Document Type: Policy	**Ref No:** HRS/HPSD/BDD/3/2021	**Version Number:** 3
Document Title: Brain Death Determination	**Issue Date:** 18/07/2021	**Effective Date:** 18/07/2021
Ownership: Health Policies and Standards Department, Dubai Healthcare Corporation		
Applicability: Hospitals licensed under the jurisdiction of Dubai Health Authority		

1. Purpose:

1.1. To align with the Dubai Health Authority (DHA) vision, mission and strategic objective,

1.2. To improve the diagnosis and reporting of brain death.

1.3. To ensure the diagnosis of brain death has been carried out as per worldwide standards and international best practices.

1.4. To ensure all health facilities comply with the United Arab Emirates (UAE) federal laws, regulations and Dubai Health Authority (DHA) policy for brain death.

1.5. To facilitate the diagnosis of brain death by the following DHA licensed physicians.

1.6. To support the organ transplantation at the national level.

2. Scope:

2.1. Assessment and determination of brain death for individuals suspected to be brain dead.

2.2. Selection of organ donation candidates.

3. Definitions and Abbreviations:

Brain death: Irreversible cessation of all functions of the brain, including the brain stem.

Brain Death by neurological criteria: is defined as the irreversible loss of the capacity for consciousness combined with the irreversible loss of all brain and brainstem functions, including the capacity to breathe. Brain Death determined by neurological criteria is equivalent to the death of the individual, even though the heart continues to beat and spinal cord functions may persist.

Coma: The absence of any cerebrally mediated response to noxious stimuli including pain in all extremities (nail-bed pressure) and in the head (e.g. supraorbital or temporo-mandibular joint pressure). "Spinal" reflexes are consistent with brain death, but decorticate and decerebrate posturing are not.

Grandfathering: is an external competent entity, which shall oversee and support a health facility to meet the requirements in certain services.

Next of kin: refers to a person who is authorized to make decision on behalf of the patient (In case the patient is incompetent). Next of kin may include relatives up to the forth degree. In case relatives up to the forth degree are not available, then relatives available from the same origin of the spouse's side will be considered as a next of kin.

Organ Donation Unit: a 24/7 operating unit within the hospital responsible for all organ donation matters, ran by a director of the unit and a unit coordinator/s.

Organ Donation Unit Director: an ICU intensivist that leads the Organ Donation Unit including all standard operation procedures required for the unit, supervise organ donation unit team, and oversees implementation of all steps of organ donation process.

Organ Donation Coordinator: Person responsible for ensuring all communications between the unit,

DHA and the National Organ Transplant Team are done on timely manner to facilitate organ donation and transplant.

Potential Deceased Brain Death (DBD) Donor: A person whose clinical condition is suspected to fulfill death by neurological criteria.

Specialist: A health professional licensed by Dubai Health Authority and qualified as per the Unified Pre-Qualification Requirements for the United Arab Emirate.

DHA: Dubai Health Authority.

EEG: Electroencephalogram.

EOTC: Emirate Organ Transplant Center.

MRP: Most Responsible Physician.

HF: Health Facility.

MD: Medical Director.

ODU: Organ Donation Unit.

ODUC: Organ Donation Unit Coordinator.

4. Policy Statement:

4.1. All DHA licensed hospitals shall have an internal policy and procedure in place that aligns with its content.

4.1.1. Hospitals shall ensure that all ICU staff are aware of this policy.

4.1.2. Hospitals shall ensure that all ICU staff received appropriate training on the organ donation program process and requirements.

a. Staff training shall be documented and up to date.

4.1.3. All Hospitals should have an Organ Donation Unit team that fulfils the requirements set out

in this policy.

4.2. The minimum following DHA licensed Healthcare Professionals can perform brain functions assessment:

4.2.1. Critical Care Specialist (Adult or Pediatric).

4.2.2. Neurology Specialist (Adult or Pediatric).

4.2.3. Neurosurgery Specialist.

4.2.4. Internal Medicine Specialist.

4.2.5. Anesthesia Specialist (Adult or Paediatric).

4.2.6. Pediatric Specialist.

4.3. The listed physicians in point 4.2, must be privileged by the Medical Director of the Health Facility to perform brain functions assessment.

4.4. If the number of physicians permitted to determine the brain death is less than three, a grandfathering approach shall be adopted.

4.4.1. Grandfathering shall only be undertaken once both hospitals have signed a memorandum of Understanding.

4.4.2. The nominated hospital to perform grandfathering shall have sufficient and competent privileged physicians who are licensed by DHA or another competent health regulator in the UAE.

4.4.3. Grandfathering shall be free from any conflicts of interest that may affect the determination of brain death.

4.5. The hospital shall ensure it has in place an active morbidity and mortality committee supported by written terms of reference.

4.5.1. The hospital morbidity and mortality committee shall maintain a register of the names of the physicians involved in brain death assessment and diagnosis.

4.5.2. The hospital morbidity and mortality committee shall review the brain dead determined cases, assessment and management.

4.6. The three essential findings in brain death are coma, absence of brainstem reflexes, and apnea.

4.7. Two clinical brainstem assessments, separated by age-defined intervals (see below), shall be carried out, in addition to one of the ancillary tests, before apnea test is performed as per the Ministerial Decision No. (550) of 2017. (**Appendix 1**).

