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## Medical Diagnosis Versus Legal Determination of Death

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**ABSTRACT:** This summary of the medical and legal descriptions of death notes that the physician makes a medical diagnosis of death, the physician then makes the legal pronouncement of death, and that statute or the courts make the legal determination of death. Medical diagnosis of death follows either the common law standard of total cessation of cardiac and respiratory function or the medically accepted standards of brain death, the latter being based on irreversible loss of brain function. Cessation of cardiorespiratory function inevitably causes brain death; similarly, brain death inevitably causes cessation of cardiac function. The common law definition of death has been redefined: death is brain death which inevitably causes cessation of the cardiorespiratory functions. Legal determination of death, since the advent of cadaver organ transplantation, has been made by case law, which is briefly summarized, or by statute in most jurisdictions. The history of the Uniform Determination of Death Act is briefly summarized; this observer joins those recommending adoption of this Act. A table gives the rules or statutes that determine death in 36 U.S. jurisdictions.

**KEYWORDS:** forensic science, jurisprudence, death, medical personnel

The medical diagnosis of death is made by a physician or physicians [1] as the basis of the pronouncement and certification [2] of death, following currently accepted medical practice [3-5].<sup>2</sup> The legal determination of death is made in connection with autopsy and burial [6], cadaver organ transplant [7-9], medical malpractice, wrongful death, inheritance, insurance [10], and homicide. The purpose of this article is to summarize medical diagnosis and legal determination and the history of their belated concordance.

### Clinical Medical Diagnosis of Death

Before the development in the 1960s of sophisticated artificial respiration and artificial circulation systems or life support systems, the physician would diagnose death by the common law standard, on his finding of irreversible cessation of all cardiac and respiratory function [11, 12]. However, when this cardiopulmonary function ceases, "systemic death" or death of the other systems of the body takes place *within minutes* [13, 9, pp. 6, 21, and 27] the brain being the first major organ to suffer irreversible loss of function [14, 15], for reasons yet unexplained [16]. The other organs perish later (see Tables 1 and 2). (Subsequent and late signs of death have been well documented [Table 3]).

But since the 1960s, using artificial ventilation and other support methods in cases of severe

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<sup>2</sup>Generally, the standard of care is one which has been accepted by a substantial and reputable number of physicians as safe and efficacious.

TABLE 1—*Diagnosis of death.*<sup>a</sup>


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CARDIOPULMONARY

“An individual with irreversible cessation of circulation and respiratory functions” is dead.

1. Cessation is recognized clinically. May use ECG.
2. Irreversibility—appropriate period of observation or trial of therapy or both.

or

BRAIN

“An individual . . . with irreversible cessation of all functions of the entire brain, including the brain stem, is dead.”

1. Cessation
  - a. Coma is present, cerebral functions are absent.  
May use EEG or blood flow study.
  - b. Brain stem functions are absent.  
“Experienced physician”; apnea present, brain stem reflexes absent.
2. Irreversibility
  - a. Coma—diagnosed, and sufficient.
  - b. “Possibility of recovery of any brain function is excluded.”  
Caution: Sedation, hypothermia, neuromuscular blockade and shock.
  - c. Appropriate period of observation or trial of therapy or both, for example, 6, 12, 24 h.

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<sup>a</sup>From Ref 3.

TABLE 2—*Definitions.*<sup>a</sup>


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1. *Cerebral unresponsivity*: a state in which the patient does not respond purposively to externally applied stimuli, obeys no commands, and does not phonate spontaneously or in response to a painful stimulus.
2. *Apnea*: the absence of spontaneous respiration, manifested by the need for controlled ventilation (that is, the patient shows no effort to override the respirator) for at least 15 min.
3. *Cephalic reflexes*: pupillary, corneal, oculoauditory, oculo-vestibular, oculocephalic, ciliospinal, snout, cough, pharyngeal, swallowing.
4. *Electrocerebral silence*: an EEG with an absence of electrical potentials of cerebral origin over 2  $\mu$ V from symmetrically placed electrode pairs over 10 cm apart and with interelectrode resistance between 100 and 10 000  $\Omega$ .

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<sup>a</sup>From Refs 14 and 15.

TABLE 3—*Later, or gross anatomical signs of death.*<sup>a</sup>


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1. Rigor mortis—begins at 2 h, apparent at 6 h, recedes at 24 h.
2. Livor mortis—dependent skin shows reddish purple blotches, begins in minutes, coalesces at 12 h.
3. Algor mortis—cooling of death—variable, for example, heat stroke.
4. Less than one week:
  - Alteration of stomach contents, pupil size, corneas, reduced introcular pressure, segmentation in vessels, Faradic reaction of small muscles.
  - Chemical changes in potassium of vitreous, blood serum, cerebrospinal fluid.
5. About five days—putrefaction and invasion by maggots.
6. Mummification or adipocere.

