The ability to certify death when there is irreversible cessation of brain function enables withdrawal of treatment on humanitarian, ethical, and utilitarian grounds. Certification of death by brain death provides an opportunity for organ donation. Brain death in adults is usually the result of subarachnoid haemorrhage or traumatic brain injury while trauma is the most common cause in children.

The concept of a clinical state of brain death was first proposed in 1968 by Harvard Medical School (Harvard criteria) and subsequently shown to be demonstrable without an EEG (Minnesota criteria). The UK statements on brain death made in 1976 & 1979 and the USA report of 1981 provide the basis for current guidelines in Australasia and many other parts of the world.

In Australia, for the purposes of organ removal for transplantation, the statutory definition of death is irreversible cessation of all brain function. In most jurisdictions, the means to determine irreversible brain function are not determined by law but have been drafted by medical bodies.

Contraindications for brain death testing are:
- The brain maintains consciousness & the sleep-wake cycle
- Pathways through the brainstem are required for cranial nerve reflexes & voluntary and coordinated trunk & limb movements
- Pathways serving eye movements pass through both the pons & midbrain
- Spontaneous ventilation is dependent on medullary nuclei
- Brain death will always result in cardiac asystole within days or weeks & despite continuation of full support with deterioration of myocardial function through poorly understood mechanisms

Brain death: young 29/11/07

(i) Timing of testing & retesting:
- Two full & separate examinations are usually required to demonstrate irreversibility. The first examination should be after at least 4 hours of observed coma and absent cough, gag, & muscle activity. The second examination should be after at least 6 hours.
- For primary hypoxic brain damage and encephalitis, prolonged observation is recommended.

(iii) Assessment of brain stem function:
- Assessment of cranial nerve reflexes
- Assessment of pupillary reflexes
- Assessment of corneal reflexes
- Assessment of oculovestibular reflex
- Assessment of Babinski reflexes

Brain death is confirmed by the absence of brainstem function, loss of cranial nerve reflexes, and absence of brainstem reflexes. The diagnosis of brain death is made after completion of two full & separate examinations, with a minimum interval of 6 hours between tests.

(i) Pain sensation: Absent motor response to pain in cranial distribution
- Motor responses in cranial distribution (e.g., grimacing) are absent.
- Absent corneal reflex: Corneal reflexes are absent to a firm touch on the cornea using a cotton wool swab.
- Absent oculovestibular reflex (cold caloric test): No eye movement occurs after slow injection of ice cold water into one or preferably each ear canal.

(ii) Respiratory: Testing for apnoea involves disconnection from the ventilator when the PaCO2 is near normal, ensuring that it reaches the threshold required to stimulate the medullary centre and observing the patient for respiratory movements.
- A PaCO2 of greater than 60mmHg and a pH of <7.30 confirms adequate stimulus.
- The threshold in patients with chronic CO2 retention needs to be adjusted eg 20mmHg above baseline.

(iii) Autonomic: Causes of auto-triggering of the ventilator in a brain dead patient include:
- Cardiogenic oscillations
- High sensitivity settings
- Circuit leaks
- Water condensation in the circuit