



Intensive Care Society

of Ireland

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Diagnosis of Brain Death in adults; Guidelines (2025)

Intensive Care Society of Ireland Working Group on Diagnosis of Brain Death

These Guidelines are based on our interpretation of the existing legal situation and 'custom and practice' in Ireland, on previously published Guidelines in Ireland and internationally, and on published literature in this area.



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Introduction

The concept of 'Brain Death' is ubiquitous in medical and lay literature. It is a recognition that some brain injured patients maintained on artificial ventilation have complete and permanent loss of brain function. Brain Death is now accepted as the legal equivalent of circulatory death, the usual criterion for certification that death has occurred.

The ability to certify Brain Death when there is permanent cessation of brainstem function enables specialists working in Intensive Care to withdraw mechanical ventilation on humanitarian, ethical and (coincidentally) utilitarian grounds.

There is no statutory law on this area in the Republic of Ireland but the legal system expects clinicians to comply with accepted medical practice, local and international. These updated ICSI Guidelines align with earlier Guidelines (the 1988 Irish Memorandum on Brain Death (1) and the 2020 ICSI Guidelines (2). There is widespread international consensus on the concept and diagnostic criteria for Brain Death (3-8) and these Irish Guidelines are aligned with this.

There are differences in terminology between the United Kingdom (which specifies 'brainstem death' as the criterion for determining death) and the United States, Australia and other countries which require 'death of the whole brain'. In practice the clinical tests to ascertain death are the same. The concept of "Death by neurological criteria" has emerged, which encompasses both approaches. For this review we will use the term 'Brain Death' which is more universally recognised.

In 2020 the World Brain Death Project was launched in an attempt to align the nomenclature and the criteria for defining brain death as widely as possible around the world (9). These revised Irish Guidelines are aligned with this Project and with recent changes in the UK.

Recent case reports have highlighted clinical scenarios where particular care must be taken to ensure the validity of the process to determine Brain Death. These 'Red Flag' scenarios are included in the text of this document and in the checklist form we recommend using for documentation of brainstem testing.

There is no documented case of an adult who has fulfilled the preconditions and the clinical criteria for diagnosis of Brain Death subsequently regaining consciousness (6,8).





Summary of significant changes in 2025 update of "Guidelines for the diagnosis of Brain Death"

Changes are listed in the order they arise in the text.

- 1. Organophosphates have been added to the list of toxins which must be ruled out as a possible cause of coma before testing for Brain Death.
- 2. The minimum temperature at which brainstem testing can be undertaken has increased from 35°C to 36°C .
- 3. The acceptable range for serum sodium for brainstem tests is 125-155 mmol/L.
- 4. The acceptable blood pressure for brainstem tests is 100mmHg systolic or 60mmHg mean arterial pressure (MAP)
- 5. The acceptable duration from loss of brainstem reflexes before formal testing is 6 hours.
- 6. If the cause of coma is hypoxic ischaemic encephalopathy (HIE), the minimum interval from return of circulation to brainstem testing is now 24 hours.
- 7. A list of 7 'Red Flag' scenarios highlights situations where there is a higher risk of confounding factors to be considered before diagnosing brain death.
- 8. CT angiography (CTA) has become widely accepted as an ancillary test to support clinical testing in determining brain death. A protocol is provided for undertaking CTA as an ancillary test.
- 9. The Guidelines emphasise the necessity to always undertake clinical tests for brain death, even when an ancillary test is used to confirm the diagnosis of brain death.
- 10. Guidance is provided on the determination of brain death in patients receiving extra-corporeal oxygenation.





Diagnosis of Brain Death by Clinical Criteria

Establishing a diagnosis of Brain Death in a comatose patient should proceed with certain principles in mind; (A) establish that coma is due to a condition which has caused permanent brain damage, (B) exclude reversible factors, (C) demonstrate the loss of all cranial nerve and brainstem responses which can be tested in coma.

Clinical tests to confirm a diagnosis of Brain Death must not be undertaken unless the preconditions in A) and B) above have first been fulfilled (unless an ancillary test will be used to confirm brain death).

