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Death Determination, the Dying Process and the Dead Donor Rule: A Critical Analysis of the Italian 20-Minute No-Touch Period in Controlled Donation After Circulatory Determination of Death

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ABSTRACT

In Italy, controlled Donation after Circulatory Determination of Death (cDCDD) requires a 20-min no-touch period documented by continuous electrocardiographic monitoring. Since Italian law adopts a single brain-based definition of death, this procedure serves as an indirect determination of the irreversible cessation of all brain functions. This differs from other countries using 5-min no-touch periods and focusing on permanent cessation of circulation. This paper argues that the Italian 20-min no-touch period lacks a convincing scientific and ethical basis. No evidence shows that 20 min is the minimum period required to establish beyond doubt the irreversible cessation of all brain functions after circulatory arrest. Moreover, the Italian legal definition of death relies on a standard that is not fully verifiable in practice, both regarding the cessation of all brain functions and irreversibility. It further maintains that the dead donor rule is vulnerable insofar as it is closely tied to legal definitions of death that do not fully capture the complexity of dying as a biological process. Donor protection should instead be based on what can be biologically proven, clinically confirmed, and ethically justified. The paper suggests a partial reformulation of the dead donor rule, based on the diagnosis of a permanent dying process that will inevitably lead to complete biological death. On this ground, Italy should reduce its no-touch period to the 5-min standard and revise death-determination protocols to document the permanent cessation of effective systemic circulation rather than the disappearance of cardiac electrical activity.

1 | Introduction

Controlled Donation after Circulatory Determination of Death (cDCDD) has become an increasingly important component of deceased organ donation activity in many countries. Its ethical and clinical legitimacy depends both on the reliability of death determination and on the ability to maintain a clear separation between end-of-life decision-making and organ procurement. Accordingly, the duration and procedures used for death determination by cardio-circulatory criteria are not merely technical matters, they

have direct implications for donor protection, organ viability, public trust and the ethical defensibility of the donation process.

In Italy, death determination by cardio-circulatory criteria requires a 20-min no-touch period documented by continuous electrocardiographic monitoring (ECG). Because Italian law adopts a single brain-based definition of death—namely, the irreversible cessation of all brain functions—death determination by cardio-circulatory criteria functions as an indirect determination of brain death.

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This framework differs substantially from that adopted in other countries practicing cDCDD, where shorter no-touch periods—most commonly around 5 min—are used and where the clinical focus is generally placed on the permanent cessation of circulation rather than on prolonged electrocardiographic silence.

This paper argues that the Italian 20-min no-touch period is scientifically and ethically difficult to justify. The claim is not that safeguards for donors should be weakened, nor that the ethical concerns underlying the Dead Donor Rule (DDR) should be abandoned. Rather, it is argued that donor protection should be grounded in what can be biologically demonstrated, clinically verified, and ethically justified. On this basis, the Italian requirement does not appear to provide evidence-based additional protection for cDCDD donors and may instead harm their interests by increasing the risk that a donation explicitly wished for by the donor cannot be completed. It may also contribute to maintaining an account of death determination that presents the legal threshold of death as if it were equivalent to complete biological death, thereby limiting the possibility of fully transparent and informed donation choices.

The argument proceeds in five steps. First, the paper outlines the Italian legal framework for the determination of death and examines the implications of the 20-min no-touch period, together with the requirement for electrocardiographic silence, for cDCDD practice, including possible effects on functional warm ischemia, organ utilization, and the feasibility of the donation pathway.

Second, the paper examines the scientific basis of the Italian standard, arguing that there is no evidence showing that 20 min is the minimum duration required to establish with certainty the irreversible cessation of all brain functions after circulatory arrest. More broadly, it shows that the Italian legal definition of death itself relies on a standard that is not fully verifiable in practice, both with regard to the cessation of all brain functions and with regard to irreversibility. By contrast, the available evidence supports, at most, the permanence of cardio-circulatory arrest after approximately 5 min, that is, the point after which autoresuscitation will not occur, and no intervention will be undertaken to restore circulation.

Third, the paper situates this problem within a broader bio-ethical discussion on brain death, biological death, and the DDR. It argues that the DDR is vulnerable because it is closely tied to legal definitions of death, which necessarily identify a precise threshold within the dying process but do not fully capture the complexity of dying as a biological phenomenon. Such thresholds are not grounded exclusively in biological facts, but are also shaped by cultural, normative, and value-based assumptions. This creates important weaknesses in the application of the DDR to Donation after Neurologic Determination of Death (DNDD) and cDCDD, where death determination should not be presented as a purely objective diagnosis of death. This does not necessarily mean that the DDR is violated in current practice, but it does suggest that its formulation and ethical foundations require reconsideration.

Fourth, the paper proposes that a more coherent ethical framework may be found in a partial reformulation of the DDR

as a “dying donor rule.” On this account, the permissibility of organ procurement would not be grounded primarily in strict adherence to a legal definition of death, but in the diagnosis that the patient has entered a permanent dying process that will inevitably lead to complete biological death. In cDCDD, this would correspond to the permanent cessation of cardio-circulatory activity after approximately 5 min, once auto-resuscitation has been excluded and no attempt will be made to restore circulation.

Finally, the paper argues that whether the current framework is maintained or a “dying donor rule” is considered, potential donors, families, and the public should receive clearer information about the nature of the dying process, the legal and clinical meaning of death determination and the procedures involved in donation. The paper concludes that the Italian no-touch period should be aligned with the 5-min standard adopted in other countries practicing cDCDD and that the procedures for death determination by cardio-circulatory criteria should be updated to document the permanent cessation of effective systemic circulation rather than the mere disappearance of cardiac electrical activity.

2 | Background

Since its inception, solid organ transplantation from deceased donors has relied on organs retrieved through Donation after Neurologic Determination of Death (DNDD). However, over the last two decades Donation after Circulatory Determination of Death (DCDD), and especially controlled Donation after Circulatory Determination of Death (cDCDD), has grown in acceptance and prevalence throughout the world [1–3]. Prospective cDCDD donors are those who die following cardio-circulatory arrest under “controlled” circumstances. They belong to Maastricht Class III, that is, patients who are already in an Intensive Care Unit (ICU), whose death is expected following the patient's or proxy decisionmaker's choice to withdraw life-sustaining treatments [4]. Typically, such decisions to withdraw treatments are made, because interventions are no longer likely to be effective, their burdens are likely to outweigh any benefits and continuation of medical interventions would not align with the person's values [5].

