>Drugs: beta-blockers, diuretics, chemotherapy</u>
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3. Examples for silent presentations of diseases:

During preoperative assessment, the presence of ECG changes suggestive of previous myocardial infarction in elderly patient without history suggesting coronary ischemia.

Osteoporosis is usually silent until fracture occurs.

Prevalence of atypical presentations in elderly:

Atypical presentations were found in approximately 20% of elderly patients in the Emergency Department (ED), with (35%) of older adults with infectious diseases presented atypically.

Silent MI in elderly, detected incidentally on electrocardiogram (ECG) is high, ranging between 38% and 60%.

Consequences of atypical presentations in elderly:

Delayed diagnosis, misdiagnosis, and mismanagement with increased morbidity.

Presentations of ischemic heart disease in elderly:

Typical	Pain is usually substernal chest pain/discomfort with exercise, relief by nitroglycerin or rest
Non specific	Fatigue , Shortness of breath
silent	Minimal or no chest pain, no shortness of breath or acute confusion, silent ECG or Echo findings
Altered	Acute confusion Syncope Acute functional decline Attack of Epigastric pain Attacks of back pain Attacks of jaw pain Attacks of neck pain

Presentation of Pneumonia

Typical	Productive cough of purulent sputum The temperature may rise to 38.9°–39.4°C
Non specific	Minimal cough, no sputum production, no fever No leucocytosis May appear tired or confused
Altered	Dwindles, delirium

Causes of atypical presentations in elderly:

- The aging process: fever is usually absent in elderly due to lower basal body temperature, thermoregulatory center aging, lower skeletal muscle mass
- Multiple Co-morbidities: presence of severe osteoarthritis of the knee with reduced physical performance may delay the presentations of heart failure and peripheral arterial disease until symptoms are present during minimal activity or even at rest.
- Poly-pharmacy: (use of beta blockers mask tachycardia in anemia or infections)

Remember: New onset functional decline is a manifestation of an acute illness in elderly.

Comprehensive Geriatric Assessment

Comprehensive geriatric assessment (CGA) is a multidimensional, interdisciplinary diagnostic process to determine the medical, psychological, and functional capabilities of a frail elderly person in order to develop a coordinated and integrated plan for treatment and long-term follow up.

Interdisciplinary Team - Team Members Overview

- Nurse
- Physician trained in Geriatrics
- Dietitian
- Physical Therapist
- Social Worker
- Patient, Family members, caregiver
- Psychologist
- Speech-Language specialist
- Audiologist
- Occupational Therapist

Assessment Domains

Medical (Medical illnesses, surgical history, medications, nutrition, dentition, Vision, Hearing, Pain, impotence, Sleep, health promotion, Geriatric giants: Urinary incontinence,, Frailty)

Psychiatric (Cognitive status, Emotional status)

Functional status (Activities of daily living ADLs, Instrumental activities of daily living IADLs)

Physical (Balance and gait, Falls)

Environmental (Social, financial status, Environmental hazards).

Geriatric depression scale – 15items

- 1- انت راضى عن حياتك دلوقتى.
- 2- انت قلت كثير من نشاطاتك واهتماماتك.
- 3- انت حاسس ان حياتك فاضية.
- 4- فى الغالب بتحس انك متضايق وزهقان.
- 5- فى الغالب معنوياتك بتكون عالية.
- 6- انت خايف ان حاجة وحشة ها تحصلك.
- 7- فى الغالب بتحس انك مبسوط.
- 8- فى الغالب بتحس انك قليل الحيلة.
- 9- بتحب تقعد فى البيت عن انك تخرج تعمل حاجات جديدة.
- 10- انت بتحس انك عندك مشاكل فى الذاكرة اكثر من الاخرين.
- 11- انت بتعتقد ان دى حاجة حلوة انك لسة عايش.
- 12- انت شايف انك عايش الحياة بطريقة مش مناسبة ليك.
- 13- انت حاسس ان عندك حيوية ونشاط.
- 14- انت حاسس ان حالتك دى ميئوس منها.
- 15- انت حاسس ان اغلب الناس اللي حواليك احسن منك

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