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General principles

- aging = the gradual decline in systemic physiological functions which render the patient more vulnerable to trespasses that could easily be tolerated by a younger person (net decline in physiological reserve or homeostatic capacity)

- no standard definition for elderly (? >65yrs, ? regional life expectancy differs (ie. Africa vs West))
- increased life expectancy = more elderly patients presenting for surgical procedures
- advances in medical technology have allowed us to offer surgical treatments to the elderly with complex problems and co-morbidity which previously would have been excluded
- REASON trial: >70 with pre-exisiting comorbidites:
  - 5% died
  - 10% admitted to ICU
  - 20% had complications
- Post delirium ⟹ ↑x5 chance of developing dementia

- HOWEVER, there is increased risk of perioperative morbidity and mortality

Physiological Aging

CARDIOVASCULAR
in 50-65% pts
- myocardial fibrosis
- ventricular wall stiffening (diastolic dysfunction)
- increased SVR -> systolic hypertension -> LVH + conductance disturbances
- ↓max CO by 1% every year from 5th decade
- widened pulse pressure
- autonomic responsiveness declines -> increased risk of hypotension
- capillary permeability increased ⟹ ↑risk of APO

RESPIRATORY

- overall = progressive loss of function and increased risk of aspiration
- ventilatory response to hypercapnia and hypoxia declines (increased risk of respiratory failure)
- loss of alveolar gas exchange surface
- O2 consumption and CO2 production fall
- increased pulmonary compliance from loss of elastic recoil, loss of chest wall compliance from joint disease (total compliance falls)
- vital capacity decreases
- closing volume increases to exceed FRC in the upright posture @ 66yrs -> increased in venous admixture
- decreased responsiveness of airway protective reflexes -> increased risk of aspiration

CENTRAL NERVOUS SYSTEM

- brain size and neuronal mass/density decreases
- decrease in Ach/noradrenaline and dopamine synthesis
- decline in slow wave sleep (patient sleep more but have difficulty falling asleep)
- progressive decrease in sympathetic and parasympathetic responsiveness
- ↓requirement for opioids & sedatives with ↑risk of ↓consciousness
- pain threshold may be increased
- POCD common >10% patients
- thirst response reduced -> susceptible to fluid depletion

RENAL

- renal mass and glomeruli fall progressively -> reduced GFR
- ↓thirst response

- deterioration in tubular function, renin-AG-ALD responsive, ADH sensitivity and concentrating ability -> susceptibility to hypovolaemia, overload and electrolyte abnormalities
- decreased renal clearance of drugs
- creatinine may be falsely normal (2nd to ↓mm mass)

HEPATIC

- cellular function well preserved
- blood flow falls over time
- decreased hepatic clearance of drugs

THERMOREGULATION

- impaired -> increased risk of hypothermia
- ability to shiver decreased c/o decreased muscle mass
- shivering & vasoconstriction dramatically increases myocardial work and O2 demand

ENDOCRINE

- tendency to hyperglycaemia and risk of DM

METABOLIC/NUTRITION

- frequently poor
- ↓mm mass. >20% = sarcopaenia
- slight ↓albumin

HAEMATOLOGY/IMMUNE SYSTEM

- decr plasma volume
- hypercoagulability and DVT increased with age & co-morbidity
- marrow response to anaemia impaired
- immune responses are impaired c/o reduced marrow, thymus and splenic mass

PHARMACODYNAMICS AND PHARMACOKINETICS

- TBW ↓ed & ↑fat %
- VD:
  - ↓ed in water soluble drugs
  - ↑ed in lipid soluble drugs ⟹ prolonged clearance
- ↓ed CO ⟹ ↓initial VD of all drugs esp impt for induction drugs
- ↑ed arm-brain circulation time
- ↓plasma albumin
- volatile MAC ↓s 6%/decade ⟹ 40% down at 80yrs:
  - ↓neuronal mass
  - ↓blood/gas partition coeeficient
  - ↓cardiac output
- ↓reduced hepatic and renal clearance

Pathological Aging

- increased risk of acquired disease
- falls
- increased risk of cancers
- polypharmacy and associated risks

CARDIOVASCULAR

- increased incidence of cardiovascular disease

- ventricular wall stiffening (diastolic dysfunction)
- AF (25% life time risk) -> decreased stroke volume, risks with anticoagulation
- pacemakers and AICD
- capillary permeability increased
- betablockers reduce MI but increase mortality and stroke rates

RESPIRATORY

- longstanding smokers -> COPD
- increased obesity and inactivity
- OSA

RENAL

- increased risk of renal failure
- prostate hypertrophy
- chronic UTI's

CENTRAL NERVOUS SYSTEM

- dementia: 10% over 65 yrs and 50% by 85 yrs
- increased CVA's
- memory impairment
- increased risk of Parkinson's Disease, depression and other psychiatric illnesses
- decreased vision
- orthostatic hypotension
- gait disturbances
- syncope
- predisposed to delirium
- more sensitive to sedatives and analgesics
- POCD common >10% patients

