A Matter of Life and Death

What Every Anesthesiologist Should Know about the Medical, Legal, and Ethical Aspects of Declaring Brain Death

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There's a big difference between mostly dead and all dead. Now, mostly dead . . . is slightly alive. —Miracle Max

Case 1

An anesthesiologist questioned his colleagues on the Internet about whether strict brain death criteria are relevant when the organ donor is not expected to survive his or her injuries. He reported a case in which, while caring for a multiple organ donor who had been declared brain dead after an intracranial hemorrhage, he administered a dose of neostigmine to treat an episode of tachycardia. The donor began to breathe spontaneously just as the surgeon announced that the vena cavae were ligated and the liver had been removed. Upon subsequent review of the patient's chart, the anesthesiologist learned that the donor had gasped at the end of an apnea test, but a neurosurgeon had certified that brain death criteria had been met.

Case 2

During an educational course for anesthesiologists, a participant described a case (not independently verified by the author) in which a 30-yr-old patient was admitted to a level 1 trauma center with severe head trauma. A computed tomography scan demonstrated diffuse cerebral damage and blood in the fourth ventricle. The patient was declared brain dead by two physicians, and preparations were made to obtain vital organs for transplantation. Liver transplantation was planned for a level 1 recipient: an otherwise healthy 19-yr-old with hepatic dysfunction of unknown origin.

The on-call anesthesiologist noted that the donor was intubated but breathing spontaneously with a tidal volume of 800 cm³ and a respiratory rate of 20 breaths/min. When the anesthesiologist questioned the diagnosis of brain death, one of the declaring physicians reportedly stated that because the donor was not going to recover, he/she could be declared brain dead, and that in any case the liver recipient would die imminently without transplantation. Vital organ collection proceeded over the protests of the anesthesiologist, who observed donor movement and hypertension with skin incision that required treatment with thiopental and a muscle relaxant. The liver recipient died in another operating room of acute hemorrhage before liver collection was complete. The liver went untransplanted.

Case 3

An anesthesiologist requests that his/her department review the events surrounding a potential organ collection. A young woman receiving intravenous magnesium sulfate for pregnancy-induced hypertension suffered seizures several hours after vaginal delivery. After the seizures, she was unarousable and posturing. She was intubated after intravenous administration of 4 mg pancuronium, and a computed tomography scan showed coning, diffuse edema, and occipital lobe infarcts. A neurologist determined that the patient had suffered a "catastrophic neurologic event." Intravenous esmolol that was being infused to control blood pressure and heart rate was discontinued, and permission was obtained from the patient’s family for the patient to become a vital organ donor.

On the day of anticipated organ collection, the anesthesiologist found that the donor had small, reactive pupils, weak corneal reflexes, and a weak gag reflex. The esmolol infusion was re instituted. Further review of the patient’s chart showed the previous administration of pancuronium, and a serum magnesium level of 5.1 mEq/l, more than 2.5 times normal several hours after the magnesium infusion had been discontinued. After the anesthesiologist administered edrophonium 10
mg intravenously, the patient coughed, grimaced, and moved all extremities.
Vital organ collection was canceled, and after consultation with a neurosurgeon, the patient underwent placement of an intracranial pressure monitor. Intracranial pressure was initially 18 cm H₂O and gradually decreased with therapy to 10 cm H₂O. The patient ultimately regained consciousness and was discharged home. She was alert and oriented but suffered from significant neurologic deficits.

The concept of death has evolved medically, legally, and culturally as medical technology has changed and as we are able to use biologic materials from the dead to benefit living patients. As key participants in organ collection and transplant procedures, it is imperative that anesthesiologists have specific knowledge about the medical and legal definitions of death, as well as the ethical concepts behind them. In each of the preceding cases, questions arose about whether existing brain death criteria were applied appropriately. The purpose of this discussion is to review legal, medical, and basic ethical features of the evolving concepts of what separates the living from the dead and, therefore, what dictates the rights of potential vital organ donors and our responsibilities to them.

**Historical and Legal Background**

**Defining Death**

From earliest recorded times, the moment of death has defined strict definition. In fact, the diagnosis of death has always relied on criteria by which death was inferred to occur. The appearance of putrefaction, rigor mortis, and incineration leave no doubt that death has occurred. Other signs that at one time were infallible harbingers of death, such as cessation of respirations and pulse, have become unreliable as medical technology has permitted artificial support of these physiologic functions after they have spontaneously ceased.

As ventilator technology advanced during the polio epidemics of the 1940s and 1950s, and as physicians developed cardiopulmonary resuscitation in the 1960s, patients and their families expressed increasing alarm that medical technology permitted doctors to sustain patients' physical lives long after meaningful existence for many had ended. Patients and doctors alike questioned whether the preservation of life at all costs was still a worthy medical goal.2-4

In 1968, an *ad hoc* committee of the Harvard Medical School, under the chairmanship of Henry Beecher, the first Harvard Professor of Anesthesiology, convened to tackle the problem of defining death. The committee stated that they had two explicit purposes: (1) to identify the moment of death for patients maintained on mechanical support to reallocate expensive resources to the living as well as to inform families as to whether relatives were alive or truly dead; and (2) to identify dead people from whom vital organs ethically could be obtained for transplantation.5-7

