

Brain Death: Medical and Legal Issues

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Irreversible cessation of brain function has become a widely accepted criterion of death. Case law, state statutes, and medical opinion, backed by clinical studies, all support the use of brain death criteria as a means of determining death. Current state statutes are in need of some uniformity, as 12 different statutory approaches to brain death are currently in use. Brain death should not be confused with the still unresolved issue of termination of life support to terminally ill, mentally incompetent patients, or those who are comatose yet do not meet brain death criteria.

Evolution of Medical Criteria for Brain Death

Case reports of clinical situations resembling brain death can be found in medical literature as far back as 1902.¹ Patients with a clinical condition meeting the current criteria of brain death and maintained on a respirator were described by Mollaret and Goulon in 1959.² With the advent of organ transplants and the development of increasingly sophisticated artificial life-support technology, the need to utilize brain death criteria increased. A case described in England in 1963 illustrates the controversies that developed.³ A 32-year-old man sustained massive brain damage. He stopped breathing and was placed on artificial respiration so that one of his kidneys could be used for transplantation. His kidney was removed and the respirator was then turned off. Great debate ensued as to whether the kidney had been removed before or after the man's death.

The first heart transplant occurred in late 1967.

Rapid progress of transplantation technology was creating a demand for viable organs that was outdistancing the supply. In response to the need for statutory reform to increase the availability of donor organs, the National Conference of Commissioners on Uniform State Laws prepared the Uniform Anatomical Gift Act (UAGA) in 1968. The rapid acceptance and implementation of the UAGA has been described by Sadler et al.⁴

The UAGA did not define death or include criteria of death, since death was felt to be a matter of medical judgment, rather than statutory law.⁴ In response to the need for commonly accepted criteria of brain death, the Ad Hoc Committee of the Harvard Medical School to Examine the Definition of Brain Death was established. The committee, consisting of physicians as well as a lawyer and a theologian, published their report in August 1968.⁵

The Harvard committee stated as their purpose defining irreversible coma as a new criterion of death.⁵ Three conditions were listed as necessary before one could be declared dead by this criterion:

1. Unreceptivity and unresponsivity, including a lack of response to painful stimuli
2. No movements or breathing, or a lack of spontaneous respiration described as no effort to breathe for three minutes off the respirator with the patient's carbon dioxide tension normal and room air being breathed for 10 minutes prior to the trial

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3. No reflexes, including fixed, dilated pupils and a lack of cranial nerve reflexes; it was felt that, as a rule, tendon reflexes could not be elicited.

The Harvard committee stated that a flat electroencephalogram (EEG) was of great confirmatory value and should be used when available, but was not absolutely necessary. It was also suggested that all tests be repeated in 24 hours and that hypothermia and central nervous system depressant intoxication be ruled out. The determination of death should be made by the physician in charge in consultation with one or more other physicians, none of whom should be involved in any later transplantation using organs from the deceased. The committee further stated that death should be declared, following which the respirator should be turned off.

Several reviews of clinical studies have confirmed the validity of the Harvard criteria.^{6,7} The criteria have been shown to be predictive of death within a defined time period,⁸ and those who fulfill the Harvard criteria have been shown to have no significant brain blood flow,⁹ which uniformly results in necrosis of the brain.¹⁰

The National Institute of Neurological Diseases and Stroke (now National Institute of Neurological and Communicative Disorders and Stroke) conducted a collaborative study and found the Harvard criteria to be excessively strict.⁸ Apnea, cerebral unresponsivity, and one isoelectric EEG predicted death within three months in 187 of 189 comatose patients in spite of continuation of life support and all therapeutic modalities. The two who did not die were both drug intoxication cases. They both had constricted pupils; therefore, dilated pupils was added as an additional criterion with the caution that dilated pupils could be found with glutethimide and scopolamine intoxication. Even though absent cephalic reflexes did not improve the criterion accuracy, they were also added. The final criteria suggested by this collaborative study were (1) coma and cerebral unresponsivity, (2) apnea, (3) dilated pupils, (4) absent cephalic reflexes, (5) electrocerebral silence, (6) criteria to be present for 30 minutes at least six hours after the onset of coma and apnea, and (7) all appropriate diagnostic therapeutic procedures to be performed. The directors also suggested a confirmatory test of cerebral blood flow if one of the seven standards is met imprecisely or cannot be tested.