4.7.1. For adults, 1 EEG is required.

4.7.2. For infants aged 7 days to 60 days: 2 EEGs separated by 48 hours are required

4.7.3. For infants aged more than 60 days to 1 year: 2 EEGs separated by 24 hours are required

4.7.4. For children older than 1 year, 1 EEG is required.

4.8. Determination of brain death shall be performed by a minimum of three DHA licensed physicians as per point 4.2 in this policy.

4.8.1. One of the three physicians shall Neuroscience Physician (Neurology/Neurosurgery).

4.8.2. Apnoea test shall be conducted once by two physicians after the second assessment and ancillary test(s).

4.9.Organ transplant physicians and transplant surgeons are not permitted to perform the brain functions assessment.

4.9.1. The ICU physicians shall intensify the management of saving the organs during the critical period of diagnosis the brain death until the discussion about the possible organ donation with the guardian or custodian in accordance with the provisions of Federal Law No. (5) of

2016 Regulating The Transfer and Transplantation of Human Organs and Tissues and Cabinet Resolution No. (25) of 2020.

4.10. The ICU physicians shall notify the brain death cases within 24hrs to the National Organ Transplantation team in order to encourage organ transplantation in the UAE and initiate the process.

4.11. All ICUs in hospitals are requested to report any potential or confirmed brain death cases.

4.11.1. The individual of any age who meets the following criteria for being a potential deceased brain death (DBD) donor:

a. Requires mechanical ventilation

b. Has experienced a severe neurological insult (post resuscitation, cerebral anoxia, CVA, cerebral haemorrhage, encephalopathy, traumatic brain injury, sedated; and

i. Glasgow Coma Scale of <8; notify DHA Organ Donation Coordinator via email and phone call using the referral form of Potential Deceased Brain Death (DBD) Donor (**Appendix 5**).

ii. Glasgow Coma Scale of <5; refer to the National Organ Transplantation team via phone call and an e-mail using the referral form of Potential Deceased Brain Death (DBD) Donor (**Appendix 5**).

4.11.2. The hospital administration shall facilitate the reassessment of the brain dead patient by the National Organ Transplantation team.

4.11.3. The DHA Organ Donation Unit shall ensure a proper communication between the health facilities, DHA and the National Organ Transplant Team, and shall maintain a donor registry of all Potential Deceased Brain Death (DBD) Donor referred by the health facilities to DHA

and EOTC.

4.12. Preconditions for Brain Death Assessment:

4.12.1. Prior to requesting the assessment, the Most Responsible Physician (MRP), or his/her deputy, shall ensure that all of the pre-assessment conditions are met. The pre-assessment conditions are:

a. The patient is in a state of deep coma due to a known reason.

b. At least six hours have lapsed since the event leading to coma.

c. The patient should not be under the influence of any sedatives, anxiolytics, hypnotics, Narcotics, muscle relaxants, central nervous system depressants or anti-depressants.

i. If the history is positive for ingestion/administration of any of above agents, then the influence of such agents should be excluded either by a laboratory test or awaiting five half-lives from the last time an agent was ingested/administered, before brain functions assessment can be done. (**Appendix 6**)

d. The patient does not exhibit any spontaneous motor activity.

e. The patient is not in a cardiovascular shock.

f. The temperature internal body temperature should be at least 36 C.

g. The patient is dependent on mechanical ventilation and cannot trigger spontaneous ventilation.

h. Biochemical tests does not indicate significant metabolic or hormonal derangements.

i. The most responsible physician (MRP), or his/her deputy, has informed the guardian or custodian about the assessment and the consequences of confirming brain death.

j. The consent of the guardian or custodian is not required to perform the assessment.

k. The MRP, or his/her deputy, shall make the request for assessment by filling and signing the brain functions assessment form (**Appendix 1**).

4.13. Brain Death Assessment:

4.13.1. The MRP shall sign the assessment form (**Appendix 1**), and hand it to the assessing physicians.

4.13.2. The clinical assessments should be performed as per below table after the specified monitoring period by the protocol is met and the result of the tests shall be recorded on the document of brain death by the assessing physicians.

4.13.3. The required interval between the first and second clinical assessment are mentioned in (**Appendix 1**).

4.14. Diagnosing brain Death Using Brain Criteria:

4.14.1. For Brain Death Assessment, the following shall be undertaken.

a. A clinical assessment shall be carried out as per the Ministerial Decision No. (550) of 2017.

b. The examining physician shall sign the first assessment and conduct the second assessment after the specified period of observation and then sign the second assessment.

4.15. Brain death declaration:

4.15.1. Upon completion of the assessment form (all the tests in the assessment form and/or the ancillary tests confirm brain death), the final brain death declaration shall be signed by:

a. A minimum of three specialists' physicians who are satisfied with the completeness of the brain functions assessment and that all tests confirm brain death.

b. The assessment form and the brain death declaration shall be uploaded into the hospital patient health record, regardless of the results.

c. The hospital health information management section shall keep all the forms and notifications, and maintain a registry (regardless of the results).

4.16. Consequent to brain death:

4.16.1. After the brain death determined by neurological criteria is duly signed, the MRP, or his deputy, should inform the guardian or custodian about the brain death and the consequences.

4.16.2. If the deceased meets the criteria for organ donation, as set by the UAE national organ transplant protocol, then the transplant coordinator should be informed for the necessary actions as per the organ transplant program (**Appendix 2, 3**).

4.16.3. If the deceased doesn't meet the criteria for organ donation or the guardian or custodian doesn't approve the organ transplantation, then life sustaining equipment is withdrawn, in compliance with Article No. (10) point 2 of the UAE Federal Decree Law No. (4) of 2016 on Medical Liability.