Although the first successful living-related renal transplant took place in 1954, and the first human heart transplant in 1967, the popularization of organ transplantation awaited pharmacologic advances in the 1970s that overcame severe mortality imposed by infection and rejection. Transplantation of vital organs from living and cadaveric donors is now commonplace and successful; today, the 1-yr survival rates are 92%, 82%, and 76% for recipients of cadaveric kidney transplants, heart transplants, and liver transplants, respectively.8

With advances in the field of organ transplantation, the medical community needed a reliable definition of death so that cadaveric tissue might be gifted ethically before the onset of the deterioration that accompanies interruption of circulation and respiration. Meanwhile, public acceptance of organ transplantation has been slow, and attitudes toward organ donation can be characterized as supportive but not overly enthusiastic. Although 94% of Americans polled in 1987 were aware of organ transplantation and of the critical need for organs and tissues, only 20% of the general population had signed donor cards, and people were more likely to donate the organs of relatives (82%) than their own (43%).9,10 With a critical shortage of healthy organs for transplantation, the continued success of organ transplant programs depends on the public's trust and cooperation for organ donations.

**Public Concerns about Defining Death**

Why has the public been hesitant to embrace organ donation? Organ donation is a complex phenomenon because human bodies and organs have value to the person and their family, to the organ recipient, to research, and to society. Although some view organs as a commodity to be bought and sold, one prevalent view in western society is that organ donation is a gift in which there are obligations of "grateful use, grateful conduct, and reciprocation."11,12 The United States has the largest transplantation program in the world based on societal values, such as voluntarism, respect for family preferences, promotion of a sense of community through generosity, and improving quality of life for others.12 Various measures have been proposed to improve the rate of organ donation, such as "required request" legislation in
which hospitals are required to request organ donation from families of eligible donors, and “presumed consent” legislation in which doctors would be allowed to procure organs from eligible donors unless the patient objected before death or the family objected at the time of death. When required request laws went into effect in several states in the 1980s, they were met with varying responses, from an increase in donations in New York, to a decrease in donations in Oregon. Widespread public support for presumed consent laws is currently lacking in the United States. Such laws may actually violate constitutional rights and are unlikely to be broadly enacted soon.

Mandated choice is an alternative approach to presumed consent legislation. In mandated choice, people are required by law to state their wishes regarding organ donation, e.g., at the time of drivers license renewal. Proponents of mandated choice believe it will increase organ donation by providing information about a potential donor’s wishes to family members who would not donate organs if the patient’s wishes were unknown. Detractors contend that there is little evidence to demonstrate that organ donations would increase significantly, and mandated choice could have a negative effect on public opinion about organ transplantation by creating perceived pressure to donate organs. Required request, mandated choice, and presumed consent laws are based on presumptions that families do not donate because they are unaware of the need, do not know their relatives’ wishes, or because they are not asked. However, documented public awareness of the critical shortage of transplantable organs, together with the low percentage of people signing organ donor cards, suggest a different problem entirely.

There is considerable evidence that people are ambivalent and anxious about organ donation. Reluctance to donate organs rests, in part, in strong psychological barriers tied to public concerns about the ability of physicians to define, recognize, and accurately diagnose death. Criteria for diagnosing death must be unambiguous, infallible, and uniformly applied. Even the perception that living patients may be inadvertently or even deliberately killed by doctors to provide organs for transplantation could have a devastating impact on organ donations.

Overcoming psychological barriers to organ donation is complicated by the fact that medical technology now permits the dead to retain characteristics that have been associated with life: for comatose patients, “their appearance resembles that of the dead as traditionally perceived... But their appearance also differs from that traditionally associated with the dead because mechanical support generates breathing, heartbeat, and the associated physical characteristics (e.g., warm, moist skin) of life.”

In the past, the signs that inferred the occurrence of death were obvious even to members of the lay public. Cessation of respiration and pulse is easily measurable and unambiguous. But today, the dead may differ little in appearance from the living, and family members must rely on the presentation of test results and data from physicians for proof that a relative has died. Many do not trust physicians, and perhaps with good reason. Transplantation strains the traditional doctor-patient relationship by presenting a conflict of interest for doctors between the best interest of the potential donor and the needs of a potential recipient. Neustwek reported one woman as saying, “Can I ever be certain that doctors would do everything possible to save my life if I had a nasty accident or a terrible disease, that they would not be influenced by what I could contribute to another person?” In a 1986 report, the two primary reasons given by the public for not signing organ donor cards were fear that doctors “might do something to me before I’m really dead,” and fear that “doctors might hasten my death.”

In a 1994 study of Swedish attitudes toward autopsy and organ donation, people who were undecided about organ donation were more likely to express fear about not being dead at the time of organ collection (22%) than those who had agreed to be donors (12%). The same people were not afraid of not being dead at the time of autopsy, “suggesting that this fear [of not being dead for organ donation] concerned uncertainty as to the concept of brain death.” Less than 50% of the Americans polled in 1985 accepted brain death as an adequate method to define cessation of life. DeJong et al interviewed family members of potential organ donors who had been declared brain dead and found that among respondents from nondonor families, only 60% believed that a patient whose heart was still beating was dead if they were declared “brain dead,” compared with 80% of respondents from donor families. Only 48% of respondents from nondonor families believed that a brain-dead patient could not subsequently recover, compared with 80% of respondents from donor families. Clearly, brain death remains a confusing concept for the public.

From the perspective of the medical profession, the ability to diagnose death is necessary to avoid treating a dead patient as though he/she was still alive. From the
perspective of the family, unambiguous criteria for death are necessary to prevent doctors from treating a living relative as though he/she was dead.