Following the withdrawal of life-sustaining measures, the time before circulatory arrest is highly variable; however, the median time to the initiation of determination of death by cardio-circulatory criteria has been reported to be 60 min [6]. Once circulation has ceased, there is a mandatory observation period (no-touch period) during which physicians must monitor the patient to ensure that circulation and respiration do not resume.

The duration of this additional observation period is particularly relevant because it contributes to the overall functional Warm Ischemia Time (fWIT), namely the combined duration of the agonal phase, the time required for death determination, and the time required to initiate organ preservation or reperfusion procedures. If excessively prolonged, fWIT may negatively affect organ suitability for transplantation, thereby compromising both the number and quality of transplantable organs and, consequently, transplant outcomes.

In countries where the practice of cDCDD is becoming increasingly common, guidelines and position statements on the determination of death after circulatory arrest show considerable variability, with recommended no-touch periods ranging from 2 to 10 min. Nevertheless, most countries adopt a no-touch period of approximately 5 min before death is declared in the absence of spontaneous resumption of circulation or respiration [6–8]. This means that physicians in these countries are required to observe the patient for a minimum of 5 min after circulation has ceased, before death can be declared and organs procured.

3 | cDCDD in Italy and the 20-min No-Touch Period

In Italy, the legal framework governing the determination of death differs substantially from that adopted in other European countries where cDCDD is practiced, with significant implications for cDCDD practice. Indeed, Italian law and implementing regulations require a 20-min no-touch period, with continuous electrocardiographic monitoring, a requirement recently reaffirmed by the Italian National Bioethics Committee [9].

3.1 | The Legal Framework for the Determination of Death in Italy

Law No. 578, which has regulated the determination of death in Italy since 1993, adopts a unified brain-based definition of death, according to which death consists in the *irreversible* cessation of *all* brain functions (art. 1). The determination of death can be performed by direct measures of brain activity (neurological criteria), or indirectly by the measurement of a prolonged absence of spontaneous cardio-circulatory function (cardio-circulatory criteria), which serves as an indirect indicator of the irreversible cessation of all brain functions (art. 2, c. 1) [10].

Hence, the no-touch period used for the death determination based on cardio-circulatory criteria is not intended to establish the irreversible cessation of circulatory function itself, but rather to indirectly determine the irreversible cessation of all brain functions resulting from cerebral ischemic injury caused by the absence of circulation.

The Law No. 578/1993 states that the procedures for the determination of death are set by a decree issued by the Ministry of Health (art.2, c. 1). According to the current regulations (Ministry of Health Decree No. 582, August 22, 1994, and the updated version of April 11, 2008), death is indirectly determined by documenting the absence of cardiac electrical activity for at least 20 min through continuous electrocardiographic (ECG) monitoring. During this 20-min period, the medical staff must refrain from any interference and must rely exclusively on ECG to verify the absence of electrical activity for 20 consecutive minutes. If cardiac activity is detected during this time, the assessment must restart from the beginning. The requirement for electrical asystole differs from other international standards, which require only the cessation of circulation

resulting from mechanical cardiac arrest and are therefore more consistent with the view that the essential issue in circulatory determination of death is the complete cessation of circulation resulting from the cessation of cardiac mechanical function, rather than the cessation of intrinsic cardiac electrical activity that does not produce circulation.

3.2 | Challenges and Implications of the Italian Legal Framework for cDCDD

Because of the current Italian regulatory framework, the duration of functional warm ischemia is substantially longer than in other European countries where cDCDD has become a significant component of deceased organ donation activity (e.g., UK, Spain, Netherlands, Belgium, and France, among the highest-volume countries). This is due not only to the 20-min no-touch period itself, but also to the requirement for electrocardiographic silence, which may further prolong asystolic/acirculatory warm ischemia, in cases in which pulseless electrical activity persists despite mechanical asystole, because pulseless electrical cardiac activity producing mechanical asystole cannot count in the 20-min standoff period but must instead be added to it. As a result, the prolonged absence of perfusion and oxygenation may significantly affect both early and long-term transplant outcomes because of the different organ-specific susceptibilities to ischemia-reperfusion injury and the occurrence of several organ-specific DCDD-related complications [11–13].

Precisely because of concerns regarding the feasibility of preserving organ viability following such a prolonged no-touch period, cDCDD began in Italy only in 2014. Its introduction therefore occurred later than in early-adopting countries such as Belgium and the Netherlands, where cDCDD was introduced in the 1990s, and Spain (2009).

Nevertheless, driven by advances in organ perfusion technologies and the progressive consolidation of clinical and organizational expertise, cDCDD activity in Italy has grown substantially, with 435 utilized cDCD donors out of a total of 616 cDCD donors reported between 2016 and 2025 [14]. As in other European countries, cDCDD is expected to represent an increasingly significant proportion of total deceased multi-organ donation activity in Italy in the coming years.

Despite this significant growth and the substantial number of effective donations achieved, it remains difficult to determine whether the longer period required for death determination truly affects the overall cDCDD pathway, including the completion of death determination procedures, the donation process itself and the long-term outcomes of transplantation.

First, the prolonged duration of death determination procedures themselves may represent a critical issue. In some cases, the recurrence of cardiac electrical activity detected by ECG during the 20-min observation period may require the procedure to restart from the beginning, potentially prolonging the determination process to the point that organ viability is compromised and donation can no longer proceed. Notably, systematic data specifically capturing death determination procedures

initiated for donation purposes but not completed within a time frame compatible with organ utilization are lacking, thereby preventing an assessment of the magnitude of this issue.

Second, with regard to the potential impact on the donation process itself, although non-utilization among most of the 181 non-utilized donors recorded between 2016 and 2025 was related to subsequent assessments of donor or organ suitability, there remains a smaller number of cDCDD donors each year for whom it has not been possible to ascertain the exact reasons why organs were ultimately not utilized, allowing only speculative explanations. Compounding this issue, meaningful cross-country comparisons are hindered by differences in how countries record the ratio between individuals undergoing death determination and those who ultimately proceed to organ procurement.