4.16.4. The guardian or custodian shall be informed about the diagnosis of brain death.

a. If the patient is not a registered organ donor, a grace period up to 48hrs shall be given to the family to respond about decision on organ donation.

i. The National Organ Transplant Committee shall obtain the unified consent from the next of kin to proceed with organ donation as outlined in (**Appendix 7**).

4.17. Documentation in the Health Record

4.17.1. The declaration of death by brain death criteria shall be documented in the health record as a death note in a manner similar to any other declaration of death and include the following information:

a. Etiology and irreversibility of coma.

b. Absence of motor response to pain.

c. Absence of brain stem reflexes.

d. Details of the apnea test, including pre and post-test arterial blood gas values.

e. Results of repeat neurological assessments, if performed.

f. The date and time of declaration of brain death (**Appendix 1**).

g. The name of the physicians that determined death by brain criteria.

4.18. Issuance of death certificate

4.18.1. The death certificate shall be issued after the brain death declaration is duly signed and as per the following:

a. If consent for organ donation is obtained after consultation with the national organ donation committee, it is issued within 6 hours before proceeding to the operating room for organ retrieval.

b. If organ donation is rejected it is issued after withdrawing of life sustaining therapy.

4.19. KPI reporting:

4.19.1. Hospitals are required to regularly report related KPIs as set by DHA.

5. References

5.1. UAE Federal Law no. (4) of 2015 concerning Private Health Facilities

5.2. Federal Law No. (4) of 2016; Medical Liabilities; Article 10 and 11.

5.3. Federal Decree-Law No. (5) of 2016 on Regulation of Human Organs and Tissue Transplantation.

5.4. Ministry of Health and Prevention, Office of the Minister, Ministerial Decision No. (550) of 2017, Death Diagnosis Criteria.

5.5. Cabinet Decision no. (29) of 2020 concerning Federal Decree no. (4) of 2015 concerning Private

Health Facilities.

5.6. Cabinet Decision no. (40) of 2019 concerning the Federal Decree of Medical Liability Law.

5.7. Cabinet Decision no. (25) of 2020 concerning Federal Decree no. (5) of 2016 concerning regulating the transfusion and transplantation of human organs and tissues

5.8. Standardized Critical Care Notification and UAE organ Brain Death Diagnosis Protocol.

5.9. Greer DM, Shemie SD, Lewis A, et al (*2020). Determination of Brain Death/Death by Neurologic Criteria: The World Brain Death Project.* JAMA; 324(11):1078–1097. https://doi:10.1001/jama.2020.11586

5.10. Eelco F.M. et al. 2010, Evidence-based guideline update: Determining brain death in adults, *Neurology Jun 2010*, Report of the Quality Standards Subcommittee of the American Academy of Neurology, 74 (23) 1911-1918; DOI: 10.1212/WNL.0b013e3181e242a8. Available online at: https://www.who.int/servicedeliverysafety/ddcr78.pdf [Accessed 13.06.2021].

Appendix 1 – Brain Functions Assessment Form

Death Documentation by Brain Function Criteria

Name:			**Medical Record Number:**		
Age: _____	**Sex:** ☐ Male ☐ Female	**Nationality:** _____	**Blood group:** _____	**Weight:** ____ Kg	**Height:** ____ cm
Hospital Name:			**Date of admission (DD/MM/YYYY):**		

First Exam	First physician		Second physician	
I. PRECONDITIONS:				
1. Clinical or neuroimaging evidence of acute Central Nervous System (CNS) catastrophe that is compatible with irreversible loss of brain function.	☐ Yes	☐ No	☐ Yes	☐ No
2. ≥ 6 hours have passed since the initial insult.*	☐ Yes	☐ No	☐ Yes	☐ No
3. Coma with no spontaneous respiration.	☐ Yes	☐ No	☐ Yes	☐ No
II. EXCLUSIONS:				
1. Hypothermia (core temperature ≤ 36°C).	☐ Absent	☐ Present	☐ Absent	☐ Present
2. Sedation or muscle relaxants (blood test or hospital record should indicate absence of significant levels of sedative drugs, muscle relaxants or intoxication).	☐ Absent	☐ Present	☐ Absent	☐ Present
3. Systolic blood pressure <100 mmHg (despite vasopressors).	☐ Absent	☐ Present	☐ Absent	☐ Present
4. Significant metabolic or endocrine causes of coma. (suggested sodium ≤ 155 mmol/L or mEq/L).	☐ Absent	☐ Present	☐ Absent	☐ Present
III. CLINICAL ASSESSMENT:				
1. Absence of any cerebrally-mediated response to auditory and tactile noxious stimulation, peripherally and in the cranium. (does not include spinal reflexes)	☐ Absent	☐ Present	☐ Absent	☐ Present
2. Absence of brain stem reflexes:				
a. Pupils response to bright light	☐ Absent ☐ Present ☐ Untestable		☐ Absent ☐ Present ☐ Untestable	
b. Corneal	☐ Absent ☐ Present ☐ Untestable		☐ Absent ☐ Present ☐ Untestable	
c. Oculocephalic (contraindicated when C-spine unstable)	☐ Absent ☐ Present ☐ Untestable		☐ Absent ☐ Present ☐ Untestable	
d. Oculovestibular (tympanic membranes must be intact) (50 ml adults 20 ml in children ice-cold water 0°C)	☐ Absent ☐ Present ☐ Untestable		☐ Absent ☐ Present ☐ Untestable	
e. Gag	☐ Absent ☐ Present ☐ Untestable		☐ Absent ☐ Present ☐ Untestable	
f. Cough	☐ Absent ☐ Present ☐ Untestable		☐ Absent ☐ Present ☐ Untestable	

UAE Federal Law No.5/2016 article 15.2: death is determined by a committee of 3 physicians including 1 specialized in neurological disease.

