Brain death: a finished discussion?

Edison Moraes Rodrigues Filho [1], *José Roque Junges* [2]

Abstract

This article is a narrative review of the main authors who establish objections to the use of the concept of brain death as a synonym for death. It focuses on their biological and philosophical inconsistencies of the concept and proposes the discussion of the topic using the epistemological concepts of Popper and Kuhn. The article adopts the concepts of biopower and biopolitics as tools in the analysis of brain death, especially in relation to the inevitable intersection with organ donation and transplants.
Keywords: Brain death. Bioethics. Transplantation.

Resumo

Morte encefálica: uma discussão encerrada?

O presente artigo faz revisão narrativa dos principais autores que estabelecem objeções à utilização do conceito de morte encefálica como sinônimo de morte, com foco em suas inconsistências biológicas e filosóficas. Propõe a discussão do tema recorrendo aos conceitos epistemológicos de Popper e Kuhn. Utiliza os conceitos de biopoder e biopolítica como ferramentas de análise da morte encefálica, especialmente no que concerne a sua inevitável intersecção com a doação e transplantes de órgãos.
Palavras-chave: Morte encefálica. Bioética. Transplante.

Resumen

Muerte cerebral: ¿una discusión cerrada?

Este artículo es una revisión narrativa de los principales autores que establecen excepciones a la utilización del concepto de muerte cerebral como sinónimo de muerte, centrándose en sus inconsistencias biológicas y filosóficas. Se propone la discusión del tema usando los conceptos epistemológicos de Popper y Kuhn. Utiliza los conceptos de biopoder y de biopolítica como herramientas en el análisis de la muerte cerebral, especialmente en relación con la intersección inevitable con los trasplantes de donación de órganos.
Palavras-clave: Muerte encefálica. Bioética. Transplante.

1. Doutorando vitangel@terra.com.br **2.** Doutor roquejunges@hotmail.com – Universidade do Vale do Rio dos Sinos, São Leopoldo/RS, Brasil.

Correspondência
Edison Moraes Rodrigues Filho – Rua da Gávea, 64/casa 3, Ipanema CEP 91760040. Porto Alegre/RS, Brasil.

Declaram não haver conflito de interesse.

Death was recognised only by cardiorespiratory criteria in the past. The techno-scientific advances of the twentieth century, such as the advent of mechanical ventilation and intensive care, made possible the support of cardiorespiratory function in victims of severe and irreversible neurological damage. Parallel to that, the development of organ transplants also influenced directly and indirectly the discussion on the fate of those patients, leading to the creation of a neurological death criteria. In Brazil, the diagnosis of brain death is confirmed by two clinical exams and a supplementary examination, as required by the Resolution 1,480 / 97 of the Federal Council of Medicine (Abbreviated as CFM in Brazil - Conselho Federal de Medicina) [1].

Most advocates of brain death as a synonym for death of the organismo share the same paradigm that the term "cerebral death" refers to an irreversible biological phenomenon, which results in the permanent interruption of the life of the organism [2]. This premise provides moral support for the removal of organs from people considered dead, what is known as dead donor rule [2]. The idea that death is the permanent cessation of the integrated functioning of a body and that brain death is a sufficient criterion for determining when such interruption occurs is also part of this vision.

The main reason for this belief comes from the fact that the brain is considered irreplaceable, as well as being the main integrator of the whole organism [2]. Another argument is that, ultimately, every death is cerebral, causing irreversible cessation of cardiorespiratory functions [3]. However, despite being widely used and established in several countries as a criterion for death of the organism, both for the suspense of vital support as well as organ donation, the diagnosis of brain death still remains a subject of controversy as a synonym for death of the organism [4].

These divergences manifest themselves in the different criteria that are used worldwide to define brain death. Based on various philosophical principles, these parameters stipulate variable intervals between clinical trials, various assignments of the professionals in charge of carrying out such tests and whether or not the execution of additional procedures are necessary [5]. A certain uneasiness is still frequent among the professionals involved, especially among critical care physicians, at the time of suspension of life support or at the time of filling in the death certificate [6,7].

Despite the fact that this uneasiness is generally attributed to the lack of knowledge about the method [8], philosophical and biological doubts persist and should not be underestimated as they can, even if intuitively, be the answer for this discomfort. In this review, we discuss the concept of death, especially the brain death, the biological and epistemological inconsistencies of this classification, in addition to the "necessity" of this diagnosis as a way to provide organs for donation and transplantation purposes.

What is death?

Every definition of death should grasp the common sense of the word used by anyone, not being primarily a legal or medical term [9]. But here we will hold to the biological paradigm, which definition is the permanent loss of critical functions of the organism as a whole [10]. Organism as a whole is an old concept of theoretical biology [11] regarding the unit of an organism and its functional integrity, and not simply the sum of its parts - a concept that brings in its core the notion of critical functions [12].

