Brain death and true patient care

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Abstract

The “brain death” standard as a criterion of death is closely associated with the need for transplantable organs from heart-beating donors. Are all of these potential donors really dead, or does the documented evidence of patients destined for organ harvesting who improve, or even recover to live normal lives, call into question the premise underlying “brain death”? The aim of this paper is to re-examine the notion of “brain death,” especially its clinical test-criteria, in light of a broad framework, including medical knowledge in the field of neuro-intensive care and the traditional ethics of the medical profession. I will argue that both the empirical medical evidence and the ethics of the doctor–patient relationship point to an alternative approach toward the severely comatose patient (potential brain-dead donor).

Lay Summary: Though legally accepted and widely practiced, the “brain death” standard for the determination of death has remained a controversial issue, especially in view of the occurrence of
chronic brain death” survivors. This paper critically re-evaluates the clinical test-criteria for “brain death,” taking into account what is known about the neuro-critical care of severe brain injury. The medical evidence, together with the understanding of the moral role of the physician toward the patient present before him or her, indicate that an alternative approach should be offered to the deeply comatose patient.

Keywords: Brain death, Severe brain injury, Apnea test, Neuro-intensive care, Hippocratic ethos.

Introduction

Death is an irreversible event that occurs instantly, distinct from the process of dying. The empirical assessment of any given event, however, “requires a certain time interval” (Ramellini 2009 Ramellini, Pietro. 2009. Death in the biological literature of life. In What is death?: A scientific, philosophical and theological exploration of life's end, ed. Alfonso Aguilar, 21–65. Città del Vaticano: Libreria Editrice Vaticana., 60). Consequently, the very moment of death cannot be determined. In his address to the 18th International Congress of the Transplantation Society, St. John Paul II reiterated this universal truth as follows: “the death of the person … is an event no scientific technique or empirical method can identify directly” (emphasis original) (John Paul II 2000 John Paul II, Pope. 2000. Address to the 18th International congress of the transplantation society. August 29. http://www.vatican.va/holy_father/john_paul_ii/speeches/2000/jul-sep/documents/hf_jp-ii_spe_20000829_transplants_en.html, no. 4). More than a century earlier, Edgar Allan Poe had also stated the same truth in his short story “The Premature Burial.” Expressing the widespread fear of being buried alive, Poe wrote, “The boundaries which divide Life from Death, are at best shadowy and vague. Who shall say where the one ends, and where the other begins?” (Poe 1966 Poe, Edgar Allan. 1966. Complete stories and poems of Edgar Allan Poe. Garden City, NY: Doubleday., 261). The fear of being buried alive is nothing but a manifestation of the well-known “universal fear of a premature, mistaken declaration of death” (Childress 2014 Childress, James F. 2014. Difficulties of determining death: What should we do about the “dead donor rule”? Zif-Mitteilungen, no. 1: 28–39. http://www.uni-bielefeld.de/(cen,en)/ZIF/Publikationen/Mitteilungen/Ausgaben/2014-1.pdf., 28). Today, advanced technology and scientific progress have all but eliminated the possibility of being buried alive. As will be shown below, the same cannot be said, however, about the risk of a premature declaration of death, especially when viewed in the context of organ procurement for transplantation.

of the Harvard report and memos between the committee members reveal an explicit connection between “brain death” and the need for organs. For instance, the advanced manuscript draft of June 3, 1968, contains the following passage:

With increased experience and knowledge and development in the field of transplantation, there is great need for the tissues and organs of the hopelessly comatose in order to restore to health those who are still salvageable. (quoted in Giacomini, Mita. 1997. A change of heart and a change of mind? Technology and the redefinition of death in 1968. Social Science & Medicine 44, no. 10: 1465–82. doi: 10.1016/S0277-9536(96)00266-3, 1475)

Evidently, the wording in the above passage reflects a pragmatic-utilitarian philosophy in which the principle of utility, aiming at maximizing the good for the greatest number of individuals, prevails. Decision-making processes and actions can then be justified by “cost-benefit” analyses or “the ends justify the means.” The pragmatic-utilitarian motives of the Harvard Committee, however toned down they might be, remained apparent in the opening paragraph of its 1968 report. They were brought out more explicitly in the subsequent discourses of Beecher, the committee's chairman, however.

In the discussion on “brain death,” most of the attention has been devoted to the legal or philosophical aspects. Where the medical aspect is touched upon, the focus has been on the clinical criteria for brain death, or the management of organ donors, that is, the care of organs prior to their surgical harvesting. In other words, once a patient is labeled “brain dead,” then his or her status becomes nothing more than that of an “organ container,” albeit a special one which is connected to a ventilator, and in which the heart continues to beat, thereby maintaining the circulation of oxygenated blood to the various organs soon-to-be harvested. Such a reality does not convey the image of a corpse, one ready to be cremated or buried, however.

Therefore, the purpose of this essay is to seriously re-examine the status of the potential heart-beating organ donor: is he or she really a corpse? Or is he or she a very debilitated patient with severe brain injury, whose condition can potentially improve or even return to a full normal life, if he or she is given: (i) timely and aggressive neuro-intensive treatment, and (ii) ample time for the slow recovery of brain functions, instead of being quickly declared brain-dead (during the first few days of acute brain injury) and destined for organ harvesting? The essay opens with a survey of patients who have survived “brain death,” a phenomenon which seriously contradicts the assertion that “brain death” equals death. The phenomenon of brain-dead survivors leads, therefore, to the necessity of a critical re-evaluation of the clinical criteria for “brain death.” From this, it will become clear that the severely brain-injured patient, so-called “brain dead,” deserves a different medical approach, one that would both respect his or her dignity and cohere better with the telos of the medical profession, and consequently, with the vocation of a Christian physician.

**Survivors of “Brain Death”**

For decades, the concept of “brain death,” since its inception in 1968 as the neurological standard for determining death, has been the basis for current policies of organ harvesting from heart-beating “cadavers.” Despite the widespread medical and legal acceptance of “brain death,” there have been persistent misgivings that many heart-beating patient-donors have been declared “brain-dead” when, in fact, they are not truly dead. Indeed, the contemporary history of medicine is not lacking in “modern day versions of Poe's horror story” (Childress 2014 Childress, James F. 2014. Difficulties of determining death: What should we do about the “dead donor rule”? Zif-Mitteilungen, no. 1: 28–39. http://www.uni-bielefeld.de/(cen,en)/ZIF/Publikationen/Mitteilungen/Ausgaben/2014-1.pdf, 29), namely the accounts of “brain-dead” patients who narrowly escaped the fatal ordeal of organ harvesting. A common pattern runs through most of these accounts: the patient is invariably a non-elderly person, constitutionally healthy, who became deeply comatose and ventilator-dependent because of a sudden and severe brain injury. Within 24 to 48 hours after the accident, he or she was

In addition to the above-mentioned dramatic, spontaneous full recovery from “brain death,” there are also many well-documented cases of “brain-death” survivors. Though pronounced dead according to the neurological standard, these patients continued to live, albeit in the severe disabling state of chronic “brain death.” The following is not an unlikely scenario: a severely brain-injured patient was declared “brain-dead”; the family, however, declined organ donation; the patient did not die, that is, he or she did not have cardiac arrest, contrary to the insistent claim that imminent asystole necessarily follows “brain death.” After a few weeks, once the initial hemodynamic instability subsides, gastrointestinal motility returns along with spinal hyperreflexia, and the patient continues to live on for weeks and months without aggressive medical intervention, requiring only a mechanical ventilator, tube feeding, and basic nursing care (Shewmon 1998a Shewmon, D. Alan. 1998a. “Brainstem death,” “brain death” and death: A critical re-evaluation of the purported equivalence. Issues in Law & Medicine 14, no. 2: 125–45., 136).