First exam	Date	Time	Name	Signature	License number
First physician	DD/MM/YYYY	HH:MM AM/PM			
Second physician ☐ An intensivist ☐ Neurosurgeon ☐ Neurologist ☐ Others specify:	DD/MM/YYYY	HH:MM AM/PM			

IV. ANCILLARY TEST(S): MINIMUM one of the following tests should be done.			Report attached
1. EEG (full brain death protocol, see last page)	☐ no reactivity (>2 uV) to intense somatosensory or Audio-visual stimuli.	DD/MM/YYYY	☐ Yes ☐ No
2. Absence of brain circulation by any of:			
2.1. ☐ Cerebral angiogram	☐ No flow	DD/MM/YYYY	☐ Yes ☐ No
2.2. ☐ Nuclear medicine cerebral blood flow study (technetium 99M SPECT)	☐ No flow	DD/MM/YYYY	☐ Yes ☐ No
2.3. ☐ Transcranial Doppler	☐ No flow	DD/MM/YYYY	☐ Yes ☐ No
2.4. ☐ CT cerebral angiogram (see appendix)	☐ No flow	DD/MM/YYYY	☐ Yes ☐ No

*Note: Recommended time interval between first and second examinations in various age groups
•Adults: minimum of 6 hours ** Infants (above 60 days – 1 year) 24 hours
•Children (above one year) 12 hours ** neonate (7 days – 60 days) 48 hours

Second Exam	Third physician		First or Second physician	
V. PRECONDITIONS:				
1. Clinical or neuroimaging evidence of acute Central Nervous System (CNS) catastrophe that is compatible with irreversible loss of brain function.	☐ Yes	☐ No	☐ Yes	☐ No
2. ≥ 6 hours have passed since the initial insult.*	☐ Yes	☐ No	☐ Yes	☐ No
3. Coma with no spontaneous respiration.	☐ Yes	☐ No	☐ Yes	☐ No
VI. EXCLUSIONS:				
5. Hypothermia (core temperature ≤ 36°C).	☐ Absent	☐ Present	☐ Absent	☐ Present
6. Sedation or muscle relaxants (blood test or hospital record should indicate absence of significant levels of sedative drugs, muscle relaxants or intoxication).	☐ Absent	☐ Present	☐ Absent	☐ Present
7. Systolic blood pressure <100 mmHg (despite vasopressors).	☐ Absent	☐ Present	☐ Absent	☐ Present
8. Significant metabolic or endocrine causes of coma. (suggested sodium ≤ 155 mmol/L or mEq/L).	☐ Absent	☐ Present	☐ Absent	☐ Present
VII. CLINICAL ASSESSMENT:				
1. Absence of any cerebrally-mediated response to auditory and tactile noxious stimulation, peripherally and in the cranium. (does not include spinal reflexes)	☐ Absent	☐ Present	☐ Absent	☐ Present
2. Absence of brain stem reflexes:				
g. Pupils response to bright light	☐ Absent ☐ Present ☐ Untestable		☐ Absent ☐ Present ☐ Untestable	
h. Corneal	☐ Absent ☐ Present ☐ Untestable		☐ Absent ☐ Present ☐ Untestable	
i. Oculocephalic (contraindicated when C-spine unstable)	☐ Absent ☐ Present ☐ Untestable		☐ Absent ☐ Present ☐ Untestable	
j. Oculovestibular (tympanic membranes must be intact) (50 ml adults 20 ml in children ice-cold water 0°C)	☐ Absent ☐ Present ☐ Untestable		☐ Absent ☐ Present ☐ Untestable	
k. Gag	☐ Absent ☐ Present ☐ Untestable		☐ Absent ☐ Present ☐ Untestable	
l. Cough	☐ Absent ☐ Present ☐ Untestable		☐ Absent ☐ Present ☐ Untestable	

Second exam	Date	Time	Name	Signature	License number
Third physician	DD/MM/YYYY	HH:MM AM/PM			
First or Second physician ☐ An intensivist ☐ Neurosurgeon ☐ Neurologist ☐ Others specify:	DD/MM/YYYY	HH:MM AM/PM			

Note: First or Second physician could be replaced by fourth doctor if applicable.

*Note: Recommended time interval between first and second examinations in various age groups

- Adults: minimum of 6 hours ** Infants (above 60 days – 1 year) 24 hours
- Children (above one year) 12 hours ** neonate (7 days – 60 days) 48 hours

VIII. APNEA TEST:

a. Must be performed in the presence of 2 physicians and done once only.
b. If inconclusive and patient remains hemodynamically stable, may continue for longer period (5-10 minutes).
c. If patient becomes hemodynamically unstable, may repeat test later after stabilization
d. If still not doable due to hemodynamic instability, substitute with a second ancillary test of a different modality than initial test.

