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## Commentary

# Whole-brain death reconsidered – physiological facts and philosophy

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### Author's abstract

*Four main areas generating confusion in discussion on brain death are identified as a) the relation of criteria of death to concepts of death, b) the argument about whether death is an event or a process, c) the inadequate differentiation of different neurological entities having different cardiac prognoses, and d) insufficient awareness of the separate issues of 'determining death' and 'allowing to die'. It is argued that if by death we mean the dissolution of the human 'organism as a whole', then whole-brain death is death. Behavioural patterns, legitimate in the presence of a cadaver, should be legitimate from the time whole-brain death is diagnosed.*

Discussions between philosophers and neurologists on the subject of death require a double commitment. As neurologists begin to differentiate their patients more carefully, philosophers will have to ask their questions more precisely. And as philosophers probe deeper into what it really means to be alive, physicians will have to abandon some of their more traditional attitudes. Neither philosophers nor neurologists can any longer accept death as a brute empirical fact, the recognition of which is just a technical problem. Whether we realise it or not there are philosophical implications to both our acts, and our failures to act. There is no harm in seeking to make our assumptions explicit. In fact recent developments in the fields of resuscitation and intensive care render the task imperative. And if philosophers wish their skills to help this endeavour, rather than hinder it, they will have to familiarise themselves with these developments.

Four main areas of confusion bedevil most discussions about brain death. They concern: the kind of relation necessary between concepts of death and criteria of death; what is meant by the 'biological fact' of death? Intimately related to this are the twin questions as to whether death is an event or a process, and whether what is of clinical significance is 'death of the organism as a whole' or 'death of the whole organism';

the recognition of the important clinical, physiological, pathological and prognostic differences between the vegetative state, whole-brain death and death of the brain stem. Unless agreed definitions are reached concerning these states, terminological problems soon render meaningful communication impossible; The difference between 'identifying death' and 'allowing to die'. Discussions about what have been called the 'uncomfortable dimensions of the care of the dying'<sup>(1)</sup> have nothing to do with identifying a dead brain stem.

### Concepts and criteria

Two boys were walking in a field, arguing fiercely. One was carrying a butterfly net, the other a mousetrap. Each was claiming that his was 'the better' instrument. They almost came to blows. A third boy (an obvious candidate for a First in philosophy) came up and asked the necessary question: 'Better for what?'.

This apocryphal tale emphasises that all talk about the criteria of death – and *ipso facto* about 'better' criteria or 'new' criteria – must be related to some overall concept of what death means. Dr Browne rightly stresses that important behavioural consequences flow from the recognition that a person is dead. But we cannot argue about whether a neurological or a cardio-respiratory approach is 'better' for recognising such a state, unless we are agreed on what exactly it is that we are seeking to identify. When we consider death, the tests we carry out and the decisions we make should be logically derived from agreed conceptual and philosophical premises.

I find it a novel experience to have to argue with a philosopher who asserts that 'even granting that . . . important legal, moral and medical consequences flow from the determination of death . . . it still does not follow that we ought to precise the definition of death'. Even more surprising is his statement that 'we can remove any uncertainty in practical affairs without fiddling with the definition of death'. Dr Browne seems here to be donning the garb of the pragmatic, unreflecting physician. It is not reassuring when philosophers, of all people, tell us that we can leave the concept of death in its present 'indeterminate' state,

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### Key words

Brain death; whole-brain death; death; philosophy; medical ethics.

and that we should get on with the job of specifying 'what can appropriately be done to whom' – and 'when'. Dr Browne questions the desire to solve practical problems by making definitions more precise. He calls it a temptation (implying it should be resisted). I believe a more positive approach would be to accept Oscar Wilde's suggestion that 'the only way to get rid of a temptation is to yield to it'. I cannot endorse Dr Browne's view that in discussing death 'we should first settle the question of what behaviour becomes appropriate when' – and even less his conclusion that 'this can be settled independently of the question of when a person is dead'.

Dr Browne seems to be arguing for an *ad hoc* patchwork of practices, of unspecified relationship to one another, and certainly unrelated to any overall philosophical concept. I don't know if any school of philosophy exists whose main aim is to purge philosophical awareness from the minds of human beings. If it does neurologists should caution their philosopher colleagues against it, for the only real alternative to an overall philosophical concept of death is a set of arbitrarily assembled rules of conduct. Who would issue such rules? On what basis? And would not the issuing of edicts, unrelated to a widely discussed and generally accepted concept of death, constitute the very 'medical paternalism' Dr Browne so rightly decries? History tends to show that when prescribed observances and practices have no roots in generally accepted conceptual frameworks they face one of two fates: they are either abandoned (and sooner rather than later) – or they are only sustained by the imposition of force. Is the latter what Dr Browne means when he quotes proposed empirical rules that threaten those who transgress them with 'the most severe sanction available' to particular jurisdictions?

