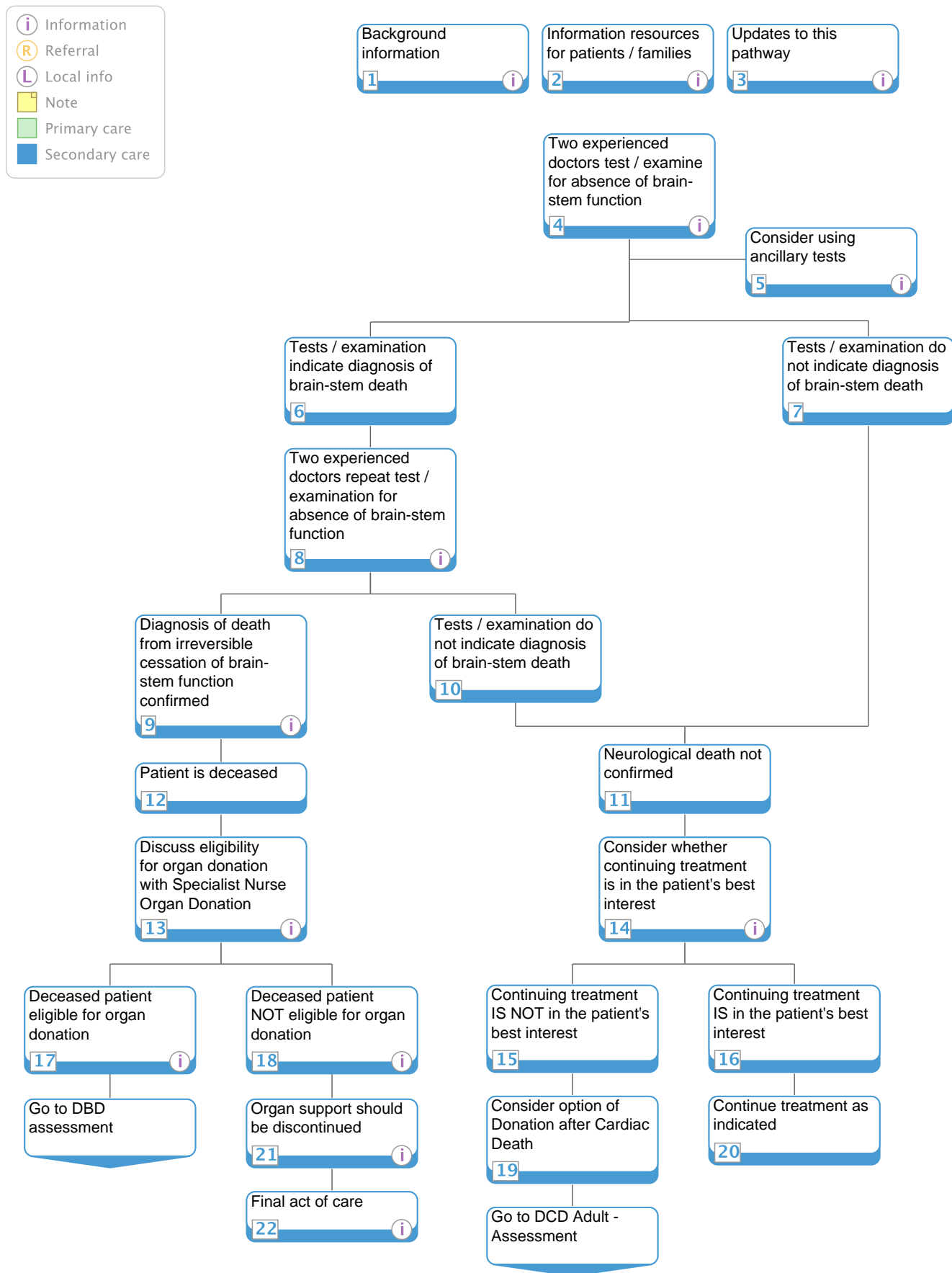


# Neurological Determination of Death - Testing, Adult

Medicine > General medicine > Neurological Determination of Death (Brain-stem Death), Adult



Locally reviewed: 16-Sep-2010 Due for review: 02-Sep-2012 Printed on: 05-Oct-2010 © Map of Medicine Ltd

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## 1 Background information

Quick info:

### Neurological Determination of Death, Adult Pathway

**Scope:**

- Management of adult patients in whom brain-stem death is suspected.

**Out of Scope:**

- Paediatric patients.