A. Prerequisites	
1. Core temperature ≥ 36.5°C	☐ Yes ☐ No
2. Systolic BP > 100 mmHg (with or without vasopressor agents)	☐ Yes ☐ No
3. Arterial pCO2 40 +/- 5 mm Hg (5.3 +/- 0.7 kPa) (In patient with normal baseline PCO2)	☐ Yes ☐ No
4. Arterial pO2 greater than 90 mm Hg (12 kPa)	☐ Yes ☐ No
5. Expose chest and abdomen	☐ Yes ☐ No
B. Apnea testing checklist	
1. Pre-oxygenate with 100% O2 for 10 minutes. Increase the inspired fraction of oxygen (FI02) without changing the ventilation rate PaO2 >200 mm Hg (26.7 kPA)	☐ Yes ☐ No
2. Disconnect patient from ventilator and deliver 100% FiO_2 into the trachea via a cannula at the level of the carina. (6 L/min adults, 1.5-2 L/min children)	☐ Yes ☐ No
*Abort the apnea test and immediately reconnect the ventilator if any: a. Systolic BP < 90 mmHg or cardiovascular collapse despite vasopressors b. Oxygen desaturation (<85% for >30 seconds) c. Significant cardiac arrhythmia d. Respiratory movements are observed	**Apnea test aborted:** ☐ Yes ☐ No
3. Check arterial blood gases at 8-10 minutes and every 5 minutes thereafter if necessary. Reconnect the ventilator when either:	
a. pCO2 ≥ 60 mmHg (8.1 kPa) adults or ≥ 50 mmHg (7.6 kPa) children	☐ Yes ☐ No
b. pCO2 is ≥ 20 mmHg (2.7 kPa) above the patient's known baseline (in patient with high baseline PaCO2)	☐ Yes ☐ No

1. ABG at baseline:	2. ABG at 8-10 minutes:	3. ABG at 5 minutes (optional)[1]:
DD/MM/YYYYHH:MM AM/PM pH ____ $PaCO_2$ ____ mmHg PaO_2 ____ mmHg	DD/MM/YYYY HH:MM AM/PM pH ____ $PaCO_2$ ____ mmHg PaO_2 ____ mmHg	DD/MM/YYYY HH:MM AM/PM pH ____ $PaCO_2$ ____ mmHg PaO_2 ____ mmHg [1]Refer to point VIII b at the top of this page

C. Apnea confirmed: absent respiratory movements over ≥10 minutes of observation.	☐ Yes ☐ No

APNEA TEST completed by	Date	Time	Name	Signature	License number
First physician	DD/MM/YYYY	HH:MM AM/PM			
Second physician	DD/MM/YYYY	HH:MM AM/PM			

**UAE Federal Law No.5/2016 article 15.2: death is determined by a committee of 3 physicians including 1 specialized in neurological disease.
***One of the four clinical exams separated by mandatory waiting time for age (see footnote) to be completed by a specialist in neurological disease.
****The final declaration needs to be signed by all three physicians who performed clinical examinations and Apnea test.
*****First or Second physician could be replaced by fourth doctor if applicable.

Final Declaration	Date	Time	Name	Signature	License number
First physician	DD/MM/YYYY	HH:MM AM/PM			
Second physician ☐ An intensivist ☐ Neurosurgeon ☐ Neurologist ☐ Others specify:	DD/MM/YYYY	HH:MM AM/PM			
Third physician	DD/MM/YYYY	HH:MM AM/PM			
Fourth physician (if applicable)	DD/MM/YYYY	HH:MM AM/PM			

Electroencephalography

- A minimum of 8 scalp electrodes should be used.
- Interelectrode impedance should be between 100 and 10,000 Ω.
- The integrity of the entire recording system should be tested.
- The distance between electrodes should be at least 10 cm.
- The sensitivity should be increased to at least 2 μV for 30 minutes with inclusion of appropriate calibrations.
- The high-frequency filter setting should not be set below 30 Hz, and the low-frequency setting should not be above 1 Hz.
- Electroencephalography should demonstrate a lack of reactivity to intense somatosensory or audiovisual stimuli.

Neurology 2010;74:1911–1918.

Types and Techniques of CTA

A standard CTA acquisition uses a multislice CT scanner to acquire a helical scan (120 kV, 200 mA) from cervical vertebra C2 to vertex timed to chase the bolus of contrast as it passes through the intracranial vessels. Intravenous contrast medium (40-120 mL) is administered in an antecubital vein or a central venous catheter with a power injector, followed by 30 mL of an isotonic saline (rate: 3-5 mL/s). CT acquisition is timed to start 5 seconds after opacification of the common carotid artery of more than 150 Hounsfield units. Axial images reconstructed with a maximum of 2.0-mm increments. Thinner slices and multiplanar reformats may also be reconstructed. For delayed phase CTA [5,6], a repeat acquisition started 55-60 seconds after starting the first scan, using the same parameters as in first scan. The delayed phase acquisition is used to confirm persistence of lack of intracranial contrast over a longer duration. The standard 1- or 2-phase CTA is limited as it provides a static volume of brain vessels images performed during 1 or 2 specified time points (snapshot views). The predetermined time point used is often unreliable in these patients due to the abnormal or delayed flow.

Can Assoc Radiol J. 2017 May;68(2):224-228.