These criteria differ from the Harvard criteria by requiring a shorter time interval (six vs 24 hours), by defining apnea differently (no effort to override the respirator in 15 minutes), by having no requirement for spinal reflexes, by making a flat EEG a requirement rather than a confirmation, and by adding a test of blood flow as a confirmation under certain circumstances.

Black⁷ has reviewed the literature and summarized the results of several suggested criteria. It now appears that limb stretch reflexes are not predictive, that widely dilated pupils may not be an absolute requirement, although fixed pupils are, and that more caution is required when no known cause of brain damage exists. One isoelectric EEG is predictive of death if done following strict criteria and if hypothermia, cardiovascular shock, intoxication, and metabolic causes are ruled out. A lack of cerebral circulation, demonstrated by any of several methods, is also predictive of brain death. Although both an isoelectric EEG and a negative cerebral blood flow study are predictive of brain death by themselves, neither is necessary by several criteria, and the use of either as a sole criterion has found poor acceptance among physicians.

Black concludes that any of several suggested criteria are accurate if they contain as a minimum apnea, lack of responsivity, lack of brain stem reflexes, and exclusion of drug overdose.

The whole concept of brain death has been questioned by some in the fields of medicine and religion.¹¹ Theirs is a minority viewpoint, and as yet no evidence has been presented that those meeting the previously described criteria will survive.

Brain Death and the Law

Legal Status Before Tucker and Kansas

Prior to 1970 there were no statutes regarding determination of death. Cases that had been decided by the courts dealt with the time of death for purposes of inheritance, termination of joint tenancies, and determination of rights in the proceeds of insurance policies. The traditional criteria of death, the cessation of vital functions of respiration and circulation, had remained unchanged for over a century. In support of the application of the traditional criteria, the courts have relied on *Black's Law Dictionary*,¹²⁻¹⁵ expert medical testi-

mony,¹⁶ and prevailing medical practices.¹⁷ In 1968 the problem of organ transplantation led to several legal articles on death, which concluded that the law recognized only the traditional definition of death.¹⁸⁻²⁰

The Kansas Statute

Kansas adopted the Uniform Anatomical Gift Act in 1968. In 1967 a Kansas court accepted the traditional "vital function" definition of death.²¹ Physicians at the University of Kansas Medical Center involved in organ transplant programs felt that they were legally vulnerable if organs were removed before the cessation of cardiac and respiratory functions. They drew up a proposed statute and took it to the state legislature, where it was well received and adopted. Those who proposed the legislation frankly admit that its purpose was to provide a way to obtain viable organs for transplantation while providing protection to the donor.¹³

The text of the Kansas law is as follows²²:

Definition of death. A person will be considered medically and legally dead if, in the opinion of a physician, based on ordinary standards of medical practice, there is the absence of spontaneous respiratory and cardiac function and, because of the disease or condition which caused, directly or indirectly, these functions to cease, or because of the passage of time since these functions ceased, attempts at resuscitation are considered hopeless; and, in this event, death will have occurred at the time these functions ceased;

or

A person will be considered medically and legally dead if, in the opinion of a physician based on ordinary standards of medical practice, there is the absence of spontaneous brain function; and if based on ordinary standards of medical practice, during reasonable attempts to either maintain or restore spontaneous circulatory or respiratory function in the absence of aforesaid brain function, it appears that further attempts at resuscitation or supportive maintenance will not succeed, death will have occurred at the time when these conditions first coincide. Death is to be pronounced before artificial means of supporting respiratory and circulatory function are terminated and before any vital organ is removed for purposes of transplantation.

These alternative definitions of death are to be utilized for all purposes in this state, including the trials of civil and criminal cases, any laws to the contrary notwithstanding.

The Kansas statute was subject for much debate. Those in favor generally felt it was a well-written first step.²³ One author argued that it even protected physicians when they determine that resuscitation is not warranted.²⁴ Others expressed uneasiness leaving the matter solely in the hands of physicians.^{25,26}

There were also those who were supportive of a statutory definition, although opposed to some components of the Kansas statute.²⁷ Frequent criticisms expressed were (1) it is too transplant oriented, (2) it does not prevent transplant physicians from determining the death of potential donors, (3) it provides two definitions of death, and (4) it does not require two physicians to certify death has occurred.

