

Criteria for the diagnosis of brain stem death

REVIEW BY A WORKING GROUP CONVENED BY THE ROYAL COLLEGE OF PHYSICIANS
AND ENDORSED BY THE CONFERENCE OF MEDICAL ROYAL COLLEGES AND THEIR FACULTIES
IN THE UNITED KINGDOM

This review of the criteria used in the diagnosis of brain stem death (hitherto known as brain death) has been produced to update earlier documents on this subject published by the Conference of Medical Royal Colleges and their Faculties (Conference of Colleges) between 1976 and 1981 [1-4] and the relevant sections of the Department of Health revised guidelines published in 1983 [5].

The definition of death

It is suggested that 'irreversible loss of the capacity for consciousness, combined with irreversible loss of the capacity to breathe' should be regarded as the definition of death. The irreversible cessation of brain stem function (brain stem death) whether induced by intracranial events or the result of extracranial phenomena such as anoxia will produce the forementioned clinical state and therefore brain stem death is equivalent to the death of the individual. It is suggested that the more correct term 'brain stem death' should henceforth replace the term 'brain death' used in previous papers produced by the Conference of Colleges and the Department of Health.

The diagnosis of brain stem death

The clinical criteria for the diagnosis of brain stem death identified by the Conference of Colleges during the period 1976-1981 have been confirmed by all published series and have therefore been adequately validated.

- a) *The beating heart in brain stem death.* Even if ventilation is continued, both adults and children will suffer cessation of heart beat within a few days, very occasionally a few weeks, of the diagnosis of brain stem death.
- b) *Endocrinological and metabolic abnormalities.* Endocrinological abnormalities, such as diabetes insipidus, biochemical abnormalities, such as hypo- or hypernatraemia, and hypothermia may occur in patients following anoxic, haemorrhagic or traumatic cerebral injury. These endocrinological abnormalities may be consequences of brain stem failure and must be differentiated from causative abnormalities of endocrinological, biochemical or autonomic function.

- c) *Limb and trunk movements.* Reflex movements of the limbs and torso may occur after brain stem death. The doctor should be able to explain clearly the significance of these movements to relatives, who should understand that they are of a reflex and not a voluntary nature.
- d) *Investigations.* The accuracy of the clinical criteria for the diagnosis of brain stem death during the past 17 years provides justification for not including the results of neurophysiological or imaging investigations as part of those criteria. At present there is no evidence that imaging, electroencephalography or evoked potentials assist in the determination of brain stem death and, though such techniques will be kept under review, they should not presently form part of the diagnostic requirements.
- e) *Children and the very young.* A report of a working party of the British Paediatric Association in 1991 [6], supported by the Council of the Royal College of Physicians suggested that, in children over the age of two months, the brain stem death criteria should be the same as those in adults. There is insufficient information on children under the age of two months and on premature babies to define guidelines. A working party of the Conference of Colleges on *Organ transplantation in neonates* in 1988 [7] recommended that organs for transplantation may be removed from anencephalic infants when two doctors who are not members of the transplant team agree that spontaneous respiration has ceased.
- f) *The persistent vegetative state.* Problems relating to the diagnosis and management of the persistent vegetative state must not be confused with those relating to brain stem death.
- g) *Peripheral neurological syndromes of critical care.* There is a range of overlapping neuropathic, neuromuscular and myopathic syndromes which may occur in the context of critical care and may cause problems in weaning a patient from a ventilator. This is not true apnoea (respiratory centre paralysis) and should not be taken as evidence of brain stem death.

CONDITIONS UNDER WHICH THE DIAGNOSIS OF BRAIN STEM DEATH SHOULD BE CONSIDERED

- 1 There should be no doubt that the patient's condition is due to irremediable brain damage of known aetiology (see Note 1).
- 2 The patient is deeply comatose
 - a) There should be no suspicion that this state is due to depressant drugs (see Note 2);
 - b) Primary hypothermia as a cause of coma must have been excluded;
 - c) Potentially reversible metabolic and endocrine disturbances must have been excluded as the likely cause of the continuation of coma. It is recognised that metabolic and endocrine disturbances are a likely accompaniment of brain stem death (eg hyponatraemia, diabetes insipidus) but these are the effect rather than the cause of that condition and do not preclude the diagnosis of brain stem death.
- 3 The patient is being maintained on the ventilator because spontaneous respiration has become inadequate or ceased altogether (see Note 3).

It is essential that these conditions be satisfied before the diagnosis of brain stem death is considered or further investigated.

NOTES:

1. It may be obvious within hours of a primary intracranial event such as severe head injury, spontaneous intracranial haemorrhage or following neurosurgery that the condition is irremediable. However, when a patient has suffered primarily from cardiac arrest, hypoxia or severe circulatory insufficiency with an indefinite period of cerebral anoxia, or is suspected of having cerebral air or fat embolism, it may take longer to establish the diagnosis and to be confident of the prognosis. In some patients the primary pathology may be a matter of doubt and a confident diagnosis may only be reached by continuity of clinical observation and investigation.

2. Narcotics, hypnotics and tranquillisers may have prolonged duration of action, particularly when hypothermia co-exists or in the context of renal or hepatic failure. The benzodiazepines are markedly cumulative and persistent in their actions and are commonly used as anti-convulsants or to assist synchronisation with mechanical ventilators. It is therefore essential that the drug history should be carefully reviewed and any possibility of intoxication being the cause of or contributing to the patient's comatose state should preclude a diagnosis of brain stem

death. It is important to recognise that in some patients anoxia may have followed the ingestion of a drug but in this situation the criteria for brain stem death will not be applicable until such time as the drug effects have been excluded.

3. Relaxants (neuromuscular blocking agents) and other drugs must have been excluded as the cause of respiratory inadequacy or failure. Immobility, unresponsiveness, and lack of spontaneous respiration may be due to the use of neuromuscular blocking drugs and the persistence of their effects should be excluded by the elicitation of deep tendon reflexes or by the demonstration of adequate neuromuscular conduction with a conventional nerve stimulator. Persistent effects of hypnotics or narcotics must be excluded as the cause of respiratory failure.

References

- 1 Conference of Medical Royal Colleges and their Faculties in the United Kingdom. Diagnosis of brain death. *Br Med J* 1976;ii: 1187-8.
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- 3 Conference of Medical Royal Colleges and their Faculties in the United Kingdom. Diagnosis of death. *Br Med J* 1979; i: 332.
- 4 Conference of Medical Royal Colleges and their Faculties in the United Kingdom. Diagnosis of death. *Lancet* 1979; i: 261-2.
- 5 Health Departments of Great Britain and Northern Ireland. *Cadaveric organs for transplantation: a code of practice including the diagnosis of brain death*. London: HMSO, 1983.
- 6 British Paediatric Association. *Diagnosis of brain stem death in infants and children*. Report of a working party. London: BPA, 1991.
- 7 Conference of Medical Royal Colleges and their Faculties in the United Kingdom. *Organ transplantation in neonates*. London: Royal College of Physicians, 1988.

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