



Perspective

Accepting Brain Death

David C. Magnus, Ph.D., Benjamin S. Wilfond, M.D., and Arthur L. Caplan, Ph.D.

Two cases in which patients have been determined to be dead according to neurologic criteria (“brain death”) have recently garnered national headlines. In Oakland, California, Jahi McMath’s

death was determined by means of multiple independent neurologic examinations, including one ordered by a court. Her family refused to accept that she had died and went to court to prevent physicians at Children’s Hospital and Research Center in Oakland from discontinuing ventilator support. Per a court-supervised agreement, the body was given to the family 3 weeks after the initial determination. The family’s attorney stated that ventilatory support was continued and nutritional support added at an undisclosed location.

In Fort Worth, Texas, Marlise Muñoz’s body was maintained on mechanical ventilation for 8 weeks

after the medical and legal criteria for death were met, in an attempt to “rescue” her fetus. Muñoz was 14 weeks pregnant when she died from pulmonary embolism. Her family asserted that continuing ventilatory support was contrary to what the patient would have wanted, but John Peter Smith Hospital cited a state law requiring that support not be terminated if a patient is pregnant. A judge ultimately ordered that the hospital follow the medically and legally indicated steps of declaring the patient dead and removing ventilatory support.

The McMath family’s attorney claimed that their constitutional rights were violated and their reli-

gious beliefs (both about when death occurs and about prognosticating a possibility of recovery) were not respected. In making this argument, proponents of allowing family members to determine death threaten to undermine decades of law, medicine, and ethics.

The current U.S. approach to determining death was developed in response to the emergence of technologies that made the traditional standard of cardiopulmonary death problematic. In 1968, an ad hoc committee at Harvard Medical School published an influential article arguing for extending the concept of death to patients in an “irreversible coma.”²¹ The emerging neurologic criteria for death defined it in terms of loss of the functional activity of the brain stem and cerebral cortex. Although clinical criteria were developed in the 1960s, it took more than a decade for consen-

Determination of Brain Death*

1. Absence of neurologic function with a known irreversible cause of coma
2. Correction of conditions affecting evaluation of brain death (performed before neurologic evaluation):
 - hypotension
 - hypothermia
 - metabolic disturbances
3. Discontinuation of medications affecting the neurologic examination (performed before neurologic evaluation):
 - sedatives
 - neuromuscular blockers
 - anticonvulsants
4. Timing of neurologic evaluation should be more than 24 to 48 hours after cardiopulmonary resuscitation or other severe acute brain injury
5. Duration of observation (pediatric cases):
 - 24 hours for neonates (37 weeks of gestation to 30 days after birth for term infants)
 - 12 hours for infants and children (>30 days to 18 years of age)
6. Clinical evaluation:
 - absence of pupillary response to a bright light
 - absence of movement of bulbar musculature
 - absence of gag, cough, sucking, and rooting reflexes shown by examining the cough response to tracheal suctioning
 - absence of corneal reflexes demonstrated by touching the cornea; no eyelid movement should be seen
 - absence of oculovestibular reflexes shown by irrigating each ear with ice water; movement of the eyes should be absent during 1 minute of observation
7. Apnea testing:
 - Pretest: confirmation of complete absence of spontaneous respiratory effort — preoxygenate with 100% oxygen, maintain core temperature above 35°C, normalize pH, blood pressure, and arterial blood gas (partial pressure of carbon dioxide [P_{aCO_2}])
 - Test: demonstration of increase in arterial P_{aCO_2} of at least 20 mm Hg above baseline and of a total P_{aCO_2} of at least 60 mm Hg, with no observed respiration
 - Ancillary study: indication to perform if there is a medical contraindication to the apnea test, hemodynamic instability, desaturation to less than 85%, or the inability to reach a P_{aCO_2} of at least 60 mm Hg
 - Evidence of any respiratory effort is inconsistent with brain death, and the apnea test should be terminated
8. Ancillary studies:
 - electroencephalography
 - radionuclide cerebral blood flow
 - spinal cord reflexes if abnormal movements present

* Derived from the American Academy of Neurology.

sus over a rationale for the definition to emerge. In 1981, the President's Commission for the Study of Ethical Problems in Medicine and Biomedical and Behavioral Research provided a philosophical definition of brain death in terms of the loss of the critical

functions of the organism as a whole.²

Shortly thereafter, the National Conference of Commissioners on Uniform State Laws produced the Uniform Determination of Death Act, which has been adopted in 45 states and recognized

in the rest through judicial opinion.³ In response to pressure from a vocal religious minority, New York and New Jersey added religious exceptions that affect the timing of the declaration of death. Even in these states, however, the vast majority of the time, the standard medical criteria for death are followed.

Over the past several decades, brain death has become well entrenched as a legal and medical definition of death. It is clearly defined by the neurologic community (see box), standards for diagnosis are in place, and it is established in law. It has become the primary basis of organ-procurement policy for transplantation. Ironically, the other standard for defining death, irreversible cessation of circulation, lacks consensus about diagnosis.

