

Brain death and care of organ donors

As intensive care practices and facilities improved and became more widely available, it became a more common occurrence for severely brain damaged patients to be supported with mechanical ventilation. There has never been an actual statutory definition of death in the United Kingdom, unlike in the United States of America (*These require, among other things, that doctors wait at least 24 hours after an electroencephalograph (EEG) has shown no brain activity, then check again. If the second EEG is as flat as the first, the doctor can then assume that even if machines are keeping the patient breathing, his brain, and thus the patient, has died*) and this was one factor that led to the development of brainstem death criteria. These would allow futile treatments to be withdrawn and organs to be donated if appropriate, safe in the knowledge that there would be no chance of a recovery.

DIAGNOSIS OF BRAINSTEM DEATH:

There is no statutory definition of death in the UK. After the “brain death criteria” were proposed by the Conference of Royal Colleges in 1976, courts in England and Northern Ireland adopted them for the diagnosis of death.

A Department of Health guideline in UK defines death as the “irreversible loss of capacity for consciousness, combined with irreversible loss of the capacity to breathe”. This essentially defines brain stem death and is equivalent to the death of an individual.

Brain death and the law

There is no statutory definition of death in Malta so Malta must adopt brain death criteria as part of the law

Brain death criteria

In UK, the actual tests must be carried out by two doctors who have held full registration with the Medical Council for more than five years, one of whom should be a consultant. Both should have adequate experience of interpreting the results and neither should be a member of the transplant team.

Two sets of tests should be performed to remove the risk of observer error. The two doctors may perform the tests together or separately and although no defined time interval has to elapse between the tests, it should be of sufficient duration to reassure the patient's next-of-kin.

The time of death is recorded when the first test indicates brain death.

The rules apply to children over the age of two months and cannot be applied to those below 37 weeks gestation. It is rarely possible to apply the criteria to children between these ages.

Once brainstem death has been diagnosed, cessation of the heart beat follows within a short period. This has been confirmed and validated in published series.

Prerequisites:

- Comatose patient unable to breathe spontaneously
- Cause of coma irreversible and untreatable i.e. potentially reversible comatose states due to drugs, hypothermia, metabolic disturbance excluded.
- (Note that in the 1998 UK guidelines there is a change in emphasis regarding circulatory, metabolic and endocrine disturbances. The presence of disturbances that are thought to be an effect of brain death rather than the cause of coma do not preclude the diagnosis of brain stem death)
- Persistence of effect of neuromuscular blocking agents should be excluded by eliciting deep tendon reflexes or with the use of a nerve stimulator.

The Tests - All brainstem reflexes absent:

1. Pupils must be fixed in diameter and not responsive to incident light. (Cranial nerves II, III).
2. There must be no corneal reflex (avoid damaging the cornea). (Cranial nerves V, VII).
3. Vestibulo-ocular reflexes are absent. No eye movements occur following the slow injection of at least 50mls of ice cold water over one minute into each external

auditory meatus. Note that the normal reflex is deviation of the eyes away from the side of the stimulus. Access to the tympanic membrane should be confirmed by otoscopy. Injury or pathology may prevent this test being performed on both sides – this does not invalidate the test. (Cranial nerves VIII, III).

4. No motor responses in the cranial nerve distribution should occur as a result of stimulation of any somatic area. No limb movement should occur in response to supra-orbital pressure. (Cranial nerves V, VII).
5. No gag reflex should occur in response to posterior pharyngeal wall stimulation with a spatula. (Cranial nerve IX).
6. No cough or other reflex should occur in response to bronchial stimulation by a suction catheter being passed down the endotracheal tube. (Cranial nerve X).
7. No respiratory movements should occur in response to disconnection from the ventilator. Hypoxia should be prevented by pre-oxygenation and insufflation of oxygen through a tracheal catheter. This tests the stimulation of respiration by arterial carbon dioxide tension which should be allowed to rise to 6.65 kPa – confirmed by arterial blood gases
8. Lack of spontaneous breathing when patient has been taken off ventilator after having been ventilated with 100% oxygen for 10 minutes. Whilst disconnected from the ventilator oxygen is supplied via a tracheal catheter at 6 l/min. Patient left disconnected until $P_{aCO_2} > 6.65$ kPa. If facility for administering 5% CO_2 in oxygen exists this should be used. Ventilate the patient with 100% O_2 for 10 minutes, then with 5% CO_2 for 5 minutes and then disconnect from ventilator for 10 minutes. If marked bradycardia or haemodynamic instability occur the test should be discontinued. Ideally the oxygen saturation should not be allowed to fall below 90%. Threshold for $PaCO_2$ needs to be increased in patients with chronic hypercapnia
9. Core temperature of above 34°C
10. An iso-electric EEG

Tests should be performed twice by 2 different doctors who have expertise in this field. Both doctors need not be present on both occasions. Neither should belong to transplant team.

First test should not be performed before 4 hours of coma associated with absent motor activity, cough and gag. In the case of anoxic brain damage this period should be increased to 12 hours

Time interval between tests is a matter for clinical judgment but the time should be adequate for the reassurance of all those directly concerned.

If there is doubt about the diagnosis or if the preconditions for brain stem testing cannot be met then objective tests of cerebral perfusion may be necessary. Indications include:

- no clear cause for coma
- possible drug or metabolic effect
- cranial nerves cannot be adequately tested
- cervical vertebra or cord injury
- cardiovascular instability precludes apnoea testing
- Acceptable objective tests include cerebral angiography – (must examine both anterior and posterior circulations) and radionuclide cerebral perfusion scan

Management OF BRAINSTEM DEAD PATIENT:

Relatives, partners, next of kin and carers need to be kept informed of the patient's condition in a sympathetic and appropriate manner. This obviously needs to be tailored to the individuals concerned.

Standard medical care must be continued in those in whom brain stem death has not been conclusively established and may be continued after this in order to maintain the condition of organs for donation. This may include maintaining fluid and electrolyte balance or haemodynamic parameters.

Initiating mechanical ventilation in those patients thought to have irremediable brain damage, who stop breathing before brain stem death testing can occur, is only justified if it is of benefit to the patient. It is unlawful for this to occur in order to preserve organ function.