ENDOCRINE

- increased glucose tolerance
- increased thyroid disorders

Common Co-morbidities

- HTN
- DM
- IHD
- OA joints
- renal impairment
- dementia

↳ diff to syndromes eg off legs/falls/↓mobility, impairment of senses, de-conditioning, malnutrition

Frailty

- state of vulnerability to poor resolution to challenges to homeostasis
- thought a problem on the cellular level
- different to defined medical co-morbidities
- assoc with ↑peri-op morbidity, ↑LOS, d/c to home
- indicators:
    - falls
    - polypharmacy
    - Canadian scale: weakness, ↓weight, exhaustion, ↓physical activity, ↓walking speed

- Montreal Cognitive assessment
- timed up & go: up, 3m walk, back to chair & sit (abnormal = >20-30secs)

General Anaesthesia Concerns

- define risk by nature of surgery:
  - improve QOL
  - palliative
  - curative
  - elective

PreAssessment

- no specific assessment risk scoring for elderly
- adopt others:
  - Lee Index
  - CHAD
  - ASA
  - NSQIP
  - P-POSUM
- consent:
  - Competency (no formal tests to assess)
  - Capacity - comprehend & remember. Thus allow effect to weigh up risks
  - Autonomy - the right or condition of self-government
  - Beneficence - health care worker should have the welfare of the patient as a goal of treatment. The opposite of this term, maleficence, describes a practice which opposes the welfare of any patient.
  - Paternalism - Health care worker has better insight into consequences of decision making than patient. Basis for disagreeing and not proceeding is that it is presumed to be in the patients best interest.
  - Non-maleficence - means non-harming or inflicting the least harm possible to reach a beneficial outcome.
- search for cause of fall
- level of physical activity useful (if joints fine)
- AMT to Ax mental status
- avoid benzo's, central anticholinergics & pethidine

Intra-Operative

- no proof regional better than GA but:
  - ↓bleeding
  - ↓DVT risk
  - ↓resp infection
  - ↓acute POCD
- small period of hypotension not assoc with stroke
- bp optimisation pre-operative
- blunted response to:
  - hypovolaemia
  - sepsis
  - hypothermia
  - POCD
- quality of anaesthetic more impt that type

Postop

- Complications:
  - POCD
  - dementia
  - POD (post op delirium) -
    - CAM confusion assessment method (CAM): = 2 of any
      - inattention

        - Altered consciousness
        - sudden onset & fluctuating
        - disorganised thinking
    - hypoactive/hyperactive
    - causes:
        - modifiable eg drugs & polypharmacy, anaemia, hypoxia, pain, B12/folate disturbance, electrolytes
        - non-modifiable eg >70, PMH of delirium, depression, poor functional status, deaf, poor vision
- Pain commonly undertreated

Post Op Cognitive Changes

Definitions

- POCD = persistent impairment of cognitive function (memory loss, concentration) after surgery without clear precipitating event or cNS pathology
- delirium = (aka acute confusional state) = acute syndrome of organically caused decline from previous baseline cognitive state which is commonly fluctuant & can include change in level of consciousness
- dementia = chronic decline of cognitive state with altered memory & cognition

Delirium

- = acute onset of disturbed mental function. Often short lived
- features:
    - Alteration of consciousness
    - Hallucinations
    - Fleeting delusions
    - Anxiety & distress
    - Diurnal variation
- Risk factors for development:
    - Age >65
    - Dementia
    - Functional impairment
    - Anaemia
    - Substance abuse
- 3 different motor types:
    - Hyperactive delirium (rare) = restless, irritable, agitated
    - Hypoactive delirium (71%) = lethargy, ↓activity, unawareness
    - Mixed (29%)
- Diagnosed using scoring systems eg CAM-ICU
- Causes & investigations - need thorough workup for reversible causes:
    - Labs - UEs, phosphate, Mg, Ca, VBGs, B12, folate
    - Infection screen
    - Medications:
        - Top 3 = anticholinergics, opioids, benzo's
        - Others eg dig, diuretics, steroids, warfarin
    - Substance abuse
    - Brain imaging
- Treatment:
    - Prevention -
        - optimise all physiological parameters eg CVS stability, o2, acid base status, electrolyte abnormalities
        - Orientation protocol - repeatedly to surroundings
        - Protected night time sleep
        - Early mobilisation
        - senses:
            - Vision - access to glasses/visual aids
            - Hearing - access to hearing devices

- Avoid dehydration/hypovolaemia
- Remove non essential lines & catheters eg urinary catheters

