Donors After Circulatory Death: Theme of Present or a Future? The Research in West Poland

Edyta Skwirczyńska[d,*], Oskar Wróblewski[a], Natalia Serwin[b], Adam Fenc[c,d], and Marek Ostrowski[d]

[a]Department of History of Medicine and Ethics, Pomeranian Medical University of Szczecin, Szczecin, Poland; [b]Department of Microbiology and Immunology, Pomeranian Medical University of Szczecin, Szczecin, Poland; [c]Department of History of Medicine and Ethics, Pomeranian Medical University of Szczecin, Szczecin, Poland; and [d]Department of General Surgery and Transplantation, Pomeranian Medical University of Szczecin, Szczecin, Poland

ABSTRACT

The most urgent issue in transplantology nowadays is to increase the number of donors as replacement of lungs, heart, and liver in end-stage disease remains the only available method to save patients. Donors after brain death (DBD), these after irreversible cessation of brain function, represent 95% of all donors. On the contrary, donors after circulatory death (DCD), namely donors after irreversible detention of circulation, a group of great potential, is totally unused. The survey was done among 500 people from the medical staff of the intensive care unit and intensive cardiological care where the probability of receiving anonymous donation after circulatory death is the highest, yet only 368 people had completed the survey and their cases were taken into consideration as far as the study was concerned. The survey was conducted in the form of a self-projected questionnaire based on the Hospital Attitude Survey. The study showed that 98.4% of respondents accept the transplant. As many as 93.1% of people did not know the Maastricht classification, and 57.5% claimed that in Poland there is permission to take organs from people with a nonbeating heart. Ninety percent of respondents expressed their willingness to participate in training, and 70% of them were interested in the subject of the training presented in the questionnaire. At a time of such immense need for organs and such a huge disparity in the number of donors and recipients, DCD type of transplantation may be an alternative for patients whose waiting time for donation from a DBD would total a few years.

THE most urgent issue in transplantology nowadays is to increase the number of donors as replacement of lungs, heart, and liver in end-stage disease remains the only available method to save patients. Treatment of end-stage renal failure would also have an unfavorable prognosis but for transplantation. Transfusions are immense burden for the patients. A deficient number of accessible organs is the main constraint and obstacle transplantology faces in countries all around the world [1].

Transparent vasculature and the possibility of uncomplicated assessment of its function, namely the excretion of urine, made the kidney the first transplanted organ. The operation was performed by Joseph Murray in monozygotic twins in 1954 [2]. Michon and Hamburger in 1952 in Paris performed the first kidney transplant; however, the rejection took place after 3 weeks [3]. In 1966, Tadeusz Bross made the first attempt to transplant a kidney in Poland; nevertheless, the first successful one was performed by Jan Nielubowicz in the same year. Professor Stanisław Zieliński was the first person who performed a simultaneous transplantation of a pancreas and a kidney; the surgery was unsuccessful. Professor Zieliński made also the first attempt to transplant a liver in Poland in 1987; his first patient died after a few days because of emboli in the hepatic artery. Jan Moll attempted to transplant a heart in 1969; however, due to advanced pulmonary disease, the patient did not survive [4]. Unfortunately, Poland is one of the last countries in

*Address correspondence to Dr Edyta Skwirczyńska, Department of History of Medicine and Ethics, Pomeranian Medical University of Szczecin, Rybacka 1, 70-204 Szczecin, Poland. Tel: +48 508 359 596. E-mail: edytas@pum.edu.pl

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Europe as far as number of organ donations is concerned. Spain, France, and Belgium are the leading countries [5].

Donors after brain death (DBDs), these after irreversible cessation of brain function, represent 95% of all donors. On the contrary, donors after circulatory death (DCDs), namely donors who are after irreversible detention of circulation, a group of great potential, is totally unused. Educating hospitals' personnel about the second mentioned group of donors may increase the number of successful transplantations. Doctors and nurses who work in the intensive care ward and intensive cardiac care ward, when better informed, may identify donors who died as a result of the mechanism of irreversible detention of circulation more often and contribute to the achievement of a higher percentage of DCDs. Statistics from 2015 convey that in 2015 in Poland, 3 potential DCDs were reported; it constituted 0.4% of all donations [6].

