

# Maternal brain death — an Irish perspective

## ABSTRACT

**Background** Brainstem death is a concept used in cases in which life-support equipment obscures the conventional cardiopulmonary criteria of death. Brainstem death during pregnancy is an occasional and tragic occurrence.

**Aims** To consider the ethical, legal and medical issues raised by maternal brainstem death.

**Methods** Medline and Embase search.

**Results** The death of the mother mandates consideration of whether continuing maternal organ supportive measures in an attempt to attain foetal viability is appropriate, or whether it constitutes futile care. There is no theoretical limit to the duration of time for which maternal somatic function may be sustained. However, successful prolongation of maternal somatic function in pregnancies of less than 16 weeks gestation has not been reported to date. There is no legal imperative to continue maternal somatic support where there is little likelihood of a successful foetal outcome.

**Conclusion** The difficult issues raised by maternal brainstem death mandates a consensus building approach to decision making in this context.

**Key Words** Maternal; Brain Death; Brainstem death; Foetus; Ethics; Legal.

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## INTRODUCTION

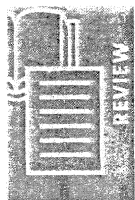
'Brain death' describes the irreversible loss of brainstem function in a patient receiving artificial organ support that delays the onset of cardiac arrest and somatic death.<sup>1</sup> It is an irremediable event which heralds the permanent loss of consciousness. Brain death is ultimately followed by circulatory arrest, and is internationally recognised as being equivalent to somatic death.<sup>2</sup> It is generally considered unethical and futile to continue to support vital organ function once a diagnosis of brain death has been made.<sup>3</sup> A potential exception is maternal brain death, where a live foetus is present. The mother and foetus are two distinct organisms, and the death of the mother mandates consideration of the appropriateness of continuing maternal somatic support in order to prolong gestation to attain foetal viability. Two recent cases have been reported in this country in recent years,<sup>4-6</sup> highlighting the need to carefully consider the issues raised by these complex and tragic situations.

## BRAIN DEATH VERSUS SOMATIC DEATH

The irreversible cessation of brainstem function implies death of the brain as a whole.<sup>7-10</sup> This concept is used to determine when death has occurred in cases in which the provision of 'life-support' obscures the conventional cardiopulmonary

criteria of death.<sup>7-9</sup> This concept is widely accepted in the medical field<sup>2</sup>, and is legally recognised in most countries, including Ireland. The Memorandum on Brain Death reinforces this diagnosis in Ireland,<sup>11</sup> though 'death' as such is not defined in law in this country.<sup>12,13</sup> This concept provides the basis for cadaveric organ donation. However, there remain significant differences worldwide in the diagnostic criteria used for determination of brain death.<sup>2</sup> Some debate does exist in the medical literature regarding the equivalence of traditional 'somatic' and 'brain' death.<sup>14-17</sup> What is not in dispute is that fact that brain death is a totally irreversible, irremediable, and final event which heralds the permanent loss of arousal and consciousness. There is no recorded case of recovery following the diagnosis of brain stem death. These findings form the basis for the concept of the equivalence of somatic and brain death.

Brain death ultimately is followed by somatic death, often within days, despite meticulous supportive care.<sup>18</sup> While there are rare and exceptional case reports of survival for longer durations in the literature, it is generally considered unethical and futile to continue to support vital organ function once a diagnosis of brain death has been made.<sup>3</sup> However, in the tragic situation of maternal brain death, attempts have been made to sustain maternal somatic function with the aim of allowing the



pregnancy to continue until the foetus has attained viability. It is not generally considered to be maternal life support *per se* in that maternal brain death, and therefore legal death, has occurred.

### **MATERNAL BRAIN DEATH AND LIMITS OF FOETAL VIABILITY**

The key determinant of success of attempts to sustain maternal somatic function is the duration of time required for the foetus to attain viability. However, there are insufficient data regarding the effects of maternal brain death on the limits of foetal viability. It does seem likely that the physiologic alterations and therapeutic interventions necessary to sustain maternal somatic function (e.g. the effects of vasopressor therapy on utero-placental blood flow) would impact adversely on the onset of foetal maturity.

Despite these reservations, it is useful to consider the data on premature delivery in the general population as a reference point in determining the limits of foetal viability in the setting of maternal brain death. A foetus born before 24 weeks has little prospect of surviving.<sup>19</sup> At 24 weeks, a foetus has approximately a 20 – 30% likelihood of survival with a 40% chance of suffering from severe handicap if born alive.<sup>19</sup> At 28 weeks, there is an approximately 80% chance of survival and a 10% risk of severe handicap. A gestational age of 32 weeks has generally been considered the earliest time at which delivery can be made with the best chance of survival and the least chance of handicap. At that stage there would be a 98% chance of survival with a less than 2% risk of handicap.<sup>19</sup>

