VIA MEDICA

REVIEWS

Anaesthesiology Intensive Therapy
2016, vol. 48, no 1, 142–145
ISSN 1642–5758
10.5603/AIT.a2016.0015
www.ait.viamedica.pl

Brain death criteria formulated for transplantation purposes: fact or myth?

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Abstract

Medical progress has moved the boundaries of life that were set many centuries ago. The development of medical techniques has allowed us to witness cases that were unknown prior to the introduction of reanimation procedures and mechanical ventilation. Towards the end of the 1950s, the term "irreversible coma" was coined, and has evolved into what is currently known as the "brain death" concept. This latter concept, proposed in 1968, is very often referred to as the new definition of death, even in medical circles. What, up until this time, used to be the classic definition of death, namely cessation of circulation and respiration, should now be recognized as the classic criteria for death. Indeed, the new criteria for recognizing death has not resulted in changing the current criteria, but in complementing them. The first part of this paper presents brief descriptions of death in the humanities over the centuries and the impact of progress in medicine on changes in how death is defined today. The second part brings to light the complexity of creating the foundations of the neurological criteria for death. The integration of concepts from two complementary medical fields — neurology and transplantology — is described. Although for some period of time they have been linked together, they may grow independently in the future. The jargon phrase "brain death" is nowadays recognized as synonym of death, but in fact should be considered tantamount to declaring pronouncing a person's death.

Key words: death, brain death, neurological criteria of death, organ donation

Anaesthesiology Intensive Therapy 2016, vol. 48, no 2, 142–145

HUMANISTIC POINT OF VIEW

Ontologically, death is a basic fact of human life. It has been observed over the centuries that in order to understand what death is, the best thing to do is to compare it with birth. Understanding this phenomenon was perceived by Seneca to be the source of all wisdom, which provides comfort in the moment of the death of people close to us, as well as at the end of our own lives [1]. St. Augustine defined life as the race to death. In the theology of hope, death is the moment at which we attain existential maturity and full self-realization [2]. Viewed from an existential standpoint, death is analysed as "the basic quality of human life" [3]. As one of the main representatives of personalism in twenty century, Max Scheler pointed out that awareness of 'death directedness' is directly connected with aging. On the basis of the statements mentioned above, the point made by Scheler that each one of us is intuitively aware of our own mortality seems to be comforting [4]. Poetry offers a more impressive description of the death phenomenon for the modern audience, which lives in the world of images and superficiality. Indeed, the essence of the discussion on life and death can be found in the following poem: "Nothing's a gift, everything is borrowed… The register is meticulous and it's evident that we are to be left with nothing… I consented to open this account… The protest against this account is what we call the soul… And it is the only thing not on the list" [5]. A popular understanding of death is presented in any dictionary as the end of life, a permanent cessation of all vital functions [6]. Depending on the acknowledged value system, this fact can be analysed as either the annihilation of a human being or as the bridge to a new existence. Bioethicists have modified the dictionary definition and proposed a more precise description: "Death is the permanent loss of all observable natural functions of the whole body, as well as the permanent loss of consciousness in the whole body and all its parts"[7]. According to Joseph Ratzinger, the nature of death is breaking free from all relationships [8]. It does not mean the out of body journey of the soul, but the

existence of a human being in a new dimension defined by God. For agnostics, the explanation of mortality and its purpose described above is the concept of programmed death. Evolutionists have stated that the finiteness of time is a feature of organic bodies. Obviously, while the concept of programmed death does not rule out the existence of circumstances that can significantly shorten life, it proves the fact that a human being is a mortal being [9]. For more than two hundred years, the human pursuit of investigating 'the nature of the issue' has demonstrated the indisputable dominance of science over the metaphysical perspective in discussions about death. In the last half century, however, our thinking about death has been modified by the assumption that the loss of bodily integrity through irreversible brain damage is the condition that allows a person to be pronounced dead.