Critical functions are those without which the body can not function as a whole, namely the control of respiration and circulation, the homeostatic and neuroendocrine regulation as well as the conscience. Death, therefore, would mean the irreversible loss of all these functions [13].

The current concept of death implies the irreversible loss of cardiorespiratory or brain function (brain "as a whole" or brain stem, according to the country in question) as a condition to attain the loss of all these critical functions [10]. It is interesting to highlight that the irreversible loss of cardiorespiratory function must be natural, since it is possible to keep it artificially - which often happens in practice - for varying periods of time [9].

Another key aspect, but difficult to answer, is whether the death is an event or a process. The Harvard Medical School Committee had a decisive influence on this issue when, in In 1968, they chose to define it as an event [14]. It is not surprising that several laws and medical guidelines have adopted the same classification after that decision [15].

One of the problems that can afflict the professionals involved in such situations is that the idea of death as an event seems to hurt the common sense. This is also reflected in the literature, in view of the extensive resumption of the discussion of death as a process [16-19]. In a very general way, it can be said that death begins at birth. More practically, however, it would be possible to consider that ,

 http://dx.doi.org/10.1590/1983-80422015233085

even when extremely short, this process still takes a lapse of time, not exact, in the linear view of time.

Inconsistencies of the biological diagnosis of brain death

There are several ways in which functions of various organs of the body and subsystems may be integrated in order to maintain homeostasis and resist entropy. Integration may occur from a central integrator, an organ which receives signals from various other organs and subsystems, processes them, and then returns these signals to the subsystems, coordinating the various functions of the parts of the organism [2]. Proponents of brain death argue that the only central integrator possible is the brain because it is irreplaceable in implementing these regulatory functions [10].

Another possible way to integrate the functions of various organs is through the decentralised interaction in which the parts are coordinated through the ability to feel, receive and process signals between each other [2]. Shewmon [20] argues that this form of integration and decentralised operation can occur between the parts of an organism without any participation of the brain. The author cites numerous cases involving the high neck section, isolation of the brain by Guillain-Barre syndrome or even death brains with artificially-induced respiration, in which there was a high degree of functional integration in the absence of regulation by the brain or by any other central integrator.

Shewmon [20] completes his examples mentioning that organisms with dead brain have the same functions of unquestionably living patients in intensive care units (ICU), and managed to keep these functions with little external support. It is also noteworthy that a study conducted by histopathological findings suggested that even when clinical guidelines for brain death were properly implemented, more than 60% of donors didn't have or had only minor structural changes in the brainstem in autopsies [21].

The risk of an incorrect declaration of brain death increases as the pressure increases to "gain" time in the removal of potentially viable organs for donation. In this scenario, it is not surprising that supporters of transplants are advocating that confirmatory tests should not be performed in order to avoid delay [22]. More worrying is what was revealed in a study involving 142 pediatric donors with beating heart, in which, after having passed through 294 neurological examinations, it was found that in only one of them the documentation of all components of the test was complete, only 26% had the apnea test properly performed, only 15% had two clinical examinations with appropriate time interval between them and only 58% had undergone confirmatory angiography [23]. Similar results were also found in studies with adult donors [24]. Published data showing such inconsistencies in Brazil was not found.

The basic issue is that the diagnosis of brain death can actually be only a prognosis of irreversibility which is arbitrarily set in a period preceding the biological death and extending in a spectrum that ranges from simple completion of a clinical examination consistent with brain death , as in Finland, until the completion of three clinical tests over a period of 24 hours, together with further examination, as it happens in Greece [5,25]. Therefore, to describe the same situation, this range goes from the simple acceptance of brainstem death as a diagnosis of brain death and therefore the death of the organism, to the demand of the death of the brain as a whole [5].

Death of the brain as a whole as a criterion for brain death

The point of view of the death of the brain as a whole professes that the loss of integrative activity of this organ with other subsystems leads inexorably to cardiorespiratory collapse, since this loss establishes a progressive state of entropy and organic disintegration. However, several other functions resulting from activities between integrated subsystems of the organism which are not dependent on cerebral control persist for indefinite time, according to the type of neurological insult and level of critical support offered. It is worth mentioning the functions that remain despite the diagnosis of brain death: circulation, hormonal balance, temperature control, digestion and metabolism, waste disposal, deep healing, combat to infections, growth and sexual maturation in children and adolescents [26], and even the ability, in victims of catastrophic brain events, to carry out a pregnancy to term [27].

A fundamental paradox of the definition of death through brain criteria, identified by Joffe [28], consists in stating that the arrest of cerebral functions is the final event of the three forms of death (cardiac, respiratory and cerebral itself) and, at the same time, affirming that brain death leads to death by loss of integration with consequent respiratory arrest and circulatory collapse, because if brain

death leads to death, then it is not the death of the organism properly said.

