

Supplementary Online Content

Greer DM, Shemie SD, Lewis A, et al. Determination of brain death/death by neurologic criteria: The World Brain Death Project. *JAMA*. doi:10.1001/jama.2020.11586

Supplement 10. Qualifications for and Education on Determination of Brain Death/Death by Neurologic Criteria

This supplementary material has been provided by the authors to give readers additional information about their work.

Qualifications for and Education on Determination of Brain Death/Death by Neurologic Criteria

David Thomson, MD¹, Panayiotis N. Varelas, MD², Fernando Goldenberg, MD³, David Greer, MD, MA⁴, Ariane Lewis, MD⁵, Sam D. Shemie, MD⁶, Sylvia Torrance, BSc⁷, Gene Sung, MD, MPH⁸

1) University of Cape Town, Cape Town, South Africa; 2) Albany Medical Center, Albany, USA; 3) University of Chicago, Chicago, USA; 4) Boston University School of Medicine, Boston, USA; 5) NYU Langone Medical Center, New York, USA; 6) McGill University, Montreal Children's Hospital, Montreal, Canada; 7) Canadian Blood Services, Ottawa, Canada; 8) University of Southern California, Los Angeles, USA

Key words: brain death, qualifications, education

Abstract

Introduction Determination of brain death/death by neurologic criteria (BD/DNC) must be performed correctly in order to ensure determinations are always accurate. Determinations of BD/DNC must be performed by examiners who are both qualified and effectively educated on assessing a person prior to making a determination of BD/DNC and on the technique to perform a determination.

Methods We conducted a review of the literature and formulated recommendations with an expert panel on the qualifications and education of examiners making determinations of BD/DNC.

Results/Conclusions Qualifications for performing a determination of BD/DNC vary around the world in terms of clinician specialty and length of time in practice. Determinations should be made by clinicians who are both licensed and trained in evaluation of BD/DNC. There are various training methods to educate practitioners about determination of BD/DNC. Clinicians should be educated during training and reeducated when they are in practice to ensure determinations are up to date with the latest medical standards. Checklists are advised for all clinicians.

Introduction

It is universally acknowledged that the determination of brain death/death by neurologic criteria (BD/DNC) must be performed correctly to ensure determinations are always accurate. Because of this, there are various safeguards in many guidelines to minimize the potential for error.¹⁻³ However, the starting point for scientific validity is the rigor of the clinical testing and the assurance that clinicians who perform determinations of BD/DNC are qualified and effectively educated on assessing a patient prior to clinical testing.

Methods

Authors conducted the initial literature searches of the Cochrane, Embase and MEDLINE databases for the time period between January 1, 1992 and July 2017. Subsequent searches were performed to capture relevant articles between July 2017 and April 2020. Because of the significant lack of data from randomized controlled trials or large studies, GRADE evaluation of the evidence was not performed. However, evidence was reviewed by a multidisciplinary group of clinicians (see Introduction chapter) and recommendations were generated according to the following criteria. Strong recommendations ("It is

recommended that”) were based on expert consensus that clinicians should follow the recommendation unless a clear and compelling rationale for an alternative approach was present, and where actions could be adopted as policy. Even though most evidence in this area is limited and of low-quality, strong recommendations were made as a precautionary, conservative approach, to prevent premature or erroneous determinations of death (false positives). Conditional or weak recommendations (“It is suggested that”) were generated when there were potentially different options and the best action may differ depending on circumstances, patients, resources or societal values, or where there is a need for further evidence or discussion among clinicians and stakeholders. In cases where there was insufficient evidence and the balance of benefits versus harms was neutral, no recommendations were made.

Clinician Qualifications

The determination of BD/DNC is more complex than that of cardiorespiratory death; therefore, the qualifications for practitioners allowed to make these determinations are more involved. Declarations of death by cardiorespiratory criteria can be made by physicians, physician assistants, nurse practitioners, nurses, dentists, chiropractors, paramedics, coroners and medical examiners.⁴ Contrastingly, declarations of BD/DNC are generally only made by physicians, but individual hospital policies and local laws variably provide specific restrictions on qualifications to perform a declaration of BD/DNC.

In some countries, a specialist (such as a neurologist, neurosurgeon, intensivist, or neuro-intensivist) is required to make a determination of BD/DNC.^{3,5,6} However, this is not always the case. A review of hospital protocols in the USA found that only 33% required that determinations of BD/DNC be performed by clinicians with expertise in neurology or neurosurgery.⁵ In South Africa, determination of BD/DNC must be performed by 2 doctors, 1 with more than 5 years’ experience.⁷ In addition to noting areas of expertise, protocols and laws often specify that the person who makes a declaration of BD/DNC cannot be a member of the organ transplant team, in an effort to prevent conflicts of interest.⁴

The amount of training a physician must complete prior to performing declarations of BD/DNC also varies.^{1,3,5,8-10} In a global survey of physicians from 123 countries with expertise in neurocritical care, neurology, or related disciplines who encounter persons who are brain dead, 25% of respondents reported that resident-level trainees were permitted to declare BD/DNC independent of faculty-level physicians.⁸ A 2016 review of 342 US hospital policies found that 62% stipulated that an attending physician must determine BD/DNC.⁵ In Canada, only physicians who have finished training and “have a full and current licensure for independent medical practice and skill and knowledge in the management of persons with severe brain injury and neurologic determination of death” are allowed to pronounce BD/DNC.^{9,10} In the United Kingdom and Australia, testing must be performed by physicians who have been registered for more than five years.^{1,3} In order to ensure that clinicians who determine BD/DNC are appropriately qualified, some countries, such as Israel, require national accreditation.¹¹

