Predictors/Outcomes

Determination of death after circulatory arrest by intensive care physicians
A survey of current practice in the Netherlands

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ABSTRACT

Purpose: Determination of death is an essential part of donation after circulatory death (DCD). We studied the current practices of determination of death after circulatory arrest by intensive care physicians in the Netherlands, the availability of guidelines, and the occurrence of the phenomenon of autoresuscitation.
Methods: The Determination of Cardiac Death Practices in Intensive Care Survey was sent to all intensive care physicians.
Results: Fifty-five percent of 568 Dutch intensive care physicians responded. Most respondents learned death determination from clinical practice. The most commonly used tests for death determination were flat arterial line tracing, flat electrocardiogram (standard 3-lead electrocardiogram), and fixed and dilated pupils. Rarely used tests were absence pulse by echo Doppler, absent blood pressure by noninvasive monitoring, and unresponsiveness to painful stimulus. No diagnostic test or procedure was uniformly performed, but 80% of respondents perceived a need for standardization of death determination. Autoresuscitation was witnessed by 37%, after withdrawal of treatment or after unsuccessful resuscitation.
Conclusions: Extensive variability in the practice of determining death after circulatory arrest exists, and a need for guidelines and standardization, especially if organ donation follows death, is reported. Autoresuscitation is reported; this observation requires attention in further prospective observational studies.

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1. Introduction

The use of organs from donation after circulatory death (DCD) donors is increasing in many countries. Donation after circulatory death, also known as donation after cardiac death or non–heart-beating donation, has become an established strategy to offer donation to more intensive care patients, expand the donor pool, and reduce the waiting list for transplantation [1]. Most DCD donors are patients admitted to the intensive care unit (ICU) who die after withdrawal of life-sustaining treatment (controlled DCD [cDCD]) [2]. Organs from cDCD donors are subjected to a period of warm ischemia, the period between the cessation of circulation and the initiation of preservation measures, which adversely affects transplant outcome [3]. To minimize the warm ischemic damage, it is paramount to initiate organ preservation as soon as possible after the patient's death. A fundamental principle within the context of organ donation is the "dead-donor rule": organs cannot be removed until death has been declared [4]. The determination of circulatory death and a subsequent obligatory no-touch period to ensure the permanent death are an essential part of

cDCD [5]. However, in contrast to the criteria for brain death, which are generally well defined and accepted with clear protocols, clearly defined criteria for determination of circulatory death are so far not available [6].

A review of contemporary international guidelines shows the currently existing variability in the determination of death after cardiac arrest [7], resulting in an ongoing discussion about the determination of cardiac death within the context of organ donation [8-11]. The main issues identified relate to the irreversibility of the loss of cardiocirculatory function, the exact moment of death, and the concern about the possibility of spontaneous resumption of a cardiac rhythm after asystole with circulatory output, termed *autoresuscitation* (AR) [12-14].

The primary objective of this study was to describe the current practices of determination of death after cardiac arrest in adults in the Netherlands by intensive care physicians. Secondary objectives included to identify the policies and guidelines which are available to physicians, to determine the perceived need for standardization of practice, and to determine the reported occurrence of AR.

2. Materials and methods

All intensive care physicians caring for adult patients in the Netherlands were approached by mail using information from the

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Dutch Intensive Care Society, combined with information retrieved from Web sites of the hospitals. The medical manager of each department was contacted by telephone or by e-mail, to explain the study and ask permission to send the questionnaire to all staff intensivists.

To assess determination of death practice, the Determination of Cardiac Death Practices in Intensive Care Survey was used [15,16]. Translations into Dutch language consisted of 2 independent forward translations, a reconciliation, a backward translation, and then another reconciliation. The translated questionnaire was evaluated by 4 intensivists and 4 transplant coordinators, who were not involved in the study. Minor adjustments were made to individual questions, and the questionnaire was again evaluated by 4 other independent intensivists. The final questionnaire consisted of 6 demographic questions, 8 questions about the determination of death, 1 question about AR with subquestions about witnessed AR, and statements about standardization of practice. The physicians were asked which of 11 "tests" they used for the determination of death after cardiac arrest.