Shewmon (1998b) Shewmon, D. Alan. 1998b. Chronic “brain death”: Meta-analysis and conceptual consequences. Neurology 51, no. 6: 1538–45. doi: 10.1212/WNL.51.6.1538 reported a collection of 175 “brain-dead patients,” whose survival extended well beyond the few days (48–72 hours) claimed to be the maximum limit after the declaration of “brain death.” There have been additional cases since then, in particular the well-publicized McMath case, whose clinical and laboratory data no longer indicate “brain death.” Most notable in Shewmon’s (2001) Shewmon, D. Alan. 2001. The brain and somatic integration: Insights into the standard biological rationale for equating “brain death” with death. Journal of Medicine and Philosophy 26, no. 5: 457–78. doi: 10.1076/jmep.26.5.457.3000 collection is the fact that children with chronic “brain death” underwent proportional physical growth as well as sexual maturation; features indicative of neuroendocrine function in the brain. One of the children, the longest survivor, lived on for twenty years after having been declared “brain-dead” at age four from acute meningitis (Shewmon 2007 Shewmon, D. Alan. 2007. Mental disconnect: “physiological decapitation” as a heuristic for understanding “brain death”. In The signs of death, ed. M.S. Sorondo, 292–333. Vatican City: Pontifical Academy of Sciences., 308). If “brain death” equals death, which implies that the “brain-dead” patient is a corpse, then the corpses of “brain-dead” children-survivors certainly demonstrate unusual properties. These are none other than holistic/integrative properties (each emerging from the mutual interaction of the parts of a whole),
which account for the integrative unity and survival of patients with chronic “brain death.” Even though these patients have lost some of the emergent holistic functions, namely consciousness and spontaneous breathing, they still retain a whole host of other important holistic/integrative properties including diverse homeostatic activities, elimination of bodily wastes, wound healing, inflammatory and immunological responses against infections, physical growth and maturation, and the capacity for successful gestation, among others. The empirical medical evidence certainly does not support the prevailing theory that the brain is the master organ responsible for the integration of the body. This rationale was advanced in Bernat, Culver, and Gert (1981 Bernat, James L., Charles M. Culver, and Bernard Gert. 1981. On the definition and criterion of death. Annals of Internal Medicine 94, no. 3: 389–94. doi: 10.7326/0003-4819-94-3-389), and Bernat (2006 Bernat, James L. 2006. The whole-brain concept of death remains optimum public policy. Journal of Law, Medicine & Ethics 34, no. 1: 35–43. doi: 10.1111/j.1748-720X.2006.00006.x). This theory has its origins in Loeb's mechanistic conception of life (Loeb 1912 Loeb, Jacques. 1912. The mechanistic conception of life. Chicago: University of Chicago Press.), which has been recognized to be scientifically flawed, and has been supplanted by theories which better reflect biological reality, namely the systems perspective of life and the notion of autopoiesis (Varela 1979 Varela, Francisco J. 1979. Principles of biological autonomy. New York: North Holland., 3–60; Maturana, Varela, and Beer 1980 Maturana, Humberto R., Francisco J. Varela, and Stafford Beer. 1980. Autopoiesis and cognition: The realization of the living. Dordrecht: Reidel.).

In addition to the reported survivors in the “brain death” literature, the data from the neuro-intensive care literature regarding the survival of brain-injured patients admitted with Glasgow Coma Scale 3 (GCS 3) is also revealing. Most of the victims of severe head trauma are children and young to middle-aged adults who, prior to their accident, were constitutionally healthy (Dunn, Julien, and Martin Smith. 2008. Critical care management of head injury. Anaesthesia & Intensive Care Medicine 9, no. 5: 197–201. doi: 10.1016/j.mpaim.2008.03.004, 197; Maas, Stocchetti, and Bullock 2008 Maas, Andrew I.R., Nino Stocchetti, and Ross Bullock. 2008. Moderate and severe traumatic brain injury in adults. Lancet Neurology 7, no. 8: 728–41. doi: 10.1016/S1474-4222(08)70164-9, 728; Werner and Engelhard 2007 Werner, C., and K. Engelhard. 2007. Pathophysiology of traumatic brain injury. British Journal of Anaesthesia 99, no. 1: 4–9. doi: 10.1093/bja/aem131, 4). This age group coincides with the heart-beating donor age group that provides the greater bulk of organ donation. A recent study of 3,306 trauma patients admitted with GCS three showed an overall survival rate of 58.2 percent, more than twice the survival rate noted in the 1980s thanks to the advances in neuro-intensive care (Ley et al. 2011 Ley, Eric J., Morgan A. Clond, Omar N. Hussain, Marissa Sourd, James Mirocha, Marko Bukur, Dan R. Margulies, and Ali Salim. 2011. Mortality by decade in trauma patients with Glasgow coma scale 3. American Surgeon 77, no. 10: 1342–5.). In this study, patients in the fourth and fifth decades achieved the highest survival rate (64%). Reports of smaller groups of patients from Germany and Japan showed similar encouraging results. The study from Nihon University Hospital in Japan used intracranial pressure (ICP)-targeted therapy with hypothermia on twenty cases of traumatic brain injury (TBI) and twelve cases of post-cardiac arrest, all of whom had an initial GCS of 3 or 4, plus bilateral fixed and dilated pupils. Fourteen of the TBI group, and six of the post-cardiac arrest group “returned to normal daily life, with their verbal communication restored, except in one patient” (Watanabe 1997 Watanabe, Yoshio. 1997. Once again on cardiac transplantation: Flaws in the logic of the proponents. Japanese Heart Journal 38, no. 5: 617–24. doi: 10.1536/jhj.38.617, 619). The study from Regensburg University Hospital in Germany on ten patients with severe head injury (all unresponsive to pain, seven with GCS 3, two with GCS 4, one with GCS 6) revealed similar results: following moderate hypothermia therapy, two patients with GCS 3 died of multi-organ failure, seven “returned to their previous occupation (good recovery) [and] one patient survived severely disabled” (Metz et al. 1996 Metz, Christoph, Matthias Holzschuh, Thomas Bein, Christian Woertgen, Anton Frey, Irmgard Frey, Kai Taeger, and Alexander Brawanski. 1996. Moderate hypothermia in patients with severe head injury: Cerebral and extracerebral effects. Journal of Neurosurgery 85, no. 4: 533–41. doi: 10.3171/jns.1996.85.4.0533, 536). It is thus possible, with the current state of the art neuro-intensive care to achieve a survival rate of 50 to 70 percent, at least in...
selected cases. In view of such an encouraging survival rate, and the continuously improving medical technology, it has been concluded that “aggressive care is indicated for patients who present to the emergency department with GCS 3” (Ley et al. 2011 Ley, Eric J., Morgan A. Clond, Omar N. Hussain, Marissa Srou, James Mirocha, Marko Bukur, Dan R. Margulies, and Ali Salim. 2011. Mortality by decade in trauma patients with Glasgow coma scale 3. American Surgeon 77, no. 10: 1342–5., 1344). In their presentations, defenders of “brain death” have not taken into consideration the advances in neuro-intensive care, however.