Shemie [29], for example, opposed the arguments of the critics of brain death, stating that these would wish that there is a clear dividing line of death, which, as required, could only happen, according to the author, with the death of all cells. But, apparently, what is desired by critics of the brain death concept constitutes a clear dividing line of death of the organism by irreversible loss of integrative capacity, a condition which today can be defined only through circulatory arrest [28].

Brainstem death as brain death

Joffe [30] discusses the criterion of death of the brain stem as a sufficient criterion of brain death, characterised by the irreversible loss of consciousness capacity also associated with the irreversible loss of ability to breathe. This criterion proves to be problematic as it is disturbing that consciousness may be preserved but be inaccessible due to the etiology of neurological damage. In addition, according to the author, it is not always clear that the loss of the ability to breathe should be spontaneous.

Ontological criteria of brain death

According to Joffe [30], the ontological criterion of death, also known as neocortical death, is not without its problems when one wants to diagnose death by the loss of the characteristics that make us human beings. There are no reliable methods to assess the absence of these features, according to the author, and it is impossible to determine the potential of reversibility of such cases.

Objectively, this parameter requires only irreversible loss of consciousness. However, accepting such a concept would result in numerous theoretical and practical problems, such as to admit that the individual could be declared dead before his or her organism was dead, a situation that would imply to authorise the burial, cremation or performing of autopsies on ill patients who are in permanent vegetative state, despite breathing and display movements or even spontaneous eye opening [31].

Donors with stopped heart

The possibility of using donors with stopped heart and assisted death brings even more debatable dimensions of the ethical point of view, as it seeks to interfere directly in the dying process, anticipating the final event with a view to the removal of potentially viable organs for donation. The question of the removal of organs after death of the organism in such cases is "resolved" by the establishment of an arbitrary time criterion of absence of auto resurrection after an assisted cardiorespiratory arrest [28].

This period, according to Joffe [28], can go from 2 minutes, in Pittsburgh, USA, to over 20 minutes, in Sweden. For the author, this death linked to organ donation, time manipulated , also hurts the criterion of irreversibility, which must be understood as the inability to reverse the fact, not as a prior decision not to try to reverse a cardiorespiratory arrest. Bernat [10,32] suggests the term *irreversible* for the impossibility of reversion characteristic of brain death, and the term *permanent* for situations in which the reversion will not be attempted, a condition which would classify the donation as stopped heart.

It is important to highlight that the reintroduction of the concept of donor with stopped heart results from the progressive reduction of brain-dead donors in some countries, consequent to the requirement of use of helmets by cyclists and motorcyclists and the improvement of the care of severe traumatic brain injury victims [33].

Is brain death a dogma?

It is possible to search in the philosophy of science some epistemological considerations to support this argument. Initially, the unique contribution of Karl Popper [34] in addressing Hume's induction problems and Kant's demarcation can be highlighted. At the confluence of these two analyses, Popper concluded that induction would not be a reliable scientific method in the field of natural sciences, since the repeated occurrence of events in the past is no guarantee of repetition in the future.

As for the problem of demarcation between science and pseudoscience, the contribution of Popper34 was to understand that knowledge, to be considered science, can never be permanently validated and must always be open to potential rebuttal. When the refutation (or fallibility) does not occur, according to the Austrian born British philosopher, the theories would not be considered definitely true, but only temporarily corroborated. A knowledge that is not open to a hypothesis test, in his view, can not be conceived as scientific.

While it is hard to imagine to what extent the theory of brain death as death of the organism can

 http://dx.doi.org/10.1590/1983-80422015233085

be submitted to hypothesis testing, the fact that it can not be widely discussed brings a question as to its scientific status, considering Popper's view on what is and what is not scientific [34].

Later, Thomas Kuhn [35] also contributed decisively and originally to the philosophy of science, when he added a generous dose of irrationality to the scientific procedure. According to him, certain knowledge often takes the characteristics of a dogma (paradigm) called normal science. It is a stage of science when new hypotheses able to refute the dominant theories are not created, therefore scientists work in pre-established lines of research, which quite often had been started by other researchers. It is worrying that the current status acquired by brain death, as a synonym for death of the organism, has become a dogma in our area.

Another form of acceptance of brain death as a synonym for death of the organism occurs in bad faith. The meaning of "bad faith" here refers to the form originally described by Jean-Paul Sartre in the famous chapter 2 of "Being and Nothingness" [36]. In the context of this work, the bad faith is the masking of an unpleasant truth [37], seen in our midst as the early closure of the discussion of brain death as synonymous with indisputability. If, on the one hand, it promotes the donation and transplantation of organs, on the other hand, restricts a continuing scientific debate.

The paradox of the bad faith, which makes it different from lie, is in the fact the deceiver and the deceived are the same person, since it is a lie that one tells oneself. The real problem, according to Sartre [36], comes from the bad faith being a dogma [37].

