

Brain Death



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KEYWORDS

- Brain death • Organ donor • Brain injury • Critical care • Confirmatory testing
- Ancillary testing • Clinical examination

KEY POINTS

- Critical care both improves outcome in survivors and improves organ graft function in those who do not survive but become brain dead organ donors.
- Brain death determination technique varies among hospitals and clinicians.
- Mimickers of brain death must be carefully considered and factors that confound the brain death examination must be absent.
- Published guidelines provide structure and process to the brain death determination process.
- Ethical controversies remain, therefore clinicians who care for neurologically injured patients should continue to engage in dialogue and research.

BRAIN DEATH IN CONTEXT

Critical care physicians are frequently called on to diagnose and manage brain death. Although the medical and legal concepts of brain death are generally accepted, establishing the diagnosis is not simple and must be performed accurately. The details of how to diagnose brain death have been codified in guidelines by panels of experts¹⁻⁴; however, precision in the brain death examination varies, and skepticism has been expressed in the lay literature about the accuracy of brain death determination.⁵ Thus, it is imperative that clinicians perform brain death determination accurately

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and beyond reproach. In this article, we describe the critical components of brain death examination and briefly review the management of patients with impending and established brain death.

The most common causes of brain death in adults are traumatic brain injury and spontaneous subarachnoid hemorrhage. In children, the most common cause is non-accidental trauma.⁶ Surgeons are keenly aware of the prevalence of end-stage chronic organ failure and the importance of organ transplantation and therefore tend to be diligent and timely in brain death evaluations and support of potential organ donors.

In caring for patients with severe neurologic injury, clinicians must first remember that most will recover. Half of patients who present with a Glasgow Coma Scale score of 3 will survive.⁷ Clinicians should not make hasty judgments but should provide optimal physiologic support and careful neurologic examination. Principles of optimal care for neurologic injury are the same as for the potential organ donor, so good critical care is always the first priority.

Today, the medical community is generally comfortable with the general concept of brain death, but testing for and determination of brain death still draws occasional uncertainty and disagreement among providers; there is significant variability across hospitals.⁸ Guidelines are available and any clinician performing brain death examination or supervising intensive care units should review and implement practice standards accordingly. The American Academy of Neurology (AAN) is considered the authoritative body on brain death testing in the United States. The AAN first promulgated its guideline, the American Academy of Neurologic Practice Parameters (AANPP), for diagnosis of brain death in adults in 1995¹ and an updated version in 2010.² The update is more prescriptive and definitive. The Society of Critical Care Medicine, American Academy of Pediatrics, and the Child Neurology Society updated their guidelines for determination of brain death in infants and children in 2011.^{3,4}

Brain death testing has become more consistent across major neurologic centers but still lacks uniformity across the United States.⁸ Variability is greater in smaller hospitals in which specialized neurologic and critical care expertise may be lacking.⁹ Two areas of major concordance today between the guidelines and actual practice that had not existed previously are the use of apnea testing and the use of ancillary tests. Major areas of continued practice variability are the exclusion of confounders of brain death determination and the precise components and technique of clinical examination. In a recent survey, only 56% of surveyed hospitals excluded hypotension and only 79% excluded hypothermia.⁸ These confounders of the examination and others, like acid-base disorders, electrolyte abnormalities, and intoxication, could reduce the examination's diagnostic accuracy. Failure to fully implement the 2010 AANPP guidelines may be due to overconfidence by providers or institutions or a lack of regulatory oversight, such as by hospital policy or leadership.

HISTORY

Mollaret and Goulon¹⁰ from the Hospital Claude Bernard in Paris first described irreversible coma ("le coma depasse") in 1959. In 1968, Harvard Medical School convened an ad hoc committee to examine the concept of brain death from a clinical and ethical perspective. Led by renowned ethicist Henry Beecher, the committee published what it felt to be its unbiased and relatively simple assessment in *JAMA* that same year.¹¹ Three years later, Mohandas and Chou¹² expanded on this work by emphasizing the role of the brainstem in brain damage in 1971. A 1976 Conference of Royal Medical Colleges in the United Kingdom described loss of brain stem function

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