I have elsewhere sought to argue against what I have called 'free floating criteria of death' and to show how, historically, different concepts of death have necessitated the adoption of different criteria of death (2). In this context I have outlined my own concept of human death (to which criteria assessing brain stem function are central). The full argument for defining human death as the 'irreversible loss of the capacity for consciousness, combined with the irreversible loss of the capacity to breathe' cannot be recapitulated here. Briefly, this admittedly hybrid definition seeks to combine philosophical and physiological considerations. The loss of the capacity for consciousness and of the capacity to breathe relate to functional disturbances at opposite ends of the brain stem, while the former is also a meaningful alternative to 'the departure of the soul'. I believe the concept to be consonant both with modern developments in the fields of resuscitation and intensive care, and with the endeavours of modern Man 'to secularise his philosophical understanding of his nature' (3). The concept itself will almost certainly have to be amended in the light of developing experience. But it provides, I hope, a momentary locus of coherence in a rapidly evolving

situation. Dr Browne, on the other hand, does not define death at all. This makes it very difficult to get to grips with what he writes. He seems opposed both to a 'whole-brain' definition of death (p 31) and to the identification of the vegetative state with death. He quotes the definition of death given in *Black's Law Dictionary* and states he is against the redefinition of death 'in any other way'. Does he then endorse the traditional definition? He is nowhere explicit enough for this confidently to be asserted. The problem with the traditional definition he quotes is that it is not really a definition at all, or at least not one that encompasses some of the more macabre by-products of modern technology. It is my belief that if the concept of death is left 'indeterminate' – as Dr Browne advocates – one will not even need to invoke the principle of indeterminacy to foretell that some of the decisions reached will prove irrational and harmful as well as arbitrary.

### Death as an event or death as a process?

Dr Browne claims that 'it is not a biological fact that one who has suffered whole-brain death is dead'. Is that correct? And what exactly does it mean?

The statement is ambiguous: it can be interpreted in two different ways. Is the 'biological fact' of death, to which – according to Dr Browne – brain death does not relate, the 'death of the organism as a whole'? Or is it the 'death of the whole organism', that is the death of each and every one of its cells? Both are legitimate interpretations of the 'biological fact' of death, but they lead to very different conclusions.

If we accept the first interpretation (namely that the 'biological fact' of death relates to the dissolution of the 'organism as a whole') Dr Browne's statement (that it is *not* a biological fact that brain death is death) is self-evidently untenable. The very opposite would seem to be nearer the truth, namely that *only* when the brain is dead can the individual (the 'organism as a whole') be considered dead. Whereas the functions of lungs and heart can (for a while) be taken over by a machine, those of the brain cannot. In this perspective the classical criteria of death (arrest of the heart beat and circulation) are only indicative of death when they have persisted for long enough for the brain to die. All human death, according to this view, is (and always has been) brain death. That is the position I hold.

Would Dr Browne agree that a decapitated individual is dead (as an independent biological unit, ie as an 'organism as a whole') from the moment the head is severed, irrespective of the fact that the heart may go on beating for some time? And if so, why? And what if the circulation had been closed prior to decapitation (the carotid arteries being joined to the jugular veins)? Would the resulting preparation, after decapitation, be alive or dead? The identity of brain death with death has been very perceptively realised by people with little or no knowledge of physiology: we have been hanging and decapitating for centuries. We have only to think

of 'whole-brain death' as physiological decapitation for the relationship to become crystal clear.

What is it that is so important, anyway, about the action of the heart? Only the hopelessly romantic would consider it an end in itself. Surely cardiac function is only relevant if it results in irrigation of the brain? Is a frog alive, whose isolated heart is kept beating in a test tube? Is a heart donor alive (even if cremated) provided the heart he or she has donated is beating vigorously in its new host? Is the recipient dead, because his own damaged heart has been removed and discarded, to make room for the new one he has just received?

Dr Browne's assertion that 'it is not a biological fact that one who has suffered whole-brain death is dead' can be taken in a different sense, however, and one which is worth exploring. It could be taken to mean that someone who is brain-dead (according to any of several possible sets of criteria of brain death) will still have a beating heart, kidneys that can form urine, or a liver still able to conjugate bilirubin. Formulated in this way, Dr Browne's statement is incontrovertibly true.