A) Establish a clear diagnosis of the cause of death

A number of conditions which can cause the loss of brainstem reflexes are reversible e.g. Guillain Barré syndrome, brainstem encephalitis, etc. These must be excluded as the cause of coma.

The underlying neurological condition which caused severe brain injury must be diagnosed definitively and this must be clearly documented. If there is any doubt about the primary diagnosis, Brain Death cannot be diagnosed clinically.

There must be evidence of severe structural brain damage from CT scan, angiography or MRI scan. However radiological evidence of severe brain damage does not obviate the need to search for confounders and to test brainstem reflexes.

B) Exclude reversible causes of coma

(i) Sedative drugs:

If sedative drugs have been used, adequate time must be allowed for residual effects to have worn off. If sedatives have been used for a prolonged period or in large doses (e.g. with head injury management) it may be difficult to decide whether these are still contributing to the coma. Particular difficulty arises with highly lipid- soluble drugs like thiopentone. There are also concerns with drugs like midazolam or morphine; if these are used in large doses for prolonged periods; the plasma half-lives are likely to be considerably extended (i.e. the concept of context-sensitive half-life). Furthermore, these drugs produce metabolites with sedative effects.



The presence of sedative drugs may be excluded by history, examination of the medication sheet and a drug screen. Consideration should be given to

- The doses and the duration of infusion of sedative agents
- · Altered pharmacokinetics with very high doses
- The possibility of drug metabolites with sedative effects
- The effects of hypothermia; hypothermia significantly reduces sedative drug clearance and these effects persist after rewarming (10-12)
- The effects of renal or liver dysfunction on elimination of sedative agents

If administration of the antidotes naloxone or flumazenil led to a change in neurological examination, this would exclude a diagnosis of Brain Death. However, lack of response to the administration of antidotes does not exclude an effect from sedative agents. If neuromuscular blocking agents have been used, a nerve stimulator should be used to confirm full recovery.

Measurement of plasma concentrations of drugs should reveal drug concentrations below the therapeutic range. The median concentration of thiopentone permitting motor response is 12 mg/L (13) but there is considerable individual variation. We recommend thiopentone levels should be < 5 mg/L before brainstem tests, (unless an ancillary test will be used to confirm brain death) (14).

The exclusion of sedative agents as a contributing cause of coma requires considerable knowledge and experience. Ultimately clinicians must use their knowledge and judgement to decide. It may be helpful to get advice from an experienced Consultant in Intensive Care Medicine.

If there is any uncertainty regarding a possible confounding effect of a sedative drug then the preconditions are not met and a diagnosis of Brain Death cannot be made by clinical tests alone.

(ii) Poisoning and drug overdose:

Toxins, poisons and drug overdose (e.g. barbiturates, baclofen, amitriptyline, organophosphates, etc.) may cause coma; the possibility of this should be apparent from the history. Obtain a toxicology screen where appropriate (although this may be positive for opiates and benzodiazepines if these have been administered for therapeutic reasons). The blood alcohol level should be below the legal limit for driving before testing for Brain Death.

(iii) Hypothermia:

Core body temperature should be more than 36° C when clinical assessment of brain stem responses is carried out.



Hypothermia can lead to delayed neurological recovery and prolonged metabolism of sedative agents. Targeted temperature management aiming for a temperature of 36°C after cardiac arrest may lead to a delay in brainstem testing; if temperature has been < 36°C for more than 6 hours; this requires a delay of 24 hours after return to normothermia before undertaking clinical tests for Brain Death (7).

Therapeutic hypothermia to lower temperatures can lead to even more prolonged recovery. Return of motor responses may be delayed for up to 5 days after hypothermia to 32-34°C (10-12) which suggests that brain stem testing should be delayed for 5 days also, especially if large doses of sedative agents have been used.

(iv) Metabolic or endocrine causes that may contribute to coma must be excluded. Hypothyroidism, panhypopituitarism, adrenal dysfunction, renal failure and hepatic failure can lead to a profound decrease in the level of consciousness.

