

## The Diagnosis of Death Following Irreversible Cessation of Brain-Stem Function

### Adults

Diagnosis is to be made by two doctors who have been registered for more than 5 years and are competent in the procedure. One doctor should be a consultant. Testing should be performed completely and successfully on two occasions with both doctors present.

#### Doctor One, Name and Designation

Name.....

Signature.....

Grade.....

#### Doctor Two, Name and Designation

Name.....

Signature.....

Grade.....

Date and time.....

#### Evidence for Irreversible Brain Damage of known aetiology:

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.....

HOSPITAL ADDRESSOGRAPH or

Surname

First Name

Date of Birth

Hospital Number

### Exclusion of Potentially Reversible Causes

	1 <sup>st</sup> Test Dr One	1 <sup>st</sup> Test Dr Two	2 <sup>nd</sup> Test Dr One	2 <sup>nd</sup> Test Dr Two
1. Is the coma due to depressant drugs? Drug Levels (if taken):	Y/N	Y/N	Y/N	Y/N
2. Is the patient's body temperature $\leq 34^{\circ}\text{C}$ ?	Y/N	Y/N	Y/N	Y/N
3. Is the coma due to a circulatory, metabolic or endocrine disorder?	Y/N	Y/N	Y/N	Y/N
4. Is the respiratory failure due to neuromuscular blocking agents, other drugs or potentially reversible causes of apnoea (eg. cervical injury, profound neuromuscular weakness)?	Y/N	Y/N	Y/N	Y/N

Tests for Absence of Brain-Stem Function				
	1 <sup>st</sup> Test Dr One	1 <sup>st</sup> Test Dr Two	2 <sup>nd</sup> Test Dr One	2 <sup>nd</sup> Test Dr Two
1. Do the pupils react to light?	Y/N	Y/N	Y/N	Y/N
2. Is there any eye movement when each cornea is touched in turn?	Y/N	Y/N	Y/N	Y/N
3. Is there nystagmus or any eye movement present when each ear is instilled with 50mls ice cold water?	Y/N	Y/N	Y/N	Y/N
4. Is the gag reflex present?	Y/N	Y/N	Y/N	Y/N
Is the cough reflex response present when a suction catheter is passed down the trachea?	Y/N	Y/N	Y/N	Y/N
5. Is there any motor response when supraorbital pressure is applied?	Y/N	Y/N	Y/N	Y/N
<b>Apnoea Test</b>  Is the $\text{paCO}_2 \geq 6.0$ KPa? Is the $\text{pH} \leq 7.4$ Is there any spontaneous respiration within 5 (five) minutes of disconnecting the ventilator?	Y/N Y/N Y/N	Y/N Y/N Y/N	Y/N Y/N Y/N	Y/N Y/N Y/N
paCO <sub>2</sub> Arterial Blood Gas Results:	1 <sup>st</sup> Test Pre: Post:		2 <sup>nd</sup> Test Pre: Post:	
Ancillary Investigations Used To Confirm the Diagnosis				
Is there felt a need for ancillary investigations to confirm the diagnosis? If yes please outline the results of these investigations:	Y/N		Y/N	
Completion of Diagnosis				
Are you satisfied that death has been confirmed following the irreversible cessation of brain-stem-function?	Y/N		Y/N	
Legal time of death is when the 1 <sup>st</sup> Test indicates death due to the absence of brain-stem reflexes. Death is confirmed following the 2 <sup>nd</sup> Test.	Date: Time:		Date: Time:	
	Doctor One Initials		Doctor Two Initials	

## NOTES

It remains the duty of the two doctors carrying out the testing to be satisfied with the aetiology, the exclusion of all potentially reversible causes, the clinical tests of brain-stem function and of any ancillary investigations so that each doctor may independently confirm death following irreversible cessation of brain-stem function.

### Evidence for Irreversible Brain Damage of Known Aetiology

- There should be no doubt that the patient's condition is due to irreversible brain damage of known aetiology.
- Occasionally it may take a period of continued clinical observation and investigation to be confident of the irreversible nature of the prognosis. The timing of the first test and the timing between the two tests should be adequate for the reassurance of all those directly concerned.

### Drugs

- As a general rule the patient should not have received any drugs that affect consciousness (narcotics, hypnotics, sedatives or tranquillisers) nor should they have received any neuromuscular blocking agents (atracurium, vecuronium or suxamethonium) during the preceding 12 (twelve) hours.
- Renal or hepatic failure may prolong metabolism / excretion of these drugs.
- Where there is any doubt specific drug levels should be carried out (midazolam should be less than  $< 10\text{mcg/L}$ , thiopentone  $< 5\text{mg/L}$ ), residual neuromuscular blockade should be tested for by peripheral nerve stimulation. Alternatively ancillary investigations may be used to confirm the clinical diagnosis.

