

Supplementary Online Content

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Supplement 9. Documentation of Brain Death/Death by Neurologic Criteria

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

Documentation of Brain Death/Death by Neurologic Criteria

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Abstract

Introduction Despite the fact that declaration and time of death have both significant medical and non-medical consequences, multiple studies have shown documentation of the determination of brain death/death by neurologic criteria (BD/DNC) is often incomplete or inaccurate.

Methods A review of the literature was conducted and recommendations with an expert panel were formulated.

Results and Conclusions While studies were focused mainly in the United States, documentation of BD/DNC may reflect similar variability in practice internationally. This highlights the need for improved documentation practices which may reduce complications surrounding the nonmedical consequences of death and could also be used as a tool to help minimize the variations and inaccuracies of BD/DNC determination itself.

Despite the fact that declaration and time of death have both significant medical and non-medical consequences, such as the initiation of mourning, estate administration and taxes, and preparation of the cadaver for burial¹, multiple studies have shown documentation of the determination of brain death/death by neurologic criteria (BD/DNC) is often incomplete or inaccurate.

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.

Results

Table 1. Studies of documentation of BD/DNC

Author	Year	No. of patients and institutions/ Country	Findings
Wang MY et al. ²	2002	58 patients Single institution United States	The clinical tests most likely to be documented were tests of pupillary (86%) and gag reflexes (78%). Corneal reflexes were noted as being tested in only 57% of cases, and motor responses were noted in only 66%.
Mathur M et al. ³	2008	277 patients (pediatric) (~220 hospitals) United States	A mean of only 5.5 of 14 examination elements were completed by neurologists and pediatric intensivists and 5.8 by neurosurgeons. No apnea testing was recorded in 60% of cases and inadequate PaCO ₂ increase occurred in more than one half. Cerebral blood flow determination was performed as a confirmatory test 74% of the time (83 of 112 cases), compared with 26% (29 of 112 cases) for electroencephalography alone.
Shappell CN et al. ⁴	2013	226 organ donors 68 hospitals United States	Complete documentation of brainstem areflexia and absent motor responses were found in 45.1%, and complete apnea testing in 73.5% of cases. Of the 60 cases without complete apnea testing, 56 (93.3%) had ancillary tests consistent with BD/DNC.
Puttinger G et al. ⁵	2016	108 patients (Multiple hospitals) Austria	89 (82%) protocols of the verified brain death cases were completed correctly, but 19 (18%) of these forms were filled in incorrectly or incompletely. The most frequent error was missing entry for time and date of examination as well as signatures
Kashkoush A et al. ⁶	2016	118 patients Single institution United States	Documentation errors occurred in 16% of cases. The most common errors were lack of documentation of time of death, incomplete documentation, and incorrect completion of documentation by at least one examiner. Attending physicians, residents and fellows were responsible for 47%, 21%, and 21% of the 19 documentation errors, respectively
Pandey A ⁷	2017	76 patients Single institution United States	Accurate documentation of time of death occurred in 59.2% of 76 adult brain death evaluations between 2011 and 2015. Overall, strict adherence to the 2010 AAN guidelines for death by neurological criteria was correctly documented in only 38.2% of cases.
Krawiec C ⁸	2019	33 patients Single institution United States	Documentation errors were up to 18%, most commonly lack of documentation or incomplete documentation, especially of inclusion parameters such as temperature or blood pressure.

Table 1 shows the results of a number of studies on documentation of BD/DNC. While these studies were focused mainly in the United States, their results likely reflect similar variability in documentation practices internationally, so highlight the need for improved documentation practices. National guidelines require that the processes and clinical tests leading to determination of BD/DNC, including the apnea test and any ancillary testing, be documented in the medical record. Most recommend using a detailed and comprehensive checklist to demonstrate explicitly that all criteria for death determination have been fulfilled.

According to the AAN Guidelines⁹, the time of death is the time the arterial PaCO₂ reaches the target value during the apnea test. In patients with an aborted apnea test, the time of death is when the ancillary test has been officially interpreted by the attending physician. Documentation of time of death is also dependent on the number of physicians legally required to declare death in a given hospital. In cases where death declaration requires one physician, the time of death is documented as the time the clinical examination is completed, including the apnea test. When two physicians are required, the time of death is variably the time of the first or second physician's assessment, depending on the hospital and country. This is an area that would be appropriate for standardization in the future.

Improving the documentation of BD/DNC determination may reduce any complications surrounding the nonmedical consequences of death and may also be used as a tool to help minimize the variations and inaccuracies of BD/DNC determination itself.

Recommendations and Suggestions

1. It is recommended that all phases of BD/DNC determination be clearly documented in the medical record, including:
 - Etiology of the coma,
 - Absence of confounders,
 - Full details of clinical testing performed and results, including apnea testing and laboratory values,
 - Neuroimaging results and timing in relation to clinical testing,
 - Reason for and type of ancillary testing performed and results, if necessary,
 - Time of death,
 - Identity of practitioner performing the evaluation.
2. It is recommended that a standardized checklist be used for death determination and its documentation.
3. It is suggested that the time of death be noted in accordance with regional legislation. If regional legislation does not dictate a standard for determining time of death, it is suggested that:
 - a. In cases where BD/DNC can be determined with a neurological exam and ancillary testing is not needed, the time of death be documented as the time the arterial PaCO₂ reaches the target during the apnea test as reported by the laboratory,
 - b. If ancillary testing is performed, the time of death be documented as the time that the ancillary test results are formally interpreted and documented,

- c. If two examinations are required to declare death, the time of death be the time that the second examination is completed.

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