The Effects of Ageing

Louise McGregor
Chair of AGILE
November 2016
Aims of Session

- To describe the age-associated changes in the:
  1. Sensory system
  2. Musculo-skeletal system
  3. Cardio-respiratory system
  4. Central nervous system

- To explore the implications of ageing on your clinical practice
Old Age

“The concept of old age is a description of people who have little in common but the length of time they have all been alive.”
What is “Normal” Ageing?

- Gradual loss of/deterioration of the body’s reserve- affecting all systems
- Life style choices, socio-economics and the environment also affect how we age
- Genetics also have an influence
Ageing ≠ Disease

- And disease is not inevitable with ageing
- However the chances of developing some diseases increase with age

Normal YOUNG

Normal AGED

(sometimes)

Passage of time

Disease
Vision

- Lens of the eye stiffens
- Reduced pupil size
- Decreased tear production
- Decreased visual acuity
- Decreased accommodation
- Decreased night vision
- Decreased contrast sensitivity

Salvi et al 2006
Hearing

- Stiffening of ear structures
- Thickening of tympanic membrane
- Changes in the cochlea
- Loss of sensory cells and neurones
- Decline in the ability of the central auditory system to process sound

*Howarth et al 2006*
Sensory Changes

- Reduced nerve conduction velocity and degeneration of the PNS
- Slowing in central processing of sensory stimuli
- Decreased tactile sensitivity
- Decreased joint position sense
- Decreased vibration sense - lower limbs affected more than upper limbs
- Decreased thermal sensitivity

Wickremaratchi et al 2006
Skin

- Decrease in moisture and elasticity - sagging and wrinkles
- Decrease in sub-cutaneous fat
- Decrease in dermis cells and vasculature
  More sensitive to hypothermia
- Decrease in epidermal renewal and tissue repair
  Slower rate of wound healing
- Decrease in sweat glands
  More susceptible to hyperthermia

Sgonc et al 2013
Musculo-Skeletal: Joints

- Cartilage becomes thinner
- Altered resilience of cartilage
- Imbalance between synthesis and removal of cartilage components - inflammation of the synovial membrane
- Connective tissue becomes more rigid
  - Ligaments and tendons stiffer and more likely to tear

Hudelmaier et al 2001
Musculo-Skeletal: Bone

Graph showing typical total bone mass in men and women.

- Peak bone mass
- Menopausal bone loss
- Bone loss with age
Musculo-Skeletal: Muscles

- Reduction in the number of muscle fibres (II > I)
- Reduction in muscle fibre size
- Loss of motor units
- Infiltration of fat and connective tissue
- Slower contraction and more susceptible to fatigue
- Decreased excitability

*Deschenes 2004, Ryall et al 2008*
Musculo-Skeletal: Muscles

![Graph showing muscle mass and strength over age]

- **Early life**: Muscle mass and strength increase.
- **Adult life**: Muscle mass and strength peak.
- **Older life**: Muscle mass and strength decrease.

- Range in individuals
- Disability threshold
Cardiac Changes

- Valves thicken and become stiffer
- Reduced number of pacemaker cells in the sinoatrial node
- Fat accumulates around the sinoatrial node
- Slight increase in the heart mass especially the left ventricle

North et al 2012
Vascular Changes

- **Arteries**
  - Aorta wall stiffens: increased resistance
  - Thickening and stiffening in the media of the large arteries
  - Smaller arteries thicken and stiffen minimally
  - Ability to dilate and constrict diminishes
  - Baro-receptors become less sensitive

- **Veins** - minimal change

*Moore et al 2003*
Functional Implications

- Increase afterload
  
  *Increased systemic vascular resistance means that the left ventricle must work harder to eject blood into the less compliant aorta.*

- Diastolic dysfunction

- Decreased contractility

- Maximal heart rate decreases

\[ CO_{max} = \text{stroke volume} \times \text{HR} \]
Respiratory System

- Reduction in cilia and effectiveness
- Cough reflex is blunted
- Number of alveoli do not change significantly
  Number of FUNCTIONAL alveoli decrease
  Wall become thin, alveoli enlarge and are less elastic
- Decreased elasticity due to collagen cross linking
- Decline in efferent neural output to respiratory mus

Sharma et al 2006
Respiratory System

- Reduced strength of respiratory muscles
- Increased stiffness of chest wall

- Pulmonary vasculature less elastic
- Increased resistance to blood flow in lungs - *increased pulmonary artery pressure*

- Lung volume changes
  - FEV1 reduces by 30 ml/year during adult life
  - VC is reduces by 20%
  - FRC and RV increase
Central Nervous System

- Volume of the brain declines at 5% per decade after 40
  Neuronal loss is mainly in the gray matter
  Some evidence of dendrite growth
- Scattered Lewy Bodies and neurofibrillary tangles
- Reduction in neurotransmitter production
- Slowed neuronal transmission- reaction times slower
- Changes in sleep cycle

*Mild episodic and semantic memory changes from middle age*

Peters 2006
Clinical Implications

We know that:

- Ageing as a process is not fully understood
- A long life implies a variety of experiences, stresses and changes
- Closely related is the extensive network of social relationships that have been part of the life of an individual
- Clinicians need to be aware of all these when working with older people
Thank you!

Louise.mcgregor@stgeorges.nhs.uk
References