Redefining Death

In 1968, the ad hoc committee of the Harvard Medical School presented clinical criteria for the definition of brain death that included coma, absence of spontaneous respirations, lack of spontaneous movement, dilated pupils, loss of cephalic reflexes, absence of postural responses, and isoelectric electroencephalogram (EEG). All of these characteristics had to be present on two separate examinations 24 h apart, without the contribution of other factors such as circulating toxins and hypothermia that might otherwise mimic brain death.7 In 1970–1972, the National Institute of Neurological and Communicative Disorders and Stroke Collaboration Study then confirmed in prospective studies that patients who fulfilled the criteria of the ad hoc committee did not recover neurologic function, and that these constituted reliable criteria for brain death, even if the time interval between examinations was shortened to 6 h.24

In 1979, the Model Brain Death Act was prepared by representatives of the American Medical Association, American Bar Association, and National Conference of Commissioners on Uniform State Laws. It stated that an individual was dead who has sustained either: “1) irreversible cessation of circulatory and respiratory function, or 2) irreversible cessation of all functions of the entire brain, including the brainstem.”25 In 1981, the President’s Commission for the Study of Ethical Problems in Medicine and Biomedical and Behavioral Research reexamined the definition of brain death, and after testimony from medical, philosophical, theological, and lay witnesses, agreed that an individual may be classified as dead on the premise of “cessation and irreversibility of cerebral and brainstem functions or irreversible cessation of circulatory and respiratory functions.” The Commission further stated that, “These determinations must be made in accordance with accepted medical standards,” and proposed that all states adopt the Uniform Determination of Death Act proposed by their study.18,24 By 1988, 44 states had adopted brain death statutes, and although the wording varies somewhat among the states, the principles established in the report by the 1981 President’s Commission are applied consistently.26

Meanwhile, the Uniform Anatomical Gift Act of 1968 was drafted in a climate of public concern about the potential illicit removal of cadaveric organs for transplant. The Act provided for competent persons older than 18 years of age to donate body parts for organ transplantation and provided for the use of organ donor cards. The authority of next of kin was also recognized in donation of organs.27

Medical Criteria for Determining Brain Death

Worldwide, medical definitions of death differ. In Japan, for example, the concept of brain death was not accepted legally until 1997, when the Japanese legislature agreed to adopt brain death as an acceptable criterion for declaring death.28 The Conference of the Royal Colleges and Faculties in Britain focused on the function of the brainstem alone to define death, and many European countries have adopted similar definitions of death.29 The medical literature includes input from diverse legal and cultural sources, and physicians in the United States may make the mistake of assuming that published, medically and legally acceptable practice elsewhere in the world may also be medically and legally acceptable in the United States. In many European countries, for example, testing for cortical activity may be discretionary if apnea testing suggests brainstem death, whereas in the United States, the definition of brain death requires demonstration of the absence of both cortical and brainstem activity. As a result of the influence of international literature, the practice of many physicians declaring brain death in the United States may have changed from the Uniform Determination of Death Act of the 1980s, although medical and legal definitions of brain death in the United States have not changed.

In the United States, brain death is defined as total and irreversible loss of function of the whole brain, including the brain stem. Medically, the diagnosis can be established by physical examination plus apnea testing, once any conditions that might confound the examination and test results are corrected. Legally, most states do not specify medical tests to confirm brain death.30 Even in the absence of any legal requirement, many institutions have policies that set practice standards that require the addition of various confirmatory tests to complete the diagnosis.

The first step in diagnosis of brain death in an apparently comatose patient is to rule out reversible causes of unconsciousness or the appearance of unconsciousness, such as depressant drugs, neuromuscular blockade, and shock. The patient cannot be hypothermic. In general, two examinations separated by at least 6 h must be
Confirmatory, but in some instances of obvious irreparable brain injury, one examination may suffice. Many institutions require that two attending physicians agree in the brain death determination, and that at least one of the physicians not be involved in plans to transplant the donor’s vital organs. Most institutions also require that at least one of the physicians be a neurologist or neurosurgeon. The examination consists of two parts: physical examination to rule out the presence of any cortical activity, cortical reflexes, or brainstem reflexes, and apnea testing to rule out brainstem activity.

To examine for the presence of cortical activity or reflexes, the physician must demonstrate absence of cortical response of any kind to painful stimuli and must demonstrate absence of decorticate or decerebrate posturing. Norton30 suggested including supraorbital ridge pressure in the examination in case spinal cord injury prevents stimulus applied to the limbs or body from reaching the brain. Minor flexion of upper or lower extremities in response to painful stimulus applied locally to the same limb represents spinal cord reflexes and not cortical activity, and it does not preclude the diagnosis of brain death. Occasionally, patients who fulfill other criteria for brain death show complex movements termed “spinal automatism,” also known as “Lazarus sign.”35 Such movements include flexion of limbs and trunk, stepping motions, grasping motions, and head turning. In the presence of spinal automatism, the clinical diagnosis of brain death may be difficult to establish, and further diagnostic tests are warranted. The patient must have no pupillary response to light; corneal response to touch; or gag, cough, or swallowing response to posterior pharyngeal stimulation. Doll’s eye reflex and cold-caloric response must be absent (table 1). Finally, a properly conducted apnea test must demonstrate no respiratory activity (table 2).31,32,54–59

Confirmatory tests in the determination of brain death are purely optional when the clinical criteria are met unambiguously, but they can be useful when the clinical picture is confusing and may be required by institutional policy. In some instances, clinical status of the potential donor may confound the clinical examination or preclude apnea testing, and confirmatory tests are needed.30,32,35,36 Confirmatory tests are used in approximately two thirds of brain death determinations.30 Common tests include EEG, cerebral blood flow (CBF) studies, and brainstem auditory evoked responses (BAERs).