The “brain-death” literature and the neuro-intensive care literature use different terminologies to designate similar groups of patients: for the first, the terminology “heart-beating” or “brain-dead” donor; and for the second, the terminology “severe brain injury” (SBI). Like any other vital organ in the body, the function of the brain and its organic survival depend on an adequate supply of blood flow to provide the proper levels of oxygen and other necessary elements. Severe brain injury encompasses a wide range of etiological injuries which result in a sharp decrease in blood flow or oxygen level to the brain. Excluding malignancies and inflammatory disorders affecting the brain, such injuries can be conceptually grouped as follows: (i) failure of the “pump,” namely, a cardiac arrest; (ii) failure in the “delivery system,” which can be precipitated by catastrophic events such as extensive hemorrhage, thromboembolism to a major cerebral artery, or a ruptured cerebral aneurysm; and (iii) direct injurious impact to the head from an external source, such as in road or sports accidents, referred to as traumatic brain injury (TBI). Overall, cardiac arrest and TBI comprise the leading causes of SBI. The TBI category “is a common cause of death and neurological disabilities in young people” (Polderman 2008 Polderman, K.H. 2008. Hypothermia and neurological outcome after cardiac arrest: State of the art. European Journal of Anaesthesiology 25, Suppl 42: 23–30. doi: 10.1017/S026502150700333X, 1955), whereas the former portends a high rate of mortality (70%) and morbidity “despite advances in cardiopulmonary resuscitation and post-cardiac arrest care” (Stevens and Sutter 2013 Stevens, Robert D., and Raoul Sutter. 2013. Prognosis in severe brain injury. Critical Care Medicine 41, no. 4: 1104–23. doi: 10.1097/CCM.0b013e318287ee79, 1104). In any of the above categories of SBI, the clinical outcome depends on: (i) the type of precipitating etiology (primary injury); (ii) the promptness and efficacy of the medical intervention; (iii) the presence of concomitant injuries; and (iv) the general constitution of the patient prior to the injury (namely his or her age and comorbidities). Concomitant multi-organ injury (e.g., in road accidents) or multi-organ failure (e.g., in post-cardiac arrest syndrome) produce multiple physiological instabilities such as hypotension, pyrexia, and coagulopathy, among others (Maas, Roozenbeek, and Manley 2010 Maas, Andrew I.R., Bob Roozenbeek, and Geoffrey T. Manley. 2010. Clinical trials in traumatic brain injury: Past experience and current developments. Neurotherapeutics 7, no. 1: 115–26. doi: 10.1016/j.nurt.2009.10.022, 115; Neumar et al. 2008 Neumar, Robert W., Jerry P. Nolan, Christophe Adrie, Mayuki Aibiki, Robert A. Berg, Bernd W. Böttiger, Clifton Callaway, Robert S.B. Clark, Romergryk G. Geocadin, Edward C. Jauch, Karl B. Kern, Ivan Laurent, W.T. Longstreth, Raina M. Merchant, Peter Morley, Laurie J. Morrison, Vinay Nadkarni, Mary Ann Peberdy, Emanuel P. Rivers, Antonio Rodriguez-Nunez, Frank W. Sellke, Christian Spaulding, Kjetil Sunde, and Terry Vanden Hoek. 2008. Post-cardiac arrest syndrome: Epidemiology, pathophysiology, treatment, and prognostication. Circulation 118, no. 23: 2452–83. doi: 10.1161/CIRCULATIONAHA.108.190652, 2456). These, in turn, increase the risk of further brain damage and worsen the patient's outcome. Similarly, Shewmon's meta-analysis of brain-dead patients shows that those with multisystem insults “deteriorate[d] quickly to asystole despite aggressive therapy,” in contrast to those who survived longer than six weeks (Shewmon 1998b Shewmon, D. Alan. 1998b. Chronic “brain death”: Meta-analysis and conceptual consequences. Neurology 51, no. 6: 1538–45. doi: 10.1212/WNL.51.6.1538, 1543–4). Of note is that, in a chapter on head injury, multisystem derangements are interpreted as therapeutic challenges to keep a critically injured patient alive, whereas in a typical chapter on BD (“brain death”) the same derangements are cited as evidence that the patient has already died. (Shewmon 1998b Shewmon, D. Alan. 1998b. Chronic “brain death”: Meta-analysis and conceptual consequences. Neurology 51, no. 6: 1538–45. doi: 10.1212/WNL.51.6.1538, 1544).
In other words, from the viewpoint of neuro-intensive care, patients with a potential good outcome are those with minimal hemodynamic instability or multisystem disturbances; but from the standpoint of organ transplantation, such patients are the best organ donors because of their healthy organs, especially since “cardiac stability [is] a relative requirement for heart donation” (emphasis original) (Shewmon 1998b. Chronic “brain death”: Meta-analysis and conceptual consequences. *Neurology* 51, no. 6: 1538–45. doi: 10.1212/WNL.51.6.1538, 1544).  

A crucial factor affecting the clinical outcome of the severely brain-injured patient is the timeliness and intensity (aggressiveness) of the neuro-intensive intervention. It would be naïve to think that this is not influenced by the general orientation/conviction of the medical staff in charge or that of the medical center itself. The few unfortunate stories that made it to publication, in particular the case reported by Coimbra (2009b) Coimbra, Cicero Galli. 2009b. Are “brain dead” (or “brain-stem dead”) patients neurologically recoverable? In *Finis vitae: “brain death” is not true death*, ed. Roberto De Mattei, and Paul A. Byrne. 313–78. Oregon, Ohio: Life Guardian Foundation., confirm the sad truth that physicians who favor brain death/organ transplantation tend to handle the severely brain-injured patient differently from those who do not. Put bluntly, the difference comes down to whether the severely brain-injured patient (constitutionally healthy prior to the injury) is anticipated as a potential organ donor or whether he or she is viewed as a patient who deserves the maximum therapeutic intervention with a view to full recovery. The resulting consequences are of great import to the patient, however, since it means the difference between life and death, or between full recovery and the severely disabled state of chronic “brain death.”

The most important concern in neuro-intensive care is the control of brain edema. To this end, several protocols of intracranial pressure-targeted therapy have been developed. In addition to the specific measures for controlling ICP and maintaining adequate cerebral perfusion, the aim is also to avoid anything that may produce systemic disturbances such as hypotension, hypoxemia, and hyperthermia, all of which may cause further insults to the already injured brain (Smith 2014 Smith, Martin. 2014. Critical care management of severe head injury. *Anaesthesia & Intensive Care Medicine* 15, no. 4: 164–7. doi: 10.1016/j.mpaim.2014.01.016, 164). It is in light of these neuro-intensive care requirements that the clinical tests (especially the apnea test) for “brain death” are evaluated in the next section.

### Critical Evaluation of the Clinical Tests for “Brain Death”

The clinical test-criteria for the determination of “brain-death” are well engrained in the “brain-death” literature since they have not changed much between the 1968 Harvard Report and the 2010 American Academy of Neurology Guidelines for Brain Death Determination (Wijdicks et al., 2010 Wijdicks, Eelco F.M., Panayiotis N. Varelas, Gary S. Gronseth, and David M. Greer. 2010. Evidence-based guideline update: Determining brain death in adults: Report of the quality standards subcommittee of the American academy of neurology. *Neurology* 74, no. 23: 1911–18. doi: 10.1212/WNL.0b013e3181e242a8). While the number of possible confirmatory tests, which are ancillary and optional, has increased, the core clinical tests performed at the bedside have remained unchanged. They include: (i) coma, with complete unresponsiveness even to the most painful stimuli; (ii) absence of brain stem reflexes; and (iii) apnea, that is, absence of a breathing drive as tested with a CO₂ challenge. Ancillary tests are of two types, for the purpose of detecting either brain electrical activity or evidence of brain blood flow. The 2010 guidelines specify, however, that “in adults, ancillary tests are not needed for the clinical diagnosis of brain death and cannot replace a neurologic examination” (Wijdicks et al., 2010 Wijdicks, Eelco F.M., Panayiotis N. Varelas, Gary S. Gronseth, and David M. Greer. 2010. Evidence-based guideline update: Determining brain death in adults: Report of the quality standards subcommittee of the American academy of neurology. *Neurology* 74, no. 23: 1911–18. doi: 10.1212/WNL.0b013e3181e242a8, 1916). Without the use of ancillary tests, the determination of the US-based “whole brain death” is identical to that of the UK-based “brainstem death.”
Problems with the clinical tests for “brain death” in general

With the worldwide legal adoption of “brain death” as death (undoubtedly driven by the society's need for organs), it appears that the medical community has accepted the clinical test-criteria for “brain death” as if they were scientific “truths,” even though they are fraught with known flaws and problems. Only a few of these are mentioned below.