The implicit (and unformulated) concept of death underlying such a statement would be that a person can only be dead when such activities cease. Biological death, according to this approach, is the death of 'the whole organism', the death of all of its component parts, the cessation of function in each and every one of its cells. But even irreversible asystole is not immediately followed by biological death, defined in this way. Quite apart from the question of continued growth of the hair and nails, there is no doubt that cells with low oxygen requirements (in skin, arterial walls and the matrix of bone) may remain alive for variable periods after the heart has permanently ceased to beat. Putrefaction would be the only criterion relevant to such a concept of biological death.

Neither doctors (too busy with practical decisions to question, as they should, the philosophical implications of what they are doing) nor philosophers (usually too concerned with conceptual problems to find time to ascertain what is real and unreal in their speculations) have ever demanded putrefaction as a criterion of death. Rightly, both are more concerned with cessation of function of the 'organism as a whole' than with cessation of function of 'the whole organism'. And here brain-stem death begins to assert its relevance. When the human organism has irreversibly lost the crucial capacity for consciousness and the ability to breathe (and thereby to maintain a spontaneous heart beat), and when moreover it has lost such important responses to its environment as the homeostatic maintenance of temperature and blood pressure (which are mediated through or by the brain stem), in what sense can it be said to be an independent biological unit?

Technological developments (such as cardiac transplantation and our capacity, for a while, to maintain a heart-lung preparation) make a redefinition of death imperative. And it helps no one when the issue is

evaded, on the ground that to face it would generate a 'conceptual crisis'. The known facts do indeed create such a crisis. In my opinion the challenge should be met.

### **The vegetative state, whole-brain death, and death of the brain stem**

Dr Browne is rightly concerned about what is appropriate behaviour in different clinical circumstances. But several of his proposals and concerns are, I think, based on faulty physiological premises. These undermine the temporal aspects of much of his argument. As a result the argument itself – at least for one familiar with the handling of such patients – has an air of unreality about it. He erects straw men – albeit perplexed straw men, constantly tormenting themselves with impossible questions.

It is important, at this stage, to be careful about the terms we use. Take the words 'irreversible coma' for instance. They have a venerable genealogy, but have come to denote quite different states. They were first used in the title of the classical American description of whole-brain death (the 1968 report of the Harvard Committee) (4). The Boston workers had spoken of 'irreversible coma' in an attempt to convey something of the flavour of '*coma dépassé*' (literally a state beyond coma) which is how the French had originally described whole-brain death in 1959 (5). The state described by these various groups was not only total death of the brain, but total death of the whole nervous system (in that areflexia of spinal origin was also demanded). Patients in '*coma dépassé*' had not only lost all capacity to respond to external stimuli, they could not even cope with their internal milieu: they were poikilothermic, had diabetes insipidus, and could not sustain their own blood pressure. The cardiac prognosis of the condition was at most a few days, but sometimes as little as a few hours.

Unfortunately, the words 'irreversible coma' were later used (quite inappropriately) to describe something very different, namely the vegetative state (and it is as a synonym for *this* condition that Dr Browne uses the words). The vegetative state was clearly described by Jennett and Plum in 1972 (6). For many years it had been 'a syndrome in search of a name'. (The condition is also known as 'neocortical death', the 'apallic state', or 'cerebral death'.) The vegetative state has a potential prognosis of months or years. It usually results from either cerebral anoxia (which may devastate the cortical mantle of the brain while sparing the brain stem) or from impact injury to the head (which may massively shear the subcortical white matter, disconnecting the cortex from underlying structures). Other pathological processes may, on occasion, be responsible. Chronic care units all over the world are full of such patients. Affected individuals open their eyes, and show alternating sleep-wake sequences. By definition they cannot be described as comatose, for coma is a state of

*sleep-like* unresponsiveness, from which the patient cannot be roused. (Empirical evidence is now overwhelming that coma, so defined, never lasts more than about three weeks. Comatose patients either develop asystole during this period, or they open their eyes and pass into a vegetative state).

Although intermittently awake, patients in a vegetative state exhibit no behavioural evidence of awareness. Conjugate roving movements of the eyes are common, orienting movements rare. The patients do not speak or initiate purposeful movement of their limbs. Abnormal motor responses to stimulation may often be produced. The patients grimace, swallow and breathe spontaneously, and their pupillary and corneal reflexes are usually preserved. They clearly have a working brain stem, but no evidence of function above the level of the tentorium. The words 'irreversible coma' should clearly be dropped when what is meant is the vegetative state. Although the condition is usually irreversible, the patients are *not* comatose.