To conform with the Harvard criteria, the Model Brain Death Act, and the 1981 President’s Commission Report, the EEG must be isoelectric.7,18,35 In practice, however, the role of EEG in confirmatory testing has been problematic, in part because some countries outside of the United States use absence of brainstem reflexes and not cerebroelectrical silence as a definition of death. Some investigators have reported series of patients in which, despite lack of brainstem function, cortical electrical activity is still demonstrable by EEG.40,41 Whether this is because so-called “pockets” of dying cortical cells continue to discharge or because the cortex can survive with ventilatory support after the brainstem has died is debatable. It is interesting that some European investigators have suggested that nonisoelectric EEG in the presence of brainstem death constitutes a reason to reconsider the concept of brainstem death and its reliaibility.41

In the United States in 1977, a National Institute of Neurologic Diseases and Stroke study accepted minimal (2-μV) electrical potential on EEG as being compatible with brain death,42 but the President’s Commission in 1981 reiterated that “cerebrocerebral silence” is confirmatory of brain death.18 As long as confusion exists, the presence of electrical activity in the absence of brainstem function suggests the need for further testing. Because EEG results can be confounded by variables such as hypothermia and depressant drugs, and because patients can have absent cortical function with an isoelectric EEG and still retain brainstem function, isoelectric EEG alone is not sufficient to establish a diagnosis of brain death.7

CBF studies are diagnostic but many have the disadvantage of requiring transport of the patient to the radiology department. Techniques that allow studies to be conducted at the bedside may permit CBF studies to

### Table 1. Doll’s Eyes Reflex and Cold Caloric Response

<table>
<thead>
<tr>
<th>Test</th>
<th>Description</th>
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<tbody>
<tr>
<td>Doll’s eyes (oculocephalic) reflex</td>
<td>The head is briskly rotated from side to side and the position of the eyes relative to the head is noted. The doll’s eyes response is absent when there is no movement of the eyes. The response is present when both eyes rotate to the side opposite to the direction of rotation of the head. Absence of doll’s eyes response without the presence of intoxicating substances is required to establish the diagnosis of brain death.</td>
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<tr>
<td>Cold caloric response (oculovestibular reflex)</td>
<td>After examination of both ears to ascertain that no material blocks the canals, each canal is irrigated with 50 ml of cold water. Tonic deviation of the eyes or the presence of nystagmus during irrigation indicates the presence of oculovestibular reflex pathways and excludes the diagnosis of brain death.</td>
</tr>
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Table 2. Performing the Apnea Test

1. The absence of muscle relaxants and respiratory depressant drugs must be established.
2. The patient's PaCO₂ is allowed to increase to 35-40 mmHg (many brain insult patients will be hyperventilated below their apneic threshold, preventing a meaningful test).
3. Oxygenate the patient for at least 5 min with 100% O₂.
4. Obtain arterial blood gases to confirm that the patient is not hypoxic and to prevent apnea testing from potentially inducing hypoxic insult to vital organs.
5. Disconnect the ventilator and place on a T-piece with 100% O₂ to permit passive oxygen flow and apneic oxygenation. Note: CPAP should not be used during the test since CPAP mode on some ventilator circuits may interrupt continuous oxygen flow unless spontaneously triggered ventilation occurs. This would interfere with apneic oxygenation and invalidate the test.
6. Monitor the patient's arterial oxygen saturation throughout, and blood gases should be obtained at intervals not more than 5 min apart throughout the test.
7. 7-10 min of apnea may be required to permit the patient's PaCO₂ to increase to 60 mmHg. Alternatively, CO₂ can be added to the ventilator circuit, as described by Lang,38 to permit the patient's PaCO₂ to increase at a faster rate and reduce apnic time.
8. Before reinstating mechanical ventilation, obtain arterial blood gases to confirm that CO₂ was 60 mmHg. PaCO₂, rather than pH, is usually used as the endpoint for the apnea test since severe acidemia may be required to provide by itself enough stimulus to breathing. Chemosensitive cells of the medullary respiratory center are stimulated more by an increase in PaCO₂ than a decrease in pH because the blood-brain barrier is poorly permeable to ions, such as H⁺ but not to CO₂.

Patients with COPD and possible CO₂ retention may have reduced response to increases in PaCO₂ and/or dependence on anoxic respiratory drive. P_{O_2} in such patients should be 60 at the end of the test.36 While no specific guidelines specify an acceptable lower limit for oxygen saturation during the test, hypoxia must be avoided. For this reason, many individuals with COPD cannot safely undergo apnea testing, and other tests, such as cerebral blood flow studies, may be needed.