**Background**

- Death is considered to be a state in which an individual has simultaneously and irreversibly lost both the capacity for consciousness and the capacity to breathe. Various criteria can be used to confirm that an individual has reached the point of death, the application of which is determined by the specific clinical circumstances that are encountered. This pathway concerns the confirmation of death using neurological criteria and refers to a clinical state that is frequently referred to as brain-stem death or simply brain death. The UK criteria are based upon the premise that irreversible and complete loss of brain-stem function is sufficient of itself to result in the irreversible loss of the capacity to breathe and the capacity for consciousness, and hence use the term brain-stem death. However, guidance in many other parts of the world (e.g. North America, Australia) is concerned with whole brain death, and uses the term brain death.

**Definition:**

- Death following the irreversible cessation of brain-stem function.

**Incidence and Prevalence:**

- The incidence of patients diagnosed as dead using neurological criteria within the United Kingdom has fallen steadily since 2005.
- The UK Potential Donor Audit (PDA) that is conducted by NHS Blood and Transplant and NHS hospitals has examined the incidence of brain-stem death in the UK since 2003. The audit, which is restricted to patients aged 75 years or less and which excludes deaths on Cardiac ICUs, reveals that the number of patients (adult and paediatric) whose death is confirmed using neurological criteria has fallen from 1339 in 2004/5 to 1147 in 2008/9.
- Further information can be found at the NHS Blood and Transplant Annual Transplant Activity Report [http://www.organdonation.nhs.uk/ukt/statistics/transplant\\_activity\\_report/transplant\\_activity\\_report.jsp](http://www.organdonation.nhs.uk/ukt/statistics/transplant_activity_report/transplant_activity_report.jsp)

**Reference:**

Academy of Medical Royal Colleges. A Code of Practice for the Diagnosis and Confirmation of Death, October 2008. <http://www.aomrc.org.uk/aomrc/admin/reports/docs/DofD-final.pdf>

## 2 Information resources for patients / families

Quick info:

Information for families is available in Appendix 5 of 'A Code of Practice for the Diagnosis and Confirmation of Death', published by the Academy of Medical Royal Colleges:

The full document can be found at:

[http://www.aomrc.org.uk/publications/reports-guidance/doc\\_download/42-a-code-of-practice-for-the-diagnosis-and-confirmation-of-death.html](http://www.aomrc.org.uk/publications/reports-guidance/doc_download/42-a-code-of-practice-for-the-diagnosis-and-confirmation-of-death.html)

## 3 Updates to this pathway

Quick info:

This is the first version of this pathway.

## 4 Two experienced doctors test / examine for absence of brain-stem function

Quick info:

There are two key components of brain-stem death testing in the UK – fulfilment of essential pre-conditions / exclusion criteria and clinical evaluation of coma, brain-stem areflexia and apnoea. Whilst the latter demonstrates the absence of brain-stem function, it is the former which determines irreversibility and which requires the greater expertise.

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Brain-stem death testing can only be carried out when clinicians have satisfied themselves fulfils the pre-conditions for testing, and that the influence of potentially reversible causes of coma and/or apnoea have been excluded. See [Neurological Death, Planning for details](#).

Detailed guidance on undertaking brain-stem death tests is published by the Academy of Medical Royal Colleges.

## Clinical assessment of brain-stem function

Clinical examination must be carried by two physicians working together and must be repeated. At least one of the doctors must be a consultant and both must have been fully registered with the GMC for more than 5 years). Neither must be potentially involved in the care of patients who might be in receipt of organs donated by the patient.

## Clinical examination of brain-stem reflexes

Demonstration of brain-stem areflexia variously reveals loss of hind brain function at the level of the mesencephalon, pons and medulla oblongata.

- The pupils are fixed and do not respond to sharp changes in the intensity of incident light. (mesencephalon, II and III).
- There is no corneal reflex (pons, V and VII)
- The oculo-vestibular reflexes are absent. No eye movements are seen during or following the slow injection of at least 50mls of ice cold water over one minute into each external auditory meatus in turn. Clear access to the tympanic membrane must be established by direct inspection. (pons, VIII, III, IV, VI)
- Access to the above reflexes may be prevented on one or other side by local injury or disease but this does not invalidate clinical testing. In the case of bilateral injury or disease, ancillary testing should be considered.
- No motor responses within the cranial nerve distribution can be elicited by adequate stimulation of any somatic area, e.g. by supraorbital pressure and pressure applied to the nail bed of a finger (the latter may be contra-indicated by a spinal injury). Care must be taken to distinguish central response from primitive spinally-mediated reflexes that can be ignored in this context.
- There is no cough reflex response to bronchial stimulation by a suction catheter placed down the trachea to the carina, or gag response to stimulation of the posterior pharynx with a spatula (medulla, IX, X).