As far as the history of DCDs is concerned, in 1968, before the definition of brain dead was coined at Harvard University, organs destined for transplantation had been harvested from living or deceased donors who were diagnosed with cardiac arrest (namely, those who developed irreversible cardiac arrest and did not have ability to breathe—these 2 were crucial factors, a basis to qualify the people as donors). These definitions—"donor after cardiac death (DCD)" or "non-heart-beating donor (NHB)"—were used. Currently, the term DCD means "donor after circulatory death." A constant shortage of organs for transplantation coaxed scientist to attempt harvesting organs from donors whose death occurred in a mechanism of circulatory arrest; therefore, in many countries, interest in the possibility of this kind of organ procurement increases. At first, doctors' main focus was on kidneys; nevertheless, they also became interested in other organs less tolerant to warm ischemia, such as the lungs, pancreas, and liver.

Transplantation is governed by the law of the country. The procedure is determined by specific legal regulations that allow it to happen. The regulations are established individually by each country. In the European Union, one can distinguish an opt-in system in which obtaining the donor card (authorization of organ donation) is necessary and opt-out systems that assume presumed consent of the deceased [7]. In the United States, Great Britain, and Germany, the donor card is mandatory to harvest organ, tissue, or cells [8]. In Poland, as far as living donors are concerned, candidates for donors, by virtue of law, need to present a doctor the written declaration of consent to allow him or her to harvest organs, tissue, or cells and to perform transplantation to a patient, who is also appointed by the candidate for donation. There is no need to appoint a receiver in the case of harvesting bone marrow or regenerative tissue of a different kind [9]. On the other hand, in case of deceased donors, an opt-out system is applied (the rule of presumed consent) in which organ donation may take place, unless there are proofs of previous objection by the potential donor [7].

In 1995 in Maastricht, during the First International Workshop on DCD, 5 types of donors were identified and described. Types I, II, IV, and V are allowed in Poland, as far as legislation is concerned. Type I includes deceased donors who passed away before admission to the hospital. Type II includes those who passed away because of irreversible circulatory arrest (hemorrhage in central nervous system or heart disease, etc). Type IV are patients who are brain dead. Type V includes patients who died in the hospital [10]. Type III concerns patients whose central nervous system is severely damaged; nevertheless, they do not meet the criteria of brain death. The prognosis is poor and in spite of the fact that brain death does not occur, when the family agrees, life support may be withdrawn. The patient dies in a mechanism of circulatory arrest, and the possibility of organ harvest is not even considered as organ procurement from type III patients is not allowed in Poland [11]. In Spain, there has been remarkable growth in the frequency of DCD transplantations after Maastricht type III was approved in 2012. Thus, last year, Spain was the country with the largest number of DCD procedures worldwide: 10.6% donors [12].

Programs that would contain coherent procedures and the cooperation of units, followed by the acceptance of the medical society, may lead to prompt implementation of DCD-related procedures. Generally accepted access to organs from donors with irreversible circulatory arrest could significantly contribute to the elimination of the shortage of organs for transplantation.

MATERIAL AND METHODS

The study used a questionnaire based on Hospital Attitude Survey 1. It was designated for doctors and nurses from those units in which the identification of DCDs is most plausible. The questionnaire consisted of 23 questions; 20 of them were closed ones, and 3 of them were open ones in which the respondent was free to express his or her opinion. The questions tested the knowledge of procedures regarding the organ procurement and care of DCDs. The questionnaire also checked whether the personnel were competent enough to identify DCDs and whether the personnel were familiar with provisions of the Maastricht classification of DCDs. The research covered 500 employees of hospitals in the West Pomeranian, Pomeranian, and Lubuskie voivodeships; 368 returned the questionnaire. The study did not reject incomplete questionnaires; information on the number of respondents who marked the same answers in individual questions was included in the statistical description. The study covered medical personnel from intensive care units and intensive cardiac care units. The selection of units was determined by the highest probability of contact with potential donors after irreversible cardiac arrest (DCD). The sample included women (N = 282, mean = 42.50, standard deviation = 8.23) and men (N = 86, mean = 40.59, standard deviation = 9.50) working as doctors and nurses at the above-mentioned hospital wards. The questions in the questionnaire dealt with issues related to transplants as a treatment option [10,11,13].

