Form for the Diagnosis of Death using Neurological Criteria in Children 2 months to 18 years* {short version}

*** midnight the day prior to the 18th birthday**

This form is consistent with and should be used in conjunction with, the AoMRC (2008) A Code of Practice for the Diagnosis and Confirmation of Death and has been endorsed for use by the following institutions: Faculty of Intensive Care Medicine, Intensive Care Society, Paediatric Intensive Care Society, the Royal College of Paediatrics and Child Health and National Organ Donation Committee: Paediatric Subgroup. Date for review: 1/5/2023

HOSPITAL ADDRESSOGRAPH or

Surname
First Name
Date of Birth
NHS/CHI number

Guidance Summary of the AoMRC and RCPCH Guidance

The diagnosis of death by neurological criteria should be made by at least two medical practitioners who have been registered for more than five years and are competent in the conduct and interpretation of brain-stem testing. One of the doctors should be a consultant, one of them should normally be a paediatrician or should have experience with children and one of them should not be primarily involved in the child's care.
Testing should be performed completely and successfully on two occasions with both doctors present. Doctor One may perform the tests while Doctor Two observes; this would constitute the first set. Roles may be reversed for the second set.

Diagnostic caution is advised in the following 'Red Flag' patient groups. (Based on the literature and unpublished case reports.)

1. Testing **<6 hours** of the loss of the last brain-stem reflex	4. Patients with **any neuromuscular disorders**	6. Prolonged **fentanyl** infusions
2. Testing **<24 hours** from the loss of last brain stem reflex where aetiology primarily anoxic damage	5. **Steroids** given in space occupying lesions such as abscesses	7. Aetiology **primarily** located to the **brain-stem or posterior fossa**
3. Hypothermia (24-hour observation period following re-warming to normothermia recommended).		

Evidence for Irreversible Brain Damage of Known Aetiology

- There should be no doubt that the child'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. **If in doubt wait and seek advice.**

Drugs

- The child should not have received any drugs that might be contributing to the unconsciousness, apnoea and loss of brain-stem reflexes (narcotics, hypnotics, sedatives or tranquillisers). Where there is any doubt specific drug levels should be carried out. Testing for DNC should not be carried out if midazolam level is > 10mcg/L, or thiopentone level is > 5mg/L. Alternatively consider ancillary investigations.
- There should be no residual effect from any neuromuscular blocking agents (atracurium, vecuronium or suxamethonium), consider the use of peripheral nerve stimulation.

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- Renal or hepatic impairment and immaturity may prolong metabolism / excretion of these drugs.

Temperature, Circulatory, Metabolic or Endocrine Disorders

- Prior to testing aim for: core temperature > 34°C, mean arterial pressure should be consistently maintained at age appropriate levels, and normal respiratory parameters *if possible* (PaCO2 < 6.0 kPa, PaO2 >10 kPa and pH 7.35 - 7.45). If prior to testing any cardiovascular or respiratory instability is present, exclude possibility that this is the cause of observed coma and apnoea. For infants/children with congenital cyanotic heart disease oxygen levels should be kept in their normal range.
- Serum Na^+ levels below 115 or above 160 mmol/l are associated with unresponsiveness. This should be borne in mind if the primary cause of unresponsiveness is uncertain. Testing for DNC should not be carried out if serum K^+ <2 mmol/L, or serum PO_4^{3-} and/or Mg^{2+} < 0.5 mmol/L or > 3.0 mmol/L as there may be associated severe neuromuscular weakness.
- Blood glucose should be between 3.0 - 20mmol/L before 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 Reflexes

- Pupils should be fixed in diameter and unresponsive to light.
- There should be no corneal (blink) reflex (care should be taken to avoid damage to cornea).
- Eye movement should not occur when each ear is instilled, over one minute, with 20 - 50mls of ice cold water, head flexed 30°. Each ear drum should be clearly visualised before the test.
- There should be no motor response within the cranial nerve or somatic distribution in response to supraorbital pressure. Reflex limb and trunk movements (spinal reflexes) may still be present.
- There should be no gag reflex following stimulation to the posterior pharynx or cough reflex following suction catheter placed down the trachea to the carina.

Apnoea Test

- End tidal carbon dioxide can be used to guide the starting of each apnoea test but should not replace the pre and post arterial $PaCO_2$.
- Oxygenation and cardiovascular stability should be maintained through each apnoea test.
- **Confirm $PaCO_2$ ≥6.0 kPa and pH <7.4.** In patients with chronic CO_2 retention, or those who have received intravenous bicarbonate, confirm $PaCO_2$ >6.5 kPa and the pH <7.4.
- Either use a CPAP circuit (e.g. Mapleson C or Ayres T piece) or disconnect the patient from the ventilator and administer oxygen via a catheter in the trachea at a rate of 2 - 6L/minute.
- There should be no spontaneous respiration within a minimum of 5 (five) minutes following disconnection from the ventilator.
- **Confirm that the $PaCO_2$ has increased from the starting level by more than 0.5 kPa.**
- At the conclusion of the apnoea test, manual recruitment manoeuvres should be carried out before resuming mechanical ventilation and ventilation parameters normalised.