Third, whether prolonged warm ischemic time affects long-term transplant outcomes remains uncertain, as comprehensive comparative long-term data are lacking. Notably, the reported success of the Italian cDCDD program does not preclude the possibility that the prolonged waiting period may be associated with less favorable graft and patient outcomes.

3.3 | Institutional Positions and Ongoing Critical Issues

In a 2021 Position Paper, updated in 2023 [15], the Italian National Transplant Center highlighted these critical issues, particularly emphasizing the difficulty of drawing conclusions from international literature and studies conducted in clinical and organizational contexts that differ significantly from the Italian setting. These differences pertain both to the methods used to determine death (invasive arterial pressure monitoring, ultrasound vs. electrocardiography) and to the duration of observation (5–10 min in other countries compared with 20 min in Italy).

Therefore, in 2021, the Italian Society of Anesthesia, Analgesia, Resuscitation and Intensive Care (SIAARTI), together with the Italian National Transplant Center (CNT) and the Italian Society of Organ Transplantation (SITO), requested an expert opinion on the matter from the Italian National Bioethics Committee. However, in the opinion issued the same year, the Committee concluded that the 20-min no-touch period should not be shortened, arguing that it ensures a reliable confirmation of irreversible death and provides strong ethical and legal safeguards [9].

Particularly noteworthy is the fact that the section dedicated to the DDR consists of only a few lines, accompanied by a brief footnote acknowledging that the rule has been the subject of intense bioethical debate. A more substantial discussion appears only in an addendum authored by some members of the Committee. Within the opinion itself, the DDR is referred to only briefly and without any substantive critical examination, being defined simply as follows:

The general rule and necessary condition for ethically and legally legitimate organ retrieval for therapeutic transplantation

is that the donor must be declared dead prior to organ removal (dead donor rule).

Yet the DDR would arguably have deserved a much more thorough ethical analysis—of the kind currently taking place in several other countries—especially considering that the very concept of death has undergone increasing scrutiny and reinterpretation in recent decades.

The unified definition of death in Italy has undeniable advantages: it aligns with the current international trend toward a unified brain-based concept of death [16–19] and it can help overcome some of the critical issues related to the reversibility of cardiovascular death during the use of Normothermic Regional Perfusion (NRP), that arise in countries adopting separate circulatory and neurological definitions of death [20–22]. It also appears to reduce concerns related to possible brain reperfusion, since after a 20-min no-touch period the risk of recovery of brain function following minimal inadvertent reperfusion appears to be extremely low.

Nevertheless, the Italian model raises significant ethical concerns. These concerns relate both to the strength of the scientific evidence underlying this approach and to the ethical issues raised by the DDR [23], which will be discussed in the following sections.

4 | Reviewing the Scientific Evidence: Current Knowledge and Gaps in Support of the Italian Regulation

A critical examination of the Italian regulation should begin by assessing whether it is grounded in verifiable biological facts and aligned with the scientific data currently available.

4.1 | Lack of Evidence on the Time Required for the Irreversible Cessation of All Brain Functions After Circulatory Arrest

Since the 20-min no-touch period is intended to establish that the permanent cessation of circulatory activity has resulted in the irreversible cessation of all brain functions, the first question is whether this 20-min waiting period is supported by scientific evidence. In this regard, there is currently no strong evidence to determine the minimum duration of circulatory arrest required to result in the irreversible loss of brain functions due to ischemia [24]. In fact, the duration of circulatory arrest required to produce an irreversible cessation of brain function—that is, a cessation that cannot be reversed even if circulation is later restored through reperfusion—is not fixed and may vary according to peri-arrest conditions as well as across clinical settings and animal models. For example, factors such as body temperature, residual oxygenation and differences between controlled and uncontrolled DCDD may influence the length of circulatory arrest after which brain functions can no longer recover following reperfusion [25].

Even when limiting consideration to the irreversible cessation of specific brain functions, the limited evidence available

suggests that, under normothermic conditions, this process may require up to 1 h to be fully completed [26].

Notably, no scientific literature supports the 20-min time frame prescribed by the Italian law.

The origin of the 20-min observation period appears to lie more in the historical medico-legal tradition aimed at preventing premature declarations of death in cases of apparent death, than in neuroscientific evidence concerning the time required for the irreversible loss of all brain functions after circulatory arrest. In particular, the requirement appears to derive from earlier provisions contained in the Italian Mortuary Police Regulations (Presidential Decree No. 285/1990), which already required prolonged electrocardiographic observation for the diagnosis of death in cases of cardiac arrest.

4.2 | The Challenge of Determining the Cessation of All Brain Functions

As previously noted, the Italian regulation adopts a unified brain-based definition of death, which requires the cessation of *all* brain functions. However, the scientific evidence supporting this standard is far from straightforward and the available data suggest that the legal concept of the irreversible cessation of all brain functions may not entirely align with biological reality [27].

Indeed, the notion of a cessation of *all* brain functions is challenged by evidence suggesting that some integrative neurological functions may persist in individuals who meet the current clinical criteria for brain death [28, 29]. For example, patients diagnosed with brain death may retain residual neuroendocrine brain functions, such as regulated hypothalamic hormone secretion, suggesting persistence of at least some hypothalamic activity [30, 31].

For all these reasons, a definition of death that requires the loss of all brain functions is untenable, because it does not correspond to the reality of the available evidence and should therefore be revised so as not to require the cessation of those functions that, according to the available evidence, may persist even partially under continued mechanical ventilation and intensive care support (cardiovascular activity, homeostasis, altered thermoregulation, certain neuroendocrine functions, proportional growth, puberty, and wound healing).

4.3 | The Challenge of Determining Irreversibility

To make a proper argument, it is necessary to clarify the distinction between permanent and irreversible cessation. Permanent cessation means that the functions, once ceased, will not spontaneously resume and no medical intervention will be undertaken that could cause the function to resume, whereas irreversible cessation means that the functions, once ceased, cannot resume, either spontaneously or through any medical intervention [32].

The concept of irreversibility is itself complex and open to different interpretations depending on the reference framework adopted. Uncertainty remains as to whether irreversibility should be assessed only in relation to currently available technologies or also with regard to future technologies that might become capable of restoring a given function. Similar questions arise as to whether such technologies should be considered relevant only if realistically applicable to all patients, or also when available only for selected groups of individuals [33].