Biopower, biopolitics, brain death and organ donation

The "need" to reify this dogma, hiding unresolved doubts, due to the use of the concept of brain death as a synonym for death of the organism, operates in parallel with the promotion of organ donation and transplantation. This need can be addressed by the help of the theoretical framework of the concepts of biopower and biopolitics.

These concepts were originally coined by Michel Foucault [38] in the first volume of "History of Sexuality". The idea of biopower joined the reflections of this author on disciplinary practices as techniques of exercise of power , particularly since the eighteenth and nineteenth centuries. Foucault called biopower the management of life as a whole through the power techniques on the biological dimension, and biopolitics the human activity on natural life and the biopower mechanisms to control it.

In the beginning of this period, the power exercised by medicine on human life was not restricted to the adoption of several specific measures, such as establishing rules for birth control, containment of illnesses and endemic diseases, hospital construction and allocation of the "mentally ill in " insane asylums ", but it was extended to sexuality in general. Subsequently, the biopower started to penetrate the very body of the subjects and their different ways of living [38]. The body was subjected to the dictates of biopower and biopolitics, with the interconnection of ideas of life to the idea of death. On the other hand, biopolitics has become the means by which to carry out resistance to biopower attempts to neutralize people [39].

In the past, to die or kill was a gift from the rulers, who hold the power on the life and death of the population. The change in the concept of death in the West established the power of death over life, according to Foucalt, through the biopower. In a brief, it can be said that biopower refers to the actual devices to which one recurs to obtain power over life, while biopolitics is the politics whose objective is to implement and manage the biopower [40]. With regard to death in a general sense and the brain death in the case of this article, biopolitics takes on the role of thanatopolitics.

In the first volume of "Homo sacer: sovereign power and bare life," Giorgio Agamben [41] resumes Foucault's concept of bio-politics 38, taking advantage of an obscure figure of the Roman law, *homo sacer* ("holy man" in Latin), a person deprived of all civil rights, and who may be killed by anyone without a punishment for his or her death; Paradoxically, however, that life was considered "sacred" and could not be sacrificed in religious rituals [41].

Agamben named this condition "bare life", a way of life which does not reflect any rights or duty, and that goes beyond its biological form. Bare life examples can be found in refugees, prisoners of concentration camps, in human subjects, political prisoners, or in people whose autonomy over their life is no longer possible: the case of individuals in a coma and with brain death [41].

Foucault [38] identified that, in the course of modernity, natural life started to be managed by the power of the state and politics became biopolitics, as the biological dimension of life was gradually occupying the center of the modern political scene.

Agabem [41] is interested in how this transformation of life in biopolitics happened. If, before, the power of the sovereign *could order death or let live*, now, the state *can order to live and let die* [38].

It is this idea of sovereignty and "sanctity" of life that Agamben [41] uses to define the concept of bare life, making use of the Holocaust phenomenon as an example where the biopower and the sacred man were markedly demonstrated. The bio-political power over life and death has been transferred to the State through medicine. Agamben believes that the politicisation of life and especially the politicisation of death occurs from the moment when one comes to understand the biological dimension of life and its needs as an integrant part of politics, to the extent that the body is the new subject of politics in modern democracy.

For Agamben [41], with the valorisation of the biological body, biopolitics has become thanatopolitics, understood as a set of devices that allow interaction of medicine with the law through the use of new technologies to prolong life, transforming death in an epiphenomenon of the technology. As a result, the biopower passed from the hands of the sovereign into the hands of the physician and the scientist, and from these, into the hands of the state. The state, in turn, converted biopolitics into biopower and then thanatopolitics, deciding who can live and who shall die, making believe that living organisms belong, in fact, to the government.

The thanatopolitics brought as a consequence the "need" to legislate on life and death, which is the main point of our discussion about what is biological death, especially brain death. The situation of the donor in cases of brain death reminds of the situation of the Agamben's *homo sacer* [41]: is sacred, to the extent that it can save several lives in this situation, and at the same time can be declared dead without this meaning an infraction; that is, the condition of the person is so inviolable as violable. It is as if the individual were a mere body without meaning, liable to become a means instead of an end in itself.

Agamben [41] understands that individuals identified with the bare life, the sheer physical life, are exposed to the dynamics of biopolitics. Following this line of thought, it can be said that the person declared brain-dead is reduced to bare life as it loses its right to personality, which is transferred to the family, as defined in Article 4 of the Federal Law 10,211 / 2001 [42]. This means moving to the scope of biopolitics actions.

The relationship between bioethics and biopolitics is narrow, since the birth of both concepts is related to the context of Nazi experiments. However, the paths they followed are irreconcilable: biopolitics is generalising and strips the man, consisting of the most extreme and aggressive manifestation of politics, whilst bioethics is concerned about the natural life and the autonomy of individuals [43].