No culture has ever considered patients in the vegetative state as dead, or suitable subjects for organ donation. No physician would be authorised, anywhere in the world, to use the bodies of such patients for what Dr Browne calls 'certain experimental or instructional purposes'. No doctor would be prepared to perform an autopsy on such a case, or to 'initiate burial procedures', or to do any of the other things which Dr Browne lists as appropriate death-behaviour. Against whom then is he arguing when he repeatedly raises the issue of such patients? For instance when he states that according to the 'cerebral-death definition of death [by which he means the vegetative state] a person is dead as soon as he is in irreversible coma?' 'Whose cerebral-death definition of death?' one may ask. That of philosophers? Idiosyncratic viewpoints aside, no authoritative medical or legal body has, to my knowledge, ever defined the vegetative state as death. In the real world, there is no socially significant acceptance of a 'cerebral-death definition of death'. Has Dr Browne, at times, confused whole-brain death with the vegetative state? I suspect he may have. For instance to what condition precisely is he referring when he talks (p 30) about patients who are 'irreversibly comatose [ie in the vegetative state] but have artificially supported respiration and heart beat'. Patients in the vegetative state breathe spontaneously, so that it cannot be about them that he is thinking. And patients who are 'whole-brain' dead – and who require artificial respiration – are not in 'irreversible coma' . . . at least not in the sense in which Dr Browne repeatedly uses the term. In his whole discussion of the vegetative state he seems to be tilting at windmills with very blurred edges.

There is, admittedly, a substantial body of medical (and lay) opinion which holds that patients in a persistent vegetative state should be allowed to die. But even to envisage that the persistent vegetative state could be equated with death is both to confuse the issues of 'allowing to die' and 'determining death' – and to

ignore some further fundamental differences between whole-brain death and the vegetative state. The latter is easier to describe than to define physiologically. In fact it is doubtful whether it will ever be possible to define it with the physiological rigour needed if practical tests (and behavioural patterns) are to flow from the definition. The loss of cognition and affect (in the vegetative state) cannot be quantitated in the way absent brain-stem reflexes can (in whole-brain death). The loss of awareness (including self awareness) in the vegetative state cannot be recognised as readily as a respiratory centre incapable of responding to an arterial carbon dioxide tension of 6.65 kPa. A second year medical student could diagnose whole-brain death – but even an experienced neurologist has difficulties in assessing the various deficits in the vegetative state. In a nutshell it is easier to test pupils than to be certain about sentience.

Death behaviour is eschewed by relatives confronted with the more severe forms of the vegetative state because open eyes, grimacing, swallowing and spontaneous breathing are, rightly or wrongly, associated in their mind with the capacity for awareness. Death behaviour is eschewed by doctors, in similar circumstances, because it is widely felt that such behaviour would be the first step along a very slippery slope. If the 'irreversible loss of higher functions' (or the 'loss of personal identity') were equated with death, then which higher functions? Damage to one hemisphere or to both? If to one hemisphere, to the 'verbalising' dominant one, or to the 'attentive' non-dominant one? To the frontal lobes or to the parietal lobes? In next to no time leading politicians all over the world would be declared brain-dead.

I described the vegetative state in some detail so that it should not be confused with *whole-brain death*, which is something very different. Brain-dead individuals exhibit no signs of neural function above the level of the foramen magnum. *Brain-stem death* is the physiological kernel of brain death, the anatomical substratum of the physical signs encountered in the condition (apnoeic coma with absent brain-stem reflexes) and the main determinant of its invariable cardiac prognosis: asystole within hours or days.

Dr Browne conjures up visions of whole-brain dead individuals, maintained on ventilators, being used as 'a self-replenishing blood or skin bank, a reservoir of transplantable organs in the freshest possible condition, a plant for manufacturing biomedical compounds and so on'. In this he seems to be under a misapprehension as to how long the heart may continue to beat when the brain stem is dead. I have summarised elsewhere (7) the published evidence concerning what happens when brain-dead patients are maintained on ventilators. Asystole invariably develops. For instance, of the 63 patients diagnosed as brain-dead in a large Danish series (8) (and maintained on the ventilator) 29 developed asystole within 12 hours, 10 between 12 and 24 hours, 16 in 24–72 hours, and the remaining 8 in 72–211 hours. Experience in Great

Britain (9) and elsewhere is in line with these observations. The reasons why the heart stops within a short while when the brain-stem-mediated baroreceptor reflexes are disrupted, and when the vasomotor centre is destroyed, are complex but the empirical fact is established beyond all doubt.