The first fundamental flaw is the lack of scientific data required for the validation of the clinical tests for the determination of “brain death.” Medicine is an empirical science; every test procedure and medical product must be validated through various phases of rigorous testing before they can be put to use in clinical practice. Yet, the Harvard report cited no medical studies or any patient data that would validate the clinical tests put forth for establishing “brain death” and equating it with death. The one single prospective study was the 1977 Collaborative Study conducted by the National Institutes of Health evaluating the data collected on 503 “brain-dead” patients (National Institutes of Health 1977 National Institutes of Health. 1977. An appraisal of the criteria of cerebral death: A summary statement. Journal of the American Medical Association 237, no. 10: 982–86. doi: 10.1001/jama.1977.03270370054022). It then called for a larger clinical trial, which still remains to be carried out. Without a valid scientific foundation, the whole of the clinical test battery (and thus the “brain-death” standard itself) is merely opinion-based, that is, reflecting the opinion of the thirteen members of the Harvard Committee and their subsequent followers.

The second major problem is the lack of consensus regarding the clinical testing itself. The law leaves it to the individual physician to determine “brain death” according to accepted medical standards, which can be national, regional, or local. Thus, a 2008 survey revealed “wide variability in the practice and determination of brain death among the … top 50 institutions for neurology and neurosurgery” (Greer et al. 2008 Greer, David M., Panayiotis N. Varelas, Shamael Haque, Eelco F.M. Wijdicks, David M. Greer, Panayiotis N. Varelas, Shamael Haque, and Eelco F.M. Wijdicks. 2008. Variability of brain death determination guidelines in leading US neurologic institutions. Neurology 70, no. 4: 284–289. doi: 10.1212/01.wnl.0000296278.59487.c2, 287). Variability was found in all areas, including apnea testing, “an area with the greatest possibility for inaccuracies,” (Greer et al. 2008 Greer, David M., Panayiotis N. Varelas, Shamael Haque, Eelco F.M. Wijdicks, David M. Greer, Panayiotis N. Varelas, Shamael Haque, and Eelco F.M. Wijdicks. 2008. Variability of brain death determination guidelines in leading US neurologic institutions. Neurology 70, no. 4: 284–289. doi: 10.1212/01.wnl.0000296278.59487.c2, 288) in which there were marked variations in technique between institutions. Such variability is indeed worrisome. It calls into question the accuracy of “brain-death” determination across institutions and even among individual physicians within the same institution. This is not a theoretical question, especially since it has been shown that “physicians involved in declaring brain death were unable to correctly identify or apply the whole brain criteria for determination of brain death” (Van Norman 1999 Van Norman, Gail. 1999. A matter of life and death: What every anesthesiologist should know about the medical, legal, and ethical aspects of declaring brain death. Anesthesiology 91, no. 1: 275–87. doi: 10.1097/00000542-199907000-00036, 281). The three cases described by Van Norman prove that it is not impossible that a patient may be inappropriately labeled as dead according to the neurological standard.

The third major flaw concerns logical and scientific incoherencies. The line of reasoning used for each of the clinical bedside tests for “brain death,” which include noxious stimulus, brainstem reflexes, and apnea testing, is the following: if a response is observed, then the brain is alive; if no response is observed, then the brain is dead (not alive). There are two problems with this line of reasoning, however. First, from the logic standpoint, it has the form of “if P then Q; not P, therefore not Q.” This is none other than the inverse fallacy, well-known in formal logic, which renders the whole reasoning invalid. Shewmon thus rightly points out, “the medical community has fallen into the logical fallacy of accepting that absence of evidence of conscious activity constitutes evidence of absence” (emphasis original), 20 when it adopted uncritically the Harvard Committee's “brain-death” standard. Second, from the scientific standpoint, these tests only give us information regarding the motor (efferent) arm of the
neural reflex pathway. There exists no means to obtain direct information on the activities of the sensory (afferent) arm and interneurons. Hence, both logically and scientifically, the bedside clinical test-criteria do not constitute sufficient grounds to conclude with certainty that the brain is dead. Moreover, it is beyond empirical science to determine sensations such as pain, a subjective, first-person, conscious experience. Thus, one cannot assume offhand from the absence of external reactions that the persons labeled brain-dead do not feel pain or that they cannot hear and are not aware of what is being said about them.21 With regard to pain, it is known that in several countries, anesthesia is administered to brain-dead patients as they are being laparotomized for organ harvesting.

Fourth, a proper understanding of the pathophysiology of brain injury helps to explain why the absence of response to the bedside clinical tests, as well as the lack of detectable electrical activity or cerebral flow, do not necessarily indicate “brain death.” Injury to the brain, just like injury to any other organ system, triggers two immediate interrelated phenomena: (i) a shutdown of brain function as a self-protective mechanism to reduce its metabolic requirement, and (ii) a cascade of inflammatory response with the release of numerous immune mediators, which leads to increased ICP and decreased cerebral blood flow (CBF).22 The net result is a condition known as global ischemic penumbra, as “the blood supply to the brain falls down to levels … between 50 to 80% lower than the normal values… [It can remain] within that range for up to 48 hours” (Coimbra 2009a Coimbra, Cicero Galli, 2009a. The apnea test—a bedside lethal “disaster” to avoid a legal “disaster” in the operating room. In Finis vitae: “brain death” is not true death, ed. Roberto De Mattei, and Paul A. Byrne, 129–61. Oregon, Ohio: Life Guardian Foundation., 132). Such a drop in CBF adds to the suppression of neurological functions, but without loss of organic vitality because physiologically, the level of energy required for sustaining the vitality of an organ is much lower than that needed for maintaining its function. Neurological functions, therefore, remain recoverable, provided that CBF is maintained such that “the oxygen extraction fraction continues to be [sufficiently] elevated” (Coimbra 1999 Coimbra, C.G. 1999. Implications of ischemic penumbra for the diagnosis of brain death. Brazilian Journal of Medical and Biological Research 32: 1479–87. doi: 10.1590/S0100-879X1999001200005, 1480). This is why the penumbra is such a critical time-window when prompt application of aggressive therapeutic intervention can significantly improve the outcomes of patients with SBI.