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<sup>a</sup>From Ref 17.

brain damage from trauma and other agents, when that damage is later proven to be irreversible, the heart may sometimes continue beating for as long as one week [9], or even 14 days, with the brain grossly decomposing [18]. The longest persistence of heart beat under such condition was in a 5-year-old child, for 32 days [19,20].

An irreversible cessation of all brain function is called brain death [21]. "Complete cessation of circulation to the normothermic brain for more than 10 minutes is incompatible with survival of brain tissue" [3]. Thus cessation of heart function causes brain death within minutes, while cessation of brain function causes loss of heart function in hours or days.

Examination of many patients whose brain injury is proven over time to be complete and irreversible [22], but who are given artificial ventilation, has shown that such patients are in deep coma, and medical authorities recommend identifying the cause of this coma and proof that the cause of coma is sufficient to account for the state of unconsciousness. This recommendation of the standard of practice notes that in brain death, the brain stem reflexes are lost. It also states that to make the diagnosis of death, the possibility of recovery, both of cardiopulmonary function and of brain function, be excluded, particularly under conditions of hypothermia (below 32.2°C or 90°F core temperature), drug intoxication, neuromuscular blockade, metabolic intoxication, young age, and shock. Also recommended is that observation or a trial of therapy establish these findings over an appropriate period of time, with suggested periods ranging from 6 to 24 h [3].

However, some patients, for example, Karen Ann Quinlan [23], with severe brain damage, are not brain dead. Quinlan [9, p. 320] demonstrates a persistent vegetative state, which is a condition of wakefulness without awareness; similar critically ill patients show an apallic syndrome, locked-in state, and so forth [21,22,24], but still have some brain stem function and therefore are not dead. Treatment of such patients may be governed by case law which prescribes a hospital ethics committee, or a prognosis committee [25].

## Legal Determination of Death

### *Statutes and Official Medical Action*

Along with the increasing sophistication of medical knowledge and of medical hardware, the need for cadaver organ transplants has grown rapidly, there now being a chronic shortage, for example, of available cadaver kidneys for life-saving transplantation [26,27]. Carnage with motor vehicles, grave brain damage from "accidents," suicide, homicide, and child abuse all continue. In addition, the limit on damages for pecuniary injury from wrongful death was removed in many jurisdictions [28].

To address this need, in 1968, a group of physicians at Harvard Medical School, assisted by a law professor and a theologian [29], proposed a definition of brain death. In 1970, Kansas was the first state to make a statutory definition of death [1]. A model statute on this subject was proposed by Capron and Kass in 1972 [30] and in 1975, The American Bar Association proposed its model law [31]. In 1978 the National Conference of Commissioners on Uniform State Laws recommended a Uniform Brain Death Act [32]. Still, the American Medical Association (AMA) refused to offer a policy paper, stating that the diagnosis of death was a purely medical matter, which should be decided only by physicians [33].

But in 1979, the American Medical Association reversed itself and proposed a Model Determination of Death Statute [34]. Promptly, collaboration by the American Bar Association, the American Medical Association, the National Conference of Commissioners on Uniform State Laws and the Medical Consultants on the Diagnosis of Death to the President's Commission for the Study of Ethical Problems in Medicine and Biomedical and Behavioral Research published the Uniform Determination of Death Act [32] of 1980:

An individual who has sustained either (A) irreversible cessation of circulatory and respiratory functions, or (B) irreversible cessation of all functions of the entire brain, including the brain stem, is dead. A determination of death must be made in accordance with accepted medical standards.

The values of this formulation include its simple delineation of death, covering persons who die in or out of hospitals, with or without life support systems, and for whom burial or cremation or autopsy or cadaver organ transplantation is contemplated. At last, the AMA, later joined by the American Academy of Neurology and the American Electroencephalogram (EEG) society, made this official proposal on this subject, which with its referenced guidelines, is satisfactory to physicians, and adequate for lawyers and the courts [1].

At this reading, the District of Columbia and ten states have adopted this Uniform Determination of Death Act. Twenty-five other jurisdictions have enacted other statutes defining death that are similar to this model law.