The currently available evidence regarding the irreversibility of the cessation of brain functions remains limited; however, recent experimental findings have partly called into question this assumption. Studies such as the experiment by Vrselja et al., which restored porcine brain cellular activity hours after death, show that the metabolic activity of individual brain cells may still be reversible [28, 34, 35]. Thus, cellular activity in the brain can resume even hours after circulatory arrest, although this does not translate into the recovery of brain functions. Nevertheless, the restoration of neuronal and cellular activity hours after death sharply contradicts the previously widespread belief that neuronal function would, by that time, be irreversibly lost.

In conclusion, the available data do not undermine the overall adequacy of the definition of brain death, but they do raise questions about whether the highly absolute and ambitious definition of death as “the irreversible cessation of all brain functions” should be reconsidered [36].

4.4 | What We Know: Permanence of Circulatory Arrest and Its Implications

Current evidence appears to support, at most, the permanent cessation of circulation—that is, that circulation, once ceased, will not spontaneously resume and that no medical intervention will be undertaken to restore it—rather than demonstrating the irreversible cessation of all brain functions.

Indeed, the only reliable evidence currently available are observational data which indicate that spontaneous resumption of cardiac activity (auto-resuscitation) is no longer possible after 5 min of asystole. Therefore, cardiac arrest persisting beyond this time point, in the context of a prior decision not to initiate interventions to restore circulation and respiration, may be considered as a permanent cessation of cardio-circulatory functions [6, 37]. Confirmation of the irreversibility of cardio-circulatory arrest represents a much higher standard to achieve than permanency: it would require waiting hours to assess whether the heartbeat could be resumed by external intervention.

Furthermore, it is important to consider that in cDCDD cases, once circulatory functions have permanently ceased, medical staff will not attempt resuscitation, as it has already been determined that such intervention would not be beneficial. For these patients, therefore, once circulatory arrest has become permanent, the prior decision not to attempt resuscitation entails that, over a time frame that cannot be precisely

determined, this condition will inevitably progress to the irreversible cessation of circulatory activity.

5 | Brain Death: A Biologically Incontrovertible Death or a Value-Laden Construct?

The status of brain death as a biologically incontrovertible form of death is often taken for granted; however, closer examination suggests that it may instead reflect a value-laden construct shaped by clinical practice, legal frameworks, and broader cultural assumptions. This tension becomes clearer when situated within the broader challenge of classifying complex biological phenomena. From a cultural and social perspective, and even more so from a legal perspective, there is a need, when dealing with complex biological phenomena such as the beginning or the end of life, to frame them within clear (often binary) categories and to identify specific moments marking the transition from one category to another. However, advances in knowledge and the corresponding expansion of technical possibilities at both the beginning and the end of life have shown that biological phenomena are better understood as a continuum. Identifying a single moment at which the observed reality changes category is therefore particularly difficult and constitutes an operation with a significant cultural and value-laden dimension.

This issue becomes especially salient in the context of organ procurement from deceased donors. The requirement to obtain viable organs from dead donors has, from the outset, posed a major challenge, as it necessitates identifying an early point at which death can be determined—that is, formulating a diagnosis of death—in a manner that could appear to rest on firm biological grounds. In practical terms, this meant identifying the earliest possible point at which the death of the donor could be established with certainty on biological grounds, while preserving organ viability.

However, despite this requirement, cadaveric phenomena currently represent, given existing knowledge and diagnostic capabilities, the only biologically incontrovertible signs of death, insofar as they indicate the irreversible loss of the organism's capacity to maintain itself as an integrated biological unit (i.e., maintaining somatic integration), preserving internal order and organization through metabolic processes, exchanges of energy and matter, and homeostatic mechanisms.

When the Harvard Commission introduced the concept of brain death in 1968 [38], it was assumed that the irreversible cessation of brain functions would be rapidly followed by the cessation of the organism's functioning as an integrated biological unit, and that brain death could therefore serve as an early indicator of biological death (i.e., somatic death). Even at that time; however, brain death functioned more as a prognosis than as a diagnosis, albeit a prognosis of an imminent event.

More recent evidence, however, has partly challenged this assumption. In rare but well-documented cases, the complete death of the organism may occur significantly later than the cessation of brain functions. Indeed, it has been shown that the cessation of brain activity does not necessarily lead rapidly to biological death, with a mean somatic survival of 8.0 days and a

wide range (1.6 h–19.5 years) [39]. The most convincing evidence concerns the persistence, under somatic support, of cardiovascular activity, homeostasis, altered but not abolished thermoregulation and certain neuroendocrine functions [29, 40]. Evidence of proportional growth, puberty and wound healing is also reported, although it derives primarily from case reports and small case series [41].

From a clinical perspective, on this basis, the determination of brain death can be understood as a diagnosis only of the irreversible cessation of brain functions (and not necessarily of all of them), but not as a diagnosis of biological death [42]. Rather, it constitutes a prognosis of biological death, which, if somatic support is maintained, will typically occur within a short time frame, but may in some cases be significantly prolonged. In jurisdictions in which brain death is legally recognized as death, the determination of brain death is immediately followed by the withdrawal of life-sustaining treatment. As a result, the potential temporal gap between the cessation of brain functions and biological death is effectively collapsed into a single process unfolding over a short period of time—a matter of hours between the determination of brain death and the withdrawal of ventilation—thereby accelerating the final stages of the organism's dying process.

In this sense, the legal recognition of brain death as death does not represent a purely descriptive translation of biological facts, but rather a normative operation that carries a significant cultural and value-laden component. Specifically, it rests on the assumption that the irreversible cessation of brain functions is sufficient to equate the death of the brain with the death of the human being as a person. As such, it does not simply reflect a biological observation but involves a transition from empirical findings to a normative classification of death, one that is shaped by underlying cultural, ethical, and institutional commitments rather than grounded exclusively in incontrovertible biological evidence.

In this light, the determination of brain death can be more appropriately understood not simply as a diagnosis, but as a prognostic judgment embedded within a broader value-laden, normative, and cultural framework, which shapes its underlying assumptions and guides its interpretation and application within our society. This highlights how the interpretation of biological phenomena such as death is influenced not only by empirical findings, but also by clinical choices and by the meanings that societies attribute to them [43].