MEDICAL POINT OF VIEW

Progress in medicine has enabled humanity to be released from many fatal conditions. This progress has also laid the foundations for successfully looking beyond the known boundaries of life. The twentieth century was a period when the understanding of phenomena that both regulate and disorganize the human body was revolutionized. Consequently, efficient methods for disease prevention and, as a result, death prevention, have been found. On the other hand, few ways of shortening life (i.e. motorization, weapons of mass destruction) have also been 'discovered'. However, this balance shows that humanity is doing better at prolonging life in a state of well-being. Since the beginning of civilization, the moment of death has been difficult to define. Orthodox Hindus still believe that death occurs when the skull breaks in the heat of the funeral pyre. Since the Talmudic period, there has been a dispute among Jewish researchers over whether the proof of death is a lack of breath or a lack of a pulse. In many cultures, the complete decomposition of the body is considered to be the exact moment of death [10]. It was not until the nineteenth century that the initial concept of death, defined as cardio-respiratory arrest, gained the status of being a more reliable diagnosis. In 1849, Eugene Bouchut was the first person to use the stethoscope in order to prove a diagnosis pronouncing a patient "dead" [11]. At the beginning of the twentieth century, medical evidence posed the question as to whether a lack of breath and heartbeat means the actual end of human life. Towards the end of the 1920s, numerous attempts proved that cessation of circulation, caused by ventricular fibrillation, was reversible by performing electrical stimulation. Moreover, in the 1950s, open-chest and then closed-chest defibrillators were introduced [12, 13]. Electrotherapy with the manoeuvres suggested by Peter Safar in cases of apnoea and cardiac arrest established the technique of cardiopulmonary resuscitation (CPR) [14]. The development of applied physiology and respiratorotherapy, which was brought about mostly by polio outbreaks, along with intensive care unit development, resulted in crossing the boundary of life that had been set many centuries previously [15, 16]. Thus, what is today regarded as the normal procedure in the case of cardiac arrest would probably have been called quackery a hundred years ago.

BRAIN DEATH — THE REDEFINITION OF DEATH?

The discoveries mentioned above enabled the observation of phenomena that, up until then, had been invisible to the human eye. Neurosurgeons began describing the phenomenon of 'cerebral circulatory arrest'. The first reports on this subject date back to early 1950s. The phenomenon was related to space-taking intracranial lesions, which influence the tone of cerebral arteries by anatomical feature, compression or spasm. The authors underlined the fact that autopsies did not reveal any obliteration within vessels [17, 18]. A milestone in formulating the concept of brain death was the publication of studies conducted by French neurologists in 1959. Indeed, Dr Wertheimar's team described a clinical state termed "the death of the nervous system"[19]. A few months later, Mollaret (a neurologist) and Goulon (an intensivist) described 23 cases of patients in a deep coma and apnoea, with a lack of reflexes, polyuria, hypotension and the absence of brain activity in an EEG. The term that they suggested for the observed phenomenon was "irreversible coma" (fr. *coma dépassé*). In their study, they stated that the heartbeat stopped either when the demand for catecholamine ceased or when breathing stopped. Despite treatment, the patients died as the result of the cessation of the heartbeat, typically a few days after establishing the diagnosis of *coma dépassé* [20]. Subsequently, the observations made by these French neurologists were implemented in practice by a Belgian surgeon, Guy Alexander, in 1963. On the basis of the neurological criteria proposed by Mollaret and Goulon, the authorities of the clinical hospital of the Catholic University in Louvain accepted, at Alexander's request, the harvesting of organs from a person whose heart was still beating. It was the first organ recovery from a person who had been deemed brain dead [21].

DEATH AND TRANSPLANTOLOGY

The year after the first cardiac transplant (1967), performed using a non-heart-beating donation, was a breakthrough for the introduction of the new the neurological concept and helped bring death into the public discussion. During the Twenty Second World Medical Assembly, the Declaration of Sydney was announced regarding the pronouncement of death: "Death is an ongoing gradual process at the cellular level in which tissues vary in their

