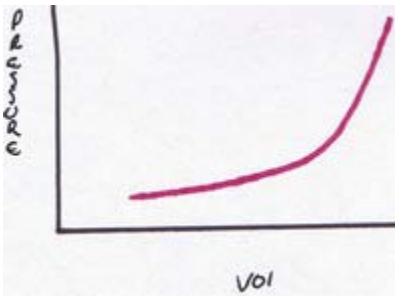
List the physiological factors that determine ICP. Explain briefly how ICP is regulated. 04A15 (57%), 97B3 (61%).

General:



- ICP is the pressure within the cranium
- CPP = MAP - (higher if ICP or CVP) Starling Resistor
- = a hydrostatic pressure
- Normal range = 5 – 15 mmHg

Monroe-Kellie Doctrine

- Skull is a rigid container ie fixed volume within the skull
  - Brain (85%)
  - Blood (5%)
  - CSF (10%)
- ↑volume of any of these components → ↑ICP

Compensatory Mechanisms

1. Translocation of CSF:
   - movement of CSF from intracranial to extracranial sites, may also get ↓brain mass, ↓CBF
2. CSF Absorption
   - linear ↑when ICP >10mmHg
3. ↓ed interstitial H20

↳ these 3 mechanisms quickly exhausted after initial buffering ⇒ quick ↑in IC volume

4. Cushing Effect: ↑MAP with ↓HR & ↑RR
5. Unconsciosness ⟹ ↓CMRO2 (cerebral metabolic rate of O2)

↳ exhaustion of these ⟹ death via herniation

NB Relationship of pressure change per unit vol is compliance (technically elastance)

Components of ICP & Autoregulation

Brain

- ↑mass → tumour, space occupying lesion (haemorrhage)
- no brain compensation available

CSF

- CSF production ~500ml/day
- Dependent on CPP
  - ↓CPP (2° ↑ICP) → <70mmHg → ↓CSF production
  - ICP up to 30cmH2 (22.5mmHg) → linear ↑reabsorption CSF
  - ICP < 7mmHg (9cmH2O)→ min reabsorption CSF
- Obstruction of drainage → ↑CSF vol → ↑ICP
- Initially, translocation can compensate for acute ↑ICP

Blood

- CBF = $\frac{CPP}{CVR}$

CPP= cerebral perfusion pressure
CVR = cerebrovascular resistance

- CPP = MAP – (CVP or ICP) → Starling Resistor
- ↑PaCO2 → ↑CBF by 2-4% per mmHg (b/n 20-80mmHg) via vasoD
- PaO2 nil effect within physiological limits (↑CBF <50mmHg PaO2)
- ↓T°C → every ↓1°C → ↓brain metabolic rate by 7%
  - ↳ Metabolism and CBF tightly coupled system
- Changes in ICP 2°respiration, cough, strain 2°transient ↑CBF
  - ↳ Can ↑by 60cmH2O