Maldonado [44] also considers bioethics and biopolitics irreconcilable because it considers the first from the humanitarian perspective and the second as associated with the idea of violence [44]. It should also be noted the position of Schramm [40], who advocates the role of bioethics resistance before the attempt to subject it to the pragmatic "needs" of the political reality, which we understand to be the focus of this discussion, as we try to discuss a theme that can be viewed as a way to disturb the process of organ donation and transplants.

Final considerations

Initially, there were two basic reasons why the definition of brain death had become accepted by society: to allow discontinuation of life support in patients with extremely severe neurological injury and to provide organ donation for transplants without the one responsible for the decision being charged with murder [14]. The first reason is no longer necessary, since the suspension of life support in patients with prognosis of irreversible neurological damage and unacceptable quality of life can be done through the prior consent of the patient or the patient's family (in the absence of an instruction previously signed by the patient). However, the second reason remains necessary to comply with that "dead donor rule" [30].

To equate brain death to death of the organism has become a "necessary" mechanism to facilitate society's acceptance and to legalise the search and removal of organs from donors with a beating heart [45]. Although brain death and organ transplantation have presented distinct historical trajectories [46], from the moment that these two concepts converged, the impact of the latter over the former could no longer be underestimated.

Doctors who work in institutions which are renowned for saving lives through transplants are often faced with candidates for transplants who are suffering and dying whilst waiting for organs as well as with the significant improvement in quality of life of patients submitted for successful transplants [30].

http://dx.doi.org/10.1590/1983-80422015233085

Moreover, they are also influenced by the feeling of futility to continue the cardiorespiratory support in patients with brain death, as many times these professionals work pressed by a context of lack of resources [30].

These issues operate consciously or unconsciously as conflicts of interest, inhibiting the dispute, by the professionals, of the brain death criterion as death of the organism30. It is also possible that doctors simply accept the definition of brain death as true, without knowing its theoretical basis and its potential conceptual problems [30]. Death determined by neurological criteria is a paradoxical death, because it is associated with the physical image of the body's normal functioning, which creates emotional and cognitive conflicts for many health professionals and relatives of the patient [47].

For Miller and colleagues [48], these unspoken conflicts may have the practical effect of the discomfort present among professionals and the discrepancy between practices and standards on the issue of donation after brain death or cardiac arrest, that is, the use of organs according to " the dead donor rule ". The authors qualify this discrepancy as a moral fiction, identified by the assertion that organs are only removed from organ donors with diagnosed death, since, when making such a claim, one is either denying reasonable doubt of the biological basis of the diagnosis of brain death as death the body, or is admitting to confuse irreversibility after cardiac arrest with the decision not to try to stop the cardiac arrest, concerning the donor with heart stopped.

There are three possible solutions to overcome this moral fiction: change practices, change the rules, or, what usually occurs, continue to act as if these bioethical conflicts don't exist 48 - a measure that is likely responsible for frequent maintenance of individuals, who are not donors, in brain death under intensive support until cardiac arrest. A shift of the standard alternative would be to define brain death as an undoubted prognostic death of the organism, and not as a diagnostics of death itself. Another possible change from the norm is the solution adopted in Japan since 1997, which allows individuals and families to define the kind of death they think is acceptable according to their beliefs and values, and in an independent way, whether they want to donate organs or not [49].

It remains paradoxical that the biologisation of death diagnosis in order to objectively define it shattered the concept of death in four possible alternatives: cardiac death, death of the whole brain, rainstem death and ontological death. Another paradox of this search for objectivity is that death has become a subject in the first person, as the irreversible loss of consciousness is important only for those who die - which, according to Holland [50], had already been perceived by Schopenhauer in "The World as Will and Representation" - without becoming objective in the third person, that is, one where a different person should recognise someone else's death.

Therefore, brain death, technically defined as an event at the end of the third examination (either clinical or complementary), remains a challenge as a valid concept of human death, since the scientific evidence is insufficient and the philosophical thought is even less convincing [33]. Some authors even consider that neurological or circulatory parameters currently used for the confirmation of death and search for transplantable organs conceals the practice of physician-assisted suicide [33]. The term "physician-assisted death" means intentional actions at the end of life, performed either by consent (such as euthanasia or suicide physician-assisted) as those practiced without explicit consent [51].

To reduce any definition of death to exclusively neurobiological criteria implies to ignore its anthropological, cultural and religious dimensions, to which many people give more value. Thus, the policies and practice of searching for organs should be consistent with aspects deeply rooted in these dimensions [33]. The concept of death is not simply of biomedical nature, but it is also a result of major sociological influences [52], being partly a social construct. The elaboration of the idea of brain death as synonymous with the body's death follows the utilitarian view of death, maybe way too much. To paraphrase Bernard Williams if utilitarianism is right, it will be better that people do not believe in utilitarianism [53].

