Why predict time to death after withdrawal of life-sustaining therapy?

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In this issue of the Journal, Coleman and colleagues[1] (*page 278*) report on tools to predict the interval between cessation of life-sustaining therapy and death in a cohort of intensive care patients. Their report is both important and timely.

Accurate prediction of the interval between withdrawal of life-sustaining therapy (WLST) and death has been of little importance in the past, other than perhaps to help inform families of dying patients and plan for use of ICU resources. With the re-emergence of donation after cardiocirculatory death (DCD, also known as donation after cardiac death and non-heart-beating donation) as a source of organs for transplantation, predicting this interval has become important.

The first transplants from deceased donors in the 1960s occurred after death was declared as a result of irreversible cessation of the circulation. This practice was largely abandoned with the advent of the brain death concept, which allowed multi-organ donation and improved conditions for organ procurement.

DCD has become increasingly practised over the past 10 years to provide additional organs for transplantation and to fulfil the wishes of individuals and families to donate when brain death criteria are unlikely to be met. In the United States in 2007, 10% of deceased donors were classified as DCD, and the proportion was as high as 20% in some regions.[2] In Australia in 2007, there were 19 DCD donors (10% of deceased organ donors).[3]

For the organs of potential DCD donors to be suitable for transplantation, death must occur soon after WLST. The warm ischaemia time, defined as the interval between extubation (as the definitive withdrawal of treatment) and initiation of cold perfusion, must typically be less than 30, 60 and 90 minutes for liver, kidney and lung transplantation, respectively. If death does not occur within these periods, then organ retrieval is abandoned, and end-of-life care continues.

Any DCD program inevitably includes a proportion of potential donors who do not die within the necessary period. Limiting this number is desirable to avoid burdening families unnecessarily and to make optimal use of health care resources. The logistical preparations for organ procurement are considerable and include having a surgical retrieval team and operating theatre on standby.

The critical importance of limiting warm ischaemia time in DCD has focused attention on the timing of the declaration of death after cardiopulmonary arrest. For the vast majority of individuals who die (who are not organ donors), death is declared at a varying and somewhat arbitrary interval after breathing and heart function have ceased. The exact duration between cardiopulmonary arrest and declaration of death has been largely irrelevant. However, for potential DCD donors a difference of minutes in warm ischaemia time can influence whether an organ is suitable for procurement and transplantation. Thus, there is a need to ensure that death is declared as soon as possible after circulatory arrest, after which organ removal can begin.

Death is defined in law throughout most of Australia, following recommendations in 1977 by the Australian Law Reform Commission, as having occurred when there is either irreversible cessation of all function of the brain of the person or irreversible cessation of circulation of blood in the body of the person.[4] The Uniform Determination of Death Act in the US in 1980 led to the establishment of similar laws throughout the world.[5]

The concept of brain death as an equivalent of death has achieved a high — but not universal — level of acceptance, and its practical application has allowed many thousands of organ transplants.

The definition of circulatory death is contentious when it comes to DCD because of the ambiguity of the word "irreversible", particularly in the context of WLST. Does irreversible mean that the heart and circulation cannot be restarted, or merely that they will not be?

Those who argue that intent is important say that death may be declared after a period of time has elapsed during which spontaneous recovery of cardiac function is thought not to occur. Although there is a paucity of information in the literature, it has been suggested that autoresuscitation does not occur beyond 2 minutes of circulatory arrest.[6] This determines the lower limit of the 2–5 minute range recommended by a number of DCD consensus statements.[6-8] Controversially, a period as short as 75 seconds has been stated to be sufficient and used in the Denver Children's Hospital paediatric heart transplant DCD program.[9]

This relatively short duration of minutes is in keeping with the usual practice for declaring death when cardiopulmonary resuscitation is either not medically appropriate or is declined by the patient, and includes the situation of WLST in dying patients. It would be nonsense in such situations to

be able to declare death only after a full attempt had been made to restore the circulation through cardiopulmonary resuscitation, or after a protracted period of waiting.

Others argue that irreversible means "that which cannot be reversed" and suggest that a period considerably longer than 2–5 minutes is required, because circulatory arrest is reversible within this time frame. Many patients who suffer a cardiac arrest of duration longer than 2–5 minutes undergo successful cardiopulmonary resuscitation, and patients who have deep hypothermic cardiac arrest to facilitate cardiovascular surgery would certainly not be considered dead.

An extension of this argument is the suggestion that brain death is the only true death and, in effect, the final common pathway. Declaration of death after circulatory arrest is only reasonable because it culminates in death of the brain.[10,11] Were one to adopt this point of view, then it follows that a longer period of cardiorespiratory arrest would be required before death could be declared. This duration is difficult to define but should be the time in which irreversible neurological damage and, in effect, brain death will have occurred.

Of further difficulty is the issue of heart transplantation from DCD donors. If a heart can be taken and successfully restarted in a recipient, does this mean that cessation of cardiocirculatory function in the donor was not irreversible and, in effect, negate the determination of death in the donor? Or should the requirement of irreversibility be restricted to circulation within the donor?

Even more counterintuitive is the practice in some countries of placing patients who have been declared dead based on cardiocirculatory criteria on full or partial (cerebral circulation excluded) extracorporeal membrane oxygenation (ECMO) until consent for donation can be obtained from next-of-kin and the logistics of organ procurement arranged. Of particular concern is the use of full ECMO, in which cerebral perfusion and consciousness may be restored.

As the need to source scarce organs for transplantation continues, the boundaries of accepted practice in death determination and organ procurement continue to be extended. It is vital that the ongoing debate about these issues in the medical and public arenas does not diminish confidence and trust in organ donation processes. Clinicians have a responsibility to the community not only to facilitate organ donation and transplantation when feasible and appropriate, but also to care for and maintain the dignity of the dying.

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