Opinion Piece

Has the Definition of Death Collapsed?

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With some variation between States, in Australian law, death is defined as:

a) Irreversible cessation of all function of the brain of the person; or
b) Irreversible cessation of circulation of blood in the body of the person.

The law does not specify the medical criteria that need to be met in order to verify that either of these conditions has been fulfilled. Worldwide there is no consensus on the medical criteria for determining brain death[1]. Different countries use different criteria. In the few Court cases where the determination of death by the brain criterion has been an issue, the Courts have tended to rely upon the medical diagnosis and the concurrence of a second medical diagnosis without actually exploring the grounds on which the diagnosis was made. Standards such as those of the Australia and New Zealand Intensive Care Society (ANZICS) are thus important for their effect on medical practice.

The law in other countries is variable. In 1995, the United Kingdom uniquely defined brain death as brain-stem death, being irreversible loss of the capacity for consciousness together with the irreversible loss of the capacity to breathe. This definition is used in some Commonwealth countries but not in Australia or New Zealand or the US[2].

Similar to Australia, the US definition of death states:

> 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 must be made in accordance with accepted medical standards[3].

In some European countries, such as France, Italy, Spain, and Singapore the required standard is that there must be evidence of zero blood volume transfer to the brain using angiography to produce an image of blood flow after a contrast dye has been injected into the blood vessels supplying the brain. The gold standard is referred to as the "four vessel test". There are also other forms of imaging such as Doppler Ultrasound which would demonstrate this. A major advantage of this standard is that it provides greater certainty and also allows for easier explanation for the family given that the medical team can use images from the tests to show that the brain is completely dead due to lack of blood supply. Being able to show the relatives an image indicating lack of blood supply to the brain is important because many people do not accept that brain death is really death. Many of those who consent to organ donation still hold that the person was only "really dead" when the heart finally stopped beating. In one study, of the relatives of 141 brain dead patients, 10% had doubts that their next-of-kin was really dead and two-thirds admitted that although they accepted the death intellectually, they felt emotionally that the person was still alive[4]. It is worth noting that organ donation amongst Australian aboriginal people is almost non-existent and there is little indigenous support for the practice[5]. In Japan the clinical tests must be supplemented by an electroencephalogram indicating an absence of neurological activity in the brain, the so-called "flat EEG"[6].

Applying the Australian definition of irreversible loss of all brain function, ANZICS states:

> Determination of brain death requires that there is unresponsive coma, the absence of brain-stem reflexes and the absence of respiratory centre function, in the clinical setting in which these findings are irreversible. In particular, there must be definite clinical or neuro-imaging evidence of acute brain pathology (e.g. traumatic brain injury, intracranial haemorrhage, hypoxic encephalopathy) consistent with the irreversible loss of neurological function[7].

The Australian standard does not require a test to show that there is an absence of blood supply to the brain. Also a matter of concern, are two further issues:

First, ANZICS states that the following activities, which are known to be mediated by the brain, are consistent with a diagnosis of death by the above criteria:

- Sweating, blushing, tachycardia
- Normal blood pressure without the need for pharmacological support; and
- Absence of diabetes insipidus (DI) (preserved osmolar control mechanism).

1 *Wijdicks EFM, "Brain Death Worldwide: Accepted Fact But No Global Consensus in Diagnostic Criteria" (2002) 58 Neurology 20.*
2 *Australia and New Zealand Intensive Care Society (ANZICS) Statement on Death and Organ Donation 2008 p. 9*
3 *UNIFORM DETERMINATION OF DEATH ACT, Accessed 2/9/09 from http://www.law.upenn.edu/bll/archives/ulc/fnact99/1980s/udda80.htm*
4 *Pearson IY, Bazeley P, Spencer-Plane T, Chapman JR and Robertson P, "A Survey of Families of Brain Dead Patients: The Experiences, Attitudes to Organ Donation and Transplantation" (1995) 23 Anaesthesia and Intensive Care 88.*
5 *Dianne Stephens "Indigenous Donation: One Intensivist's Pesrpective" from NT http://www.iih.org/shadomx/apps/fms/fmsdownload.cfm?file_uuid=6F1B25F3-D380-7A94-05F8-302CCC0C3206&siteName=iih*
6 *Morioka Mashiro "Reconsidering Brain Death: A Lesson from Japan's Fifteen Years of Experience" The Hastings Center Report July 1, 2001*
7 *ANZICS Op Cit p. 11*

The lack of DI in about 50% of those diagnosed by the Australian criteria is disturbing because the control mechanism is located in the mid-brain and operates through the hypothalamic-pituitary axis. The medical criteria being applied may be consistent with the UK definition of death (death of the brain stem only), but not the Australian legal definition, which requires irreversible loss of *all* brain function.

