



# Evidence-based guideline update: Determining brain death in adults

Report of the Quality Standards Subcommittee of the American Academy of Neurology



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## ABSTRACT

**Objective:** To provide an update of the 1995 American Academy of Neurology guideline with regard to the following questions: Are there patients who fulfill the clinical criteria of brain death who recover neurologic function? What is an adequate observation period to ensure that cessation of neurologic function is permanent? Are complex motor movements that falsely suggest retained brain function sometimes observed in brain death? What is the comparative safety of techniques for determining apnea? Are there new ancillary tests that accurately identify patients with brain death?

**Methods:** A systematic literature search was conducted and included a review of MEDLINE and EMBASE from January 1996 to May 2009. Studies were limited to adults (aged 18 years and older).

**Results and recommendations:** In adults, there are no published reports of recovery of neurologic function after a diagnosis of brain death using the criteria reviewed in the 1995 American Academy of Neurology practice parameter. Complex-spontaneous motor movements and false-positive triggering of the ventilator may occur in patients who are brain dead. There is insufficient evidence to determine the minimally acceptable observation period to ensure that neurologic functions have ceased irreversibly. Apneic oxygenation diffusion to determine apnea is safe, but there is insufficient evidence to determine the comparative safety of techniques used for apnea testing. There is insufficient evidence to determine if newer ancillary tests accurately confirm the cessation of function of the entire brain. *Neurology*® 2010;74:1911-1918

## GLOSSARY

**AAN** = American Academy of Neurology; **CI** = confidence interval; **CPAP** = continuous positive airway pressure; **CTA** = CT angiography; **HMPAO** = Tc 99mHexametzime; **MRA** = magnetic resonance angiography; **PEEP** = positive end-expiratory pressure; **SSEP** = somatosensory evoked potential; **TCD** = transcranial Doppler; **UDDA** = Uniform Determination of Death Act.

The President's Commission report on "guidelines for the determination of death"<sup>1</sup> culminated in a proposal for a legal definition that led to the Uniform Determination of Death Act (UDDA). The act reads as follows: "An individual who has sustained either 1) irreversible cessation of circulatory and respiratory functions, or 2) irreversible cessation of all functions of the entire brain, including the brain stem, is dead. A determination of death must be made with accepted medical standards."<sup>2</sup> Most US state laws have adopted the UDDA. Several states have added amendments regarding physician qualifications, confirmation by a second physician, or religious exemption.

The UDDA does not define "accepted medical standards." The American Academy of Neurology (AAN) published a 1995 practice parameter to delineate the medical standards for the determination of brain death.<sup>3</sup> The parameter emphasized the 3 clinical findings necessary to confirm irreversible cessation of all functions of the entire brain, including the brain stem: coma (with a known cause), absence of brainstem reflexes, and apnea.

Despite publication of the practice parameter, considerable practice variation remains. In leading US hospitals, variations were found in prerequisites, the lowest acceptable core temperature, and the number of required examinations, among oth-

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Appendices e-1–e-4 and references e1–e5 are available on the *Neurology*® Web site at [www.neurology.org](http://www.neurology.org).

Approved by the Quality Standards Subcommittee on August 22, 2009; by the Practice Committee on October 15, 2009; and by the AAN Board of Directors on February 11, 2010.

*Disclosure:* Author disclosures are provided at the end of the article.