AGE-RELATED CHANGES

island health

Cardiovascular

- ↑ amount of collagen and fat in cardiac muscle
- Thickening and rigidity of valves
- ↓ oxygen utilization
- Myocardial hypertrophy, but over-all heart size is not affected by age
- Coronary artery blood flow decreased
- ↑ peripheral resistance
- myocardial irritability
- ↓ blood flow to all organs

Consequences

- ↓ stroke volume, cardiac output
- ↓ ability to increase heart rate in response to stress
- ↑ aortic volume and systolic blood pressure
- No change in resting heart rate
- ↑ risk of extra systoles
- Electrocardiogram changes

Genitourinary

- ↓ number of nephrons
- ↓ glomerular filtration rate and tubular reabsorption
- Change in renal threshold
- ↓ blood flow to kidneys
- ↓ bladder capacity from 500 ml to 250 ml
- ↓ elasticity of bladder
- ↓ bladder tone
- ↓ muscle tone of urethra
- Benign prostatic hyperplasia common in males

Consequences:

- ↓ creatinine clearance
- ↓ ability to concentrate urine
- ↑ risk of urinary retention
- ↑ incidence of incontinence
- ↑ urinary frequency; nocturia
- Effects on drug clearance via kidneys

Musculoskeletal

- Muscle cells atrophy
- Generalized symmetrical muscle wasting
- Demineralization of bones
- Deterioration of cartilage surface of joints
- Thinning of intervertebral discs
- Loss of cartilage in vertebral column
- Loss of elastic fibers in muscle tissue
- Kyphosis

Consequences:

- ↓ muscle strength after age 70
- Two-inch loss of height between ages 20 and 70
- ↑ incidence of osteoporosis
- ↓ joint range of motion
- ↓ flexibility
- ↓ mobility
- ↑ risk of falls
- Gait changes
- Changes in body image

Visual

- Yellowing, opacity, rigidity of lens
- ↓ pupil size
- ↓ accommodation
- Less efficient absorption of intraocular fluid
- Narrowing of visual field
- ↓ lacrimal secretions
- ↓ number of cones in retina

Consequences

- Presbyopia –inability to focus properly
- Distorted depth perception
- ↓ colour discrimination
- Need for Stronger light
- Increased sensitivity to glare
- Drier cornea

Gastrointestinal

- Poor dentition
- ↓ number of taste buds
- ↓ muscle strength for chewing
- ↓ saliva production
- ↓ ptyalin in saliva
- Weakened gag reflex
- ↓ gastric acid secretion
- ↓ emptying of esophagus and stomach
- ↓ intrinsic factor
- Thickened bile
- Thinned gastric mucosa
- ↓ ability of small intestine to absorb sugars and lipids
- ↓ hepatic enzymes and storage capacity

Consequences

- ↓ taste sensation
- ↓ appetite
- ↓ chewing ability
- ↓ digestion of starch
- Possible swallowing difficulty
- Indigestion, flatus
- Risk of pernicious anemia
- ↑ problems with elimination
- ↓ tolerance for fats
- Possible change in drug metabolism
- Difficulty gaining weight

Integumentary

- Thinning and atrophy of epidermis
- ↓ strength and elasticity of epidermis
- ↓ blood flow
- ↑ vascular fragility
- Loss of subcutaneous fat
- ↓ size and function of sweat glands
- ↓ sebaceous secretions
- "Clustering" of melanocytes
- ↓ number of nerve cells
- Thinning and graying of scalp, pubic, and axilla hair
- Thickening of nasal and ear hair
- ↑ facial hair in women
- ↓ blood supply to nailbed
- ↑ longitudinal striations in nails
- Accumulation of "debris" under nails

Consequences:

- ↑ susceptibility to infection, trauma, malignant lesions, pressure ulcers
- Skin is dry, scaly, wrinkled
- ↓ skin turgor
- ↓ ability to maintain body temperature and homeostasis; baseline temperature may be lower than normal
- Slower rate of healing
- Slower absorption of drugs by subcutaneous route
- "Liver Spots"
- Nails thicken, grow slowly, become brittle and yellowed
- ↑ risk of splitting, infections of the nails

Neurological

- ↓ number of neurons
- ↓ weight of brain
- Histological changes in brain
- ↑ intracellular pigment,
- ↓ protein synthesis, senile plaques
- ↓rate of conduction in peripheral nerves
- Change in sleep patterns
- Depletion of dopamine and some of the enzymes in the brain
- ↑ accumulation of lipofuscin
- query diminished brain cholinergic reserve

Consequences:

- ↓ Adaptability
- Slower response to stimuli
- ↓ Sensation
- Impaired proprioception
- Gait changes
- ↓ deep tendon reflexes
- Slower voluntary movement
- Sleep pattern disturbances
- ↑Susceptibility to environmental temperature changes
- ↓ short-term memory

Hearing

- ↓ number of nerve cells in 8th cranial nerve
- ↑ production of cerumen
- ↑ amount of keratin in cerumen
- Atrophy of rigidity of ossicles
- ↓ elasticity of tympanic membrane

Consequences

- Presbycusis (hearing loss due to changes in the inner ear)
- High frequency loss occurs first
- Tone discrimination loss
- Difficult following conversations
- Cerumen impaction
- Social isolation