This article is not meant to be an indictment of the donation and transplantation of organs, but a proposal for a resumption of discussion, made tacit, concerning the basis the premise of brain death as a synonym for death of the organism. It also aims to warn about the limits that must be guarded against biopower and biopolitics, regarding their influence on life and death. It also seeks to point out another negative aspect of biopolitics: the fact that even when brain death is accepted as a diagnosis of death of the organism, in practice the life of the patient is perpetuated - not infrequently - through the intensive support of those non-dead donors.

However, it is these same biopower and biopolitics that , while managing the fate of the bo-

dies, allow lives to be saved by organ donation and transplantations. Such ambiguity reinforces the theoretical potential of these concepts in the analysis of bioethical issues. The primary questions, how could they not be, remain unanswered: what is death? Is brain death synonymous with death of the organism? Who owns the right to define the outcome of the process of dying? Do organ transplants, though instrumental nowadays, have to be socially constructed on a cloudy premise?

References

1. Conselho Federal de Medicina. Resolução CFM nº 1.480, de 8 de agosto de 1997. Critérios de morte encefálica. Diário Oficial da União. 21 ago 1997;seção 1:227-8.
2. McMahan J. An alternative to brain death. J Law Med Ethics. [Internet]. 2006 [acesso 10 jan 2015];34(1):44-8. DOI: 10.1111/j.1748-720X.2006.00007.x
3. Bernat JL. How do physicians prove irreversibility in the determination of death? In: Sorondo MS, editor. The signs of death: the proceedings of Working Group 11-12 September 2006. [Internet]. Vatican City: The Pontifical Academy of Science; 2007 [acesso 28 jul 2015]. p. 159-76. (Scripta Varia, 110). Disponível: http://www.casinapioiv.va/content/dam/accademia/pdf/sv110/sv110.pdf
4. Whetstine LM. Bench-to-beside review: when is dead really dead, on the legitimacy of using neurologic criteria to determine death. Crit Care. [Internet]. 2007 [acesso 30 jul 2015];11(2):208. DOI: 10.1186/cc5690
5. Haupt WF, Rudolf J. European brain death codes: a comparison of national guidelines. J Neurol. [Internet]. 1999 [acesso 21 dez 2014];248(6):432-7. DOI: 10.1007/s004150050378
6. Lago PM, Piva J, Garcia PC, Troster E, Bousso A, Sarno MO *et al*. Brain death: medical management in seven Brazilian pediatric intensive care units. J Pediatr (Rio). [Internet]. 2007 [acesso 21 dez 2014];83(2):133-40. DOI: 10.2223/JPED.1594
7. Moraes EL, Carneiro AR, Araújo MN, Santos FS, Massarollo MCKB. Desconexão do ventilador mecânico de não doadores de órgãos: percepção de médicos intensivistas. Revista Bioethikos. [Internet]. 2011 [acesso 28 jul 2015];5(4):419-26. Disponível: http://www.saocamilo-sp.br/pdf/bioethikos/89/A8.pdf
8. Ríos A, López-Navas AI, Ayala-García MA, Sebastián MJ, Abdo-Cuza A, Alán J *et al*. Knowledge of the brain death concept by personnel in spanish and latin-american healthcare centers. Int J Artif Organs. [Internet]. 2014 [acesso 30 dez 2014];37(4):336-43. DOI: 10.5301/ijao.5000305
9. Gert B. Definition of death. APA Newsletter; Newsletter on Philosophy and Medicine. [Internet]. 2009 [acesso 29 jul 2015];9(1):6-9. Disponível: http://c.ymcdn.com/sites/www.apaonline.org/resource/collection/250A3149-F981-47C2-9379-618149806E75/v09n1Medicine.pdf
10. Bernat JL. A defense of the whole-brain concept of death. Hastings Center Report. [Internet]. 1998 [acesso 26 dez 2014];28(2):14-23. DOI: 10.2307/3527567
11. Loeb J. The organism as a whole. [Internet]. New York: G. P. Putnam's Sons; 1916 [acesso 30 jul 2015]. Disponível: http://www.columbia.edu/cu/lweb/digital/collections/cul/texts/ldpd_6121971_000/ldpd_6121971_000.pdf
12. Korein J, Machado C. Brain death. In: Machado C, Shewmon DA, editors. Brain death and disorders of consciousness. New York: Kluwer Academic/Plenum; 2004. p. 1-21.
13. Laureys S. Death, unconsciousness and the brain. Nat Rev Neurosci. [Internet]. 2005 [acesso 28 dez 2014];6(1):899-909. DOI: 10.1038/nrn1789
14. Ad Hoc Committee of the Harvard Medical School. A definition of irreversible coma. Report of the Ad Hoc Committee of the Harvard Medical School to examine the definition of brain death. Jama. [Internet]. 1968 [acesso 21 dez 2014];205(6):337-40. DOI: 10.1001/jama.1968.03140320031009
15. Youngner SJ, Arnold RM. Philosophical debates about the definition of death: who cares? J Med Philos. [Internet]. 2001 [acesso 21 dez 2014];26(5):527-37. DOI: 10.1076/jmep.26.5.527.3002
16. Botkin JR, Post SG. Confusion in determination of death: distinguishing philosophy from physiology. Perspect Biol Med. [Internet]. 1992 [acesso 21 dez 2014]; 36:129-38. DOI: 10.1353/pbm.1993.0060
17. Emanuel LL. Reexamining death: tThe asymptotic model and a bounded zone definition. Hastings Cent Rep. [Internet]. 1995 [acesso 28 dez 2014];25(4):27-35.
18. Halevy A, Brody B. Brain death: reconciling definitions, criteria, and tests. Ann Intern Med. [Internet]. 1993 [acesso 23 dez 2014];119(6):519-25. DOI: 10.7326/0003-4819-119-6-199309150-00013
19. Wowk B. The future of death. J Crit Care. [Internet]. 2014 [acesso 21 dez 2014];29(6):1111-3. DOI: 10.1016/j.jcrc.2014.08.006
20. Shewmon A. Chronic "brain death": meta-analysis and conceptual consequences. Neurology. [Internet]. 1998 [acesso 29 dez 2014];51(6):1538-45. Disponível: http://www.neurology.org/content/51/6/1538.full
21. Wijdicks EF, Pfeifer EA. Neuropathology of brain death in the modern transplant era. Neurology. [Internet]. 2008 [acesso 22 dez 2014];70(15):1234-7. DOI: 10.1212/01.wnl.0000289762.50376.b6
22. Greer DM, Varelas PN, Haque S, Wijdicks EF. Variability of brain death determination guidelines in leading US institutions [author reply]. Neurology. [Internet]. 2008 [acesso 21 dez 2014];71(14):1126. DOI: 10.1212/01.wnl.0000334352.27463.49