### **LIKELIHOOD OF SUCCESSFUL MATERNAL SOMATIC SUPPORT**

The determination of the likelihood of successfully maintaining maternal somatic function for the duration necessary to achieve a good foetal outcome is of central importance. The rarity of prolonged maintenance of somatic function following brain death is clear from earlier studies reporting the ventilation of patients post brain stem death until cardiac arrest supervened. In their series of 1200 brain dead patients, Jennett and Hessest were unable to find a single case of somatic survival beyond 14 days.<sup>20</sup> Hung and Chen, in a prospective study of 73 patients that met the clinical criteria for brainstem death, found that 97% developed cardiac asystole within seven days despite continued full cardiorespiratory support.<sup>21</sup> In an older study,

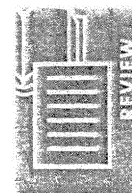
Jorgensen reported that of 63 patients diagnosed as brain dead, 100% developed asystole within nine days.<sup>22</sup> Median time to cardiac arrest following brain death was 3.5 – 4.5 days in a UK study.<sup>23</sup> More recently, Shewmon, in his meta-analysis of somatic survival following brain death, did report multiple cases of prolonged maintenance of somatic function following brain death, but acknowledged that was very much the exception.<sup>24</sup>

The longest duration for which successful support of maternal organ function following maternal brain death has been achieved to date is 107 days.<sup>25</sup> The woman involved was a 30-year-old who suffered a massive brain injury at 15 weeks gestation. She was declared brain dead 10 days later, i.e. at 16.5 weeks. Vital organ support was provided for 15 weeks and two days (i.e. 107 days), and a live infant was delivered at approximately 32 weeks gestation. Maternal somatic function remained relatively stable up until organ support was discontinued following delivery of the infant. This raises the potential that support of maternal function could have been prolonged for longer in this case, had it been necessary.

In summary, it is possible, at least in theory, to sustain maternal somatic function for extended periods of time. However, the duration of successful maternal somatic support has not been extended in fifteen years, despite dramatic advances in organ support therapies in the interim. Of importance, the successful delivery of a live foetus has never been reported where pregnancies were less than 16 weeks gestational age at the time of maternal brain death.

### **ETHICAL ISSUES**

Maternal brain death raises difficult ethical issues. While it is clear that the nearer the pregnancy is to term, the more likely that there can be a successful delivery by caesarean section, the outer limits of successfully maintaining a body on life support in the absence of brain stem function are unclear. In addition, there is no proven management strategy to maintain maternal somatic function; therefore this can be considered to constitute experimental therapy. The question arises as to whether attempting to sustain maternal somatic function for a prolonged duration following brain death is an ethical option. It seems that it can only be considered ethical if there is some – albeit poorly quantified – hope of success. An alternative viewpoint is that this constitutes medical experimentation with little or no hope of success. Other issues which require



detailed consideration with respect to the mother include the woman's right to autonomy, the need to respect a body following brain death and the woman's right to die with dignity. Balanced against these considerations regarding the mother are the ethical issues which centre on the foetus. A key issue is an examination of whose interest takes primacy, i.e. the interests of the foetus or those of the mother.

Finnerty et al have raised three possible approaches to these ethical issues.<sup>26</sup> The first approach is to view the subject as a terminally ill, autonomous patient; in this case, maternal wishes as expressed previously will prevail. With this approach, it is particularly important to determine the existence of any previously expressed maternal opinions (e.g. advanced directive, living wills, discussion with family). The second approach is to view the subject as a 'cadaveric incubator' with no autonomous rights; in this case the rights of the foetus prevail. The third approach is to view the patient as a voluntary organ donor if the patient had previously expressed positive views regarding organ donation; in this case it could be viewed that she is willing to act as an incubator for the benefit of the foetus.<sup>26</sup>

The interests and concerns of other family members, particularly the next-of-kin, also deserve consideration. Further issues may arise where there is uncertainty as to the identity of the next of kin, such as where the maternal next-of-kin is not the foetal next-of-kin. The immediate family must be centrally involved in decision-making, be offered counselling and made aware of their right to independent legal and medical advice.

### LEGAL ISSUES IN THE IRISH CONTEXT

The legal rights conferred on the foetus are closely linked to the maternal right to therapeutic abortion, generally depend on gestational age, and vary across Europe. In the Irish Republic, the foetus has been accorded a legal right to life, as stated in Article 40.3.3 of the Constitution of the Republic of Ireland:

*"The State acknowledges the right to life of the unborn and with due regard to the equal right to life of the mother, guarantees in its laws to respect, and as far as practicable by its laws, to defend and vindicate that right."*

Article 40.3.3 asserts the *right to life* of the unborn, and treats the foetus as a person having the same right to life as any other human being, and it makes

no attempt to suggest that that right is limited or qualified by the stage of foetal development. Mills argues that the State, in its application of this Article, considers life to begin at implantation.<sup>27</sup> Article 40.3.3, in referring to the '*equal right to life of the mother*', necessarily implies that no interest of the mother, or of anyone else, short of a right to life, can overbear the right to life of the unborn. Given that the mother is legally dead, then in the strict legal sense, her right to life is no longer of relevance.