## Apnoea Test

The apnoea test should only be considered once brain-stem areflexia has been confirmed, and is performed as follows:

- Increase FiO<sub>2</sub> to 1.0
- Check arterial blood gases to confirm that the measured PaCO<sub>2</sub> and SaO<sub>2</sub> correlate with the monitored values
- With oxygen saturation greater than 95%, reduce minute volume ventilation by lowering the respiratory rate to allow a slow rise in ETCO<sub>2</sub>
- Once ETCO<sub>2</sub> rises above 6.0 kPa, check arterial blood gases to confirm that PaCO<sub>2</sub> is at least 6.0 kPa and that the pH is less than 7.40.
- If cardiovascular stability is maintained, disconnect the patient from the ventilator and deliver oxygen at 5L/min via an endotracheal catheter. Observe for five minutes. If the maintenance of adequate oxygenation proves difficult, then CPAP (and possibly a prior recruitment manoeuvre) may be used
- After five minutes of apnoea repeat arterial blood gas, confirm a minimum of a further 0.5 kPa rise in PaCO<sub>2</sub>. Loss of respiratory drive is confirmed at this point and mechanical ventilation resumed.

A summary of the tests to be undertaken are:

- The pupils are fixed and do not respond to sharp changes in light intensity
- There is no corneal reflex
- The oculovestibular reflexes are absent.
- No motor responses within the cranial nerve distribution in response to stimulation of any somatic area
- There is no cough reflex response to bronchial stimulation by a suction catheter placed down the trachea to the carina, or gag response to stimulation of the posterior pharynx with a spatula
- There is no evidence of spontaneous respiration or respiratory effort during the apnoea test

## Reference:

Academy of Medical Royal Colleges. A Code of Practice for the Diagnosis and Confirmation of Death, October 2008. <http://www.aomrc.org.uk/aomrc/admin/reports/docs/DofD-final.pdf>

## 5 Consider using ancillary tests

Quick info:

### Ancillary Testing

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The current Academy of Medical Royal College Code of Practice on the confirmation of death using neurological criteria is based upon the premise that this is a diagnosis that can be made clinically in the majority of cases and that only rarely should there be a need to consider a confirmatory investigation. It is similarly the case that there will be occasions when an experienced clinician may feel able to discount the relevance of potentially reversible influences such as residual sedation when there is independent evidence to suggest that the patient is brain dead (e.g. on the basis of the CT head scan or a prolonged period of malignant intracranial hypertension).

On rare occasions, clinicians may judge that brain-stem death cannot be diagnosed without an independent ancillary investigation of cerebral perfusion or function. 'A Code of Practice for the Diagnosis and Confirmation of Death' published by the Academy of Medical Royal Colleges offers the following guidance on 'ancillary testing' in paragraph 6.7:

'The accuracy of the clinical criteria for the diagnosis of death as a result of cessation of brain-stem reflexes over the past thirty years provides justification for not including the results of neurophysiological or imaging investigations as part of these criteria. However, death cannot be diagnosed by the testing of brain-stem reflexes alone in instances where a comprehensive neurological examination is not possible (e.g., extensive facio-maxillary injuries, residual sedation and some cases of paediatric hypoxic brain injury), where a primary metabolic or pharmacological derangement cannot be ruled out or in cases of high cervical cord injury (see section 5.3). In such cases a confirmatory test may reduce any element of uncertainty and possibly foreshorten any period of observation prior to formal testing of brain-stem reflexes.

'The various tests available, together with an assessment of their relative benefit and complexity, are listed in Appendix 3. All such investigations are prone to artifice and each has attracted its own literature defining false positive and negative rates. All ancillary investigations require appropriate training and experience both to perform and to interpret, which may not be available in all hospitals or outside normal office hours. Patients with the provisional diagnosis of irreversible cessation of brain-stem reflexes are frequently physiologically unstable and their transfer to another part of the hospital for further investigation may carry a significant risk, were the provisional diagnosis subsequently proven to be wrong. Where appropriate, such cases should be referred for a specialist neurological or neurosurgical opinion. In this situation, further time may be required before death may be confirmed. The increasingly widespread availability of spiral CT angiography may prove to be a helpful advance but further validation studies are required.'

## Reference:

Academy of Medical Royal Colleges. A Code of Practice for the Diagnosis and Confirmation of Death, October 2008.

<http://www.aomrc.org.uk/aomrc/admin/reports/docs/DofD-final.pdf>

## 8 Two experienced doctors repeat test / examination for absence of brain-stem function

### Quick info:

If the first set of brain-stem tests shows no evidence of brain-stem function a second set of tests is required to confirm irreversible loss of brain-stem function.

A short of time will be required between the two sets of brain-stem tests to allow the return of the patient's arterial blood gases and baseline parameters.

Irreversible loss of brain-stem function is confirmed by the second set of brain-stem tests.