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Ancillary Investigations

- Ancillary investigations are **NOT** required for the diagnosis and confirmation of death using neurological criteria. Any ancillary or confirmatory investigation should be considered **ADDITIONAL** to the fullest clinical testing and examination carried out to the best of the two doctors' capabilities in the given circumstances.

Organ Donation

- National professional guidance advocates the confirmation of death by neurological criteria wherever this seems a likely diagnosis and regardless of the likelihood of organ donation.
- NICE guidance and PICS Standards recommends that the specialist nurse for organ donation (SN-OD) should be notified at the point when the clinical team declare the intention to perform brain-stem death tests and this is supported by GMC guidance.

Further Reading

Academy of Medical Royal Colleges (2008) "A Code of Practice for the Diagnosis and Confirmation of Death" www.aomrc.org.uk

GMC (2010) "Treatment and care towards the end of life." www.gmc-uk.org

Heran et al (2008) "A review of ancillary tests in evaluating brain death." Can J Neurol Sci; 35:409–19

NICE (2011) "Organ Donation for Transplantation" www.nice.org.uk Report from the Organ Donation Taskforce (2008) "Organs for Transplant"

Paediatric Intensive Care Society (2014) "PICS Organ Donation Standards" http://picsociety.uk/resources/

Wijdicks E (2001) "The Diagnosis of Brain Death" NEJM 344:1215-21

A series of helpful education videos are available: https://www.odt.nhs.uk/deceased-donation/best-practice-guidance/donation-after-brainstem-death/diagnosing-death-using-neurological-criteria/

Form authorship and feedback

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RCPCH Endorsed
Royal College of Paediatrics and Child Health

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Primary Diagnosis:

Evidence for Irreversible Brain Damage of Known Aetiology:

Diagnostic caution is advised in certain 'Red Flag' patient groups. See Page 1 for details

Exclusion of Reversible Causes of Coma and Apnoea

	1st Test Dr One	1st Test Dr Two	2nd Test Dr One	2nd Test Dr Two
Is the coma due to depressant drugs? Drug Levels (if taken):	**Yes / No**	**Yes / No**	**Yes / No**	**Yes / No**
Is the core body temperature ≤ 34°C?	**Yes / No**	**Yes / No**	**Yes / No**	**Yes / No**
Is the coma due to a circulatory, metabolic or endocrine disorder?	**Yes / No**	**Yes / No**	**Yes / No**	**Yes / No**
Is the apnoea due to neuromuscular blocking agents, other drugs or a non brain-stem cause (*e.g.* cervical injury, any neuromuscular weakness)?	**Yes / No**	**Yes / No**	**Yes / No**	**Yes / No**

Tests for Absence of Brain-Stem Reflexes

	1st Test Dr One	1st Test Dr Two	2nd Test Dr One	2nd Test Dr Two
Do the pupils react to light?	**Yes / No**	**Yes / No**	**Yes / No**	**Yes / No**
Is there any eyelid movement when each cornea is touched in turn?	**Yes / No**	**Yes / No**	**Yes / No**	**Yes / No**
Is there any motor response when supraorbital pressure is applied?	**Yes / No**	**Yes / No**	**Yes / No**	**Yes / No**
Is the gag reflex present?	**Yes / No**	**Yes / No**	**Yes / No**	**Yes / No**
Is the cough reflex present?	**Yes / No**	**Yes / No**	**Yes / No**	**Yes / No**
Is there any eye movement during or following caloric testing in each ear?	**Yes / No**	**Yes / No**	**Yes / No**	**Yes / No**

Apnoea Test

	1st Test Dr One	1st Test Dr Two	2nd Test Dr One	2nd Test Dr Two

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Arterial Blood Gas pre-apnoea test check: (Starting $PaCO_2 \geq 6.0$ kPa and starting pH < 7.4)	**1st Test** **Starting $PaCO_2$:** **Starting pH:**		**2nd Test** **Starting $PaCO_2$:** **Starting pH:**	
Is there any spontaneous respiration within 5 (five) minutes following disconnection from the ventilator?	**Yes / No**	**Yes / No**	**Yes / No**	**Yes / No**
Arterial Blood Gas Result post apnoea test: $PaCO_2$ should rise > 0.5 kPa.	**1st Test Final $PaCO_2$:** ***Perform lung recruitment***		**2nd Test** **Final $PaCO_2$:** ***Perform lung recruitment***	

Document any Ancillary Investigations Used to Confirm the Diagnosis or any required Clinical Variance from AoMRC (2008) Guidance

Completion of Diagnosis		
Are you satisfied that death has been confirmed following the irreversible cessation of brain-stem function?	**YES / NO**	**YES / NO**
Legal time of death is when the 1st Test indicates death due to the absence of brain-stem reflexes. **Death is confirmed following the 2nd Test.**	**Date:** **Time:** **Dr One** **Name** **Grade** **GMC Number** **Signature** **Dr Two** **Name** **Grade** **GMC Number** **Signature**	**Date:** **Time:** **Dr One** **Name** **Grade** **GMC Number** **Signature** **Dr Two** **Name** **Grade** **GMC Number** **Signature**

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.