The severely depressed brain activity during the penumbra explains why external stimuli (clinical bedside tests) elicit no response and no electrical signals are recorded on the electroencephalogram (EEG). Besides the known limitations of EEG testing, it is also known that “when CBF reaches about 20 ml/100 mg/min, EEG isoelectricity occurs;”23 that level of CBF is still above the CBF threshold (10 ml/100 mg/min) at which neuronal injury becomes irreversible. In other words, the lack of detectable brainstem reflexes and a flat EEG in an apneic, comatose patient do not necessarily indicate the loss of neuronal vitality or “brain death.” Thus, it cannot be simply decreed that the lack of detectable functions is equivalent to the irreversible loss of function (which implies the organic death of the organ). In this regard, post-mortem studies showed that in at least 60 percent of cases, the brains of heart-beating donors had no or minimal structural change of the brainstem (Wijdicks and Pfeifer 2008 Wijdicks, Eelco F.M., and Eric A. Pfeifer, 2008. Neuropathology of brain death in the modern transplant era. Neurology 70, no. 15: 1234–7. doi: 10.1212/01.wnl.0000289762.50376.b6, 1236); one cannot, therefore, exclude the possibility that brainstem functions could have returned if the patients had not been rushed to organ donation.24

Similarly, the reduction in CBF during the penumbra can fall below the detection threshold of radionuclide angiography, while still remaining above the critical level at which infarction of neuronal tissue occurs. Therefore, the absence of intracranial blood vessels on angiographic studies cannot be taken as “indisputable evidence for intracranial circulatory arrest” (Coimbra 1999 Coimbra, C.G, 1999. Implications of ischemic penumbra for the diagnosis of brain death. Brazilian Journal of Medical and Biological Research 32: 1479–87. doi: 10.1590/S0100-879X1999001200005, 1485). Recently, Bernat strongly asserted that “the absence of intracranial blood flow proves that the loss of clinical brain functions is total and permanent,” and therefore a laboratory test for intracranial blood flow should be

In brief, taking into account the knowledge about the penumbra, the test-criteria for “brain death” only demonstrate that neurological activity and blood flow are not detectable at the time of the testing (when the brain is most likely in penumbra). Certainly, the results of the clinical tests fulfill the criteria for “brain death,” but they cannot be taken as the sine qua non of the irreversible loss of neurological functions, let alone “brain death” or the death of the patient. In fact, what could very well push the injured brain to a state of irreversible damage would be the apnea test itself.

Problems with the apnea test

According to the published guidelines, the apnea test is the cornerstone procedure for declaring a patient brain-dead. This procedure, just like all the other clinical test-criteria put forth by the Harvard Committee, has never been validated. A recent review of current-practice apnea testing reveals that “it still lacks consensus standardization regarding the actual procedure, monitored parameters, and evidence-based safety measures that may be used to prevent complications” (Scott et al. 2013 Scott, J Brady, Michael A Gentile, Stacey N Bennett, MaryAnn Couture, and Neil R MacIntyre. 2013. Apnea testing during brain death assessment: A review of clinical practice and published literature. Respiratory Care 58, no. 3: 532–38. doi: 10.4187/respcare.01962, 532). A close look at the apnea test in light of the neuro-intensive care requirements for SBI demonstrates that this procedure does not take into account the pathophysiology of brain injury and coma, namely those factors which can worsen cerebral ischemia, brain edema, and cerebral hypertension (increased ICP).

In SBI, it is known that “the presence of cerebral ischemia is associated with a poor ultimate neurological outcome, that is, dead or vegetative state” (Werner and Engelhard 2007 Werner, C., and K. Engelhard. 2007. Pathophysiology of traumatic brain injury. British Journal of Anaesthesia 99, no. 1: 4–9. doi: 10.1093/bja/aem131, 5). For this very reason, one of the aims in neuro-intensive care is to prevent anything that may cause an increase in the partial pressure of arterial carbon dioxide (PaCO₂) because hypercarbia leads to cerebrovascular vasodilatation and increased ICP (Mongardon et al. 2011 Mongardon, Nicolas, Florence Dumas, Sylvie Ricome, David Grimaldi, Tarik Hissem, Frédéric Pène, and Alain Cariou. 2011. Postcardiac arrest syndrome: From immediate resuscitation to long-term outcome. Annals of Intensive Care 1, no. 1: 1–11. doi: 10.1186/2110-5820-1-45, 6), which, in turn, worsens cerebral ischemia and potentially contributes to brain herniation (Joffe, A.R., N.R. Anton, and J.P. Duff. 2010 Joffe, A.R., N.R. Anton, and J.P. Duff. 2010. The apnea test: Rationale, confounders, and criticism. Journal of Child Neurology 25, no. 11: 1435–43. doi: 10.1177/0883073810369380, 1437). The injured brain has decreased tolerance to CO₂, such that even a minor increase in PaCO₂ can aggravate the existing brain edema. Cerebral ischemia, brain edema, and increased ICP mutually affect one another, resulting in a vicious cycle. Brain edema leads to increased ICP, which in turn causes compression of the cerebral vasculature resulting in further reduction of CBF. With hypoperfusion, there is decreased availability of oxygen to brain tissue and concomitant accumulation of CO₂, resulting in intracellular metabolic stress, increased membrane permeability, and worsening edema.

In the apnea test, the patient is disconnected from the ventilator to let the PaCO₂ rise above a certain threshold (e.g., 60 mmHg in the United States, 50 mmHg in the UK) or at least 20 mmHg above the


These harmful side-effects of the apnea test are known in the medical community, even by scholars who support “brain death.” From the perspective of medical ethics, it is most disturbing that the apnea test directly violates the fundamental principles for the management of SBI, in which the prevention of

Taking all these factors into consideration, it is rather evident that any hypercarbia-producing test can be of no therapeutic benefit to a ventilator-dependent and brain-injured individual; it may even cause him or her great harm (however slight the risk might be), which is contrary to the telos of medicine. It is in view of this telos that the role of the physician toward his or her severely brain-injured patient is examined next.

Ethical Foundations of Patient Care—Primum Non Nocere

In recent decades, scientific progress, sociocultural changes, and moral pluralism have altered the practice of the medical profession. Besides a weakening of the moral fabric in the medical community, there has been also a “transformation of the physician into a variety of roles” (Pellegrino and Thomasma 1993 Pellegrino, Edmund D., and David C. Thomasma. 1993. The virtues in medical practice. New York: Oxford University Press., 35) much to the detriment of the doctor–patient relationship. Yet, it is this very relationship that constitutes the essence of the medical profession. It is a relationship in which the very sick person finds him- or herself in a most vulnerable and exploitable condition; his or her welfare thus depends not just on the knowledge and skills of his or her doctor, but also on the latter's ethical outlook. This is why medicine is “an inherently moral practice” (Sulmasy 2014 Sulmasy, Daniel P. 2014. Edmund Pellegrino’s philosophy and ethics of medicine: An overview. Kennedy Institute of Ethics Journal 24, no. 2: 105–12. doi: 10.1353/ken.2014.0015, 107), in which the role of the physician as a moral agent is of central importance. Thus, despite the dominance of principle-based ethics, introduced by Beauchamp and Childress (1979) Beauchamp, Tom L., and James F. Childress. 1979. Principles of biomedical ethics. New York: Oxford University Press., the truth remains that in medicine, we are dealing with a sick human being, rather than with abstract principles. The telos of the medical profession thus rests on the telos of the doctor–patient relationship. This, in turn, means that the physician's moral attitude, and consequently, his or her clinical acts “must be directed to what is necessary to heal and to help this patient” (emphasis original) (Pellegrino 1995 Pellegrino, Edmund D. 1995. Toward a virtue-based normative ethics for the health professions. Kennedy Institute of Ethics Journal 5, no. 3: 253–77. doi: 10.1353/ken.0.0044, 267).

