


Lecture Notes

Brain Stem Death and Organ Transplantation

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The meaning of death

For centuries there has been a dread of being declared dead while still alive. However, it is only since 1959 that there have been conceptual and practical problems with the diagnosis of death following the description of "brain death". The ability to ventilate brain dead bodies in intensive therapy units preceded the developments of transplant surgery. The concept of brain death is not simply a convenience invented to satisfy the demands of transplant surgeons.

There is no legal definition of death. The diagnosis of death is traditionally made using the Triad of Bichat which states that death is "*the failure of the body as an integrated system associated with the irreversible loss of circulation, respiration and innervation*". This is also known as somatic death or clinical death.

Death is now accepted as meaning brain stem death or brain death. The brain stem is a small area of the brain which controls respiration. If this area is dead the person will never be able to breathe spontaneously or regain consciousness.

Molecular death may be defined as "*the death of individual organs and tissues of the body consequent upon the cessation of circulation*". Different tissues die at different rates depending on their oxygen requirements. Thus, within four minutes of the blood supply to the brain ceasing, the central nervous system is irreversibly damaged.

Some authorities recognise a third concept of apparent death. This is also known as a suspended animation. It may occur under certain specialised conditions for example drowning or hypothermia.

Severe brain damage which does not involve the brain stem may result in a persistent vegetative state. These patients breathe spontaneously, open and close their eyes, swallow and make facial grimaces. However, they show no behavioural evidence of awareness. It is in these cases that the moral dilemma of "allowing some-one to die" arises.

The above dilemma does not apply to those who are brain stem dead. These patients are dead irrefutably and unequivocally. Switching off a ventilator under these circumstances would not kill the patient but would discontinue ventilating a corpse.

In 1976 the Conference of the Medical Royal Colleges and Faculties of the United Kingdom issued guide lines on the subject of brain stem death. These guide lines are regularly updated and used by doctors in intensive care units throughout the U.K. in the diagnosis of brain stem death.

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Diagnosis of brain stem death

Exclusions

- a. where the patient may be under the effects of drugs e.g therapeutic drugs or overdoses.
- b. where the core temperature of the body is below 35°C e.g. exposure.
- c. where the patient is suffering from severe metabolic or endocrine disturbances which may lead to severe but reversible coma e.g. diabetes.

Preconditions of diagnosis

1. The patient must be deeply comatose.
2. The patient must be maintained on a ventilator.
3. The cause of the coma must be known.

Personnel

- a. The brain stem death tests must be performed by two medical practitioners.
- b. The doctors involved should be experts in this field. Under no circumstances are brain stem death tests performed by transplant surgeons.
- c. At least one of the doctors should be of consultant status. Junior doctors are not permitted to perform these tests.
- d. Each doctor should perform the tests twice.

Tests

Before the tests are performed the core temperature of the body is taken to ensure that it is above 35°C.

The diagnosis of brain stem death is established by testing the function of the cranial nerves which pass through the brain stem. If there is no response to these tests the brain stem is considered to be irreversibly dead.

1. The pupils are fixed in diameter and do not respond to changes in the intensity of light.
2. There is no corneal reflex.
3. The vestibulo-ocular reflexes are absent, i.e. no eye movement occurs after the installation of cold water into the outer ears.
4. No motor responses within the cranial nerve distribution can be elicited by painful or other sensory stimuli, i.e. the patient does not grimace in response to a painful stimulus applied to the face or to the limbs.
5. There is no gag reflex to bronchial stimulation by a suction catheter passed down the trachea.

6. No respiratory movements occur when the patient is disconnected from the ventilator for long enough to ensure that the carbon dioxide concentration in the blood rises above the threshold for stimulating respiration i.e. after giving the patient 100% oxygen for 5 minutes the ventilator is disconnected for up to 10 minutes. If no spontaneous breathing of any sort occurs within that 10 minutes the brain stem is incapable of reacting to the presence of the carbon dioxide and is thus dead.

Once two doctors have performed these tests twice with negative results the patient is pronounced dead and a death certificate can be issued. It is at this stage that a decision concerning the use of organs for transplantation purposes may be raised and the decision made as to whether the corpse should be maintained on the ventilator until the organs may be harvested.

Advances in medicine have enabled the use of several organs for transplant purposes. It is now possible to harvest from a cadaver the eyes, kidneys, liver, pancreas, small intestine, lungs and heart. From the living donor it is possible to transplant one kidney.

The cornea of the eye may still be suitable for transplant up to 24 hours after death. Other organs such as the heart, are very sensitive to low oxygen levels and deteriorate very quickly following the cessation of circulation. It is this which has led to the controversy regarding the ventilation of corpses prior to harvesting of organs.

ORGAN TRANSPLANTATION

Transplantation of human organs is now covered by The Human Tissue Act 2004. This Act replaces The Human Tissue Act 1961, The Anatomy Act 1984 and The Human Organ Transplants Act 1989.

The Human Tissue Act 2004

(<http://www.legislation.gov.uk/acts/acts2004/20040030.htm>)

Applies to England & Wales. Provisions relating to retention of material for DNA testing also apply to Scotland .

Formulated in response to public concern regarding organ retention scandals (Bristol Royal Infirmary & Alder Hay, Liverpool)

Summary:

Regulates removal, storage & use of human tissue

Creates new offence of “DNA theft”

Makes it lawful to preserve organs of deceased for transplantation

Authorises museums to move human remains

Human Tissue (Scotland) Act 2006

(<http://www.legislation.gov.uk/legislation/scotland/acts2006/20060004.htm>)

Part 1 - Transplantation etc.

Sets out the Scottish Ministers' duties as respects transplantation, makes provision for the authorisation of the use of parts of the body of a deceased person for purposes of transplantation, research, etc, contains restrictions on transplants involving living donors, and prohibits commercial dealings in human body parts for transplantation;

Part 2 - Post-mortem examinations

makes provision for the authorisation of hospital post-mortem examinations by an adult or mature child while still alive, or, failing such authorisation, by a nominee of the person or by his or her nearest relative, and, for children, authorisation by a person with parental rights and

responsibilities;

Part 3 - Tissue sample or organs no longer required for Procurator Fiscal purposes

Provides for tissue samples no longer required for the fiscal's purposes to be retained as part of the deceased's medical record and used without authorisation for diagnostic and audit purposes, and for such tissue samples and organs no longer required for the fiscal's purposes to be used, with authorisation, for education, training or research

Part 4 - Supplementary provision to Parts 1 to 3

Defines 'nearest relative' and makes provision about witnessing of authorisations and related matters

Part 5 - Amendment of the Anatomy Act 1984

Makes changes to provisions which govern the use of cadavers and body parts for the purposes of anatomical examination, the principal purpose being: to allow for the practice of surgical reconstruction to be carried out on bodies and body parts and also the practice of removing whole organs and parts of organs by healthcare professionals; prevent any unlicensed exhibition of bodies and body parts in public exhibitions under the guise of education or art, and enable the post of HM Inspector of Anatomy for Scotland to continue following changes in England and Wales.

Part 6 – Miscellaneous

Makes provision to allow the Scottish Ministers to arrange with a public authority anywhere in the UK to assist them with certain of their functions under the Act, and gives the Scottish Ministers power by regulations to amend the Act in order to give effect to Community obligations relating to material consisting of human cells.



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