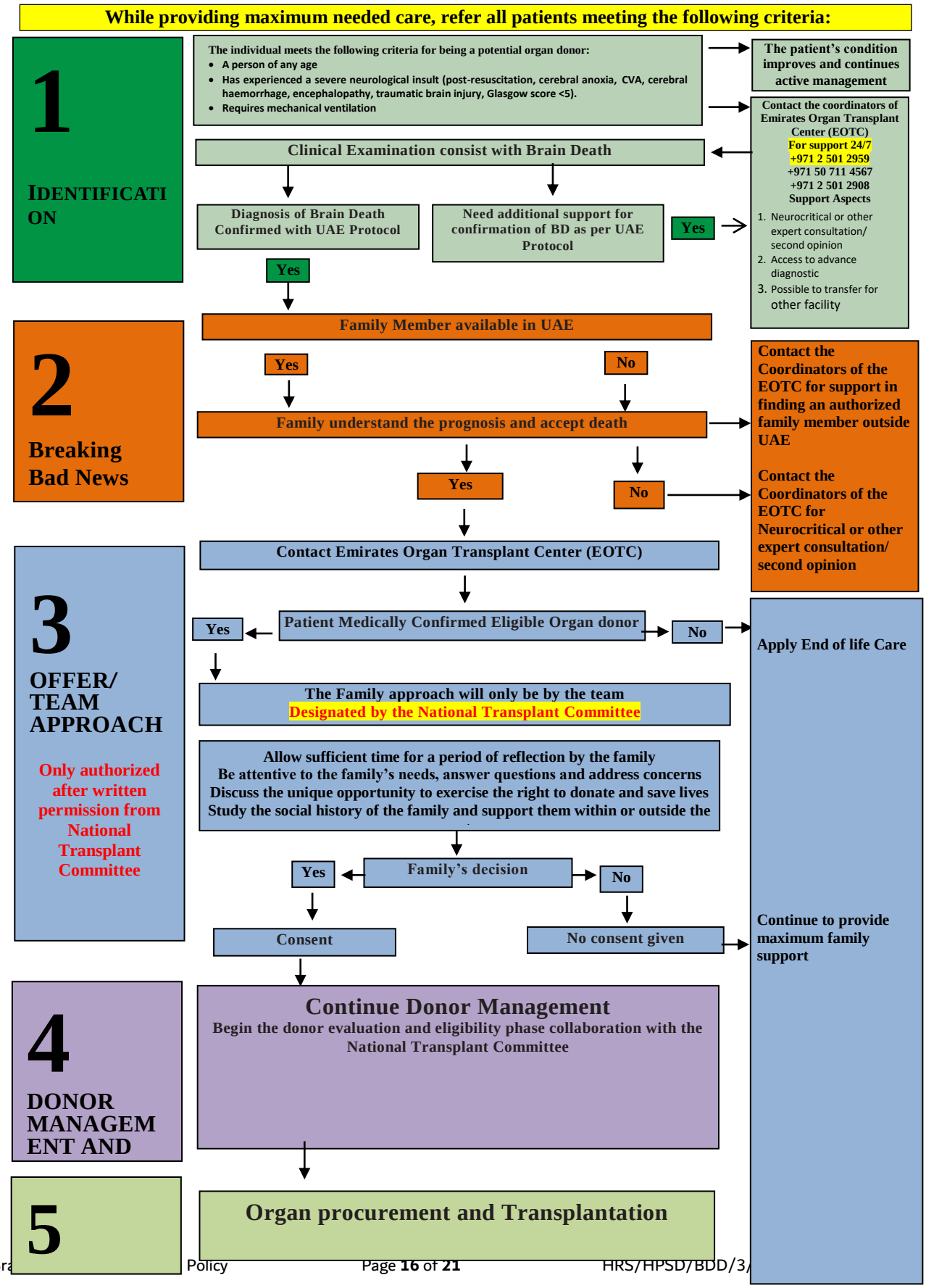
4-point CTA score

Vessel	Lack of Opacification
Right cortical segment of middle cerebral artery	☐ Yes ☐ No
Left cortical segment of middle cerebral artery	☐ Yes ☐ No
Right internal cerebral vein	☐ Yes ☐ No
Left internal cerebral vein	☐ Yes ☐ No
AJNR Am J Neuroradiol 2009;30:1566e70. Can Assoc Radiol J. 2017 May;68(2):224-228.	