The twin pillars of Dr Browne's whole argument have now been shown to be shaky. The categorisation of what is or is not appropriate death-behaviour is *irrelevant* in the context of patients in the vegetative state (whom no one would consider dead). It is *unreal*, in practical terms, in the context of whole-brain death (because as soon as this state is diagnosed doctors usually withdraw ventilatory support and the heart stops). Even if physicians did not act in this way, the repertoire of potential behaviour patterns possible between the two events (the irreversible cessation of brain function and the irreversible cessation of heart function) would be strictly limited, for reasons of time. And what if the heart could be permanently replaced by some mechanical device? It is impossible to predict how prevailing attitudes would, by then, have evolved. But it will certainly be a meaningless question to ask, for those who still accept the framework of *Black's Law Dictionary*.

### Death . . . and appropriate 'death-behaviour'

We are told that 'it has not been characteristic for advocates [of a whole-brain concept of death] to acknowledge, let alone defend' its implications, and that 'some weighty moral arguments' are needed before those who accept such a concept can justify 'death-behaviour' such as the harvesting of organs.

I do not see the need for special pleading when confronted with what I have called a 'beating heart cadaver', that is a dead patient in whom only a machine (maintaining ventilation) ensures a transient continuation of the heart beat. If one is convinced, sincere and logical about one's conviction that whole-brain death equals death, what one considers to be permissible flows simply and without fuss. A death certificate may, for instance, be issued. And with proper respect for the susceptibilities and wishes of the relatives all classical cadaver-related behaviour becomes acceptable (dissection, the removal of organs, the teaching of anatomy, etc). No intellectual contortions are needed. The whole matter centres on the acceptability of the conceptual premise, and on confidence that the clinical assessment has been meticulously carried out.

Dr Browne and I would agree, I suspect, that what is considered acceptable is culturally determined. We are now in a state of transition in these matters. In many countries brain death has achieved legal status and is synonymous with death (10). In some parts of the world the concept of a 'beating heart cadaver' is widely established, and not only among doctors. In California, for instance, a surgeon who transplanted the anoxic and discoloured kidneys of a brain-dead donor whose

heart had been allowed to stop would probably be guilty of malpractice. In other parts of the world, such as Poland and Sweden, brain death is recognised and disconnection from ventilators is permissible, although surgeons have to wait some 20 minutes until the heart has stopped before they can remove organs. This state of conceptual schizophrenia cannot be expected to last. It is striking how readily the relatives of brain-dead patients already accept the diagnosis. I recently informed the nephews of a brain-dead patient that I had just diagnosed their uncle as brain-dead. 'That's strange', one of them said, 'I thought he died last Tuesday'.

Those who think that 'weighty moral arguments' are necessary seem to doubt that whole-brain-dead individuals, maintained on ventilators, are 'really dead'. They imply (although seldom say so explicitly) that such individuals are not really dead, and that whatever is done to them is somehow being done to 'persons'. The very use of such terms as 'maintaining life-support systems' and 'the administration of health care' (when applied to the brain-dead) are examples of terminological sleight of hand. Playing on atavistic anxieties generated by the presence of a still beating heart, those who reject the whole-brain concept of death seek to lure their opponents into terminological quagmires. The trap is easy to avoid if recognised. The best way to avoid it is to ask those who refuse a whole-brain definition of death to come out in the open, and give us their own concept of death. To seek refuge behind legalistic dictionary 'definitions' that predate the development of modern intensive care facilities – and which often are not definitions at all – is just not good enough.

There is finally something offensive – and not a little paranoid – in the suggestion that those who want to redefine death (some would say, who want to define it adequately for the first time) are seeking a 'death justification' to legitimise their practices. It is implied that physicians are seeking to change the definition of death so that they may continue to do what they want, without being accused of practising euthanasia. There is no foundation for this view. Brain death has a sound physiological basis, in its own right. It had been identified before renal transplantation got under way. And if better methods were discovered for treating end-stage renal failure, well run intensive care units would still be producing whole-brain-dead patients, in increasing numbers all over the world.

Modern technology, in its desperate attempts to save human life, has produced the entity we call brain death. The conceptual problems this creates will not go away, just because we choose to ignore them. The redefining of death has become one of the more important challenges of modern medicine. In accepting the challenge physicians need the creative help of philosophers, not proclamations of conceptual agnosticism.

Dr Browne's arguments have been directed against both a specific target of 'whole-brain death', and

against the more general target of *any* definition of death in terms of brain function. I have attempted to show why his arguments fail against each of these targets. I have suggested elsewhere, however, that just as brain death is the necessary and sufficient component of human death so is brain-stem death the necessary and sufficient component of brain death (11). Brain stem death can moreover readily be identified clinically. But that is another issue.

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