The test should be terminated for any of the following reasons:
1. The patient coughs, gasps, or makes any kind of respiratory effort. The patient is not brain dead.
2. The patient becomes hemodynamically unstable and this instability cannot be easily managed with judicious use of vasopressors and/or fluids. Termination of the test for hemodynamic instability constitutes an indeterminate test; confirmatory testing, such as CBF studies, should be performed.
3. The P_{CO_2} is >60 mmHg in the absence of confounding factors, the P₁O₂ is adequate (and in the case of COPD patients, 60 mmHg), the patient is hemodynamically stable, and there have been no respiratory movements of any kind. This result confirms absence of brainstem activity. It is required to diagnose brain death but is insufficient by itself. Examination for absence of cortical activity must also be conducted.

become the most useful confirmatory tests. Complete cessation of blood flow to a normothermic adult brain for more than 10 min is incompatible with survival of brain tissue; therefore, the total absence of CBF as determined by nuclear or radiographic studies is conclusive of brain death.26,27,43 Because certain radiographic techniques may be unreliable in demonstrating blood flow to the posterior fossa, four-vessel angiography has been recommended to rule out residual posterior fossa blood flow.18 More recently, radiographic techniques using technetium scanning have been suggested as sensitive and reliable tests that allow evaluation of posterior fossa blood flow.44 Doppler studies can also be used, but most institutions are unwilling to rely on Doppler studies alone to document brain death.40 The presence of blood flow on any of these studies does not, conversely, rule out the diagnosis of brain death because blood flow to the brain can continue even after all brain tissue has died.

Brainstem auditory evoked responses have also been used as confirmatory tests to rule out brainstem function.24,45 Because the test involves applying a stimulus (sound) to the auditory nerve and monitoring for brainstem electrical activity in response, the test requires that the auditory nerve be intact and that there be no pre-existing brainstem dysfunction. Although the test is simple, inexpensive, and accurate, many hospitals do not have the equipment or personnel to perform it. In that BAERs test brainstem function only, a negative test is not sufficient to diagnose brain death. Cortical testing must be conducted as well.

Brain death determination in children younger than 1 yr of age requires longer observation than in adults.24,46 Some sources suggest examinations must be stable over 48 h for children between 7 days and 2 months of age, and 24 h for children between 2 months and 1 yr of age.47,48 An ad hoc task force representing the American Academy of Neurology, American Academy of Pediatrics, American Bar Association, American Neurological Association, and the Child Neurology Society published guidelines for the determination of brain death in children in 1987 that excluded preterm and term infants less than 7 days of age because of lack of data.47 Although recent evidence suggests that brain death can be diagnosed in preterm and term infants younger than 7 days of age,49 diagnosing brain death in infants less than 7 days old is not presently supported by all authorities,48,50 and the guidelines provided by the ad hoc task force remain the prevailing practice.

Appendix 1 includes a checklist to confirm that brain
WHAT ANESTHESIOLOGISTS SHOULD KNOW ABOUT BRAIN DEATH

Death determination has followed established requirements and has been documented. Although many anesthesiologists will not be directly involved in determination of brain death, they should nevertheless review the chart for appropriate documentation that these tests have been conducted under proper conditions. Youngner et al.\(^5\) found that two thirds of physicians involved in declaring brain death were unable to correctly identify or apply the whole brain criteria for determination of brain death. For this reason, a final review of the determination should be the responsibility of every anesthesiologist participating in organ retrieval procedures. It may be useful (and life-saving) to include the checklist at the beginning of anesthesia organ retrieval protocols.

Ethical Treatment of the Living and the Dead

Autonomy

Respect for patient autonomy is respect for the idea that, once patients have appropriate information and understanding, they have the right to make unencumbered choices regarding their bodies and lives. This principle is essential to the ethical care of patients and is uniformly supported in the courts.

Once a patient is dead, he/she ceases to have autonomy. Indeed, once dead, an individual ceases to exist at all. From an ethical standpoint, the treatment of remains is dictated by principles of respect for survivors and for members of the society to which the person previously belonged.\(^52,53\) As Arnold and Youngner\(^54\) stated, “family authority over the fate of the newly dead, about to be dead or probably dead bodies of children, parents, or spouses is a cultural value that will be difficult to obliterate by government regulation...” A principle of respect for human dignity might dictate that the remains of the dead not be mutilated because it would violate the principle of respect for people to whom the remains have value. But a corpse itself does not have dignity or autonomy, nor does it have any rights.\(^52,55\)

In contrast, an unconscious individual who may be dying but is not actually dead has rights that are protected by both ethical principles and law. Although such an individual no longer has autonomy because he/she either cannot make choices or cannot express them, he/she still retains dignity as a human quality. Respect for dignity cautions against any action that diminishes the inherent value of life itself. Legal precedent for the rights of unconscious persons was set in 1976, when the father of Karen Ann Quinlan brought suit in New Jersey State Supreme Court. His daughter had lapsed into a coma of unproven etiology and required ventilatory support. Mr. Quinlan proved that before her injury, his daughter had clearly expressed her feelings that she did not desire a life dependent on medical machinery and that she would not want such an intervention. He requested the court’s recognition of his daughter’s right to have decisions she made as an autonomous individual implemented after she had suffered cerebral damage that had rendered her no longer autonomous.

Chief Justice Hughes commented that the matter was “of transcendent importance, involving questions related to the definition and existence of death...” In rendering a decision in favor of Mr. Quinlan, the court made two firm points: (1) under any legal standard, Karen was alive and not dead; and (2) as a living but nonautonomous person, Karen was protected by constitutional law guaranteeing her right to privacy, and her right as an individual to have her expressed choices regarding her medical care implemented, even after she had lost her autonomy.\(^56\) In a highly unusual gesture to emphasize that this unconscious woman retained life and individuality although she was permanently comatose, throughout his decision, Justice Hughes referred to Karen by her first name.