The commonest metabolic abnormality in brain dead patients is hypernatraemia, often related to diabetes insipidus. Serum sodium should not be grossly abnormal; we recommend 125-155 mmol/L as the acceptable limits for brain stem testing. Similarly, blood glucose, phosphate and magnesium levels of other electrolytes should not be grossly deranged; ensure blood glucose is 3.0-20.0 mmol/L, phosphate 0.5-3.0 mmol/L, magnesium 0.5-3.0 mmol/L,

(v) Severe hypotension precludes testing of brain stem reflexes. Blood pressure should be greater than 100mmHg systolic (or MAP > 60mmHg) for brain stem tests. Infusion of fluid and vasoactive drugs may be needed to maintain blood pressure.

The diagnosis of Brain Death sometimes requires complex clinical judgement. In complicated cases and especially if a practitioner does not undertake Brain Death testing often, we suggest getting advice from a Consultant in Intensive Care Medicine who undertakes the diagnosis of Brain Death on a regular basis.

If the preconditions above cannot be complied with, then clinical testing alone cannot be relied on to confirm Brain Death However, demonstration of absence of cerebral blood flow when combined with clinical testing may be used to reach a diagnosis of Brain Death (see 'Ancillary tests 'below).

C) Test formally for motor responses and brainstem reflexes

Observation period.

The first formal examination can be undertaken when the patient fulfils the pre-conditions in A) and B) and cranial nerve and brainstem responses have been absent for at least 6 hours (i.e. pupils unreactive, no cough and no apparent respiratory effort). If the cause of coma is hypoxic-ischaemic



encephalopathy (after cardiac arrest or severe hypoxia), brainstem testing should not be undertaken until at least 24 hours after the return of circulation.

(See the list of 'Red Flags' for other situations where testing should be delayed for at least 24 hours).

Who should do the clinical tests?

A full set of tests must be undertaken separately by two different doctors; of whom at least one is a hospital consultant, the other must have been fully registered for at least 5 years.

Both should be engaged in acute hospital care and have expertise in testing for Brain Death. If organ donation is being considered, the doctors undertaking tests for Brain Death should not be involved in the transplantation procedure.

Other staff may observe, for training purposes and to gain an insight into the concept of Brain Death.

Brainstem Tests 1.

All the neurological responses below (A to H) must be absent for a diagnosis of brain death to be made:

- A. **Motor response**. Look for a motor response of face or limbs in response to painful stimulation within the trigeminal nerve distribution. Absent response to a painful stimulus applied peripherally could be the result of a high cervical injury, thus stimulation must always be performed within the distribution of the trigeminal nerve. Stimulation can be applied by pressure on the supraorbital notch or at the level of the temporomandibular joint.
- B. **Pupillary response** to light. A history of pre-existing abnormalities of the pupil or previous surgery to the eye (e.g. iridectomy) may influence interpretation of this test. Examine each eye with dimmed light in the room and use a strong light. The normal response is brisk constriction of the pupil. Round, oval or irregularly shaped pupils are compatible with Brain Death. In most brain-dead patients, pupils are in the mid position (4-6mm).
- C. **Corneal reflex.** Touch the cornea with a wisp of cotton wool and look for blinking. If this fails to elicit a response a stronger stimulus is applied with for example, firm direct pressure with a sterile throat swab. Blinking of the eyelids is the normal response and both eyelids must be observed.
- D. Oculovestibular reflex (caloric testing). Inspect both ears using an auroscope to confirm that the tympanic membrane is intact and the external auditory canal is not obstructed by wax or other material. A fractured base of skull resulting in blood, CSF or brain tissue in the external auditory canal is a contra-indication to performing the test on that ear. The patient's head is placed in the midline and elevated 30° from the supine position. This ensures that the lateral semi-circular canal is vertical, maximising the response. A soft catheter is introduced into the external auditory canal for gentle, slow irrigation with at least 50ml of iced water while the eyes are held open by an assistant. The eyes should be observed for a minute after irrigation is completed.



In an unconscious patient, an intact oculovestibular reflex causes slow deviation of the eyes towards the irrigated ear. Any movement of one or both eyes, whether conjugate or not, excludes a diagnosis of Brain Death. When the reflex is absent the eyes remain fixed.