Clinician Education

A variety of educational strategies and tools have been utilized to train medical students, residents and clinicians about both the technical aspects of making determinations of BD/DNC and strategies to communicate with families and surrogates about BD/DNC. The most basic method to teach about determination of BD/DNC is to require review of written guidelines or a syllabus followed by a test. Often education includes observing or being observed doing a brain death determination, but the trainee

experience may be limited because of the small number of brain death determinations done at an institution.¹² Given current advances in teaching pedagogy, this method may no longer be optimal and more interactive and engaging teaching methods are postulated to improve learning. There are several training videos and courses about determination of BD/DNC available on the internet from academic institutions.¹³⁻¹⁷ Additionally, the Neurocritical Care Society offers a brain death toolkit to teach both clinicians and the public about determination of BD/DNC.¹² Lastly, simulation-based training has been used at some facilities.^{18,19}

Recommendations and Suggestions

1. It is recommended that BD/DNC determinations be performed by practitioners who have completed training and are licensed to independently practice medicine. These practitioners should be trained in determination of BD/DNC and in counselling families at the end of life, and have experience in the management of devastating brain injury.
2. It is suggested that practitioners be periodically certified in determination of BD/DNC.
3. It is recommended that trainees in fields that manage patients with devastating brain injuries be educated about BD/DNC and counselling families in end of life care.
4. It is suggested that students in all healthcare fields be educated about BD/DNC.
5. It is recommended that education about BD/DNC be comprehensive and include a discussion of prerequisites for testing, clinical testing procedures, indications for and performance of ancillary testing, management of complications, and techniques for effective communication with families/surrogates and religious and cultural viewpoints about death.

Questions to Inform Research Agendas

1. What is the best way to evaluate and validate BD/DNC training programs?
2. How often should practitioners involved in determination of BD/DNC be required to complete certification?
3. What are the most effective strategies to educate the public and health care professionals about the BD/DNC concept?
4. What is the best model and frequency of certification?

References

1. Australian and New Zealand Intensive Care Society. The ANZICS Statement on death and organ donation. 4 ed. Melbourne: ANZICS; 2018.
2. Wijdicks EF, Varelas PN, Gronseth GS, Greer DM, American Academy of N. Evidence-based guideline update: determining brain death in adults: report of the Quality Standards Subcommittee of the American Academy of Neurology. *Neurology*. 2010;74(23):1911-1918.
3. Academy of Medical Royal Colleges. A Code of Practice for the Diagnosis and Confirmation of Death. 2008. <https://bts.org.uk/information-resources/publications/>. 2008.
4. Lewis A, Cahn-Fuller K, A. C. Shouldn't dead be dead?: The search for a uniform definition of death. *The Journal of law, medicine & ethics : a journal of the American Society of Law, Medicine & Ethics*. 2017;45:112-128.
5. Greer DM, Wang HH, Robinson JD, Varelas PN, Henderson GV, Wijdicks EF. Variability of Brain Death Policies in the United States. *JAMA Neurol*. 2016;73(2):213-218.

6. Nakagawa TA, Ashwal S, Mathur M, Mysore M, Committee For Determination Of Brain Death In Infants C. Guidelines for the determination of brain death in infants and children: an update of the 1987 task force recommendations-executive summary. *Ann Neurol.* 2012;71(4):573-585.
7. McQuoid Mason D. Human tissue and organ transplant provisions: Chapter 8 of the National Health Act and its Regulations, in effect from March 2012 – what doctors must know *South African Medical Journal.* 2012;102(9):733-735.
8. Wahlster S, Wijdicks EF, Patel PV, et al. Brain death declaration: Practices and perceptions worldwide. *Neurology.* 2015;84(18):1870-1879.
9. Shemie SD, Doig C, Dickens B, et al. Severe brain injury to neurological determination of death: Canadian forum recommendations. *CMAJ.* 2006;174(6):S1-13.
10. Teitelbaum J, Shemi SD. Neurologic determination of death. *Neurol Clin.* 2011;29(4):787-799.
11. Cohen J, Steinberg A, Singer P, Ashkenazi T. The implementation of a protocol promoting the safe practice of brain death determination. *J Crit Care.* 2015;30(1):107-110.
12. Neurocritical Care Society. Brain death toolkit <https://www.neurocriticalcare.org/education/digital-education/brain-death-toolkit>.
13. Cleveland Clinic. Death by neurological criteria course <https://www.cchs.net/onlinelearning/cometvs10/dncPortal/default.htm>
14. University of Chicago. Brain death simulation workshop <https://cme.uchicago.edu/bdsw2016>.
15. University of Cape Town. Organ donation: From death to life <https://www.coursera.org/learn/organ-donation>
16. NHS Blood and Transplant. Diagnosing death using neurological criteria. <https://www.odt.nhs.uk/deceased-donation/best-practice-guidance/donation-after-brainstem-death/diagnosing-death-using-neurological-criteria/>
17. Canadian Blood Services. Neurological determination of death. <https://cbs.online-compliance.com/default.php>
18. Araki T, Yokota H, Ichikawa K, et al. Simulation-based training for determination of brain death by pediatric healthcare providers. *Springerplus.* 2015;4:412.
19. MacDougall BJ, Robinson JD, Kappus L, Sudikoff SN, Greer DM. Simulation-based training in brain death determination. *Neurocrit Care.* 2014;21(3):383-391.