The above notion coheres with the Hippocratic Oath, which contains the following important clause, “I will use treatment to help the sick according to my ability and judgment but never with a view to injury and wrong doing.” Thus, the most fundamental obligation of the physician is to do no harm, and any medical decision regarding the health or the life and death of a patient must be for his or her own good. Medically speaking, this good requires that he or she is “not only to be protected from harm, but also … to have health restored … or … his [or her] disability lessened” (Pellegrino and Thomasma 1988 Pellegrino, Edmund D., and David C. Thomasma. 1988. For the patient's good: The restoration of beneficence in health care. New York: Oxford University Press., vii–viii). This twofold notion of beneficence and non-maleficence has been, since time immemorial, “the central moral principle in the
ethics of medicine” (Pellegrino and Thomasma 1988 Pellegrino, Edmund D., and David C. Thomasma. 1988. For the patient's good: The restoration of beneficence in health care. New York: Oxford University Press., vii). At the same time, however, the Hippocratic ethos also requires that physicians recognize when treatment is no longer effective. Such an ethos coheres with the teaching of the Catechism of the Catholic Church, in which it is written: “Discontinuing medical procedures that are burdensome, dangerous, extraordinary, or disproportionate to the expected outcome can be legitimate” (Catechism 2003 Catechism of the Catholic Church. 2003. Vatican City: Libreria Editrice Vaticana., no. 2278).

The end of medical care is thus to relieve pain or suffering and restore health, and as such, preserve life. It is not to sustain life by futile and disproportionate means when death is imminent, however. The common scenario that fits this description is a patient with multi-organ failure as the result of a steadily downhill course caused by a pre-existing illness (e.g., cancer). It is legitimate, therefore, in such cases, to withdraw life support to allow the patient to progress to a natural death.

There is a distinction between allowing the patient to die and killing him or her, however. As stated in the Catechism, “whatever its motives and means, direct euthanasia consists in putting an end to the lives of handicapped, sick, or dying persons. It is morally unacceptable” (Catechism 2003 Catechism of the Catholic Church. 2003. Vatican City: Libreria Editrice Vaticana., no. 2277). The Catechism, while praising organ donation as a noble act of charity, emphasizes that it must cohere with the moral law, precisely because “it is not morally admissible to bring about the disabling mutilation or death of a human being, even in order to delay the death of other persons” (emphasis added) (Catechism 2003 Catechism of the Catholic Church. 2003. Vatican City: Libreria Editrice Vaticana., no. 2296).

As demonstrated in the previous sections, brain death cannot be equated with the biological death of the human person. This, in turn, implies that harvesting vital organs from brain-dead donors is the event that brings about their true and premature death. In other words, heart-beating organ procurement from patients with impaired consciousness is de facto a concealed practice of active euthanasia and physician-assisted death, both of which, either concealed or overt, the Catholic Church opposes. (Verheijde and Potts 2010 Verheijde, J.L., and M. Potts. 2010. Commentary on the concept of brain death within the Catholic bioethical framework. Christian Bioethics 16, no. 3: 246–56. doi: 10.1093/cb/cbq019, 246)

also (i) that it has been established by “clearly determined parameters commonly held by
the international scientific community” (emphasis added) (that is, a medical consensus, which the pope
presupposed), and (ii) that it coheres with sound Christian anthropology.\(^{32}\) Space limitation does not
permit a detailed analysis of the pope's address in this paper.\(^{33}\) Suffice it to note, however, that the
pope's requirement of a medical consensus is yet to be fulfilled.

It is also worthwhile to note that Pope Benedict XVI, who in his discourses often made reference to his
predecessors (in particular John Paul II), did not make any reference to the 2000 address during his
address to the participants of the 2008 international congress organized by the Pontifical Academy for
Life. Instead, Benedict XVI gave the following short and clear reminder:

Individual organs cannot be extracted except \textit{ex cadaver}… In an area such as this [that is, in the area
of the determination of death], in fact, there cannot be the slightest suspicion of arbitration
[arbitrariness] and where certainty has not been attained the principle of precaution must prevail… The
principal criteria of respect for the life of the donator [donor] must always prevail so that the extraction
of organs be performed only in the case of his/her true death.\(^{34}\) (Benedict XVI 2008 Benedict XVI,
\textit{Pope}. 2008. Address to participants at an International Congress organized by the Pontifical academy
xvi_spe_20081107_acdlife_en.html.)

In a way, the cautious admonition of Benedict XVI is a reminder of the fundamental principle in
medical care, \textit{primum non nocere}. The responsibility of the physician is therefore a grave one, when by
virtue of his or her medical subspecialty, he or she is involved in the care of a patient suffering so-
called irreversible coma, who up until then has been constitutionally healthy, with no prior comorbidity
such as heart disease or cancer, and no significant associated systemic injury which could affect the
quality of the organs. Because such a patient is comatose, the decision making concerning his or her
medical condition falls upon the family members. The family, being in a state of great distress, cannot
adequately partake in the process, not only because of their limited medical knowledge, but above all,
because the full truth about “brain death” has never been officially made known to the public. The
content of the available information is mostly promotional, to promote organ donation under the
putative good reasons of noble charity or “finding meaning in death”; critical information regarding the
means and procedures used in organ harvesting is noticeably absent, however.\(^{35}\) In the same vein,
organ-procurement organizations have carefully kept the public uninformed with regard to the many
controversies surrounding “brain death” (Nair-Collins 2010 Nair-Collins, Mike. 2010. Death, brain
death, and the limits of science: Why the whole-brain concept of death is a flawed public policy.

It is at the moment of great distress and vulnerability that the request of organ donation is posed to the
family. It is not infrequent, among those who work with the families of “brain-dead” donors, to
encounter families who subsequently express negative feelings about their experience of donation, and
who “doubt whether their [loved one] was in fact dead at the time [of the declaration of death]” (Tonti-
Quarterly} 65, no. 2: 51–72., 57). Such doubts only surface after the relatives have had enough time to
reflect (and investigate), and in the process, to question the information which health professionals
have given them concerning the death of their loved one. They feel assaulted and exploited when they
find out, subsequently, that “organs are taken while the heart still beats” and that the harvesting
procedure necessitates the use of general anesthesia “to suppress the capacity to feel pain” (Nair-

This is why the physician, by virtue of his or her expertise, carries the greater share of the moral
responsibility toward the severely brain-injured patient. The moral decision is then between (a)
declaring the patient brain-dead and sending him or her for organ harvesting, or (b) administering state-of-the-art modalities for the acute management of SBI, thereby offering the patient a chance to recover.

In the field of neuro-intensive care, it is known that it is not possible to predict the patient's outcome in the immediate acute phase of SBI. To determine the patient's prognosis requires not only several sequential evaluations, but also that some period of time (in terms of days and weeks) has elapsed to give a more complete picture of the patient's clinical course. What the patient needs is prompt neuro-intensive care during the therapeutic window of ischemic penumbra, and a generous amount of time to permit brain function to recover, even if just partially. Instead, too often, he or she is given just “supportive measures to maintain vital signs, [which] consume the critical time window” (Coimbra, Cicero Galli. 2009b. Are “brain dead” (or “brain-stem dead”) patients neurologically recoverable? In Finis vitae: “brain death” is not true death, ed. Roberto De Mattei, and Paul A. Byrne, 313–78. Oregon, Ohio: Life Guardian Foundation., 332), followed by a declaration of “brain death” and a request for organ donation) within 24 to 36 hours of admission. In light of the Hippocratic ethos (primum non nocere) and the teaching of the Catholic Church, to which the principle in dubio, pro vita should be added, I, as a Catholic physician and moral theologian, would follow the second moral option, even if this seems counter-cultural. A brief overview of neuro-intensive care is thus presented as the conclusion of this paper.