- Drugs:
  - Haloperidol (better than benzo's & respiridone):
    - Initial: 1-2mg IV/PO/IM
    - Maintenance: 0.25-0.5 IV/PO/IM 4hourly
      ↳can double doses if severe agitation
- Specific circumstances:
  - Delirium 2nd to substance withdrawal:
    - Down taper dose rather than stopping
    - Alpha 2 agonist eg clonidine
  - Central anticholinergic syndrome - dramatic delirium (hypo or hyper)
    - Use physostigmine 10-30mcg/kg

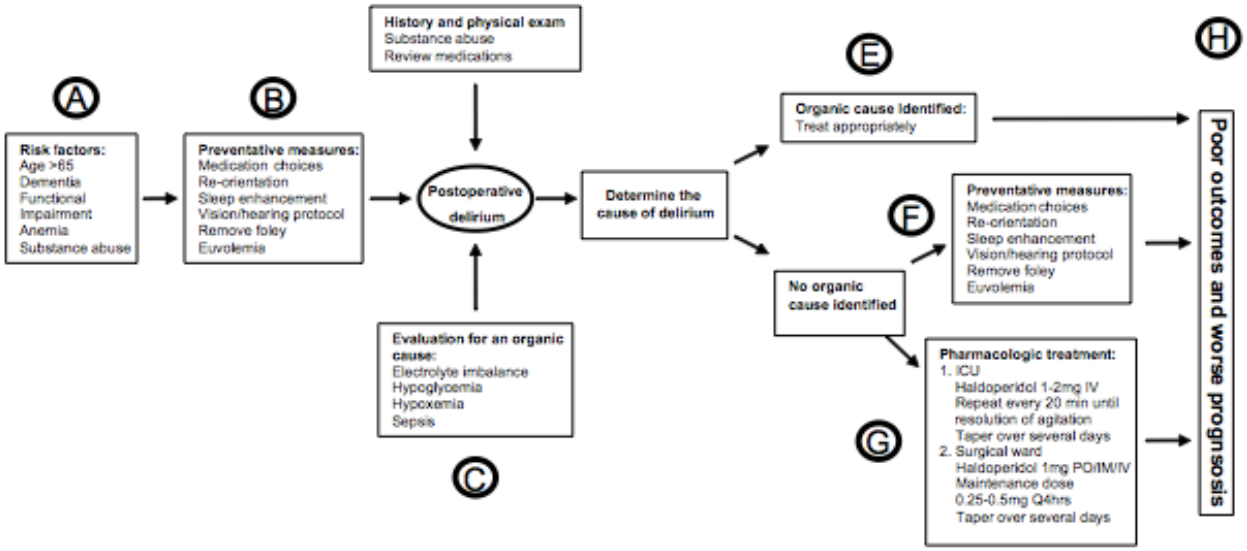

Figure 1 Postoperative delirium in the elderly – A diagnostic and treatment algorithm.

Dementia

- Defined as:
  - series of chronic organic brain syndromes with irreversible pathology
  - Global deterioration of cognitive function without clouding of consciousness
- Frequent misdiagnosis of delirium vs dementia. Both can occur together
- Many causes of dementia assoc failure cholinergic transmission
  ↳ ∴ anticholinesterases can be used to ↑cognitive function

Postop Cognitive Dysfunction

- Definitions:
  - = deterioration in formal neuropsychological testing that would be expected in <3.5% of controls
    ↳ doesnt define clinical features or severity
  - Disorder of thought processes which effect memory, comprehension, attention
- Difficult trial to do
- 1 study 1200 >60yrs old incidence of POCD:
  - 25% at week 1
  - 10% at 3 months
  - ↑incidence in age: 33% of 80+ group

- Known causes:

Table 2 Predisposing factors for POCD

Early POCD
Increasing age
General rather than regional anaesthesia
Increasing duration of anaesthesia
Respiratory complication
Lower level of education
Re-operation
Postoperative infection
Prolonged POCD (months postoperatively)
Increasing age only

- Theorised causes:
  - inflammatory reactions
  - altered hormonal homeostasis
  - direct anaesthesia toxicity
  - multiple emboli - especially following bypass
  - Periop physiological disturbances - eg
    - Hyponatraemia
    - Hypoxaemia/hypotension - although no evidence to support this
  - Pre-existing cog impairment - ↑risk with pre-existing issues

Conduct of Anaesthesia to ↓POCD

- Need to give best Anaesthetic - avoid hypoxia & hypotension
- Regional vs GA:
  - POCD incidence in 1st week: regional (12.7%) vs GA (21.2%)
    ↳ but difference does not persist at 3 months
  - Overall no difference in POCD between regional & GA
    ↳ but early differences may have large effect on recovery/length of stay/mobility