The concept of brain death has periodically come under criticism.⁴ The primary objections focus on inadequacies in the philosophical rationale for the concept that the unifying functioning of the body has been lost with loss of brain functioning, combined with a concern that biologically, there is still a sense that the body is alive, often long after brain death occurs. Wound healing can continue to occur, most organs continue to function for some period, hormonal and body-temperature regulation may be maintained. It has been reported that a child's growth can continue. And as the Muñoz case demonstrates, a pregnancy can be maintained even after the pregnant woman has met the neurologic criteria for death.

Even many of the most vocal critics of brain death agree that there is no obligation to continue providing mechanical support after brain death. Although they do

not consider brain death to be death, many of them agree that the person has ceased to exist and has no interests at stake in the discontinuation of ventilator support. Although some physicians accommodate a family's grief by allowing a brief delay either before completing brain-death examinations or before discontinuing mechanical support after a brain-death determination, these actions are for the family, not the patient. In addition, many believe that it is appropriate to procure organs after such declarations.

Unfortunately, these views raise severe difficulties for public policy. In a society tolerant of individual values and views, family views are appropriately given great weight in deciding exactly when to discontinue mechanical support. If brain death were not defined as death, it would be more difficult to justify routine decisions to discontinue mechanical support in this context. Families often need time to accept death, and that can be particularly complicated in cases of brain death. For the family's benefit, a short-term accommodation can be ethically justified. But these psychological realities do not undermine the important social construction of death when the brain has ceased all meaningful activity.

Rejecting brain death by shifting toward a more fluid and variable standard might undermine support for cadaveric organ donation. The "dead-donor rule," a fundamental concept of transplant ethics, requires that patients not be killed by the removal of vital organs necessary for life. Some critics of brain death seek to abandon the dead-donor rule. Whatever one thinks of the argu-

ments for that as a philosophical position, it is far out of touch with currently accepted medical and legal standards and public opinion.⁵

We believe that there is no good reason to take such a drastic step. Dying is a process. Parts of the body die, and then other parts do. Eventually, gradually, all the cells die. Where in that process should the line between life and death be drawn? Given the brain's importance in determining who we are and its crucial role in driving the activity of bodily organs and systems, it is not surprising that loss of cortical and brain-stem function should be equated with death.

Seen in this light, the decision reached by the medical and particularly the neurology community to articulate and promulgate the concept of brain death as the right place to draw the line between life and death is extremely reasonable. There are clear medical criteria that can be reliably and reproducibly utilized to determine that death has occurred. If professional standards are followed properly, there are no false positives. Brain-dead patients are clearly past the point of any possibility of recovery. Although one could conceivably draw the line somewhere else, such as loss of cognitive functioning, the reliability and social consensus that has emerged around brain death as death is reflected in the broad legal agreement under which brain death is recognized in every state.

Medical and legal acceptance that the irreversible loss of brain functioning is death enables families to grieve the loss of their loved ones knowing that they were absolutely beyond recovery, as distinct from patients in a

coma or a vegetative state. It errs on the side of certainty when organ procurement is requested. The determination of death is a highly significant social boundary. It determines who is recognized as a person with constitutional rights, who deserves legal entitlements and benefits, and when last wills and testaments become effective. Sound public policy requires bright lines backed up by agreed-on criteria, protocols, and tests when the issue is the determination of death. The law and ethics have long recognized that deferring to medical expertise regarding the diagnosis of brain death is the most reasonable way to manage the process of dying. Nothing in these two cases ought to change that stance.

Disclosure forms provided by the authors are available with the full text of this article at NEJM.org.

From the Center for Biomedical Ethics, Stanford University, Palo Alto, CA (D.C.M.); the Treuman Katz Center for Pediatric Ethics, Seattle Children's Hospital, Seattle (B.S.W.); and the Division of Medical Ethics, New York University, New York (A.L.C.).

This article was published on February 5, 2014, at NEJM.org.

1. A definition of irreversible coma: report of the Ad Hoc Committee of the Harvard Medical School to Examine the Definition of Brain Death. *JAMA* 1968;205:337-40.
2. President's Commission for the Study of Ethical Problems in Medicine and Biomedical and Behavioral Research. Defining death: a report on the medical, legal and ethical issues in the determination of death. Washington, DC: Government Printing Office, 1981.
3. National Conference of Commissioners on Uniform State Laws. Uniform Determination of Death Act, 1981 (<http://www.uniformlaws.org/shared/docs/determination%20of%20death/udda80.pdf>).
4. Truog RD, Miller FG, Halpern SD. The dead-donor rule and the future of organ donation. *N Engl J Med* 2013;369:1287-9.
5. Bernat JL. Life or death for the dead-donor rule? *N Engl J Med* 2013;369:1289-91.

DOI: 10.1056/NEJMp1400930

Copyright © 2014 Massachusetts Medical Society.