Conclusion—Alternative to Brain Death: Neuro-Intensive Care of Severe Brain Injury


In addition, the management of SBI also includes other measures of general intensive care, with particular attention to the correction of hemodynamic instability, as well as electrolyte disturbances and hormonal deficiencies caused by hypothalamic-pituitary dysfunction. In this regard, it is ironic that the guidelines for the care of the organs of brain-dead donors are closely similar to those for patients with SBI (albeit, minus the brain-targeted therapy). In the care of organs, the goal is “to maintain body temperature, ensure adequate oxygenation, circulating blood volume, cardiovascular stability, and adequate urine output … [in order to avoid] the most common derangements, [namely] hypothermia, hypotension, and diabetes insipidus” (McKeown, Bonser, and Kellum 2012 McKeown, D.W., R.S. Bonser, and J.A. Kellum. 2012. Management of the heartbeating brain-dead organ donor. British Journal of Anaesthesiology 108 Suppl 1: i96–107. doi: 10.1093/bja/aer351, i98–9). Some guidelines even include thyroid hormones to maximize the number of organs to be harvested (Salim et al. 2007 Salim, Ali, Matthew Martin, Carlos Brown, Kenji Inaba, Bradley Roth, Pantelis Hadjizacharia, Angela Mascarenhas, Peter Rhee, and Demetrios Demetriades. 2007. Using thyroid hormone in brain-dead donors to maximize the number of organs available for transplantation. Clinical Transplantation 21, no. 3: 405–9. doi: 10.1111/j.1399-0012.2007.00659.x). Thus, it is not a far-fetched exaggeration to say that “once the patient goes brain dead and his relatives sign his organ donation consent form, he will get the best medical care of his life” (Teresi 2012 Teresi, Dick. 2012. The undead: Organ harvesting, the ice-water test, beating-heart cadavers—How medicine is blurring the line between life and death. New York: Vintage Books., 146–7).

In conclusion, medicine considered as a whole, has for its lofty raison d’être healing and saving or preserving life; it can therefore be presumed that transplantation medicine per se is interested in saving the lives of human beings. Nevertheless, as Spaemann pointed out, “it has to be ensured, however, that saving lives does not happen at the expense of the lives of other people” (emphasis added) (Spaemann 2007 Spaemann, Robert. 2007. Is brain death the death of the human being? On the current state of the debate. In The signs of death: The proceedings of the working group 11–12 September 2006, edited by Marcelo Sánchez Sorondo, 130–41. Vatican City: Pontifical Academy of Sciences., 133). To do otherwise is both a gross abuse and misunderstanding of the notion of organ donation as a noble act of solidarity with the neighbor, and a violation of the most basic human right of the donor, the right to life. This is what has taken place since the introduction of the Harvard criteria. Spaemann thus wrote:

The new definition of death as “brain death” makes it possible to declare people dead while they are still breathing and to bypass the dying process in order to quarry spare parts for the living from the dying. Death no longer comes at the end of the dying process, but—by the fiat of a Harvard commission—at its beginning. (Spaemann 2006 Spaemann, Robert. 2006. When death becomes inhuman. Communio 33, no. 2: 298–300., 299)

In other words, even a noble act such as organ donation can be manipulated to serve utilitarian, materialistic, and dehumanizing motives, whereby the most vulnerable members of society are conveniently excluded from the human moral community (Veatch 2004 Veatch, Robert M. 2004. Abandon the dead donor rule or change the definition of death? Kennedy Institute of Ethics Journal 14, no. 3: 261–76. doi: 10.1353/ken.2004.0035, 267–8). As mentioned in the introduction, pragmatic-utilitarian motives were evident in the workings of the Harvard Committee to bring about the birth of “brain death.” Such motives have remained well hidden behind both the veil “of the powerful metaphor of the ‘gift of life’ associated with the transplant world” (Lock 2002 Lock, Margaret. 2002. Inventing a new death and making it believable. Anthropology & Medicine 9, no. 2: 97–115. doi: 10.1080/1364847022000029705, 114), and the loud appeal to altruism and noble charity. With respect to brain-dead donors, however, we must ask ourselves, “Is such a vigorous appeal to altruism and charity grounded in truth?”

Notes
Notes

1 The term “brain death” in this paper refers to the notion of “whole brain death.” The term “brain death” is also put in quotation marks because of its semantic ambiguity; see Shewmon (1989) Shewmon, D. Alan. 1989. “Brain death”: A valid theme with invalid variations, blurred by semantic ambiguity. In The determination of brain death and its relationship to human death, ed. RJ White, H Angstwurm and Carrasco de Paula, 23–51. Vatican City: Pontifical Academy of Sciences.. It is so ingrained in the literature, however, that it is used in this paper as a stand-in for the longer, but more precise phrase “brain-based criteria for the determination of death.”


3 Mollaret and Goulon did not equate le coma dépassé with death. The same syndrome was later called irreversible coma. At the Ciba symposium, the terminology “brain-dead donor” was not yet invented; labels such as “heart-lung preparation” or the oxymoron term “living cadavers” were used instead to refer to patients with coma dépassé. Among the strong supporters for adopting a new criterion for death was Joseph E. Murray, a transplant surgeon and future member of the Harvard Committee. See Murray (1966 Murray, Joseph E. 1966. Organ transplantation: The practical possibilities. In Ethics in medical progress: With special reference to transplantation, edited by G.E.W. Wolstenholme and M. O'Connor, 54–77. Boston: Little Brown and Company., 69). It is also very telling that some physicians, although supporting the redefinition of death, specifically stated that they would not permit this to be done to their loved ones (Platt 1966 Platt, Robert. 1966. “Ethical problems in medical procedures.” In Ethics in medical progress: With special reference to transplantation, edited by G.E.W. Wolstenholme and M. O'Connor, 149–70. Boston: Little Brown and Company., 163).

4 For passages quoted from the committee's drafts and memos, see Giacomini (1997) Giacomini, Mita. 1997. A change of heart and a change of mind? Technology and the redefinition of death in 1968. Social Science & Medicine 44, no. 10: 1465–82. doi: 10.1016/S0277-9536(96)00266-3. All documents related to the committee's work in progress are part of the Beecher manuscripts, preserved at the Francis Countway Library of Medicine at Harvard University. The records are closed to the public, however, except to some specific persons.

5 After the publication of the Harvard report, Beecher subsequently reiterated his views, openly stating that, “at whatever level we choose to call death, it is an arbitrary decision... It is best to choose a level where, although the brain is dead, usefulness of other organs is still present” (emphasis added). In other words, the new definition of death “will lead to greater availability than formerly of essential organs in


8 For self-evident reasons related to the health of the organs, 85% of all donors fall within the age group from the second to the fifth decade of life (data retrieved from the Organ Procurement and Transplantation Network [2015] Organ Procurement and Transplantation Network. 2015. [http://optn.transplant.hrsa.gov](http://optn.transplant.hrsa.gov).)


12 The lower the GCS score, the worse the head injury. A brain-injured patient is classified as GCS 3 (that is, the lowest possible score) when at the initial assessment, he or she demonstrates no eye opening, no verbal response, and no motor response (flaccid).


15 Jahi McMath is a case in point in which unchecked hemorrhage led to cardiac arrest and “brain death.” The 13-year-old patient was left to bleed profusely for five hours, after the surgical removal of her tonsils and adenoids, without any intervention from the responsible physicians. See Dreger and Haskell (2015) Dreger, Alice, and Helen Haskell. 2015. Was Jahi McMath’s case preventable. Pacific Standard. March 13. [http://www.psmag.com/health-and-behavior/was-jahi-mcmath-case-preventable/](http://www.psmag.com/health-and-behavior/was-jahi-mcmath-case-preventable/).

16 A conflict of interest is evident. Younger age group and absence of comorbidity are good prognostic
factors from the viewpoint of brain-injury management. But SBI individuals with these very characteristics are ideal donors from the viewpoint of “brain-death” advocates. See also notes 2 and 8 above.