E) Oculocephalic reflex (Doll's eye phenomenon). The examiner holds the patient's eyes open and the head is turned suddenly from the middle position to the side. When the reflex is intact the eyes turn contrary to the side of head movement as if lagging behind. The reflex is absent when the eyes move with the head and do not move within the orbit.

If Test (D) above can be performed this test may be omitted as both tests assess the same neurological pathway. This test must not be performed in patients with an unstable cervical spine injury.

- **F) Pharyngeal (gag) reflex.** A tongue depressor is used to stimulate each side of the oropharynx and the patient observed with a torch for any pharyngeal or palatal movement.
- **G)** Laryngeal (cough) reflex. A suction catheter is introduced into the endotracheal or tracheostomy tube far enough to stimulate the carina. The patient is observed for any cough response or movement of the chest or diaphragm.
- **H) Apnoea testing**. This test is an essential part of the diagnosis of Brain Death. It should be undertaken when all other brain-stem reflexes are found to be absent.

The three components of the apnoea test are:

- Disconnection from mechanical ventilation for long enough to allow arterial CO2 tension to reach a critical point (with a resultant respiratory acidaemia).
- Prevention of hypoxaemia during this period.
- Assessment for spontaneous respiratory efforts during this period.

Ventilate the patient with 100% oxygen before the test to ensure maximal oxygenation. Check the patient's arterial blood gases. If the PaCO₂ is outside normal limits, adjust the ventilator to achieve a normal PaCO₂ for that patient (normally 4.8-5.8 kPa). Disconnect the ventilator (as connection to the ventilator can lead to artefactual detection of breathing by the ventilator due to the cardiac impulse). Deliver oxygen at 7 litres/min via C-circuit with-the valve fully open (a Valsalva effect may occur if the expiratory valve is fully closed). An appropriate CPAP valve can be attached to keep the airways open and optimise oxygenation if necessary. A CPAP valve may also prevent atelectasis and improve the condition of the lungs for subsequent transplantation.



Delivering oxygen via a narrow suction catheter inserted into the tracheal tube is no longer recommended due to the loss of positive airways pressure associated with this technique and conversely the risk of barotrauma or Valsalva effect if airway pressures are too high (15).

Inspection of the reservoir bag of the breathing circuit will enable monitoring of respiration; visual inspection for chest and abdominal movement is also required. Visual inspection of the chest and abdomen may show minimal movement synchronous with heart beat. Arterial blood gases are checked until the PaCO₂ increases to 8.0 kPa or higher and associated acidaemia has developed (pH<7.30). Occasionally it takes more than 10 minutes for the required changes in PaCO₂ and pH. Using lower flows of supplemental oxygen will shorten the time required for PaCO₂ to reach 8.0kPa.

If, despite hypercarbia and acidaemia, there is no attempt at spontaneous respiration, the test is consistent with Brain Death.

If the patient has a history of chronic respiratory disease, allowance must be made for decreased sensitivity to a high PaCO₂. During the apnoea test, the arterial PaCO₂ should be allowed increase to 2.7kPa above their baseline (if known).

The apnoea test may lead to instability in the patient's condition and cardiac arrests have occurred during this procedure. Maintain oxygen saturation levels within the normal range with application of CPAP or delivery of 1 - 2 breaths if patient desaturates. If hypotension occurs, vasopressors may need to be increased.

It may not be possible to undertake apnoea testing in patients with a high cervical cord injury or in patients with poor gas exchange. In such patients, determination of Brain Death by clinical tests alone will not be possible and additional ancillary tests (e.g. cerebral angiography) will be needed to confirm Brain Death (see below).

More detailed descriptions of the clinical tests of brainstem function are available if required (7).