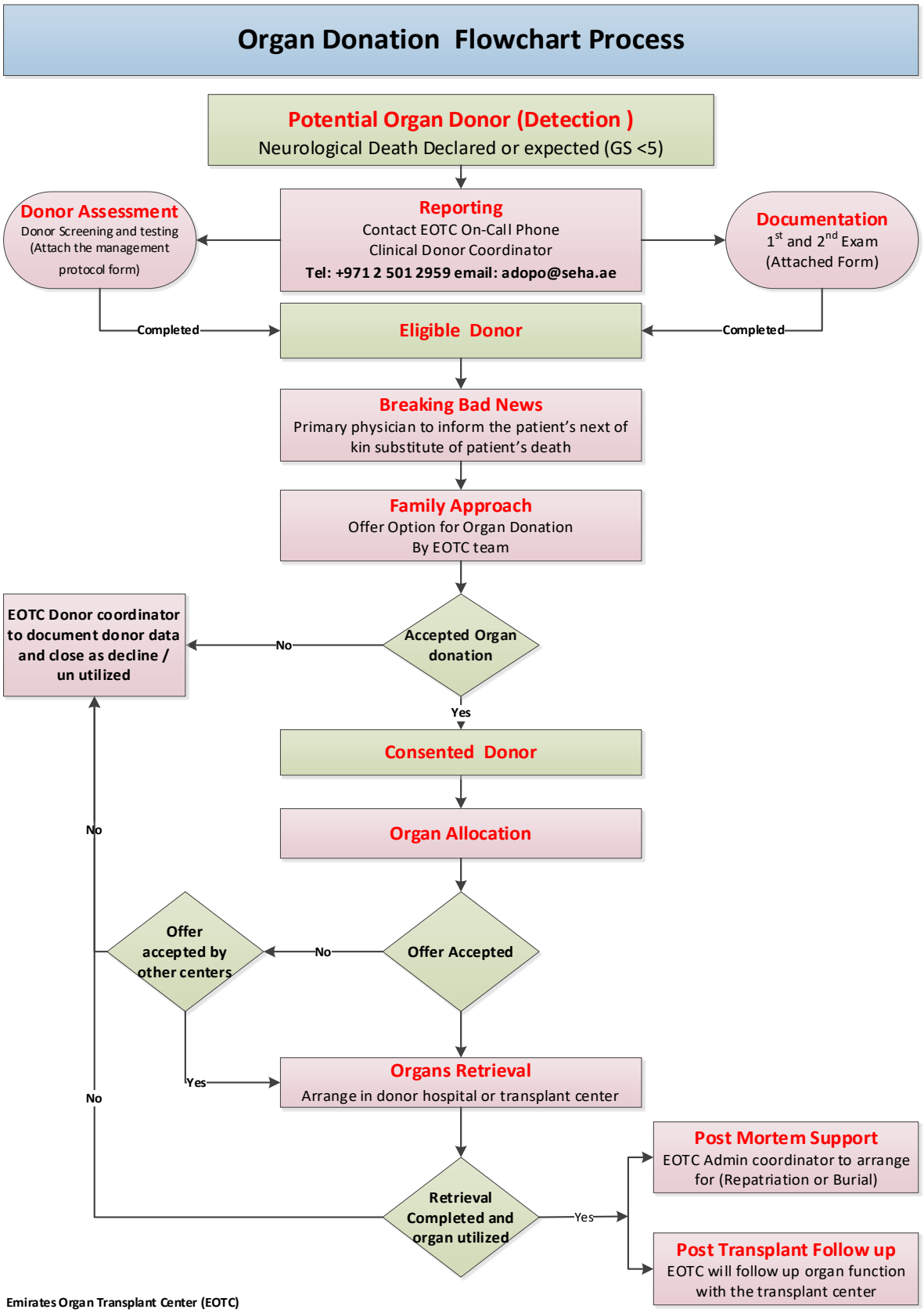
7-point CTA score

Vessel	Lack of Opacification
Right pericallosal segment of middle cerebral artery	☐ Yes ☐ No
Left pericallosal segment of middle cerebral artery	☐ Yes ☐ No
Right cortical segments of the middle cerebral artery	☐ Yes ☐ No
Left cortical segments of the middle cerebral artery	☐ Yes ☐ No
Right internal cerebral vein	☐ Yes ☐ No
Left internal cerebral vein	☐ Yes ☐ No
vein of Galen	☐ Yes ☐ No
Am J Neuroradiol 1998;19:641e7. Can Assoc Radiol J. 2017 May;68(2):224-228.	

Appendix 2- UAE Organ Donation Process Management Protocol: Standardized Critical Care Case Notification and Referral of Possible Deceased Organ Donor



Appendix 3- Organ Donation process flow chart



Appendix 4- Withdrawing of life sustaining equipment form

The three physicians, who did the clinical assessment plus the Medical Director, should sign withdrawing of life sustaining equipment.

Patient Name:	**Hospital:**
Date of Birth:	**Gender:**
Nationality:	**Health Record No.:**
Diagnosis:	

This document is to confirm that the above named patient is declared brain dead. Hence, the life sustaining equipment will be withdrawn.

Neuroscience Physician (Neurology/Neurosurgery)	**Second Physician**	**Third Physician**
Name:	Name:	Name:
Signature and stamp:	Signature and stamp:	Signature and stamp:
Date and time:	Date and time:	Date and time:

Medical Director
Name:
Signature and stamp:
Date and Time:

Appendix 5 – Referral of Potential Deceased Brain Death (DBD) Donors Referral Form

(Insert Facility Logo)			
Referral of Potential Deceased Brain Death (DBD) Donors Referral Form			
Referral Date:			
Referring Hospital:			
Patient Name		**Referral Time**	
Nationality		**Location / Unit**	
Date for Birth (dd/mm/yyyy)		**MRN**	
Police Case	☐ **Yes** ☐ **No**	**Gender**	☐ **Male** ☐**Female**
Cause of Brain Injury (ICD Name and Code)		**ICU Admission Date**	
Other, please specify		**Blood Group**	
Next of Kin Available	**in UAE:** ☐ **Yes** ☐ **No**	**Outside:** ☐ **Yes** ☐ **No**	
Next of Kin Available Name			
Next of Kin Available Relationship			
Next of Kin Available Contact Number			
MRP Name			
MRP Contact Number			
ODU Coordinator Name			
ODU Coordinator Contact Number			

- GCS <8 :
  - Complete the form and send it to DHA Organ Transplant Coordinator at the following email snHernandez@dha.gov.ae, for any clarification please contact the number 050-3647117.
- GCS <5:
  - Inform the National Organ Transplant Team on:
    - +97125012959
    - +971507114567
    - +97125012908
  - Complete the form and send it to adopo@seha.ae

Appendix 6- Half-Lives of drugs that may need to be considered when making a determination of brain death