Within the medical community, however, there remains a strong need to preserve the idea of an incontrovertible biological grounding for the definition of brain death, treating it as fully comparable to the ascertainment of death based on the appearance of cadaveric phenomena. This need reflects both the importance of maintaining public trust and the requirement to preserve coherence with the DDR, namely the principle that organ procurement should occur only after death, understood according to legally and clinically accepted criteria, which do not necessarily coincide with the biological death of the organism.

This tension becomes especially clear in countries such as Italy, where a single brain-based definition of death is applied

through two distinct modes of determination: a direct one using neurological criteria and an indirect one using cardio-circulatory criteria. In this context, the claim that death has been established through these modes of determination in a biologically incontrovertible sense becomes difficult to sustain on two grounds.

First, as noted above, the determination of brain death using neurological criteria does not necessarily correspond to biological death. Rather, it identifies the irreversible cessation of brain functions, after which biological death may follow within a variable time frame, depending on whether somatic support is maintained or withdrawn.

Second, when brain death is determined using cardio-circulatory criteria, uncertainty remains regarding the time required for the cessation of circulatory activity to result in the irreversible cessation of brain functions. Current evidence does not support the identification of a clearly defined temporal threshold beyond which such irreversibility can be considered biologically established.

Taken together, these considerations suggest that, in both DNDD and DCDD, organ procurement does not take place after biological death of the organism but rather following the determination of death according to legally and clinically accepted criteria. From this perspective, the DDR is not, strictly speaking, violated, insofar as it requires that organs be procured only after a person has been declared dead within the relevant legal and clinical framework.

At the same time; however, the way in which death is framed and communicated in clinical practice often tends to assimilate this legal determination to a biologically incontrovertible state, without fully acknowledging the complexity and gradual nature of the dying process. This tension gives rise to several concerns. It may expose the practice to a loss of public trust, particularly when atypical clinical cases bring this complexity to light; it may generate uncertainty regarding the ethical legitimacy of certain peri-mortem and post-mortem interventions performed on potential donors; and it may contribute to a lack of sufficiently transparent information for patients and families, thereby limiting the possibility of fully informed and meaningful choices.

Against this background, the question is not simply whether the DDR is respected in its current formulation, but whether its conceptual foundations are adequately aligned with the biological and normative realities of dying. This suggests that it may be appropriate to reconsider the DDR, not by abandoning its underlying ethical aims, but by reformulating it in a way that more explicitly considers the complexity of the dying process and reduces its reliance on a purely legal determination of death.

6 | The Dead Donor Rule and Its Vulnerabilities

At the beginning of transplant history, as Miller and Truog note, the DDR was commonly accepted as “an ethical premise that did not require reflection or justification” [44]. It was only in 1999 that Robertson explicitly articulated the rule, giving it its

current name and defining it as “the ethical and legal rule that requires that donors not be killed in order to obtain their organs” [45]. In its original formulation, Robertson focused on the requirement that organ procurement must not cause the death of the patient, without placing explicit emphasis on whether the donor must be declared dead. The rule was thus conceived primarily as a specification of the principle of non-maleficence, aimed at ensuring that patients are not killed for the purpose of obtaining their organs [46].

As the DDR was translated into organ procurement practice, greater emphasis came to be placed on the requirement that donors be declared dead before organ retrieval; the development of cDCDD made this aspect of the rule especially relevant. As a result, the DDR has increasingly been formulated as comprising two complementary conditions, which are now typically understood as jointly necessary rather than alternative: that organ procurement must not cause the death of the donor, and that vital organs should be removed only from patients who are dead [47, 48].

As others have noted, these two parts of the rule are often conflated, yet they are not equivalent [49]. The first focuses on ensuring that organ procurement is not the cause of death, whereas the second frames the rule in terms of the sequence between the declaration of death and organ retrieval.

In either case, whether the rule is considered in its dual formulation or with emphasis placed on one of its components, it raises important questions about the relationship between the legal determination of death, the way it is applied in clinical practice and its biological underpinnings, questions that warrant closer examination.

Although the DDR is an ethical norm, it is deeply connected to the logic of homicide law and to the legal definition of death, insofar as it seeks to ensure that organ procurement neither constitutes the cause of death nor occurs before death has been legally determined. For this reason, in contemporary transplantation practice the DDR functions not only as an ethical principle, but also as a clinical and medico-legal framework.

This has undoubtedly represented one of the major strengths of the DDR, as it has enabled the rule to be applied systematically in the protection of potential donors, while its integration into clinical and medico-legal practice has contributed to the credibility of the transplantation process and to public trust in organ donation.

However, the fact that the DDR relies on the legal definition of death and on the legally established criteria for determining it, also represents one of its deepest conceptual vulnerabilities, particularly when these criteria are applied within the realities and practical demands of contemporary clinical transplantation practice. This can be understood in light of at least two considerations.

The first is that the law, by its very nature, requires the identification of precise thresholds capable of marking transitions between categories, a need that becomes particularly evident when distinguishing between life and death. In doing so, the

law necessarily tends to identify a single decisive event marking the transition from one state to another, whereas the biological process of dying often unfolds as a gradual and heterogeneous process rather than as a discrete moment. This tension has become increasingly evident with the development of cDCDD practices, particularly in debates surrounding thoraco-abdominal normothermic regional perfusion (TA-NRP) in the United States, where the restoration of circulation and the potential reperfusion of the brain following the legal determination of death have raised questions regarding the relationship between legal death, biological functions and the permanence or irreversibility of death determination [49, 50]. More broadly, DCDD has made increasingly visible the difficulties involved in identifying a single biologically incontrovertible moment of death within a dynamic and medically mediated dying process.

A second reason is that the criteria required for the determination of death in Italy, as well as—albeit in different ways—in many other countries, rely on standards that may be excessively demanding and, in some respects, not fully verifiable in light of currently available scientific knowledge, as discussed in Section 3. In practice, this has led to a series of adjustments and pragmatic adaptations within transplantation medicine. In the context of cDCDD in the United States, for example, even where the irreversible cessation of circulatory activity is theoretically required, clinical practice often verifies permanence rather than irreversibility. Conversely, in countries such as Italy, the attempt to maintain a stricter standard has led to the adoption of highly rigid criteria, such as the 20-min no-touch period, despite the absence of solid scientific evidence supporting the necessity of such a threshold.