Observations Compatible with a Diagnosis of Brain Death:

Spinal reflexes (16-18)

These movements result from spinal cord activity which can persist despite Brain Death. Spinal reflexes have been consistently documented in patients who fulfil clinical criteria for Brain Death confirmed by absent intracranial blood flow. Movements may be spontaneous or elicited by stimulation and include the following:

- extension or flexion of the arms,
- · leg movements,
- head rotation
- movement of the body towards sitting up, sometimes as much as 40-50° (Lazarus sign).
- sweating
- blushing
- tachycardia

Some patients may fulfil the clinical criteria for Brain Death but preserve some homeostatic functions of the brain e.g. pituitary function, vasomotor function. The concept of 'Death by Neurological Criteria' is a useful way of accommodating the finding of preservation of primitive brain functions within the definition of 'Brain Death'.

Observations incompatible with a Diagnosis of Brain Death:

- Decerebrate or decorticate posturing
- Facial movement
- Seizures

The apnoea test is the final test to be done. If the other tests show no evidence of brainstem function and if there is no ventilatory response during the apnoea test, these combined findings confirm the absence of brainstem reflexes.

Brainstem Tests 2

A second clinician must repeat the entire process described in (A), (B) and (C) above. A 'reasonable' period of time should intervene between the two sets of tests (although no specific minimum time period has been recommended).

Declaration of death.

If the preconditions for a clinical diagnosis of Brain Death have been satisfied and the second set of brainstem tests again demonstrate the absence of cranial nerve responses or brainstem reflexes, this confirms Brain Death,

One of the clinicians who undertook the clinical tests should formally document that the findings of two sets of brainstem tests are diagnostic of Brain Death. The time at which the clinician confirms this diagnosis is the official time of death.



Documentation

Many ICUs use a checklist to be completed by the two clinicians undertaking tests. An example in Appendix 2 is recommended.

The findings of each of the formal sets of tests should be fully documented, ideally in checklist form and also summarised in the medical records. If both sets of tests show no evidence of brainstem function and the preconditions for a clinical diagnosis of Brain Death are satisfied, Brain Death is diagnosed and documented.

When a diagnosis of Brain Death is not possible using clinical criteria alone:

The internationally accepted standard for diagnosis of Brain Death is by clinical testing after the preconditions have been fulfilled. However, issues requiring clinical judgement often arise. Clinicians must use their clinical judgement in conjunction with the formal Guidelines to judge whether the preconditions are fulfilled and whether sufficient brainstem tests have been performed to be able to diagnose Brain Death clinically.

Severe head and facial injuries can make it impossible to test all the brainstem reflexes. Periorbital swelling or direct eye injury may affect the ability to test pupillary and corneal reflexes. CSF otorrhoea or occlusion of the external auditory canal may preclude caloric testing of the oculovestibular reflex. Lesions of the cervical cord, severe respiratory disease and other conditions may preclude apnoea testing.

There are differences between International Guidelines as to the minimum number of brainstem reflexes that must be tested. Apnoea testing is essential and we recommend that you should be able to test both eyes and at least one ear. (6)

Recent case reports have highlighted scenarios where there is particular concern about relying on clinical brainstem tests alone to make a diagnosis. These clinical scenarios have been characterised as 'Red Flags' situations where either clinical brainstem testing should be delayed for a longer period after the disappearance of obvious brainstem reflexes or a confirmatory or ancillary test should be used. In all cases there should be radiological evidence of severe structural brain damage.



RED FLAGS

- 1) Patients with a neuromuscular disorder
- 2) Prolonged fentanyl infusions
- 3) If the mechanism of brain damage is primarily hypoxic-ischaemic injury, delay testing until at least 24 hours after the loss of brain-stem reflexes.
- 4) If brain pathology is primarily located in the brain-stem or posterior fossa; require CT evidence of extensive brain injury in the anterior cerebral circulation also.



- 5) Therapeutic decompressive craniectomy; allow at least 24 hours for a benefit to become apparent.
- 6) If steroids were given for space occupying lesions such as abscess or tumour; delay testing 24 hours for benefit to become apparent.
- 7) Hypothermia; if temperature was less than 36°C for more than 6 hours, allow 24 hours with temperature above 36°C before brainstem testing.