	Drug	Half life	
Opioids	Fentanyl	3.3-4.1 hours	↑CPBS, Aged, Prem; ⇔Child
	Oxycodone	2.1-3.1 hours	
Sedatives	Dexmedetomidine	2 hours	
	Diazeoam	30-56 hours	↑Aged, LDL; ⇔HTh
	Lorazepam	9=19 hours	↑LD, Neo, RD; ⇔Aged, CPBS, AVH; ↓Burn
	Midazolam	1.3-2.5 hours	↑Aged, Obese, LD; ⇔Smoking
	Pentobarbital	15-50 hours	
	Phenobarbital	81-117 hours	↑LD, Aged; ↓Child; ⇔Epilepsy, Neo
	Thiopental	8-10 hours	
	Propofol	2.3-4.7 hours	A much longer terminal t1/2 was reported following prolonged IV infusion.
	Zolpidem	1.7-2.1 hours	↑Aged, LD; ⇔RD; ↓Child
Other	Baclofen	2.8-4.7 hours	
	Bupropion	10-11 hours (7.9-18.4)	↑Aged, LD; ⇔ Alcohol

AVH Acute Viral hepatitis; CPBS Cardio Pulmonary Bypass Surgery; HTh Hyperthyroid; LD Chronic Liver Disease; NEO Neonate; Prem Premature infants; RD Renal Disease.

Greer DM, Shemie SD, Lewis A, et al (*2020). Determination of Brain Death/Death by Neurologic Criteria: The World Brain Death Project.* JAMA; 324(11):1078–1097. https://doi:10.1001/jama.2020.11586

Appendix 7– Unified Consent Form

UNITED ARAB EMIRATES
MINISTRY OF HEALTH & PREVENTION
الإمارات العربية المتحدة
وزارة الصحة ووقاية المجتمع

سلطة مدينة دبي الطبية
DUBAI HEALTHCARE CITY AUTHORITY

دائرة الصحة
DEPARTMENT OF HEALTH

هيئة الصحة بدبي
DUBAI HEALTH AUTHORITY

التاريخ Date	الوقت Time	رقم الملف الطبي Medical Record No.	رقم الملف بالمركز EOTC File No.

المعلومات الخاصة بالمتوفى Deceased person Information

الاسم Name		اسم المنشأة الصحية التي حدثت فيها الوفاة The Name of the Health Facility Where the Death Occurred	
رقم الهوية / جواز السفر ID/ Passport No.			
تاريخ الميلاد D.O.B			
الجنسية Nationality			

معلومات الشخص الذي أبدى الموافقة على التبرع بأعضاء وأنسجة المتوفى المذكور أعلاه
The Person Authorized to Consent for Organs & Tissues Donation of the deceased mentioned above

Name:	الاسم:	صلة القرابة Relationship	
D.O.B:	تاريخ الميلاد:	أب Father	☐
ID/ Passport No:	رقم الهوية/ الجواز:	أكبر الأبناء سنا Elder Son	☐
Valid to:	صالحة لغاية:	الابن الوحيد في الدولة Only son resident in the State	☐
Issuing Place:	مصدرها:	الجد Grandfather	☐
E-mail:	البريد الالكتروني:	أكبر الأخوة الأشقاء ثم أكبرهم لأب إن لم يوجد الشقيق Elder sibling, then elder half-brother, if there is	☐
Telephone No. :	رقم التلفون:	الأخ الوحيد داخل الدولة Only brother in the State	☐
Address:	العنوان:	العم العصبة ويقدم العم الشقيق على العم لأب Uncle by agnates. The full uncle shall be	☐
Nationality:	الجنسية:	الزوج أو الزوجة إذا لم يعرف للمتوفى عصبة حسب الترتيب السابق Spouse, if the deceased's agnates by the above-mentioned order are not known	☐

☐ وفقًا لقانون دولة الإمارات العربية المتحدة (مرسوم بقانون اتحادي 5 لسنة 2016)، أعلن أنا المذكور أعلاه وأنا بكامل قواي العقلية وبدون أي إكراه مادي او معنوي بأنني موافق على التبرع بأعضاء وأنسجة قريبي المتوفى المذكور أعلاه، وذلك لزراعتها لأي مريض مناسب حسب ما تراه الجهات المختصة في هذا المجال.

☐ According to UAE (Federal Law No. (5) of 2016) , I declare the aforementioned, with full mental strength, granting consent to donate organs and tissues of my deceased relative mentioned above, in order to transplant them to any suitable patient as deemed by the competent authorities in this field.

☐ أصرح بدفن قريبي المتوفى المذكور أعلاه داخل الدولة
☐ I authorize the burial of my deceased relative in UAE

☐ أرغب في إعادة جثمان قريبي المتوفى إلى الوطن الأم
☐ I wish to repatriate the body of my deceased relative to Home Country

Remarks:	ملاحظات:

Signature: التوقيع:

The Witness الشهود

Name الإسم	Relationship صلة القرابة	Identification No. رقم الهوية	Signature التوقيع

The Coordinator who obtains approval to donate organs and tissues: (Assigned by the National Organ Transplant Committee to approach deceased family for organ donation)	Name:	الاسم:	المنسق الذي حصل على الموافقة بالتبرع بالأعضاء والأنسجة: (المعتمد من قبل اللجنة الوطنية لزراعة الأعضاء لمقابلة ممثلي عائلة المتوفي، للحصول على الموافقة بالتبرع بالأعضاء والأنسجة)
	Signature:	التوقيع:	

Please attach copy of the authorized relative ID/ Passport who signed this Consent form *الرجاء ارفاق نسخة من هوية/ جواز سفر الشخص الموقع بالموافقة على هذا الإقرار

ص.ب P.O.BOX 1853 دبي المتحدة العربية الإمارات. DUBAI, UNITED ARAB EMIRATES فاكس FAX +971 4 2301929 هاتف TEL +971 4 230 1000
www.moh.gov.ae