### Reference:

Academy of Medical Royal Colleges. A Code of Practice for the Diagnosis and Confirmation of Death, October 2008. [http://](http://www.aomrc.org.uk/aomrc/admin/reports/docs/DofD-final.pdf)

[www.aomrc.org.uk/aomrc/admin/reports/docs/DofD-final.pdf](http://www.aomrc.org.uk/aomrc/admin/reports/docs/DofD-final.pdf)

## 9 Diagnosis of death from irreversible cessation of brain-stem function confirmed

### Quick info:

Neurological determination of death confirmed following completion of tests / examinations as above.

The legal time of death is the time of completion of the first set of tests.

## 13 Discuss eligibility for organ donation with Specialist Nurse Organ Donation

### Quick info:

Decisions regarding eligibility for organ donation should be made in conjunction with your local Specialist Nurse Organ Donation.

In principle, all potential donors, without an absolute contraindication to donation (see below) should be discussed with the local Specialist Nurse Organ Donation, as per the recommendation of the Organ Donation Taskforce.

The only **absolute contra-indications** for organ donation are:

- known or suspected nvCJD and other neurodegenerative diseases associated with infectious agents

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- known HIV disease (but not HIV infection alone)

In addition, it is highly likely that donors with the following conditions will also be declined, although there may be occasions when organs are accepted if the alternative for a specific recipient is imminent death (e.g. from fulminant hepatic failure):

- disseminated malignancy
- melanoma (except local melanoma treated > 5 years before donation)
- treated malignancy within 3 years (except non-melanoma skin cancer)
- age > 90 years
- known active tuberculosis
- untreated bacterial sepsis

Consideration of organ donation should be a normal part of end-of-life care.

## Reference:

Department of Health. Organs for Transplants: A Report from the Organ Donation Task Force, 2008. [http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH\\_082122](http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_082122)

## 14 Consider whether continuing treatment is in the patient's best interest

### Quick info:

Any decision to withdraw life-sustaining cardio-respiratory organ support should:

- be based upon a multi-disciplinary consensus that it is no longer in a patient's best interests to continue or escalate life sustaining cardio-respiratory organ support.
- be robust enough to bear objective scrutiny.
- adhere to a local policy on withholding and withdrawing treatment, based on national guidance.
- be documented, signed and dated in patient's notes.
- be fully independent from any subsequent discussion regarding consideration of organ donation.
- not involve members of staff potentially involved in transplantation of organs retrieved from the patient following death.
  - Clinical Leads for Organ Donation working in their role as intensivists are not members of the transplant team.

Unless brought up by the family, the issue of donation should not be discussed until the decision to withdraw life-sustaining treatment has been accepted by the family.

Some Units will leave discussions regarding organ donation until a subsequent conversation.

### Reference:

Academy of Medical Royal Colleges. 'A Code of Practice for the Diagnosis and Confirmation of Death, October 2008. <http://www.aomrc.org.uk/aomrc/admin/reports/docs/DofD-final.pdf>

General Medical Council, 'Withholding and withdrawing - guidance for doctors',

Sections of particular interest:

[http://www.gmc-uk.org/guidance/ethical\\_guidance/withholding\\_lifeprolonging\\_guidance.asp#clinical](http://www.gmc-uk.org/guidance/ethical_guidance/withholding_lifeprolonging_guidance.asp#clinical)

[http://www.gmc-uk.org/guidance/ethical\\_guidance/withholding\\_lifeprolonging\\_guidance.asp#recordingdec](http://www.gmc-uk.org/guidance/ethical_guidance/withholding_lifeprolonging_guidance.asp#recordingdec)

## 17 Deceased patient eligible for organ donation

### Quick info:

All deceased patients in whom there is no absolute contraindication to solid organ donation are eligible to be considered as solid organ donors. The only absolute contra-indications for donation are:

- Known or suspected nvCJD and other neurodegenerative diseases associated with infectious agents
- Known HIV disease (but not HIV infection alone)

## 18 Deceased patient NOT eligible for organ donation

### Quick info:

Absolute contraindications:

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- Known or suspected nvCJD and other neurodegenerative diseases associated with infectious agents
- Known HIV disease (but not HIV infection alone)

## 21 Organ support should be discontinued

### Quick info:

If the patient is not eligible for organ donation or the patient has expressed a wish in their lifetime not to donate or agreement cannot be obtained, organ support should be discontinued.

### Reference:

Academy of Medical Royal Colleges. A Code of Practice for the Diagnosis and Confirmation of Death, October 2008. <http://www.aomrc.org.uk/aomrc/admin/reports/docs/DofD-final.pdf>

## 22 Final act of care

### Quick info:

The Final Act of Care will be carried out as per hospital policy.

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## Key Dates

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