Those opposed to any statutory definition wanted to leave the matter to the courts and medical profession,¹¹ and argued that a statute would be too rigid and would inhibit medical progress in the field of life support and transplantation, even though the statute did not spell out which criteria were to be used to determine brain death. They also pointed out that both the Harvard committee and the National Conference of Commissioners on Uniform State Laws had stated an opposition to a statutory definition of death. In spite of these criticisms, the law has remained unchanged, and in 1977 the Kansas Supreme Court reviewed the Kansas Brain Death Statute and gave it judicial approval.^{28,29}

Tucker vs Lower and Subsequent Case Law

The first judicial action accepting brain-related criteria of death was in Oregon.³⁰ Here a defendant appealed his second-degree murder charge on the grounds that the victim's death was caused by withdrawal of life-support systems rather than a gunshot wound to the head, which the defendant had inflicted. The court ruled that based on medical testimony, the gunshot wound resulted in brain damage as the cause of death.

Better publicized was the case of Tucker's administrator vs Lower.³¹ This case involved a wrongful death action that claimed an individual was not dead at the time his kidneys and heart were removed for transplantation. Originally, the judge ruled that the case would be tried using the standard legal concept of death, not the medical concept of neurological death.^{31,32} The presenta-

tion of the medical evidence apparently changed the judge's mind, as his final charge to the jury included both the legal and medical definitions. The jury was allowed to choose which to use. They chose to accept the medical evidence of brain death and returned a verdict in favor of the transplant surgeons.

Since the Tucker case there have been a number of court cases in which the question of brain death criteria has been introduced. Most have involved defendants in homicide cases attempting to lay blame on physicians for causing the death of the homicide victim because of the removal of life-support systems. In all cases the defendants have lost their appeals.²⁸ As of November 1981, 16 states had cases on record in which courts ruled in favor of brain death criteria.³³ Twelve involved homicide cases, and three dealt with requests to remove patients from life-support systems. This judicial approval has extended to six state supreme courts, where both common law and statutory usage of brain death have been ruled on.

Statutes Since Kansas

Since passage of the Kansas Brain Death Statute, 29 states have adopted similar laws.³⁴ As of 1981, 26 states had brain death statutes, 16 states had case law rulings favoring brain death, 6 states had both, and 17 states had neither.³³

As more states have adopted brain death statutes, some of those originally opposed to statutory definition of death now argue for uniform legislation to avoid confusion.³⁴ Support of uniform legislation was adopted by the American Bar Association (ABA) in 1975 and the American Medical Association (AMA) in 1979. Representatives from the ABA, the AMA, and the National Conference of Commissioners of Uniform State Laws agreed upon model legislation in May 1980. This model was also endorsed by the President's Commission for the Study of Ethical Problems in Medicine and Biomedical and Behavioral Research and 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 shall be made in accordance with accepted medical standards.

Currently, state statutes are in need of some uniformity, since there are 12 different approaches used, based on three major patterns: (1) the Kansas statute, using alternative definitions of death, (2) the model suggested by Capron and Kass,²⁵ in which brain death criteria are to be used only where artificial support of respiration and circulation preclude determination of death by standard criteria, and (3) a model adopted by the ABA in 1975, which states that "for all legal purposes, a human body with irreversible cessation of total brain function, according to usual and customary standards of medical practice, shall be considered dead."³⁵ The pros and cons of each approach have been discussed at length.^{25,35} Eight statutes state that two physicians must make the determination of brain death, and eight statutes include some specific mention of transplantation (either precluding physicians who make a determination of brain death from participating in any transplant involving organs from the deceased or defining when organs can be removed). Table 1 summarizes the specifics of each state statute.

Although state laws differ in certain respects, physicians can meet the requirements of all of them by (1) using the commonly accepted criteria of brain death, (2) having two physicians, one of whom is a neurologist, make the brain death determination, (3) avoiding a conflict of interest by having physicians separate from the transplant team certify the brain death of potential donors, and (4) determining brain death before removing any organ or removing any life support equipment.

Legal authorities are generally of the opinion that physicians in states without statutes or case law precedent can feel secure in using commonly accepted brain death criteria to determine death.³⁴ No cases on record have been decided against physicians for using these criteria.