A related model law, the Uniform Anatomical Gift Act, which determines the time of death [35], has been adopted by all U.S. jurisdictions. This medicolegal observer supports the uniform adoption of the Uniform Determination of Death Act. Table 4 summarizes the determination of death statutes in 35 U.S. jurisdictions.

TABLE 4—Rules on determination of death in 35 jurisdictions.<sup>a</sup>

Alabama	§22-31-1. No spontaneous cardiopulmonary function, or brain death.
Arizona	<i>State v. Fierro</i> , 603 P.2d 73 (Ariz. 1979). Cardiopulmonary loss or Uniform Brain Death Act or Harvard standards.
Alaska	§9.65.120. No spontaneous cardiopulmonary or brain function.
Arkansas	§82-537, et seq. Brain and breath death.
California	Health and Safety §7180. Brain death.
Colorado	§12-36-136. Uniform Determination of Death Act.
Connecticut	§19-139(i). Two physicians shall use generally recognized and accepted scientific and clinical means to pronounce brain death, which means cardiopulmonary death.
District of Columbia	Uniform Determination of Death Act.
Florida	§382.085. Brain death.
Georgia	§88-1715.1. Brain death, but may use other medically recognized standards.
Hawaii	§327 C-1. Cardiopulmonary or brain death, biannual review.
Idaho	§54-1819. Uniform Determination of Death Act.
Illinois	§302. Brain death, but see Ill. Stat., Ch. 110½, Uniform Determination of Death Act.
Iowa	§702.8. Cessation of spontaneous cardiopulmonary or brain function.
Kansas	§77-202. Hopeless absence of cardiopulmonary function or absence of spontaneous brain function.
Louisiana	§111. Spontaneous cardiopulmonary loss or brain death.
Maryland	§54(F). Absence of spontaneous cardiopulmonary or brain function.
Michigan	§14.15 (1021). Cessation of spontaneous cardiopulmonary or brain function.
Mississippi	§41-36-1. Uniform Determination of Death Act.
Montana	§50-22-101. Brain death.
Nevada	§451.007. Uniform Brain Death Act.
New Mexico	§12-2-4. Absence of spontaneous cardiopulmonary or brain function.
North Carolina	§90-323. Brain death or other medically recognized criteria.
Oklahoma	§1-301. Brain death and inability to resuscitate.
Oregon	§146.087. Irreversible cessation of spontaneous brain or cardiopulmonary function.
Pennsylvania	Uniform Determination of Death Act.
Rhode Island	Uniform Determination of Death Act.
Tennessee	§53.459. Brain death.
Texas	§4447(t). Cessation of spontaneous cardiopulmonary or brain function.
Vermont	Uniform Determination of Death Act.
Virginia	§54-352.7. Absence of spontaneous cardiopulmonary or brain function. (First enacted one year after <i>Tucker v. Lower</i> .)
Washington	Uniform Determination of Death Act.
West Virginia	§16-19-1. Cessation of spontaneous brain function.
Wisconsin	Case law
Wyoming	§35-19-101. Cessation of purposeful brain function.

<sup>a</sup>From Ref 1.

## Case Law

### *Traditional Common Law*

In a state without a statute defining death, a 1977 court [36] noted that while the present statutory trend is toward adoption of the "brain death theory" Ohio has "not yet altered the traditional common law approach that death means the permanent cessation of all vital functions, and the fact and time of its occurrence are questions for the jury."

### *Proximate Cause*

In murder trials, the defendant may contend that the victim was still alive when the respirator was disconnected, claiming that the cause of death was this disconnection. No cases have been found in which this contention was successful [1].

The prosecution's argument of proximate cause relies on the well-known principle that a criminal defendant is liable for the natural consequences of his act [37]. Even negligent medical care of the victim does not relieve the defendant from responsibility for these natural consequences. Therefore, even if the victim were legally alive when the respirator was disconnected, the criminal indictment and conviction would not be invalid. "The state is only required to prove, beyond reasonable doubt, that the defendant's acts were a substantial factor in producing the death" [38, 39]. Similarly, the Arizona Supreme Court found that a victim's death was caused by the defendant's inflicting a gunshot wound, and not by the removal of the ventilator [40].

### *Cause in Fact*

Cause in fact is the *vel non* component of proximate cause, or that item without which the event would not have taken place. Using this approach, courts have accepted the medical witness' conclusions on cause of death as a matter of fact. Thus an Oregon court held that the victim's life was terminated by the bullet wound that caused "great damage to the vital centers of the brain, which control respiration and other body activities" [41].