17 Coimbra (2009b) Coimbra, Cicero Galli. 2009b. Are “brain dead” (or “brain-stem dead‘) patients neurologically recoverable? In Finis vitae: “brain death” is not true death, ed. Roberto De Mattei, and Paul A. Byrne, 313–78. Oregon, Ohio: Life Guardian Foundation. recounts the story of a 15-year-old brain-injured female patient referred to as BBA. Not only was the patient not given aggressive neuro-intensive therapy for the reduction of brain edema, she was subjected to the apnea test twice, and declared “brain dead” less than 24 hours after admission. The family “declined repeated requests for organ donation,” however, and succeeded in getting the patient transferred on the 5th day to a different hospital to be under the care of Dr. Coimbra. By then, the precious time window (namely, the first 48 hours after the onset of injury) for efficacious aggressive therapy, which might have brought the patient back to full recovery, was already lost. Under Coimbra’s appropriate care, which included hormonal replacement for secondary thyroid and adrenal insufficiencies, and other measures, the patient's condition gradually stabilized. She lived on with chronic “brain death” for at least another 7 to 8 months.


21 A case in point is Zack Dunlap who recovered after being declared brain dead in accordance with the established published guidelines (Morales 2008 Morales, Natalie. 2008. “Dead” man recovering after ATV accident. NBC News. March 23. http://www.nbcnews.com/id/23768436/ns/dateline_nbc-newsmakers/t/dead-man-recovering-after-atv-accident). The patient heard what was being said about him (the claim that he was dead), but was physically unable to react.


24 Note the correspondence between the 60% of “brain dead” donors with nil to minimal damage of the brainstem on post-mortem examination, and the roughly 60% survival rate among patients with severe TBI as reported in the neuro-intensive literature; see Metz et al. (1996) Metz, Christoph, Matthias Holzschuh, Thomas Bein, Christian Woertgen, Anton Frey, Irmgard Frey, Kai Taeger, and Alexander.


27 A case in point are physicians who condone abortion and euthanasia/physician-assisted suicide, thereby rejecting the tenets of the Hippocratic Oath.

28 Roles such as businessperson, scientist, proletarian, bureaucrat, or corporate executive.


31 In Hippocrates, *On the Art* III, we read: “First I will define what I conceive medicine to be. In general terms it is to do away with the sufferings of the sick, to lessen the violence of their diseases and to refuse to treat those who are overmastered by their diseases realizing that in such cases medicine is powerless.” Quoted in Pellegrino (2001 Pellegrino, Edmund D. 2001. Physician-assisted suicide and euthanasia: Rebuttals of rebuttals—the moral prohibition remains. *Journal of Medicine & Philosophy* 26, no. 1: 93–100. doi: 10.1076/jmep.26.1.93.3034, 94).
32 In article 5 of the 2000 address, John Paul II specifically stated, “the [neurological] criterion adopted in more recent times for ascertaining the fact of death, namely the *complete and irreversible* [original emphasis] cessation of all brain activity, *if* [emphasis added] rigorously applied, *does not seem to conflict* [emphasis added] with the essential elements of a sound anthropology.” In the paragraph preceding this statement, the pope presupposed that there has been an international consensus on the parameters (that is, the clinical tests) of the “brain-death” standard. “Sound anthropology” refers to the understanding (stated in article 4) that death is “a single event” — the separation of the soul from the body — resulting in “the total disintegration of [the] … integrated whole that [was] the [human] person.”

33 An in-depth analysis (with philosophical discussion) of John Paul II's Address to the Transplantation Society is being treated in a manuscript in preparation.

34 Since Pope Benedict XVI is a non-medical person, it is reasonable to think that he used the term *cadavere* in the sense of a true corpse/cadaver, and not in the oxymoron sense of “heart-beating cadaver” promoted by “brain death” advocates. The pope has never explicitly expressed his personal thought on the matter of “brain death.” However, it is publicly known that the German philosopher Robert Spaemann is a close friend of Benedict XVI—it was at the pope's request that the Pontifical Academy of Sciences had to invite (at the last minute) Spaemann to the “The Signs of Death” conference (see Shewmon 2012b Shewmon, D. Alan. 2012b. You only die once: Why brain death is not the death of a human being; a reply to Nicholas Tonti-Filippini. *Communio* 39: 422–94., 484). Hence, it would not be unreasonable to think that Benedict XVI most likely shares the views which Spaemann holds with regard to “brain death” (see Spaemann 2007 Spaemann, Robert. 2007. Is brain death the death of the human being? On the current state of the debate. In *The signs of death: The proceedings of the working group 11–12 September 2006*, edited by Marcelo Sánchez Sorondo, 130–41. Vatican City: Pontifical Academy of Sciences.).

35 For most people, the understanding about organ donation is limited to the consent forms filled in at their state Department of Motor Vehicles, or online at regional organ procurement organization websites. The information provided on such websites is unidimensional, geared toward promoting donation and reinforcing consent. In particular there is no mention of any other options for end-of-life care (e.g., hospice). In that sense, it is difficult to say that the average lay person is fully informed when he or she signs the consent for organ donation after death. See Nair-Collins (2010 Nair-Collins, Mike. 2010. Death, brain death, and the limits of science: Why the whole-brain concept of death is a flawed public policy. *Journal of Law, Medicine & Ethics* 38, no. 3: 667–83. doi: 10.1111/j.1748-720X.2010.00520.x, 677–8).


37 To establish that the loss of neurological functions is indeed irreversible would require at least two determinations, and these should not be too close to one another in time. In practice, however, in most institutions, only one determination is carried out. It is deemed that to lengthen the time of observation

38 Every organ in the body, once injured, requires a good amount of time to recover. The more severe the injury and the more vulnerable or vital the organ is, the more time it will take, not in terms of hours or days, but rather weeks.


41 The two patients reported by Watanabe and Coimbra are typical examples of patients with severe TBI who were not given the required ICP/CPP-directed therapy because they were seen as potential organ donors. The patient reported by Coimbra was even subjected to two apnea tests.

42 According to Robert Veatch (2004) Veatch, Robert M. 2004. Abandon the dead donor rule or change the definition of death? *Kennedy Institute of Ethics Journal* 14, no. 3: 261–76. doi: 10.1353/ken.2004.0035, 267–8), who worked closely with the Harvard Committee members as a graduate student, “none of the members was so naive as to believe that people with dead brains were dead in the traditional biological sense of the irreversible loss of bodily integration. … Rather, committee members implicitly held that, even though these people are not dead in the traditional biological sense, they have lost the moral status of members of the human moral community. They believed that people with dead brains no longer should be protected by norms prohibiting homicide. … In effect, the committee and its fellow travelers proposed an entirely new definition of death, one that assigned the label ‘death’ for social and policy purposes to people who no longer are seen as having the full moral standing assigned to other humans. … Among the implications would be that organs that normally preserve life could be removed without the elaborate moral defense normally necessary to justify a homicide” (emphasis added).

43 According to the teaching of St. Thomas Aquinas, truth has to do with the conformity of our intellect to the reality (the real properties) of “a thing known.” The proper notion of truth is encapsulated in the well-known expression “veritas est adaequatio rei et intellectus.” With respect to natural “things,” our intellect gets its scientific knowledge from the “things” themselves. Therefore, our intellect is measured by natural “things,” and not vice versa; the human intellect measures only man-made things. Natural “things” are measured only by the divine intellect that has created them. See Thomas Aquinas (1952) Aquinas, Thomas. 1952. *Truth: A translation of Quaestiones Disputatae De Veritate, Volume I, Questions I–IX.* translated by Robert W. Mulligan. Chicago: Henry Regnery Company. [http://dhspriory.org/thomas/QDdeVer1.html#2](http://dhspriory.org/thomas/QDdeVer1.html#2), q. 1, a. 2).