There are numerous articles in the literature indicating similar lists of continued functions of the brain in persons who are diagnosed as dead by the clinical criteria[8].

Second, some intensivists have raised concern that the Apnoea Test (AT), in which ventilation is reduced to cause carbon dioxide levels to rise, in fact causes damage to the brain[9]. The AT would never be done on someone who was not thought to have already been declared brain dead. The problem that has been identified is that the rising level of carbon dioxide in blood during the test also causes dilatation of brain blood vessels, if the brain is still alive. The increase in blood flow increases pressure inside the skull (intracranial hypertension) which opposes further blood flow and results in brain death. The skull is a rigid container (box) - 90% of the contents are three incompressible tissues: brain tissue - 80% of volume, blood – 5% of volume, and cerebrospinal fluid – 5% of volume. Hence, if one component increases in volume, another must decrease or exit the skull ("Monroe-Kelly doctrine").

The test therefore should not be performed if there are other tests available for determining whether the brain is alive. However, there are other tests available:

- Demonstration of absence of intracranial blood flow (required in 40% of guidelines of 70 countries), for example with Radionuclide Perfusion Scanning (scintigraphy)
- Tc-99m HMPAO - Four vessel angiography (both carotids and vertebrals)

Professor James Tibballs of Melbourne's Royal Children's Hospital suggests that instead of proceeding immediately to the AT, it would be better to mandate a test for brain perfusion to diagnose "whole brain death" before performance of the apnoeic-oxygenation test. The perfusion test would:

- Avoid causing harm to the patient and even death of the brain - the condition it aims to diagnose
- Eliminate confounding factors
- Strengthen the diagnosis of "whole brain death"
- Produce an image to help convince lay-persons and health-care personnel that doctors are not taking organs from donors not truly dead[10]

When this issue was raised by Prof Tibballs at the 2009 Colloquium of the Australian Association of Catholic Bioethicists, the chairman of the ANZICS committee, Prof. Geoffrey J. Dobb, said that the test was only done when the doctors were of the view that the patient was dead and hence beyond the state at which harm could be done. The troubling nature of this response is that the AT is meant to be a step required to determine that death has occurred. The possibility that it may do harm and that it is of no therapeutic benefit to the patient raises a question about whether the AT is ever permissible.

The problem, then, for providing advice to people about diagnosis of death by the brain criterion and a satisfactory explanation on the basis of a Christian understanding of the human person is that there are differences between different jurisdictions about how death is defined and about what are the accepted medical criteria for diagnosing the condition according to the definitions of that jurisdiction. Furthermore, the tests currently used do not provide a way to assist doctors to explain that someone who looks alive and still has a functioning heart, still has spinal reflexes and still breathes (with assistance), is dead, or that one of the tests used could cause damage to the brain of a person whose bran was not already dead.

The National Health and Medical Research Council explains death by the brain criterion in *Organ and Tissue Donation after Death, for Transplantation:*

> "…the death of a person is understood to consist of the irreversible loss of the integrated and coordinated life of the person as a single living organism. When this functional unity is lost irreversibly, the person has died, even if 'life' continues at the sub-personal level of cells, individual organs or isolated physiological systems. A body that lacks all function of the brain lacks this intrinsic unified organisation, even though it may retain some degree of organisation due to the maintenance of some functions by technological means."[11]

The NHMRC Guidelines do not require ancillary tests to establish loss of blood flow, but:

8 *Grenvik A, Powner DJ, Snyder JV, Jastremski S, Babcock RA and Loughhead MG, "Cessation of Therapy in Terminal Illness and Brain Death" (1978) 6 Critical Care Medicine 284; Fiser DH, Jimenez JF, Wrape V and Woody R, "Diabetes Insipidus in Children With Brain Death" (1987) 15 Critical Care Medicine 551; Grigg MM, Kelly MA, Celesia GG, Ghobrial MW and Ross ER, "Electroencephalographic Activity After Brain Death" (1987) 44 Archives of Neurology 948; Barelli A, Corte FD, Calimici R, Sandroni C, Proietti R and Magalini SI, "Do Brainstem Auditory Evoked Potentials Detect the Actual Cessation of Cerebral Functions in Brain Dead Patients?" (1990) 18 Critical Care Medicine 322; Truog RD and Fackler JC, "Rethinking Brain Death" (1992) 20 Critical Care Medicine 1705; Halevy A and Brody B, "Brain Death: Reconciling Definitions, Criteria, and Tests" (1993) 119 Annals of Internal Medicine 519; Truog RD, "Is It Time to Abandon Brain Death?" (1997) 27 Hastings Center Report 29; Shewmon DA, "Recovery from 'Brain Death': A Neurologist's Apologia" (1997) 64 Linacre Quarterly 30.*