In each of the cases that introduced this article, the patient was unconscious but alive. Ethical principles and legal precedents obligate us to treat such individuals with respect for their wishes. If any of them previously had expressed wishes to not be maintained by medical machinery, it would have been ethical either to not institute such care or to withdraw it. If any of the patients previously had expressed wishes to donate vital organs, it would have been ethical to proceed with vital organ collection after death. Presumably, none previously had expressed a desire to be killed for their vital organs. Even if they had, ethical principles of beneficience, nonmaleficence, and justice, together with values of trust and respect for life, would prohibit physicians from fulfilling such a wish.

Beneficence (Promoting Good) and Nonmaleficence (Avoiding Harm)

When we speak of beneficence and nonmaleficence, what exactly do we mean by “promoting good” and “avoiding harm” for patients? In the past, physicians interpreted beneficence to mean promotion of continued life, almost at any cost. Early statements of medical ethical principles dating to the Hippocratic Oath are...
specific in exhorting physicians to promote continued life. Physicians were proscribed from the practice of procedures or the administration of medications that might hasten death.\textsuperscript{57} The concepts of beneficence and nonmaleficence evolved with the advancement of medical technology. As reflected in the writings of Jonsen,\textsuperscript{58} the principle of beneficence now refers to the promotion, not merely of life itself, but of meaningful, or "good-quality" life. The physician is ethically obligated not to promote life at all costs, but rather to enable patients to choose what kind of life represents a "good life" to them and what kind of life does not. The decisions regarding what constitutes a good life depend on the values and interests of the person who lives it. Individual values are based on experience, perceptions, culture, biases, and individual limitations, and quality-of-life decisions are by nature patient-specific and frequently not in agreement with physician perceptions. When patients cannot speak for themselves, having someone who knew them make decisions for them seems to be a reasonable compromise. But surrogate decisions are imperfect: at best, they only approximate the patient's wishes, and at worst, surrogate decisions may come no closer to reflecting a patient's wishes than flipping a coin. In one study that compared patient desires regarding resuscitation with their physicians' predictions of their responses, the accuracy of physician predictions did not exceed that due to chance alone in five of six cases. Spouses were not more accurate than chance in predicting patient responses in three of six cases.\textsuperscript{59} Another study found that physicians often rated their patients' quality of life as much poorer than did the patients themselves.\textsuperscript{60} When physicians make value-laden decisions regarding whether certain types of life are worth living, they are more likely substituting their own values, biases, perceptions, and limitations for that of the patient.

None of the donors in the cases presented at the beginning of the article were capable of communicating their values with regard to what would benefit or harm them. Being killed for their vital organs provides no medical, psychological, or social benefit to the patients themselves, and it deprives them of life. The individual doctor-patient relationship is seriously harmed when the physician fails to perceive a badly injured or dying individual as a patient with their own intrinsic value, and instead objectifies them into mere tools to benefit someone else.\textsuperscript{61} Relationships between doctors and patients are irreparably harmed when patients can no longer trust doctors to value their lives and take care of them, even if they are damaged or dying. Ultimately, transplantation programs are harmed if patients cannot feel "safe" once they agree to donate vital organs.

### Justice

The ethical principle of justice demands that the individual's worth not be judged exclusively on intellectual or physical attributes, nor on social status. Vulnerable persons such as the elderly, the very young, the handicapped, or otherwise impaired individuals should not be treated differently with regard to respect for their autonomy and with regard to principles of beneficence and nonmaleficence.\textsuperscript{54} In case 2, the life of the donor was weighed directly against the life of the recipient. Yet both ethical and legal principles prohibit physicians from doing just that\textsuperscript{62} because no person's life has more or less intrinsic value than the next.

### Is a Person Dead if They Are No Longer a Person?

Was the \textit{ad hoc} committee's work comprehensive enough? Are patients who are actually dead being maintained on machines? Should we consider adopting a "consciousness-based" definition of death or abandon the brain death definition altogether, as suggested by some investigators?\textsuperscript{63–65} The President's Commission in 1981 struggled to establish a means by which unconscious individuals could be separated by objective criteria into categories that would differentiate those who had, by virtue of injury or disease, permanently lost that quality that, in the words of Veatch,\textsuperscript{65} "is essentially significant to the nature of man." When the Commission reviewed cases, such as that of Karen Ann Quinlan, who were in persistent vegetative states with spontaneous respirations and heartbeat, the members believed that such individuals had lost their "personhood" and might be dead. But they were vexed with the problems of defining exactly what constituted "personhood" and consequently identifying strict criteria to determine its loss. What makes a person a person? Just how much cortical damage is necessary to equate a loss of personhood with death? Would demented patients under the concept of loss of personhood be considered dead? What about patients with neurologic injuries?\textsuperscript{18}

Another problem exists when we consider the definition of personhood. How do we predict with certainty which individuals have permanently lost personhood and which patients may have even a remote chance of...
regaining personhood and, potentially, even their autonomy? In 1989, in the case of Carrie Coons, the New York State Supreme Court vacated an order allowing withdrawal of life-sustaining treatment when Carrie unexpectedly regained consciousness. Having suffered a massive stroke several months earlier at the age of 86 yr, Mrs. Coons had entered a persistent vegetative state and required placement of a feeding tube for nutritional support. The court supported a request from her sister to withdraw the feeding tube, convinced by medical experts that Mrs. Coons had no chance of recovery. When Mrs. Coons then unexpectedly awoke and expressed feelings of uncertainty about the decision to withhold feedings, the court’s order was vacated, and nutritional support was reinstated.66