If the clinician is not fully confident that clinical tests allow the diagnosis to be made, Brain Death cannot be diagnosed through clinical tests alone. However, the diagnosis of Brain Death is still possible if ancillary tests are used to supplement the findings of the clinical tests that were undertaken.





Ancillary tests for diagnosis of Brain Death

Ancillary tests can be used to support the diagnosis of brain death if the preconditions for brainstem testing are not fulfilled or if clinical tests cannot be completed fully. Tests to support the findings of clinical tests for Brain Death rely on demonstrating the absence of parenchymal blood flow in the brain.

1) Four vessel cerebral angiography that demonstrates the absence of intracranial blood flow is the 'gold-standard' ancillary test to diagnose Brain Death (6-9). There is a detailed description in the ANZICS guidelines (6).

This aid to diagnosis of Brain Death is only possible in specialist centres where cerebral angiography is available.

- 2) CT angiography (CTA) is more widely available and is now generally accepted as an ancillary test to confirm brain death. (6-8). A formal protocol for the use of CTA as an ancillary test with a detailed description is provided in Appendix 1. Clinicians relying on CTA must be personally satisfied with its reliability as an ancillary test and ensure there is verification from an experienced radiologist that the CTA study confirms the absence of blood flow in the brain.
- **3) EEG, MRI and Transcranial Doppler** are not currently recommended as reliable tests to confirm a diagnosis of Brain Death.

International guidelines agree that ancillary tests should always be used as a supplement to clinical tests to diagnose Brain Death, NOT as stand-alone tests. When ancillary tests are required, death cannot be diagnosed until (i) the clinical tests indicate loss of brainstem reflexes and (ii) the ancillary radiological test has demonstrated the absence of cerebral blood flow as assessed by the radiologist.

At this point, one of the clinicians who undertook clinical tests can confirm that the findings of two sets of clinical tests and of the ancillary test are diagnostic of Brain Death; this is the official time of death. Documentation of the findings should include details of the ancillary test used.



Brain Death during pregnancy

The approach to the diagnosis of Brain Death in pregnancy is the same as in any other adult. Concerns may be expressed about the impact of apnoea testing on the fetus. Changes in maternal and fetal acid-base relationship during apnoea testing have not been subject to clinical trials. However, numerous reports of mechanical ventilation in ARDS and acute severe asthma in pregnancy and experience during the COVID-19 pandemic suggest that maternal hypercapnia is tolerated by the fetus with ultimate good outcomes provided hypoxaemia is avoided (22-23). International Brain Death guidelines adopt the same approach to the diagnosis of Brain Death in pregnancy as for other adult patients (8-9).

Continuation of maternal organ support after the diagnosis of brain death requires consideration. The international literature has documented cases of Brain Death during pregnancy which, with extended somatic support, resulted in viable fetal outcomes (24).

Decisions regarding continuation of maternal organ support are determined by three central assessments:

- (i) What is the appropriate gestation for delivery of the fetus which balances optimal neonatal outcomes against prolonged maternal organ support? The threshold for fetal viability is currently considered to be 23 weeks' gestation. However, the question of viability should be considered by obstetricians and neonatologists on a case-by-case basis and informed by changes in practice and outcomes.
- (ii) Can organ support be provided in an effective and dignified manner until the optimal time of delivery?
 This is also assessed case-by-case, depending on the etiology of brain death and the physiological responses of the mother to brain death and subsequent clinical events (e.g. acquired infection or other complications).
- (iii) What are the known or presumed wishes of the patient and the wishes of the patient's family and surrogate decision makers?

A multidisciplinary team (MDT) from intensive care medicine, obstetrics and neonatology should define for the family the factors influencing continuation of organ support. Normally a consensus will be reached with the family in keeping with the interests of the fetus and the likely wishes of the mother. On rare occasions, where a family's wishes are not aligned with the MDT consensus on the fetal interests, expert legal interpretation may be necessary to clarify the status and rights of the fetus (25-27).

Brain Death Determination and ECMO:

The principles and practice guidelines for determination of brain death are unchanged for patients receiving extracorporeal membrane oxygenation (ECMO). Guidance with regard to apnoea testing is available (8-9).