9 *Saposnik G, Rizzo G, Vega A, Sabbatiello R and Deluca JL, "Problems Associated with the Apnea Test in the Diagnosis of Brain Death" (2004) 52 Neurology India 342; Raper RF and Fisher MM, "Brain Death and Organ Donation – A Point of View" (1995) 23 Anaesthesia and Intensive Care 16; James Tibbals "Non-Compliance of clinical guidelines for organ donation with Australian statute law" Journal of Law and Medicine, 2008, Vol.16, pp. 335-355*

10 *The 2009 colloquium received a presentation from Professor James Tibballs on this issue.*

11 *National Health and Medical Research Council Organ and Tissue Donation after Death, for Transplantation Australian Government 2007*

- Place emphasis on neuro-imaging to determine extent of brain injury
- Recognise that clinical brain stem tests have a place only to show that the known destruction of the cerebrum and cerebellum extends to include the brain stem.
- Recognise that brain stem tests are only confirmatory for a known pathway of damage in which loss of blood flow results in total destruction.

The NHMRC thus supports the view that the Catholic and other Churches have taken. There is thus something of a difference of emphasis between the NHMRC and ANZICS in relation to the latter depending more on the clinical tests than on the neuro-imaging. There is also a difference between the NHMRC and the US President's Commission in relation to loss of integration of the body as a result of loss of all brain function.

Pope John Paul II wrote in 2000 that the "neurological" criterion for death consists in establishing, according to clearly determined parameters commonly held by the international scientific community, the complete and irreversible cessation of all brain activity (in the cerebrum, cerebellum and brain stem). This is then considered the sign that the individual organism has lost its integrative capacity. John Paul II continued, "*The death of the person* is a single event, consisting in the total disintegration of that unitary and integrated whole that is the personal self. It results from the separation of the life-principle (or soul) from the corporal reality of the person. The death of the person, understood in this primary sense, is an event which *no scientific technique or empirical method can identify directly*".[12]

The Pontifical Academy for Science addressed the issue of doubts about death by the brain criterion in 2006. They argued for the following conclusion:

- There is not more than one form of death
- So-called "brain death" means the irreversible cessation of all the vital activity of the brain (the cerebral hemispheres and the brain stem). This involves an irreversible loss of function of the brain cells and their total, or near total, destruction. The brain is dead and the functioning of the other organs is maintained directly and indirectly by artificial means.
- Loss of all brain function is death because it is associated with loss of integration of the body as a single whole.
- Death by the brain criterion can only be diagnosed with certainty if there is evidence that there is no blood supply to the brain, and that the "established clinical criteria" were in most circumstances a reliable indicator for the loss of all brain function.[13]

In 2009 there was a significant development when the US President's Council on Bioethics reported:

> There remains considerable public confusion, both about the meaning of the term "brain dead" and about its relation to the death of a human being. There is persistent dissent by some clinicians, philosophers, and other critical observers who have never been convinced that "brain death" is, indeed, the death of the human being. There are, as well, pressures against insisting that declaring death, or at least "organ donation eligibility," requires the irreversible loss of function in the whole brain. And, perhaps most important, there are critics who have published evidence of ongoing integrated bodily activities in some persons meeting the criteria of "whole brain death" and who have claimed that this evidence invalidates the rationale for today's consensus position.[14]

Significantly, the majority position within the Council abandoned the *loss of integration* view on which Church teaching is based. They rejected it on biological grounds largely on the basis of the evidence of Alan Shewmon and his collaborators that the body remains integrated even if the medical diagnosis of death by the brain criterion has been made[15]. This led the Council to abandon what had been the accepted explanation that death of the brain is associated with loss of the integrated functioning of the body. The latter explanation had been readily accepted by the Catholic and other Christian Churches in the 1980s and is the basis for the current acceptance by the Churches of the diagnosis of death by the brain criterion.

In place of the integration view the Council substituted the view that it is what an organism "does" that distinguishes every organism from non-living things, and what it does distinguishes a *living* organism from the dead body that it becomes when it dies. They then claim that the work of the organism, expressed in its commerce with the surrounding world, depends on three fundamental capacities:

1. Openness to the world, that is, receptivity to stimuli and signals from the surrounding environment.
2. The ability to act upon the world to obtain selectively what it needs.
3. The basic felt need that drives the organism to act as it must, to obtain what it needs and what its openness reveals to be available.[16]

12 *ADDRESS OF JOHN PAUL II TO THE 18th INTERNATIONAL CONGRESS OF THE TRANSPLANTATION SOCIETY Tuesday 29 August 2000 www.vatican.va/holy_father/john_paul_ii/speeches/2000/jul-sep/documents/hf_jp-ii_spe_20000829_transplants_en.html*