A recent disturbing report in the British Medical Journal indicates that 43% of patients in one rehabilitation unit who were diagnosed as suffering from persistent vegetative states were, in fact, aware of their surroundings, and some were capable of communication under appropriate conditions.67 This study underscores the uncertainties of predicting whether patients with profound neurologic injuries will recover function and whether patients who seem to be comatose might, in fact, be aware of what is happening to them. These cases demonstrate some of the difficulties posed by definitions of death that include a “loss of personhood.” Criteria for loss of personhood are vague and probably cannot be separated from the personal values, experiences, and biases of the people who formulate the criteria.68 Furthermore, loss of personhood carries an uncertain prognosis, as opposed to the strict criteria for brain death. As Dagi69 noted, “there is a critical difference between changing brain-based criteria for death because technological advances confer analogous certainty with less complicated tests, and changing the degree of certainty required for diagnosis.” If the diagnosis of death by “loss of personhood” is not 100% reliable, then how could we convince the public that fears of being alive during organ collection, or worse, fears of knowingly being killed for vital organs, are unfounded?

The issue of personhood has been recently used to argue that certain living individuals can ethically be sacrificed to provide vital organs for others.70 In 1995, the American Medical Association Council on Ethical and Judicial Affairs (CEJA) rendered an opinion in favor of using anencephalic neonates as vital organ donors, despite the fact that such individuals are not dead. The CEJA argued that anencephalic neonates never have the capacity for consciousness, and therefore never have an “established identity or set of interests.” The infants never were persons, despite the fact that biologically they are certainly alive. Can we justify using such living individuals as vital organ donors? Must we treat live individuals who have either never been persons or who have at some point permanently lost their personhood with the same values with which we treat persons? Should we be concerned that other vulnerable individuals in society may then similarly be, to quote Churchill and Pinkus71 “excluded from the human community through redefinition,” as the pressure for more transplantable organs continues to increase?

Slippery Slopes

The principle of nonmaleficence dictates that we should avoid acts that, although beneficial themselves, might lead us into other similar but morally objectionable acts. This can happen when no logical, defensible distinction can be drawn to justify acts that are “good” and prohibit acts that are objectionable. This argument, called a “logical slippery slope” or “wedge” argument, was an immediate and obvious rebuttal to the recommendations of the American Medical Association council. How do we limit vital organ collection from one group of living individuals and not risk other vulnerable persons? The CEJA dismissed the idea that there was a logical slippery slope involved in using anencephalic neonates as vital organ donors.70 They argued that a distinct and logical line can be drawn between anencephalic neonates, which they asserted are identifiable and unique, and other types of vulnerable “persons,” such as patients in persistent vegetative states, so that use of anencephalic neonates as vital organ donors does not logically lead to use of any other living individuals. Less than 1 yr after the CEJA presented its original report, it reviewed more scientific evidence regarding anencephaly, and because of concern about certain diagnoses of anencephaly and the lack of understanding of consciousness in such neonates, the Council withdrew its opinion in favor of continued study.72

There is another kind of slippery slope. On a psychological-sociological slippery slope, once constraints against the use of one group of living individuals as vital organ donors are removed, psychological or social forces may provide disincentive to draw those logical, appropriate, clear, and defensible distinctions between anencephalic neonates and other living but vulnerable individuals.71,73,74 As the expense of caring for comatose patients increases, the number of such patients increases, and the demand for transplantable organs con-

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continues to outstrip supply, there is danger that a gradual erosion of society's distinctions between living "nonpersons" and living but nonautonomous "persons" will occur. It is relatively easy to defeat the logical slippery slope argument by noting the medical and ethical distinctions that can be drawn between a particular group of individuals such as anencephalic infants and other vulnerable individuals such as patients in persistent coma. But defeating a psychological-sociological slippery slope argument is much more difficult. To quote Beachamp and Childress, "Rules against killing in a moral code are not isolated fragments; they are threads in a fabric of rules, drawn in part from nonmaleficence, that support respect for human life. The more threads we remove, the weaker the fabric becomes."

When whole brain-death criteria are applied to the three cases introducing this article, it is evident that none of the donors or potential donors was dead. Furthermore, there is evidence in the two cases in which vital organ collection occurred that physicians knew or should have known that their donor was not brain dead. In the first case, death was declared despite an apnea test that indicated brainstem activity. The fact that reversal of muscle relaxation enabled the donor to breathe suggests that a critical point in the declaration of brain death may have been missed: the presence of muscle relaxants, toxins, and sedatives must be ruled out before clinical testing. In the second case, the patient was obviously breathing at the time of organ collection, an observation that precludes the diagnosis of brain death. In the third case, an alert anesthesiologist recognized that brain death criteria were not met in a patient with intact cranial reflexes and successfully treated with edrophonium an apparent residual effect of pancuronium, probably potentiated by a toxic serum magnesium level.