Communication, organ donation and end-of-life care

Family should be made aware that tests are being undertaken to diagnose death. An outline of the process including the need for two separate sets of tests and two separate doctors should be explained in advance. The findings should be communicated after each set of tests including the definitive diagnosis of death after the second set.

Occasionally families may request being present during brainstem testing. This may be helpful for families and may help acceptance of the concept of brain death if they have reservations. It is advisable to have them present during the second set of tests to allow them be forewarned if there were spinal reflex movements or if significant hypoxemia occurred during the first set of tests.

The diagnosis of Brain Death provides the opportunity for families to consider organ donation. If the second set of clinical tests result in the diagnosis of Brain Death the family should be sensitively informed that this opportunity arises. Sometimes families ask about organ donation at an earlier stage and it is reasonable to convey that if Brain Death is diagnosed, organ donation will be fully discussed with them. Organ Donation Clinical Nurse Managers and / or Clinical Leads in Organ Donation can help with these conversations.

For many patients in whom Brain Death is diagnosed, the circumstances make it mandatory to report the death to the Coroner (as per Coroner's Guidelines). If the case is reportable to the Coroner, his/her permission is required for organ retrieval for transplantation. The Coroner normally grants permission for this; however he/she may place limitations on organ retrieval. Families should be advised of the role of the Coroner in these cases.

Organ donation and End-of-Life

Clinical Leads in Organ Donation and the Organ Donor Nurse Managers are available in hospital groups to discuss and facilitate organ donation as required. They are available to provide support to families and give further information that may be required by medical or nursing staff.

The National Organ Procurement Service (NOPS) operating through Organ Donation Transplant Ireland. have specialist organ donor coordinators on call to accept referrals**. NOPS provides a 24-hour service, planning and arranging transplantation, liaising with medical teams and supporting the patient's family. Further information re organ donation is available on the HSE website***

The Joint faculty of Intensive Care Medicine of Ireland runs an annual one-day Irish Donor Awareness Programme (IDAP) as part of the required training of Intensive Care Medicine trainees and as a

^{** 1800-100-016}

^{***} https://www.hse.ie/eng/about/who/acute-hospitals-division/organ-donation-transplant-ireland/



Continuing Professional Development opportunity for Consultants or others. This Programme includes training in the diagnosis of Brain Death.

If organ donation is not to take place, a time should be set to withdraw organ supports. Most families prefer to be in attendance when the final cessation of circulation occurs; they should be advised that it may be 10 - 20 minutes after the ventilator is stopped before this happens. Privacy and religious or other ceremonies should be facilitated as much as possible during this time.





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APPENDICES



Appendix 1: CT Angiography Technique for confirmation of brain death

The scan should be performed according to the standard protocol for multiphase CT angiography (CTA) for acute stroke, with modifications for field of view and phases as described below

- The patient should have an 18g (or larger) canula sited in a large peripheral vein.
- Immediately prior to scanning, a mean arterial pressure above 60mmHg (or age- appropriate parameters in paediatrics) should be confirmed and documented.
- The first scan is acquired before the injection of contrast. (120 ml in adults, 1-2 ml/kg in paediatrics)
- The second scan is acquired at 20 seconds after commencing the contrast injection.
- The third scan is acquired at 60 seconds after commencing the contrast injection.
- Images are acquired with a section thickness of ≤ 1.25 mm or less at 120 kV, 250 mm field of view, and 512 x 512 matrix.
- Images must be clearly labelled as to whether they are the pre-contrast, 20 second or 60 second runs.
- The localisation images (including the scanned range) should be saved and included in the image set sent to the picture archiving and communication system.