13 *Pontifical Academy of Sciences Why the Concept of Brain Death is Valid as a Definition of Death: Statement by Neurologists and Others Vatican 2006 http://www.vatican.va/roman_curia/pontifical_academies/acdscien/2008/excerpt_signs_of_death.pdf*

14 *President's Council "Controversies in the Determination of Death" August 2009 p. 6 http://www.bioethics.gov/reports/death/determination_of_death_report.pdf*

15 *Shewmon DA: Mental disconnect: 'Physiological decapitation' as a heuristic for understanding 'brain death.' In: Sanchez Sorondo M (ed): The Signs of Death. The Proceedings of the Working Group 11-12 September 2006. Vatican City: Pontificia Academia Scientiarum, Scripta Varia 110, 2007, pp. 292-333.); and Shewmon DA: Brain-body disconnection: Implications for the theoretical basis of brain death. In de Mattei R (ed): Finis vitae. Is Brain Death Still Life? Rome: Edizioni Consiglio Nazionale delle Ricerche, Rubbettino Editore, 2006, pp. 211-250; Shewmon, D A, "The dead donor rule: lessons from linguistics Kennedy Institute of Ethics, J , 2004, Vol 14, pp 277-300*

16 *Ibid. p. 61*

The majority concludes that appreciating these capacities as mutually supporting aspects of the organism's vital work will help us understand why an individual with total brain failure should be declared dead even when ventilator-supported "breathing" masks the presence of death. Thus they have abandoned the *integration* view and in its place adopted what they have called a *mode of being* view, which requires the living being to be receptive to stimuli, act upon the world to obtain what it needs, and be driven by basic felt needs[17].

The definition of death in terms of the loss of all brain function has therefore been rejected by the US President's Council and in Australia the major medical body responsible for setting the medical criteria has adopted a standard that allows death to be diagnosed while some brain functions continue. In effect, therefore, the definition of death by the brain criterion has indeed collapsed. Further, the reasoning of the Church that accepted the definition has also been rejected by the Council and in practice by ANZICS.

A further development in relation to the determination of death is a return to using death defined by the irreversible loss of circulation or "donation after cardiac death" (DCD) (Part (b) of the definition of death). In many ways this may be a helpful development, because it creates the possibility of more organs being available. Only a small proportion of people die in the circumstances of catastrophic brain injury and support by a ventilator – the two essential circumstances for organs being available after death by the brain criterion. Many more people die through failure of the circulatory system. It is also helpful if the circulatory criterion is used because it avoids some of the conceptual difficulties of death by the brain criterion and the recent problems about diagnosis and the philosophical explanation of death by loss of brain function. People more readily accept that death has occurred when the heart has stopped beating permanently.

However, the recent development of diagnosing death by the circulatory criterion also has some problems that need resolution. The first is the practice of undertaking interventions before death in order to make organs more available after death. The proposals include administering drugs to stop the blood clotting when it stops flowing, and the second is to surgically create access to the femoral arteries in the groin and the placement of large bore tubing to make it easy to flush the major organs with a cool preserving solution as soon as death is diagnosed. It overcomes the problem that it is more difficult to access the arteries when blood flow stops and there is no pressure in the arteries.

A second problem is that there is no agreement over how long the circulation must cease before death can be diagnosed. The time involved varies depending on the cause of death and on the age of the patient. Children can recover after a much longer time than adults. Also related to that issue is the reality of the circumstances that are likely to be when death by irreversible loss of circulation is predictable after life support has been withdrawn. Such withdrawal may include drugs called "inotrophics" that sustain heart function or it may involve withdrawal of a ventilator. If the loss of circulation is a result of withdrawal of a treatment it raises a question about irreversibility - could not the patient be resuscitated and the treatment re-applied and thus it may be possible to re-establish circulation? The loss of circulation would therefore not be irreversible as the law requires for a diagnosis of death.

Finally, because the likely circumstance of diagnosis after cardiac death is withdrawal of treatment, it does raise questions about the ethical issues involved in withdrawal of life support. It is important that those involved in transplantation are quite separate from the decision to withdraw life support and to diagnose death. However, the urgency of the timing means that the transplant team will have to be notified and involved prior to death in order to make obtaining major organs possible before they are too badly damaged by being left warm and without blood flow. Therefore, there are also difficulties with the application of part (b) of the legal definition of death.

The determination of death by the brain criterion has collapsed due to there being a lack of consensus about the medical criteria which determines that there is loss of all brain function; confusing differences in the legal definition of brain death between international jurisdictions; and some authorities having rejected the definition as the loss of integration, in favour of the loss of mode of being. This collapse has focussed greater attention on death as defined by circulatory criteria, however this attention has also revealed numerous ethical and practical problems in regard to organ donation following cardiac death in the controlled circumstances of treatment withdrawal.

17 *Ibid.*