

Death, Physiology and Donation

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Deceased donation

- Common causes of death
 - ICH, ICT, HBI, Trauma
- On average, per DBD donor
 - 4 organs are donated/retrieved
 - <4 transplanted
- In theory: Maximum could be 8 organs
 - 1 heart
 - 2 lungs
 - 1 liver
 - 1 pancreas
 - 2 kindeys
 - 1 Small bowel

Diagnosing Death

- **Circulatory Death**
- Non-Heart Beating
- DCD – Donation after Circulatory Death

- **Brainstem Death = Brain Death**
- Heart Beating
- DBD – Donation after Brainstem Death

Diagnosing Death: Circulatory Death

- Absence of circulation
- 5 minutes observation following cessation of circulation (UK)
- Absence of heart sounds
- Absence of pulse
- Asystole on continuous ECG

Maastricht criteria

- I – Uncontrolled: Dead on arrival to hospital
- II – Uncontrolled: Unsuccessful Resuscitation
- III – Controlled: Awaiting cardiac arrest after withdrawal of Tx
- IV – Controlled: Cardiac Arrest in a DBD donor
- V – Uncontrolled: Unexpected cardiac arrest in a critically unwell patient

DCD Donors

- Cardiac arrest AND "functional warm ischaemia"
- Functional Warm Ischaemia
 - Systolic BP < 50mmHg
 - Sats < 70%
- <30 mins: Liver and pancreas can be considered
- <3-4 hours: Kidneys can be considered

Diagnosing Death: Brainstem Death

- Why?
 - Technical advances in 1960s and 1970s
 - Requirement for diagnosing death in patients artificially supported on ventilator
- Loss of Capacity for consciousness AND Loss of Capacity to breathe
 - Brainstem contains nuclei controlling body's homeostatic mechanisms (including Respiratory, CVS and arousal centres, and CN 3-12 nuclei)
- Difference between brainstem death and PVS?
 - Persistent vegetative state (Loss of higher brain function but intact brainstem)

Brain Death Physiology

- **Cardiovascular instability and autonomic storm**
- Monroe-Kelly doctrine (Skull – rigid container; $CPP = MAP - ICP$)
- $\uparrow ICP \rightarrow \downarrow CPP$
- Cushing's reflex
 - Baroreceptors in brainstem detect $\downarrow CPP \rightarrow$ Activation of SNS (vasoconstriction: $\uparrow MAP$ and $\uparrow HR$)
 - Further \uparrow in ICP \rightarrow Activation of PNS (Reduced HR)
 - \rightarrow Brainstem herniation through foramen magnum
 - Catecholamine levels \uparrow ; SBP $\uparrow\uparrow\uparrow$
 - Post coning BP \downarrow

Brain Death Physiology

- **Hypothalamic Failure**
- Hypothermia
- Failure of hypothalamic-pituitary axis
- Diabetes Insipidus
 - Lack of ADH
 - Polyuria
 - $\downarrow K^+$, $\uparrow Na^+$
 - IV Desmopression

Brain Death Physiology

- **Management of Brain Dead Donor**
- Hypotension and Hypovolaemia
 - Fluids
- \uparrow Na⁺
 - Independantly associated with hepatic dysfunction and graft loss
- Hormonal Resuscitation
 - Methylprednisolone (SIRS)
 - Vasopressin (DI)

Brainstem Death Testing

- When can you do it?
 - Once preconditions are met
- Preconditions:
 - Apnoeic coma
 - Irreversible brain injury
 - Exclusion of metabolic, cardiovascular and endocrine causes
 - Exclusion of Hypothermia ($>34^{\circ}\text{C}$)
 - Exclusion of depressant drugs

Brainstem Death Testing

- When can you do it?
 - Once preconditions are met
- In apnoeic coma after ICH, SAH, Neurological intervention
 - Need minimum 6h ventilation
- In apnoeic coma after HBI
 - Need minimum 24h ventilation

Brainstem Death Testing

- Time of Death
 - At end of 1st set of tests
- 2 experienced non-Transplant clinicians
 - At least 5 years post-GMC registration
 - At least 1 consultant

Brainstem Death Testing

- Absence of CN Reflexes
 - Pupillary response to light (A: II, E: III)
 - Corneal Reflex (A: V, E: VII)
 - Vestibulo-Ocular Reflex (A: VIII, E: III,IV,VI)
 - Cough/Gag Reflex (A: IX/X, E: X)
- No Motor Response
 - In CN distribution to adequate supraorbital pressure/somatic simulation
- Apnoea test

Brainstem Death Testing

- Apnoea test
 - Pre-oxygenate for 10min (100% O₂)
 - Lower RR/Minute ventilation until pCO₂ >6kPa and pH <7.4 (or pCO₂ >6.5kPa in COPD patients)
 - Disconnect from ventilator
 - Attach Oxygen (5l/min) to ET tube
 - Observe for any respiratory response for 5min