For 7 questions, a multiple-choice format for answers was used, to facilitate those surveyed, to minimize the time required for its completion, and to simplify data collection. Ample space for narrative comments was provided for 8 questions.

Three questions were constructed using a 5-point Likert scale, ranging from never to always.

The survey was distributed between November 2012 and May 2013. The questionnaire was sent with a self-addressed return envelope. If the questionnaire was not returned within 6 weeks, a reminder was sent. Names were removed from the list when questionnaires were returned, when physicians proved to be retired, or when physicians had withdrawn from intensive care practice. The study was performed in agreement with the code of conduct on the use of data in health research, put forward by the Dutch Federation of Biomedical Scientific Societies [17].

Ethical approval for the study was waived by the medical ethical examination committee of the Maastricht University Medical Center. The respondents consented to participate to the study by returning the completed questionnaire.

2.1. Statistics

Each questionnaire was numbered and linked with a respondent identifier to track the responses. Descriptive summaries of responses to each question were recorded. For categorical questions, frequencies and percentages were tabulated. For numeric questions, means, medians, and ranges were tabulated. Narrative comments were transcribed verbatim and presented in groups. Analysis of these narrative comments was performed. The proportion of nonresponse for each question was recorded. SPSS version 16.0 for Windows was used for the analysis (SPSS, Chicago, IL).

3. Results

3.1. Demographics

All approached medical managers agreed to sending the questionnaire to their staff intensivists; 582 staff ICU physicians were approached.

The response rate was 55% (311/568); 14 were excluded (not practicing as intensivist, retired, or duplicated). The most frequent speciality training of participating intensivists included internal medicine and anesthesia. Most respondents (72%) were working in a university hospital, followed by a large teaching hospital (41%) and a district hospital (32%). Fifty percent of the respondents worked in a level 3 ICU, the highest ICU level (range, 1-3). Physicians had a median of 7 years of experience as an intensivist (range, 0-40 years). The numbers of beds in the ICUs ranged from 3 to 51 with a median of 16 beds (Table 1.)

3.2. Determination of death practice

The reported frequency of personally performing determination of death after circulatory arrest ranged from 0 to 52 times per year (median, 10). Seventy-nine of 311 respondents reported a frequency of determining cardiac death more than 20 times per year. Many respondents (44%) were not aware of any guideline or written policy for the determination of death after circulatory arrest in their hospital. There was a local guideline or written policy according to 28% of responses. Most of the time, the criteria were learned through clinical experience (learning by doing or experiential learning, 85%), followed by informal training (mentor/modeling) (67%). Twenty-five percent of the respondents used nonlocal guidelines or derived guidance on determination of death from the literature (19%).

3.3. Tests for determination of death

Fig. 1 lists the percentage of tests used, ranging from "never" to "always" used. Flat electrocardiographic (ECG) tracing (standard 3-lead ECG) was the test most commonly used assessment to determine death, followed by flat arterial line tracing and the assessment of fixed and dilated pupils. Clustering the "always" and "usually" categories, the top 3 tests were flat arterial line, flat electrocardiogram, and fixed and dilated pupils. Tests that were "never" and "rarely" used were absence of pulse by echo Doppler examination, absent blood pressure by noninvasive monitoring, and unresponsiveness to painful stimulus. Combinations of methods most frequently used for determination of death are clustered in Table 2. Seventy-five percent of respondents reportedly "always" performed 2 to 5 tests.

Table 1
Demographic characteristics of respondents (n = 311)

Characteristics	% of respondents
Background (n = 311)	
Internal medicine	49.5
Anesthesia	39.5
Surgery	4.5
Neurology	2.3
Cardiology	1.9
Other	1.6
No. of years practicing in ICU (n = 309)	
Median	7
Min	0
Max	40
Type of ICU patients (n = 311)	
Surgical	98
Internal medicine	98
Cardiological	92
Neurologic	92
Trauma	77
Thoracic surgical	55
Neurosurgical	40
Pediatric	11
Other	11
Type of hospital (n = 310)	
Large teaching	41
District	32
University	27
Level of intensive care (n = 310)	
3	50
2	28
1	21
No. of beds (n = 310)	
Median	16
Min-max	3-51
No. of times/year of determining death after cardiac death	
Median	10
Min-max	0-52