The close connection between the DDR and the legal definition of death gives rise to several critical issues. On the one hand, certain clinical situations may appear difficult to reconcile with the presumed irreversibility and certainty of death, particularly in cases involving the restoration of circulation or concerns regarding possible brain reperfusion. On the other hand—and perhaps even more importantly—these conceptual and practical ambiguities may prevent potential donors and their families from receiving sufficiently complete and transparent information about the nature of the dying process and the procedures involved in organ procurement, thereby limiting the possibility of truly informed decision-making regarding donation.

These considerations suggest that it may be more appropriate to reconsider the foundations of the DDR by grounding it more explicitly in the biological facts of the dying process as currently understood, rather than tying it so closely to the legal definition of death. One possible objection is that, instead of revising the DDR, legal definitions of death themselves should be reformulated. However, experience has repeatedly shown how difficult such reforms are to achieve in practice—as illustrated, for example, by attempts to revise the Uniform Determination of Death Act (UDDA) in the United States [42]. Moreover, even if such changes were implemented, they would still be unlikely to produce substantial uniformity among the legal frameworks of countries practicing DCDD, given the considerable variability that already characterizes national approaches to the determination of death.

7 | Towards a “Dying Donor Rule”?

The considerations discussed so far suggest that the ethical legitimacy of organ procurement should not depend primarily on the attempt to identify a single legally defined moment of death capable of functioning as an incontrovertible boundary. Rather, it may be more appropriately grounded in the biological realities of the dying process and in the individual's freedom to decide, according to their own values and to the meaning they ascribe to death. This does not mean abandoning the ethical concerns that originally motivated the DDR, particularly the need to protect vulnerable patients and to ensure that organ procurement does not become a form of unjustified killing. Rather, it suggests the need to reconsider how these ethical aims are formulated and operationalized.

In what follows, I will argue that this may require a partial reformulation of the DDR itself, based more explicitly on the biological facts of the dying process as currently understood. This proposal does not seek to reject the ethical foundations of the rule, but to reconsider its two core components—the requirement that organs be removed only after death has been declared and the prohibition against causing death through organ procurement—in light of the conceptual and practical difficulties discussed above. From this perspective, a “dying donor rule” may offer a more coherent framework for addressing the realities of contemporary organ procurement practices.

Focusing first on what may be described as the “temporal” component of the DDR—namely, the requirement that “vital organs should be removed only from patients who are dead”—a fundamental question arises: at what point within the dying process should the line be drawn? Should we consider adequate the threshold identified by Italian law, namely the irreversible cessation of all brain functions? Or should we instead anchor the rule to the only biologically indisputable endpoint, namely complete biological death?

Each of these solutions presents substantial difficulties. The first relies on a standard that is, in practice, not fully verifiable and, moreover, does not make explicit that the individual has not yet fully completed the biological process of dying. The second, by contrast, would in practice make organ procurement impossible because of the damage that would occur to organs before complete biological death is reached. In this respect, the approaches adopted in other countries do not appear entirely satisfactory either, since they also reveal a misalignment between currently available biological evidence and the criteria required for the determination of death. In any case, all legal definitions of death risk creating the impression that the legally established point marking death is fully equivalent to total biological death, without making explicit that this determination itself reflects broader cultural and value-laden choices.

A formulation of the “temporal” requirement that may be more appropriate and more closely aligned with the biological reality of death, as well as with what already occurs in clinical practice, would be to refer not to death itself, but to a dying process that has entered a permanent course, although not yet completed with biological death. This would identify the point from which

organ procurement may proceed, without harm to the potential donor and in accordance with the donor's wish to donate. In essence, the rule could be reformulated as follows: "Vital organs should be removed only from patients in whom the process of dying has been permanently initiated and will inevitably lead to biological death".

It should be clarified that reference has been made to the concept of permanence, rather than irreversibility, because of the conceptual difficulties surrounding the latter. Permanence is here intended to refer to circumstances in which the spontaneous recovery of functions is no longer possible and either a prior decision has been made not to intervene to restore them in a stable and sustained manner capable of reversing or arresting the dying process, or no technical capacity currently exists to do so.

In the context of DNDD, the process of dying may be regarded as permanently initiated once there is a permanent (as previously stated, this term is preferred over "irreversible") loss of all functions of the brain, with the exception of certain residual functions that may persist under somatic support, as discussed in Section 3.2 (cardiovascular activity, homeostasis, altered thermoregulation, certain neuroendocrine functions, proportional growth, puberty and wound healing). This threshold can be clinically identified and marks the beginning of a dying process that may continue for a variable period of time but that, according to current knowledge and clinical practice, is not expected to reverse.

In cDCDD, by contrast, the relevant point would be the permanent cessation of cardio-circulatory activity once the possibility of autoresuscitation has been excluded. Current evidence suggests that autoresuscitation does not occur beyond 5 min. After this point, no attempt would be made to restore cardiac activity through external intervention, either because such treatment would be considered clinically inappropriate or because it would be regarded as disproportionate considering the patient's previously expressed wishes or those reconstructed through proxy decision-makers.

The clarification provided above regarding the concept of permanence is particularly important in relation to thoraco-abdominal normothermic regional perfusion (TA-NRP) in DCDD. As proposed here, permanence refers to circumstances in which the spontaneous recovery of functions is no longer possible and either a prior decision has been made not to intervene to restore those functions in a stable and sustained manner capable of reversing or arresting the dying process, or no technical capacity currently exists to do so. The fact that TA-NRP may restore regional perfusion and may be associated with the resumption of cardiac mechanical activity should not be understood as meaning that the relevant functions have been restored in the sense intended here. The relevant question is not whether some circulation or cardiac mechanical activity can be temporarily re-established for organ-preservation purposes, but whether the patient's circulation is restored in a stable and sustained manner capable of reversing or arresting the dying process. In the context of organ procurement, TA-NRP is not an intervention aimed at restoring sustained systemic circulation for the benefit of the patient or at returning the patient to a

recoverable clinical state. Rather, it is a temporary organ-preservation procedure, undertaken within a framework in which no attempt will be made to restore circulation as a life-sustaining intervention [51]. Moreover, TA-NRP is performed with measures intended to prevent cerebral reperfusion, (occlusion of the aortic arch vessels, or equivalent measures). For this reason, the transient restoration of regional perfusion, even when associated with the resumption of cardiac mechanical activity, does not by itself undermine the claim that the process of dying has been permanently initiated and will inevitably lead to biological death.