23. Mathur M, Petersen L, Stadtler M, Rose C, Ejike JC, Petersen F *et al*. Variability of pediatric brain death determination and documentation in Southern California. Pediatrics. [Internet]. 2008 [acesso 27 dez 2014];121(5):988-93. DOI: 10.1542/peds.2007-1871
24. Greer DM, Varelas PN, Haque S, Wijdicks EF. Variability of brain death determination guidelines in leading US institutions. Neurology. 2008 [acesso 21 dez 2014];70(4):284-9. DOI: 10.1212/01.wnl.0000296278.59487.c2
25. Evans DW. Seeking an ethical and legal way of procuring transplantable organs from the dying without further attempts to redefine human death. Philos Ethics Humanit Med. [Internet]. 2007 [acesso 30 jul 2015];2:11. DOI: 10.1186/1747-5341-2-11
26. Truog RD. Brain death: too flawed to endure, too ingrained to abandon. J Law Med Ethics. [Internet]. 2007 [acesso 10 jan 2015];35(2):273-81. DOI: 10.1111/j.1748-720X.2007.00136.x
27. Yeung P, McManus C, Tchabo JG. Extended somatic support for a pregnant woman with brain death from metastatic malignant melanoma: a case report. J Matern Fetal Neonatal Med. [Internet]. 2008 [acesso 11 jan 2015];21(7):509-11. DOI: 10.1080/14767050802086560
28. Joffe AR. The ethics of donation and transplantation: are definitions of death being distorted for organ transplantation? Philos Ethics Humanit Med. [Internet]. 2007 [acesso 30 jul 2015];2:28. DOI: 10.1186/1747-5341-2-28
29. Shemie SD. Clarifying the paradigm for the ethics of donation and transplantation: was 'dead' really so clear before organ donation? Philos Ethics Humanit Med. [Internet]. 2007 [acesso 30 jul 2015];2:18. DOI: 10.1186/1747-5341-2-18
30. Joffe AR. Is there good justification for the universal medical acceptance of brain death as death? APA Newsl Philo Med. [Internet]. 2009 [acesso 30 jul 2015];9(1):9-12. Disponível: http://c.ymcdn.com/sites/www.apaonline.org/resource/collection/250A3149-F981-47C2-9379-618149806E75/v09n1Medicine.pdf
31. DeGrazia SD. Identity, killing, and the boundaries of our existence. Philos Public Aff. [Internet]. 2003 [acesso 26 dez 2014];31(4):413-42. DOI: 10.1111/j.1088-4963.2003.00413.x
32. Bernat JL. How the distinction between "irreversible" and "permanent" illuminates circulatory-respiratory death determination. J Med Philos. [Internet]. 2010 [acesso 21 dez 2014];35(3):242-55. DOI: 10.1093/jmp/jhq018
33. Verheijde JL, Rady MY, McGregor JL. Brain death, states of impaired consciousness, and physician-assisted death for end-of-life organ donation and transplantation. Med Health Care Philos. [Internet]. 2009 [acesso 30 jul 2015];12(4):409-21. DOI: 10.1007/s11019-009-9204-0
34. Popper K. Os dois problemas fundamentais da teoria do conhecimento. São Paulo: Editora Unesp; 2013.
35. Kuhn TS. A estrutura das revoluções científicas. 10ª ed. São Paulo: Perspectiva; 2010. (Coleção Debates).
36. Sartre J-P. O ser e o nada: ensaio de ontologia fenomenológica. 9ª ed. Petrópolis: Vozes; 2001. Capítulo 2, A má-fé; p. 92.
37. Lecourt D. Prefácio. In: Gouyon PH, Lecourt D, Memmi D, Thomas J-P, Thouvenin D. A bioética é de má-fé? São Paulo: Loyola; 2002. p. 7-14.