### Temperature, Circulatory or Metabolic or Endocrine Disorders

- If the core temperature is  $\leq 34^{\circ}\text{C}$  brain stem testing cannot be carried out.
- Prior to testing the mean arterial pressure should be consistently  $> 60\text{mmHg}$  with maintenance of normocarbida and avoidance of hypoxia, acidaemia or alkalaemia ( $\text{PaCO}_2 < 6.0\text{KPa}$ ,  $\text{PaO}_2 > 10\text{KPa}$  and  $\text{pH } 7.35 - 7.45$ ).
- Serum  $\text{Na}^+$  should be between  $115-160\text{mmol/L}$ .
- Serum  $\text{K}^+$  should be  $> 2\text{mmol/L}$ .
- Serum  $\text{PO}_4^{3-}$  and  $\text{Mg}^{2+}$  should not be profoundly elevated ( $> 3.0\text{mmol/L}$ ) or lowered ( $< 0.5\text{mmol/L}$ ) from normal.
- Blood glucose should be between  $3.0-20\text{mmol/L}$  and should be tested prior to each brain stem test.
- If there is any clinical reason to expect endocrine disturbances then it is obligatory to ensure appropriate hormonal assays are undertaken.

### Brain Stem Function

- Pupils should be fixed in diameter and unresponsive to light.
- Nystagmus or any eye movement should not occur when each ear is instilled with 50mls of ice cold water. Each ear drum should be clearly visualised before the test.
- There should be no corneal reflex.
- There should be no spontaneous or reflex movement within the cranial nerve distribution. Reflex limb and trunk movements represent spinal reflexes and may still be present. The potential for these reflexes should be explained to relatives, partners, carers and other staff, so that they understand these reflexes do not represent residual brain-stem function.
- There should be no gag reflex following stimulation to the posterior pharynx or cough reflex following suction catheter passed into the trachea.

## Apnoea Test

- More detailed description of the apnoea test can be found in the reference below.
- End tidal carbon dioxide can be used to guide the starting of each apnoea test but should not replace the pre and post arterial  $\text{paCO}_2$ .
- Oxygenation and cardiovascular stability should be maintained through each apnoea test. To ensure oxygenation throughout the apnoea test  $\text{FiO}_2$  should be 1.0 and the patient should be pre-oxygenated for a minimum of 5 (five) minutes.
- Ensure the  $\text{paCO}_2 > 6.0$  KPa and the  $\text{pH} < 7.4$ . In patients with chronic  $\text{CO}_2$  retention, or those who have received intravenous bicarbonate, ensure the  $\text{paCO}_2 > 6.5$  KPa and the  $\text{pH} < 7.4$ .
- Disconnect the patient from the ventilator and administer oxygen via a catheter in the trachea at a rate of  $> 6\text{L/minute}$ . If oxygenation is a problem consider the use of a CPAP circuit.
- There should be no spontaneous respiration within 5 (five) minutes of disconnecting the ventilator. Intensive Care Society guidance is for 10 (ten) minutes and some clinicians may prefer to follow this guidance.
- At the conclusion of the 1<sup>st</sup> apnoea test a period of ventilation will be required to normalise parameters.

## Ancillary Investigations

- Ancillary investigations are not required for the diagnosis of death following irreversible cessation of brain-stem function. They may be useful however where neurological examination is not possible (*eg.* 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. 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 utility of each ancillary investigation is for the two testing doctors to decide. Some possible ancillary investigations are:
  - Rotation of the head to either side should not produce any eye movement (absent doll's eyes response). This should NOT be performed if there is suspected or possible cervical spine injury.
  - Administration of 2mg atropine should not lead to an increased heart rate ( $> 3\%$ ).
  - Neurophysiological demonstration of loss of bioelectrical activity in the brain (EEG, evoked potentials).
  - Radiological demonstration of absent cerebral blood flow or brain tissue perfusion (CT angiography, 4 vessel angiography, transcranial doppler). A guideline for 'Neuroimaging for ancillary testing in establishing the diagnosis of brain death' is available.

## Reference

- Academy of Medical Royal Colleges (2008) "A Code of Practice for the Diagnosis and Confirmation of Death"  
<http://www.aomrc.org.uk/aomrc/admin/reports/docs/DofD-final.pdf>
- Intensive Care Society (2005) "Guidelines for Adult Organ and Tissue Donation"  
[http://www.ics.ac.uk/intensive\\_care\\_professional/organ\\_and\\_tissue\\_donation\\_2005](http://www.ics.ac.uk/intensive_care_professional/organ_and_tissue_donation_2005)