### *Duty of the Court*

In a state which was then without a determination of death statute, the court may add the brain death standard to the old common law cardiopulmonary criterion, as did Massachusetts and Colorado [42, 20]. In the Colorado case, *Lovato v. District Court* [20], the court pointed out that in the absence of such a statute, it is the duty of the court to resolve the legal issue of whether irreversible loss of brain function can be used to determine death. It held that "we adopt the provisions of the Uniform (Brain Death) Act."

### *Civil Cases Revising Common Law*

In *Tucker v. Lower* [43] in 1972, the plaintiff's brother sustained a brain injury, was medically declared brain dead, the heart and kidneys removed for transplant, and the respirator discontinued; plaintiff asserted that the heart was beating when the patient was declared dead, therefore this declaration was false, and sued the doctors under the wrongful death statute. This Virginia trial court rejected the motion by the defendant surgeons for summary judgment, on the ground that the court was bound by the common law definition of death until statutory law was made by the legislature. However, at the last minute, the judge instructed the jury that it shall determine the time of death, by using a definition of death which included, "... the time of complete and irreversible loss of all functions of the brain ..." [43]. The jury acquitted the defendants.

In *New York City v. Sulsona* [44], another cadaver organ transplant case, the issue involved not only the common law cardiopulmonary definition of death, but also the brain death medical standard and the time of death under New York's Anatomical Gift Act. The defendant doctors were acquitted. In *Bowman* [45], the Washington court adopted the 1980 Uniform Determination of Death Act.

### *Cases Testing Statutes*

Statutes on determination of death have successfully withstood court testing, and interesting themes have appeared. In Kansas, *State v. Schaffer* [46] convicted of murder, first degree, claimed the determination of death statute was not intended to apply to criminal homicide, and therefore the jury instructions pursuant to this statute were in error. The court disagreed. The court also held that it was not unconstitutionally vague for the statute to use either the cardiopulmonary or the brain standard, and also held that the statute was not unconstitutionally vague for failure to enumerate details of "ordinary standards of medical practice" used by doctors to diagnose death. It also relied on the proximate cause theory of criminal responsibility noted above, in *People v. Olson* [39] and *State v. Fierro* [40].

In Michigan, *People v. Vanderford* [47] convicted in involuntary manslaughter, challenged the determination of death statute as unconstitutionally vague. The court held, inter alia, that the defendant had no personal interest in the constitutionality of the statute since, even if it were found unconstitutional, his conviction would stand, because Michigan also employs the legal rule that intervening medical error is not a defense when the accused has inflicted a mortal wound upon another. In North Carolina, *No. Carolina v. Holsclaw* [48] held that an intervening cause of death would have to be the sole cause of death to release the criminal defendant from responsibility for the homicide.

### **Terminologic Clarity**

The wording of statutes is usually corrected early on, but in several states the determination of death statute, in the neurologic portion, still notes death as occurring "in the absence of spontaneous brain function." The word "spontaneous," which a Maryland jury did not understand [49] has different meanings for a lawyer, a general physician, and a neurologist. Etymologically, it can mean voluntarily, as it does in the legal term *sua sponte*. Physicians consider spontaneous movement to be self-initiated, as opposed to reflex movement. The neurologist is familiar with patients who have grave brain damage, whose electroencephalograms show no spontaneous activity, but do show electrophysiologic reflexes consisting of evoked auditory potentials [50,51]. These evoked responses show that there is some brain stem function, therefore they are not dead [50,3].

In Maryland [52] this term spontaneous led to a mistrial; charges were dropped and a bargain made, and the prosecutor was quoted as saying, "We need an acceptable universal definition of death" [1].

### **Freestanding Statute**

A determination of death statute should be freestanding and not attached to special purpose legislation, such as a Natural Death Act, or legislation of any variety that governs cadaver organ transplantation. In Connecticut, the statute determining brain death was adopted only as part of that state's Uniform Anatomical Gift Act. In that state, a patient [53] was diagnosed as having suffered cardiac arrest and later, brain death. Even though the family wished to have the patient removed from the respirator, but because the patient was not an organ donor, and since the doctor was concerned about being prosecuted, there ensued both a convoluted legal

proceeding and more than one month of hospital intensive care before the body was removed from the respirator.

### Conclusion

Modern medical investigation shows that cessation of cardiac function causes brain death in less than 10 min. Cessation of all brain function, therefore including brain stem function, defined as brain death, inevitably causes cessation of cardio-respiratory functions, within hours or days. The common law definition of death consisting of cessation of the vital functions has been medically confirmed and legally redefined: death is brain death, which causes the inevitable cessation of the vital functions.

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