Respiratory

- ↓ elasticity of lungs
- ↓ number of alveoli
- ↑ size of alveoli
- ↑ diameter of alveolar ducts and bronchioles
- ↓ ciliary action
- ↑ anteroposterior chest diameter
- Weakening of respiratory muscles
- ↓ coughing reflex
- Calcification of costal cartilages

Consequences

- 50% increased residual capacity
- ↓ vital capacity
- ↓ mobility of bony thorax
- ↓ arterial blood oxygen level
- ↓ oxygen uptake during exercise
- ↑ risk of infection
- ↑ amount of dead air space
- ↓ exercise tolerance
- ↓ gas exchange

Sources: Brown, Jeri B., Bedford, Nacy K., White, Sarah J. (1999). *Gerontological Protocol for Nurse Practitioners*. Lippincott Williams & Wilkins, Inc.; American Assn. for Geriatric Psychiatry. (2005). *Comprehensive Textbook of Geriatric Psychiatry,* 3rd Ed. W.W. Norton & Co.

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	Changes	Consequences
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Gastrointestinal	• Poor dentition • ↓ number of taste buds • ↓ muscle strength for chewing • ↓ saliva production • ↓ ptyalin in saliva • Weakened gag reflex • ↓ gastric acid secretion • ↓ emptying of esophagus and stomach • ↓ intrinsic factor • Thickened bile • Thinned gastric mucosa • ↓ ability of small intestine to absorb sugars and lipids • ↓ hepatic enzymes and storage capacity	• ↓ taste sensation • ↓ appetite • ↓ chewing ability • ↓ digestion of starch • Possible swallowing difficulty • Indigestion, flatus • Risk of pernicious anemia • ↑ problems with elimination • ↓ tolerance for fats • Possible change in drug metabolism • Difficulty gaining weight
Genitourinary	• ↓ number of nephrons • ↓ glomerular filtration rate and tubular reabsorption • Change in renal threshold • ↓ blood flow to kidneys • ↓ bladder capacity from 500 ml to 250 ml • ↓ elasticity of bladder • ↓ bladder tone • ↓ muscle tone of urethra • Benign prostatic hyperplasia common in males	• ↓ creatinine clearance • ↓ ability to concentrate urine • ↑ risk of urinary retention • ↑ incidence of incontinence • ↑ urinary frequency; nocturia • Effects on drug clearance via kidneys
Integumentary	• Thinning and atrophy of epidermis • ↓ strength and elasticity of epidermis • ↓ blood flow • ↑ vascular fragility • Loss of subcutaneous fat • ↓ size and function of sweat glands • ↓ sebaceous secretions • "Clustering" of melanocytes • ↓ number of nerve cells • Thinning and graying of scalp, pubic, and axilla hair • Thickening of nasal and ear hair • ↑ facial hair in women • ↓ blood supply to nail bed • ↑ longitudinal striations in nails • Accumulation of "debris" under nails	• ↑ susceptibility to infection, trauma, malignant lesions, pressure ulcers • Skin is dry, scaly, wrinkled • ↓ skin turgor • ↓ ability to maintain body temperature and homeostasis; baseline temperature may be lower than normal • Slower rate of healing • Slower absorption of drugs by subcutaneous route • "Liver Spots" • Nails thicken, grow slowly, become brittle and yellowed • ↑ risk of splitting, infections of the nails

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Musculoskeletal	• Muscle cells atrophy • Generalized symmetrical muscle wasting • Demineralization of bones • Deterioration of cartilage surface of joints • Thinning of intervertebral discs • Loss of cartilage in vertebral column • Loss of elastic fibers in muscle tissue • Kyphosis	• ↓ muscle strength after age 70 • Two-inch loss of height between ages 20 and 70 • ↑ incidence of osteoporosis • ↓ joint range of motion • ↓ flexibility • ↓ mobility • ↑ risk of falls • Gait changes • Changes in body image
Neurological	• ↓ number of neurons • ↓ weight of brain • Histological changes in brain; ↑ intracellular pigment, • ↓ protein synthesis, senile plaques • ↓rate of conduction in peripheral nerves • Change in sleep patterns • Depletion of dopamine and some of the enzymes in the brain • ↑ accumulation of lipofuscin • query diminished brain cholinergic reserve	• ↓ Adaptability • Slower response to stimuli • ↓ Sensation • Impaired proprioception • Gait changes • ↓ deep tendon reflexes • Slower voluntary movement • Sleep pattern disturbances • ↑ Susceptibility to environmental temperature changes • ↓ short-term memory
Respiratory	• ↓ elasticity of lungs • ↓ number of alveoli • ↑ size of alveoli • ↑ diameter of alveolar ducts and bronchioles • ↓ ciliary action • ↑ anteroposterior chest diameter • Weakening of respiratory muscles • ↓ coughing reflex • Calcification of costal cartilages	• 50% increased residual capacity • ↓ vital capacity • ↓ mobility of bony thorax • ↓ arterial blood oxygen level • ↓ oxygen uptake during exercise • ↑ risk of infection • ↑ amount of dead air space • ↓ exercise tolerance • ↓ gas exchange
Visual	• Yellowing, opacity, rigidity of the lens • ↓ pupil size • ↓ accommodation • Less efficient absorption of intraocular fluid • Narrowing of visual field • ↓ lacrimal secretions • ↓ number of cones in retina	• Presbyopia –inability to focus properly • Distorted depth perception • ↓ colour discrimination • Need for Stronger light • Increased sensitivity to glare • Drier cornea

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