CTA radiological criteria for supporting a clinical diagnosis of Brain Death

- The pre-injection acquisition is inspected for any pre-existing vascular density which could confound interpretation, such as recent previous contrast enhanced imaging study, thrombus or calcifications.
- Opacification of superficial temporal arteries is assessed on the second acquisition at 20 seconds to confirm the correct injection of contrast medium.
- The third acquisition at 60 seconds is used to evaluate opacification of intracranial vessels at 4 anatomical locations:
 - (i) cortical segments (M4) of the left middle cerebral artery
 - (ii) cortical segments (M4) of the right middle cerebral artery
 - (iii) left internal cerebral vein; and
 - (iv) right internal cerebral vein.
- A clinical diagnosis of brain death cannot be supported if the CTA demonstrates contrast opacification in any one of the 4 vessels specified above.
- The Report must be provided by a Consultant Radiologist with adequate expertise in reporting CTAs. A written Report of the CTA by the Consultant Radiologist must be available either in the chart or on the formal Radiology reporting system. The Report should document the absence (or otherwise) of significant intra-cranial blood flow.
- The radiological findings alone are not sufficient for a definitive diagnosis of brain death as clinical testing showing absence of all brain stem reflexes is also required.
- The findings of the CTA, combined with the findings of clinical brainstem testing may allow the doctors undertaking brainstem testing to diagnose brain death (i.e. death by neurological criteria).



CTA radiological criteria for supporting a clinical diagnosis of Brain Death

- The pre-injection acquisition is inspected for any pre-existing vascular density which could confound interpretation, such as recent previous contrast enhanced imaging study, thrombus or calcifications.
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- The findings of the CTA, combined with the findings of clinical brainstem testing may allow the
 doctors undertaking brainstem testing to diagnose brain death (i.e. death by neurological
 criteria).



Appendix 2; Checklist for documentation of Brain Death (ICSI 2025)					
Name:	Cause of coma	a:			
Address					
Date of birth MRN					
Adequate observation period; Is cause of coma irreversible? Severe brain damage on neuroimaging;	Yes No Yes No Yes No				
Preconditions; could apnoeic coma be du	ie to any of the following?				
Sedative drugs? Neuromuscular blockade? Hypothermia? Metabolic causes? Endocrine disturbance? Sedative drugs? Other 'confounder'? (see Guidelines for details of other poten	Assessor A Yes No Yes Yes No Yes Yes No Yes Yes No Yes	Assessor B Yes No Yes			
If preconditions are not fulfilled, an ancill required (in addition to the clinical tests) In all patients there must be a clear diagr	, to allow a diagnosis of brai	n death.			
CLINICAL TESTS OF BRAIN STEM FUNCTION					
Motor response to painful stimulus in cranial N distribution? Do pupils react to light? Are corneal reflexes present? Do eyes deviate on caloric testing? Is there a gag reflex? Is there a cough reflex? Apnoea test; PaCO ₂ pH Respiratory movements?	Yes □ No □ Pre Post Yes □ No □	Assessor B Yes No Yes			
Date / time of tests: Name, IMC no Grade Signature Do the clinical tests alone confirm brain of preconditions not met, was an ancillary Did ancillary test demonstrate absent into	test undertaken?	Assessor B			
Confirmation of brain death					
Date / time of death					
Name / IMC no Signature Signature					
Outcome of tests to be documented in cl	inical notes also, with time a	nd date of confirmation of death			



Page 2 of Checklist form for Brainstem Testing



RED FLAGS

The situations listed below require particular care to ensure all preconditions are fulfilled, including radiological evidence of severe structural brain damage. If there are any doubts, an ancillary test is required for confirmation of brain death.

- 1) Patients with a neuromuscular disorder
- 2) Prolonged fentanyl infusions
- 3) If the mechanism of brain damage is primarily hypoxic-ischaemic injury, delay testing until at least 24 hours after the loss of brain-stem reflexes.
- 4) If brain pathology is primarily located in the brain-stem or posterior fossa; require CT evidence of extensive brain injury in the anterior cerebral circulation also.
- 5) Therapeutic decompressive craniectomy; allow at least 24 hours for a benefit to become apparent.
- 6) If steroids were given for space occupying lesions such as abscess or tumour; delay testing 24 hours for benefit to become apparent.
- 7) Hypothermia; if temperature was less than 36°C for more than 6 hours, allow 24 hours with temperature above 36°C before brainstem testing.



Appendix 3

ICSI Working Group on Diagnosis of Brain Death

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