There are several issues concerning dying patients that should not be confused with brain death statutes or case law. These include (1) the termination of life support or refusal of therapy to noncompetent patients, and (2) termination of life support from patients who do not meet completely the brain death criteria.

The first issue has involved some confusion following the Saikewicz decision in Massachusetts.³⁶ The court ruled that decisions on removal of life-support systems or continuation of life-extending therapy in otherwise dying patients who are in-

Table 1. Requirements for Determination of Death According to State Law

	Brain Death to Be Used Only When the Patient Is on Artificial Life Support	Certification by Two Physicians Required	Death to Be Pronounced Before Artificial Life Support Removed	Pronouncing Physician Cannot Be on Transplant Team	Miscellaneous
Alabama	X	X	X		
Alaska	X		X		
Arkansas	—	—	—	—	—
California		X		X	
Connecticut		X		X	
Florida	X	X*			
Georgia		X			
Hawaii	X	X	X	X	
Idaho		X			
Illinois	—	—	—	—	—
Iowa	X	X			
Kansas			X		
Louisiana	X	X**		X†	
Maryland			X		
Michigan	X		X		
Mississippi					X††
Montana	—	—	—	—	—
New Mexico			X		
North Carolina	—	—	—	—	—
Oklahoma			X		
Oregon	—	—	—	—	—
Tennessee	—	—	—	—	—
Texas	X		X		
Virginia		X‡			
West Virginia	—	—	—	—	—
Wyoming					X‡‡

*Second opinion must be from a board-certified or -eligible neurologist, neurosurgeon, internist, pediatrician, surgeon, or anesthesiologist
**Second opinion required only when organs are to be used for transplantation
†Only the second opinion need be from a nonmember of the transplant team
††Defines brain death as including cessation of brain stem functions
‡Consultant must be a neurologist, neurosurgeon, or specialist in electroencephalography
‡‡Brain function defined as purposeful activity on the brain as distinguished from random activity

competent because of mental retardation or incapacity, or who are under the age of maturity, must go before a probate court for approval. This ruling had nothing to do with patients who meet brain death criteria. That some confusion exists is evident from several recent cases. One involved a patient who met brain death criteria after a few days but was kept on a respirator and given supportive care until a court order was obtained on day 74.

Court approval for removal of artificial life support is not necessary when a patient is dead by

brain death criteria. The language used in one such case in Connecticut is interesting:

And, I would like to also make it clear on the record that the court feels that the matter which is presented here for its determination is one in which judicial intervention is not necessary or required. The court would just like to state for the record that on the basis of its reading of the applicable cases and the literature on the subject that the issues involved in this case are best determined by the family, by the attending physician, and by the hospitals involved, and that judicial intervention should be required only where it is necessary to protect those per-

sons who are acting in their professional capacity from possible civil or criminal consequences.³⁷

The second issue involves patients who have suffered irreversible coma, defined as a vegetating state in which all functions attributed to the cerebrum are lost, but certain vital functions, such as respiration, temperature, and blood pressure regulation, are retained.⁸ (The Harvard committee originally used the term *irreversible coma* in a different manner.) Such patients can have flat EEGs.³⁸ It has been argued that such a state should be considered brain death, but this has not won common acceptance. Dealing with such patients will continue to be an ethical dilemma for which current brain death criteria offer no assistance.

Conclusions

It is clear that case law, statutory law, and medical opinion heavily favor the use of brain death as a means of determining death. The different criteria for verifying irreversible cessation of brain function that have been suggested all contain the common requirements of apnea, lack of responsiveness, lack of brain stem reflexes, and the exclusion of drug overdose. Continuing technical advances will undoubtedly contribute to the further refinement of brain death criteria.

Since statutory uniformity is lacking among those states with brain death statutes, it is suggested that physicians familiarize themselves with the situation in their state. Case law has uniformly approved the use of brain death criteria, and medical-legal experts have concluded that physicians in a state without brain death statutes or case law precedent can feel secure in using commonly accepted brain death criteria as a means of determining death.

Comatose patients who meet brain death criteria need not pose an ethical or legal problem to physicians or family. Comatose patients who do not fulfill these criteria will continue to present a dilemma that will be resolved only by further medical and legal advances.

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