In case 1, an anesthesiologist questioned the utility of strict brain death criteria in mortally damaged patients. To answer, we should recall the struggles of others to define what it is to lose personhood. If we consider damaged individuals by virtue of their injuries to be dead instead of alive, then just how much injury can an individual sustain and still be classified as living? When, in that formulation, is a person "all dead" and not just "mostly dead?" Although we might argue that the prognosis for even short-term survival is dismal for many such patients, current literature and experience demonstrate that the outcome is far from certain.

In case 2, the donor was unconscious and no longer autonomous but possessed human rights, protected by law, together with life and its intrinsic value. In my opinion, the physicians erred in their belief that the donor could medically, legally, or ethically be declared brain dead and may have been biased by the conflict of interest in their well-intentioned desire to benefit an organ recipient. By making such judgments, they stepped onto a slippery slope. For although the patient was certainly profoundly damaged and unlikely to survive, the patient was nevertheless a member of a continuum of damaged but living individuals.

As case 3 illustrates, profound neurologic injury does not preclude recovery of meaningful function in nonbrain-dead individuals. Had her anesthesiologist been less knowledgeable about criteria for declaring brain death or less forceful about pursuing his/her concerns, this patient might have become a vital organ donor and never rejoined her family.

Summary

Accurate criteria for death are increasingly important as it becomes more difficult for the public to distinguish between patients who are still alive from those who, through the aid of medical technology, merely look like they are alive even though they are dead. Patients and their families need to know that a clear line can be drawn between life and death, and that patients who are alive will not be unintentionally treated as though they are dead. For the public to trust the pronouncements of medical doctors as to whether a patient is dead or alive, the criteria must be unambiguous, understandable, and infallible.

It is equally important to physicians that accurate, infallible criteria define death. Physicians need to know that a clear line can be drawn between life and death so that patients who are dead are not treated as though they are alive. Such criteria enable us to terminate expensive medical care to corpses. Clear criteria for death also allow us to ethically request the gift of vital organs. Clear, infallible criteria allow us to assure families and society that one living person will not be intentionally or unintentionally killed for the sake of another. The pressure of organ scarcity must not lead physicians to allow the criteria for life and death to become blurred because of the irreparable harm this would cause to the patient-physician relationship and the devastating impact it could have on organ transplantation.

As the cases presented here illustrate, anesthesiologists have an important responsibility in the process of ensuring that some living patients are not sacrificed to benefit...
Appendix

Review data supplied in the chart supporting the diagnosis of brain death and seriously question inconsistencies and inadequate testing conditions. Knowledge of brain death criteria and proper application of these criteria could have changed the course of each of the cases presented.

The author thanks Thomas Hornbein, MD, former chairman, Department of Anesthesiology University of Washington, mentor and friend.

Appendix

Brain Death Determination Requirements; A Check List for Anesthesiologists

1. Etiology of coma
   - absence of sedation
   - absence of shock (systolic BP 90 mmHg, or within 10% of patient’s baseline)
   - absence of neuromuscular blocking agents, confirmed by nerve stimulator
   - absence of hypothermia (core temp 32.5°C in all cases, higher in some institutions)
   - absence of the following metabolic or endocrine disorders:
     - hypoglycemia
     - ketonuria
     - uremia
     - hepatic failure
     - hyponatremia
     - hypercalcemia
   - In cases of coma of unknown etiology, documented absence of panhypopituitarism, adrenal cortical insufficiency, or myxedema coma through documentation of TSH and cortisol levels.

2. Clinical examination (all must be checked to confirm diagnosis):
   - no spontaneous movement
   - no movement in response to pain,* including supraorbital ridge pressure
   - no seizures or cerebrate, decorticate, or dyskinetic movements or posturing

* Movement due to spinal reflexes are acceptable. Such movement should be local, minor flexion only in response to locally applied painful stimulus—for example, painful stimulus to an upper extremity should elicit no movement or only minor flexion of the extremity to which the stimulus is applied. Other types of movement, spinal automatism (Lazarus sign) requires further confirmatory testing to establish the diagnosis of brain death.

Brain stem reflexes (all must be checked to confirm diagnosis):
   - absent pupillary response to light
   - absent corneal reflexes
   - absent caloric response
   - absent pharyngeal reflexes

4. Time between clinical assessments (note—in some cases of obvious irreparable brain damage, two tests may not be required):
   - at least 6 h in adults
   - at least 24 h in infants between 2 months and 1 yr of age
   - at least 48 h in infants younger than 2 months of age

5. Apnea test (all must be checked to confirm appropriate apnea testing and brain death diagnosis):
   - baseline arterial blood gases with patient being ventilated with 100% oxygen
     - $P_aO_2$ 200 mmHg
     - $P_aCO2$ 35 mmHg
   - final arterial blood gases with patient breathing 100% oxygen via a T piece:
     - $P_aO_2$ 60 if patient carries diagnosis of COPD
     - $P_aCO2$ 60
   - no movements, gasping, coughing, or respiratory effort of any kind

6. Confirmatory tests (medically optional if physical exam and apnea test confirm brain death, but may be required if the clinical picture is confusing, or if institutional policy dictates)
   - EEG should be isoelectric (NOT sufficient by itself as a confirmatory test). The presence of electrical activity on EEG testing may indicates a need for further confirmatory tests.
   - Cerebral blood flow study by nuclear, radiographic or Doppler technique demonstrates no cerebral blood flow, including no blood flow to the posterior fossa (sufficient by itself to confirm brain death).
   - Brain stem evoked responses show no brain stem activity (NOT sufficient by itself to confirm brain death).

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