One possible objection to this proposal is that the 5-min standard conflates a prognosis with a diagnosis—that is, at 5 min we may predict that the patient will die and that autoresuscitation will not occur, but this is conceptually distinct from claiming that the patient is already dead. The point advanced here; however, is precisely that the diagnosis being made is not a diagnosis of death itself, but rather a diagnosis of a dying process, which itself carries a certain prognosis of death.

Importantly, identifying the beginning of dying process that has entered a permanent course as the minimum threshold for organ procurement means considering that, from that point onward, the conditions deemed necessary to proceed are fulfilled: namely, that the donor is regarded as sufficiently protected and that organ procurement is not considered to cause harm. Beyond this point, the decision to donate ultimately depends on the individual donor's wishes, values, beliefs and personal preferences. The central issue then becomes how the obligation to avoid harm to the potential donor should be understood, particularly with regard both to the possibility of causing suffering and to the question of whether organ procurement itself may cause the death of the patient.

With regard to the issue of suffering and the possibility of conscious pain perception, available evidence suggests that clinical loss of consciousness and loss of EEG activity occur within approximately 30 s after abrupt circulatory arrest and may occur even before circulatory arrest in the context of progressive hypoxia-ischemia [25]. Further support for the high likelihood that the neurophysiological conditions necessary for consciousness cease well before 5 min comes from recent evidence showing that cerebral blood flow velocity and brain tissue oxygen tension cease before complete systemic cardiovascular arrest, and that the brain undergoes a diffuse limitation in oxygen extraction during the dying process [52]. Although these findings do not allow definitive conclusions regarding subjective experience, they strongly suggest a rapid loss of the neurophysiological conditions necessary for consciousness and pain perception.

Turning to the second issue related to the requirement not to cause harm to the donor, if we now examine the requirement that organ procurement must not cause the death of the patient, a further question arises: once that a dying process has entered a permanent course and will inevitably lead to biological death—that is, once strong evidence demonstrates beyond any reasonable doubt that autonomous recovery is no longer possible and that the ongoing loss of functions will inevitably lead to death—can organ retrieval still be considered the cause of death?

From a legal standpoint, the answer may differ; yet from an ethical perspective, it seems questionable to argue that organ retrieval causes death when a dying process has entered a permanent course, because the cause of death lies upstream of the dying process itself. Rather, organ procurement may be understood as accelerating a dying process, an acceleration to which the person has consented through the decision to donate (provided that the person has been adequately informed and is fully aware of what this entails). In this respect, it does not appear fundamentally different from the decision to withdraw life-sustaining treatment, which suspended an already initiated dying process through the artificial replacement of a vital function.

Within this framework, the objective should be to establish—beyond reasonable doubt—that the dying process has been permanently initiated by independent physiological causes and value-based choices and that organ procurement does not cause death but may, at most, hasten its final stages. The second component of the DDR could therefore be reformulated as follows: “Organ procurement must not cause the permanent initiation of a dying process.” It obviously remains implicit that any decision not to initiate or to withdraw treatment must, as has always been emphasized, remain entirely independent from the donation process and must be made exclusively based on clinical considerations and the patient’s wishes, without being shaped by the prospect of organ donation.

It should be emphasized that the proposal advanced here largely represents a more ethically and clinically coherent formalization of practices that already occur in countries performing DNDD and cDCDD, particularly in jurisdictions adopting a 5-min no-touch period for cDCDD. As already noted, such a period cannot provide certainty regarding the irreversible cessation of circulatory function. Rather, it identifies, in practice, the beginning of a process from which cardiac activity will not spontaneously resume in the absence of external intervention (interventions that will not be undertaken because a prior decision has been made not to undertake them), together with a reasonable degree of certainty that extensive ischemic brain injury has already begun and is progressing toward completion.

The main implication of adopting a framework of this kind is therefore the need for more explicit and transparent communication regarding the donation process, something that arguably should already be required given the discrepancy between legal definitions of death, what can actually be clinically measured and verified, and the complex biological reality of the dying process. The issue of information thus becomes central. Potential donors should be fully informed, when they express their willingness to donate, about what donation may entail in practice, so that they may evaluate whether such a choice is consistent with their own wishes, values, and personal beliefs. This would also help avoid presenting death as a purely punctual and entirely objectifiable event, while instead acknowledging the complexity and gradual nature of the dying process and enabling individuals to understand more clearly what organ donation may involve and what they themselves consider ethically acceptable.

8 | Transparency, Trust and the Complexity of Communication

The ethical legitimacy of the argument developed here ultimately depends on one essential condition: the meaningful involvement of potential donors and of the public through clear and adequate communication capable of supporting genuinely free and informed donation choices, together with in-depth discussions with families and surrogate decision-makers.

Acknowledging that we are not actually dealing with a diagnosis of complete biological death—neither in DNDD nor in cDCDD—is difficult, because it requires moving away from the certainty of a purely biological fact and recognizing that death may be identified by different individuals at different points along a biological continuum. The legal and clinical definitions of death currently employed are therefore not grounded exclusively in an objective biological fact with a single unequivocal interpretation. Rather, they are also shaped, at least in part, by cultural and value-based assumptions.

Whether one accepts the idea of a “dying donor rule” or continues to rely on the current framework, the complexity of the dying process cannot be obscured. Nor can the illusion be maintained that the death of the donor simply coincides with complete biological death.

This is perhaps the most difficult and yet unavoidable challenge. Determining how such information should be communicated, through which channels, and with what degree of detail or complexity—likely in different ways depending on whether the context involves public information, the registration of a donation decision or discussions with families and surrogate decision-makers—requires much more extensive investigation. Nevertheless, this is a problem that will need to be addressed regardless of whether the current framework grounded in the legal definition of death is maintained or whether a reformulation of the DDR such as the one proposed here is adopted.