38. Foucault M. História da sexualidade: a vontade de saber. Rio de Janeiro: Graal; 1988.
39. Negri A. Cinco lições sobre Império. Rio de Janeiro: DPA; 2003.
40. Schramm FR. A bioética como forma de resistência à biopolítica e ao biopoder. Rev. bioét. (Impr.). [Internet]. 2010 [acesso 30 jul 2015];18(3):519-35. Disponível: http://revistabioetica.cfm.org.br/index.php/revista_bioetica/article/view/583/588
41. Agamben G. Homo sacer: o poder soberano e a vida nua. Vol. 1. Belo Horizonte: Editora UFMG; 2007.
42. Brasil. Lei nº 10.211, de 23 de março de 2001. Altera dispositivos da Lei nº 9.434, de 4 de fevereiro de 1997, que "dispõe sobre a remoção de órgãos, tecidos e partes do corpo humano para fins de transplante e tratamento". [Internet]. 2001 [acesso 30 jul 2015]. Disponível: http://www.planalto.gov.br/ccivil_03/leis/leis_2001/l10211.htm
43. Kottow M. Bioética y biopolítica. Revista Brasileira de Bioética. [Internet]. 2005 [acesso 30 jul 2015];1(2):110-32. Disponível: http://bioetica.org/cuadernos/bibliografia/kottow.pdf
44. Maldonado CE. Biopolítica de la guerra. Bogotá: Universidad El Bosque; 2003.
45. Giacomini M. A change of heart and a change of mind? Technology and the redefinition of death in 1968. Soc Sci Med. [Internet]. 1997 [acesso 21 dez 2014];44(10):1465-82. Disponível: http://www.sciencedirect.com/science/article/pii/S0277953696002663
46. Machado C, Korein J, Ferrer Y, Portela L, García MC, Manero JM. The concept of brain death did not evolve to benefit organ transplants. J Med Ethics. [Internet]. 2007 [acesso 22 dez 2014];33:197-200. DOI: 10.1136/jme.2006.016931
47. Long T, Sque M, Addington-Hall J. Conflict rationalization: how family members cope with a diagnosis of brain stem-death. Soc Sci Med. [Internet]. 2008 [acesso 21 dez 2014];67(2):253-61. Disponível: http://www.sciencedirect.com/science/article/pii/S0277953608001822
48. Miller FG, Truog RD, Brock DW. The dead donor rule: can it withstand critical scrutiny? J Med Philos. [Internet]. 2010 [acesso 20 dez 2014];35(3):299-312. DOI: 10.1093/jmp/jhq019
49. Bagheri A. Individual choice in the definition of death. J Med Ethics. [Internet]. 2007 [acesso 19 dez 2014];33:146-9. DOI: 10.1136/jme.2006.016014
50. Holland S. Bioética: enfoque filosófico. São Paulo: Centro Universitário São Camilo/Loyola; 2008.

51. Thimoty E, Quill TE. Legal regulation of physician-assisted death: the latest report cards. N Engl J Med. [Internet]. 2007 [acesso 20 dez 2014];356(19):1911-3. DOI: 10.1056/NEJMp078061
52. Kellehear A. Dying as a social relationship: a sociological review of debates on the determination of death. Soc Sci Med. [Internet]. 2008 [acesso 21 dez 2014];66(7):1533-44. Disponível: http://www.sciencedirect.com/science/article/pii/S0277953607006818
53. Williams B. Moral: uma introdução à ética. São Paulo: Martins Fontes; 2005.

Participation of the authors
Edison Moraes Rodrigues Filho and José Roque Junges wrote and revised the article jointly.

Recebido: 15.1.2015
Revisado: 24.5.2015
Aprovado: 6.6.2015