ability to withstand the deprivation of oxygen. The moment of the death of particular cells and organs does not play as significant a role as confirming that the ongoing process is irreversible and no medical devices can restore life" [22]. The second milestone was publishing the *Report of the Ad Hoc Committee of the Harvard Medical School to Examine the Definition of Brain Death* whose ad hoc definition initiated further discussion on the legitimacy of calling a coma, death [23]. Comments on this report may serve as an example of how a new concept might be misinterpreted without sufficient knowledge of the subject. Passage from comment titled 'Redefining Death', a commentary to the first page article by Robert Reinhold entitled "Harvard panel asks definitions of death be based on brain", in The New York Times: "As old as medicine is the question of what to do about the human vegetable, the individual who goes into irreversible coma. Sometimes these living corpses have "survived" for years. It is such cases, as well as the needs for organs to be transplanted, that the Harvard faculty committee had in mind that death be redefined as irreversible coma" [24]. Thomas Starzl addressed a challenge that the authors of the report would have to face three years prior to the announcement of the criteria of brain death by the Harvard School Committee. The leaders of transplantology voiced their considerable doubts during this factual debate during a Ciba meeting :" I doubt whether any member of our transplant team would declare a person dead as long as this person's heart was still beating… Would any doctor make a decision to remove vital organs prior to circulatory arrest?" [25]. Starzl's words were his reaction to Dr Alexander's speech on the measures taken at Louvain Hospital. Sir Roy Calne, another pioneer of transplantology, stated: 'The criteria presented by Dr Alexander are medically persuasive, according to traditional definitions of death he is in fact removing kidneys from live donors. The traditional diagnosis of death is made if the heart has stopped beating for five minutes"[25]. Dr Alexander's experience is the first example of blending the 'neurological criteria' of death with transplantology. The concept of *coma dépassé* presented during the Ciba conference, as well as the procedure of harvesting organs from a person who has been pronounced dead in accordance with brain criteria, was considered unacceptable to most of the symposium participants. When reading the report of the Harvard Committee, the protocol proposed by French neurologists and established by the Belgian doctors, was accepted in many places by author's report to formulate the neurological criteria of death. The collaboration of doctors, ethicists, sociologists and lawyers allowed a homogenous stance of opinion-forming bodies to be worked out, which laid the foundation for a consistent message for society in general. Progress in medical knowledge established the current criteria of death. The pronouncement of brain death means ending the use of extraordinary measures in treatment which result in cardiorespiratory arrest. In a situation in which basic life functions are supported, the possibility of organ recovery for transplant purposes may be considered. A consequence of this fact is the necessity to anticipate organ donation in the best way possible. In English-speaking world this requires first person consent to be in accordance with a high degree of respect for civil liberty and sovereignty. As proof of this right to self-autonomy, the following letter to the editor of New York Times from Julian Lapides, the Governor of Maryland, representing one of the first states in North America to accept the Anatomical Gift Act, may be considered: "Perhaps one can glean from this legislative experience that man's ambivalence toward the use of his body for scientific and medical purposes to which the author refers is something which man is glad to have resolved — if only partially — by legal means… a bereaved family which might be prevented for complicated psychological reasons from acting rationally if not generously, with regard to decedent's body and its usable parts"[26]. In European countries, authorization for donation is based mostly on presumed consent [27].

CONCLUSIONS

Defining the criteria for brain death has led to an unusual situation. Till the late 50's of twenty century death had not raised any doubts from a "classical perspective". Cardiorespiratory arrest was considered equivalent to the end of any remaining life functions. This was the result of an unwritten principle that was confirmed by physicians' own competence. Thanks to Robert Hooke's invention of the microscope, we discovered that our body consists of cells, tissues and organs [28]. Although even at that time, we already knew that the body does not die when the heartbeat and breathing stop, nobody suggested that a person was still alive then and does not actually die until the moment of complete decomposition. For over 2,000 years, since the Hippocratic period, death has been determined in an unquestioned way. Have we been wrong this whole time? Indeed, it was not until resuscitation skills were developed that a change in the condition which was commonly regarded to be the end of life became possible. Moreover, it took us 25 years to come to the conclusion that resuscitation is not a fully efficient way of restoring life. The artefact of intensive care described in the 'Harvard criteria' were the answer to the failure of treatment. From a historical standpoint, the above-presented events were crucial in the evolution of our understanding the biological death of a human being. For many years, neurological concepts of brain functions were only analysed by neurologists while developments in clinical transplantology were occurring simultaneously. The year 1963 was the first time that the concepts of both

fields of medicine were combined. Since the Harvard report was published, the neurological criteria of the determination of death have become part of transplant medicine to such an extent that most people recognize them as the 'brain death concept' and, at the same time, the result of the needs of transplant medicine. Indeed, it seems that we are witnessing the union of two fields of medicine. One may wonder, therefore, about what the future relationship between the determination of death and transplantation will look like when safe methods of xenotransplantation, or genetic engineering through forming cells and organs from multipotent somatic cells, is mastered. Thanks to the complementarity of the previously mentioned concepts, they have been linked together for a period of time in order to redevelop independently. Thus, the question may be posed as to when this will become fact. Judging by the current progress in discovering the mysteries of the human body, it may be assumed that this will occur sooner than the verification of the death criteria. However, questions about the legitimacy and correctness of the death criteria will remain similar to those posed today.

ACKNOWLEDGEMENTS

1. The authors declare no financial disclosure.
2. The authors declare no conflict of interest.

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Received: 30.07.2015
Accepted: 12.10.2015