If the transplant system is grounded in public trust, then it also bears the responsibility of communicating transparently and guaranteeing individuals the freedom to choose according to their own values and beliefs, even if greater transparency may potentially affect donation rates. Without transparency; however, the relationship of trust on which transplantation depends risks ultimately being seriously undermined.

9 | Reconsidering the Italian 20-min No-Touch Period

An essential preliminary consideration is that, although the benefits for organ recipients are undeniably significant, the process of death determination must be kept separate from the process of organ donation, in order to protect potential donors and avoid reducing them to a mere means to an end. Therefore, if a revision of the Italian 20-min no-touch period and of the current procedures for death determination is to be considered, the central issue is neither the potential benefit to recipients nor the harm that may result from a missed donation opportunity. Rather, the relevant ethical question concerns the tension

between the duty to safeguard the donor and the obligation to respect the donor's autonomous decision and wish to donate, a decision that may also express solidarity and benefit others.

The analysis developed in the preceding sections suggests that the Italian 20-min no-touch period is affected by significant scientific and ethical vulnerabilities. Indeed, no evidence shows that a 20-min observation period is the minimum duration required to be certain that, following the absence of circulation and the resulting ischemic injury, all brain functions have irreversibly ceased. This vulnerability is not limited to the duration of the observation period. The Italian legal definition of death itself (i.e., the irreversible cessation of all brain functions) relies on a standard that is not fully verifiable in practice, both with regard to the totality of brain functions and with regard to irreversibility. Based on current knowledge, therefore, it is not possible to claim with absolute certainty that the conditions required by the legal definition of death have actually been met.

These scientific vulnerabilities also have direct implications for the practical applicability and ethical defensibility of the DDR. As argued above, the DDR becomes fragile when it is anchored too rigidly to legal definitions of death that do not fully correspond to the complex biological reality of the dying process and that cannot be straightforwardly translated into verifiable biological thresholds. This fragility becomes apparent in cDCDD, where the relevant clinical reality is the identification of a point after which autoresuscitation will not occur and no intervention will be undertaken to restore cardio-circulatory activity.

It is precisely for this reason that reformulating the DDR as a "dying donor rule" may provide a more coherent ethical framework. Rather than grounding the permissibility of organ procurement primarily in the legal determination of death, with all the conceptual and biological difficulties this entails, this framework grounds it in the diagnosis of a dying process that will inevitably lead to complete biological death, independently of organ procurement. In cDCDD, this means identifying the point at which cardio-circulatory activity has permanently ceased, autoresuscitation will not occur and no attempt will be made to restore circulation. On this basis, the 5-min no-touch period adopted in several countries practicing cDCDD appears ethically more defensible than the Italian 20-min no-touch, not because it establishes the irreversible cessation of all brain functions under the current Italian legal standard, but because it is supported by evidence concerning the permanence of cardio-circulatory arrest and is consistent with the proposed reformulation of the relevant threshold as the diagnosis of a dying process that has entered a permanent course.

On these grounds, the Italian 20-min no-touch period does not appear to provide better protection for cDCDD donors. Its prolongation cannot be justified simply by appealing to greater caution if it does not provide any evidence-based additional safeguard. On the contrary, maintaining this standard may harm the donor's interests by increasing the risk that a donation explicitly wished for by the donor cannot be completed, either because the death determination procedure is delayed or interrupted to the point that procurement can no longer proceed within a time frame compatible with organ utilization, or

because, even when death determination is completed, the prolonged warm ischemic time may contribute to organs being deemed unsuitable for transplantation. Maintaining the current legal framework as a whole may also harm the donor's interests in a second, less visible but ethically important sense: it may sustain the impression that death determination is a purely objective clinical act, comparable to the confirmation of death based on cadaveric signs, rather than a legally and clinically accepted threshold that does not fully correspond to the complex biological reality of dying. This may limit the possibility of a truly informed donation choice.

To understand why the failure to fulfill a person's wish to donate may itself constitute a harm, it is important to recall that, whereas the ethical and legal approach to end-of-life issues is primarily centered on personal autonomy, organ donation also involves a dimension rooted in solidarity. This dual nature complicates the assessment of benefits and harms. The benefits of donation do not concern only recipients, who may gain substantial clinical advantages, but also the donor, for whom donation may represent an expression of personal identity, values and solidarity beyond death. Safeguarding autonomy and solidarity—as reflected in Articles 2, 13 and 32 of the Italian Constitution—therefore requires making every reasonable effort to fulfill the individual's expressed wish to donate. Any unnecessary reduction in the likelihood of a successful donation—that is, a reduction that does not provide any additional protection to the donor—should therefore be regarded as a harm to the potential donor, insofar as it decreases the possibility of fulfilling the donor's autonomous wishes and desire to act in solidarity with the community. The key term is "unnecessary". Some reduction in the likelihood of donation may be morally required if it provides a genuine safeguard against exploitation or harm. However, if extending the no-touch period increases warm ischemic injury, or if ECG-based determination creates a risk that the procedure cannot be completed because of recurrent non-perfusing cardiac electrical activity, without offering any evidence-based additional protection to the donor, then the resulting reduction in the likelihood of donation should be regarded as unnecessary.

10 | Conclusion

Taken together, the scientific and ethical arguments developed in this paper suggest that no biologically or philosophically meaningful threshold can be identified between a 5-min and a 20-min no-touch period. Accordingly, it would be more appropriate to align the Italian no-touch period with the 5-min standard adopted in other countries practicing cDCDD, since this threshold is supported by evidence concerning the permanence of cardio-circulatory arrest and is consistent with the diagnosis of a dying process that will inevitably lead to complete biological death.

Such a revision should be accompanied by a revision of the protocols for death determination by cardio-circulatory criteria. These procedures should rely on validated, reliable, and widely available tools for confirming the absence of effective systemic circulation, thereby reducing the risk of both geographical inequalities and lost donation opportunities resulting from

limited access to appropriate technologies. At the same time, they should be designed to document the permanent cessation of effective circulation rather than the mere disappearance of cardiac electrical activity. A framework that aims to protect donors should focus on what is ethically and biologically relevant in this context: the permanent cessation of effective systemic circulation and the prior decision not to attempt resuscitation or restore circulation, not the persistence or disappearance of residual non-perfusing cardiac electrical activity.

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Conflicts of Interest

The author declares no conflicts of interest.

Data Availability Statement

The author has nothing to report.

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