Sheikh and Cusack, in considering the medicolegal implications of this legal protection of the foetus, contend that there is an obligation to maintain a foetus to a viable gestational age.<sup>5</sup> It seems likely that a court would consider that if it can be said that there exists a realistic prospect of delivery of a live baby, then no-one (whether the Health Authorities, the Hospital, a family member or the putative father) would be justified in removing life support when that would inevitably result in ending the life of the foetus. However, Sheikh and Cusack raise the possibility that, if maternal organ support were continued, and resulted in the birth of a seriously injured child, then that child could then institute legal proceedings for negligence.<sup>5</sup>

In contrast, if the available medical evidence suggested that there is no realistic prospect of delivery of a live baby, then maternal somatic support would be considered futile, and would not be permitted.<sup>5</sup> This position is supported by the advice of the then Attorney General in the case of a maternal brain death at 14 weeks gestation in this country.<sup>5,6</sup> He stated that withdrawal of ventilation, nutrition and fluids would not require legal sanction given that the likelihood of successful foetal outcome was considered to be remote.<sup>5,6</sup> Therefore, even though the foetus has considerable legal rights in this country, there appears to be no legal imperative to continue maternal somatic support where there is little likelihood of a successful foetal outcome. However, this remains controversial, and has not been subjected to legal challenge.

Finally, the lack of a defined maximum period for sustaining maternal somatic function, coupled with the protection afforded to the foetus, raises the potential for the need to exclude pregnancy, even in its earliest stages, in all brain dead females of childbearing age prior to terminating somatic support.

## MEDICAL INTERVENTIONS REQUIRED TO SUSTAIN MATERNAL SOMATIC FUNCTION

As already stated, there is no medical therapy or management strategy which prolongs maternal somatic function for prolonged durations of time following brain death. The intensive care physician is faced with extrapolating from the experience of sustaining organ function following brain death to allow for organ donation, and consulting case reports<sup>3,25,26,28</sup> and reviews<sup>29</sup> in the literature. A relatively predictable picture involving loss of cardiovascular stability, complete pituitary failure, sepsis and bradyarrhythmias resulting in eventual cardiac arrest emerges.<sup>3,25,26,28</sup> Support of multiple organ systems, including the respiratory, cardiovascular and endocrine systems are near universal requirements. Nutritional support should be instituted early, preferably by the enteral route. Specific invasive procedures may be necessary, including placement of a tracheostomy to facilitate long-term mechanical ventilation, and placement of invasive lines including a central venous pressure line and an arterial line to facilitate management of cardiovascular instability. Pituitary failure is likely, mandating hormonal replacement with thyroid hormone, corticosteroids and vasopressin and management of diabetes insipidus. Insulin therapy may be required to manage glucose intolerance. Thermovariability may be particularly difficult to manage, and may require heating and cooling blankets and repeated septic screens. Blood transfusion may be required for management of persistent anaemia. The efficacy of erythropoietin in this context is not known. Maternal thromboembolism must be considered a high risk, mandating prophylaxis with fractionated or unfractionated heparins.

Sepsis, in the absence of haemodynamic collapse, constitutes the greatest risk to maternal somatic function. Repeated episodes of sepsis, including recurring [ventilator associated] pneumonias, and [urinary catheter associated] bladder and kidney infections are likely. Blood stream infections are particularly likely, due to the presence of intravascular catheters. These infections are likely become increasingly resistant to antibiotic therapy over a time period of several months in the ICU. Strict asepsis, if possible involving isolation of the maternal body, within the ICU, is necessary to reduce the likelihood of developing sepsis. Consideration should be given to strategies to reduce the incidence of catheter-associated sepsis, although unproven in this

context, including the use of antibiotic or bactericide coated catheters and/or using tunnelled central venous lines.

## CONCLUSIONS

Maternal brain death raises difficult ethical and legal issues. A consensus building approach that involves broad based consultation including the immediate family, appropriate legal advice and external medical experts is central to resolving these issues. It is clear that there is no theoretical limit to the duration of time for which maternal somatic function may be sustained. However, successful prolonged maintenance of maternal somatic function is rare. The right to life conferred on the foetus from the earliest stages of gestation in this State may only be usefully exercised if there exists some expectation of successful delivery of a live baby. If no realistic prospect of success exists, then maternal somatic support would be considered futile, and should not be permitted. It seems reasonable to consider prolongation of maternal somatic function to be futile if the pregnancy is of less than 16 weeks gestation at the time of maternal brain death, given the absence of reports of successful delivery of a live foetus in these pregnancies. This might be an appropriate cut-off point in this context. However, the fact that this is an arbitrary cut-off point must be emphasised.

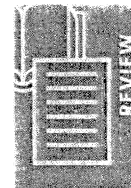
Despite these difficulties, there remains an imperative to develop guidelines for healthcare providers in Ireland regarding how to resolve the issues raised by maternal brain death. It is likely that further similar cases will arise in this country in the future.

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