Table 1. Choice of Criteria to Declare Brain Death With Division Into Sex and Professional Position

Sex	No.	%
Woman		
Neurologic criteria	223	42
Circulatory criteria	38	7
Both criteria	21	4
Overall	282	53
Man		
Neurologic criteria	68	37
Circulatory criteria	10	5
Both criteria	10	5
Overall	86	47
Professional position		
Doctors		
Neurologic criteria	162	53
Circulatory criteria	10	3
Both criteria	10	3
Overall	182	59
Nurses		
Neurologic criteria	118	26
Circulatory criteria	41	9
Both criteria	27	6
Overall	186	41

RESULTS

Statistical analyses were performed using the IBM SPSS Statistics 23 package (IBM SPSS Statistics for Windows, Version 23.0, Armonk, NY), which was used to analyze basic descriptive statistics and to check the χ^2 test. A level of significance below $P < .05$ was statistically significant. Statistical analysis was carried out using the χ^2 test. Statistically significant relationships between the professional position of the examined persons and their knowledge of the criteria necessary for the identification of a potential DCD were checked. The conducted analysis turned out to be statistically significant. There is a weak correlation between professional position and death criterion, Cramer's V (0.21). The professional position certainly has an impact on the death criteria. In the next study, it was checked whether there were significant statistical relationships between the professional position of the respondents and their knowledge of transplantation from donors who died as a result of irreversible cardiac arrest. The conducted analysis also turned out to be statistically significant. Variables such as occupational status and the percentage of donors in other countries are not independent. There is a strong correlation between Cramer's V variables (0.82). The study showed that the perception of the organ donation potential depends on the professional position of the medical staff. Unlike nurses, doctors do not see the potential of transplantation from donors after irreversible cardiac arrest. Only 6 out of 118 doctors who responded to the questionnaire indicated that, in their opinion, the percentage of donors after irreversible cardiac arrest in other countries ranges from 25% to 50%. Among the nurses' group, as many as 104 indicated that the percentage of DCDs in other countries ranged from 25% to 50%.

Table 2. Comparison of Knowledge of the Procedures Resulting From the Law and Concerning Organ Procurement From Donors With Nonbeating Heart With Division Into Sex and Professional Position

Sex	No.	%
Woman		
Yes	46	16.3
No	232	82.3
Overall	278	98.6
No response	4	1.4
Overall	282	100
Man		
Yes	9	10.5
No	71	82.6
Overall	80	93.0
No response	6	7.0
Overall	86	100
Professional position		
Doctors		
Yes	19	10.4
No	155	85.2
Overall	174	95.6
No response	8	4.4
Overall	182	100
Nurses		
Yes	36	19.4
No	148	79.6
Overall	184	98.9
No response	2	1.1
Overall	186	100

The study showed that 98.4% of respondents accept transplant as a treatment method. Analysis of attitudes revealed that 79% of respondents declared acceptance of neurologic criteria as adequate to diagnose death in the case of a potential organ donor, 12% of respondents indicated circulation criteria, and only 9% declared both criteria as suitable for the diagnosis of death. A significant percentage of respondents (79%) do not accept equivalent consideration of cardiovascular and neurologic criteria as suitable for diagnosing the death of a potential donor. Table 1 presents data concerning the choice of criteria of death made by medical personnel, taking sex and professional position into account. Table 2 presents knowledge of procedures with division including sex and professional position. The conducted research showed that the majority of those surveyed do not possess knowledge of procedures concerning organ procurement from donors with nonbeating hearts. Despite the fact that surveyed personnel were segregated, taking professional position and sex into account, any differences in the knowledge of any of these groups were not proved.

Despite the declarations of knowledge of DCD and non-heart-beating donor terms, the vast majority of respondents (93.1%) did not know the Maastricht classification, and 84.5% did not know the procedures related to the identification of DCDs. The main organs mentioned by the respondents as those that could qualify for DCD donation

Table 3. Training Preferences With Division Into Sex and Professional Position

Sex	Want it	Don't want it
Female		
Clinical management of donor	45 (16.1%)	237 (83.9%)
Coordination of organ procurement	37 (13.2%)	245 (86.8%)
Donors with nonbeating heart	99 (35%)	183 (65%)
Conversation with family	74 (26.1%)	208 (73.9%)
Male		
Clinical management of donor	23 (26.7%)	63 (73.3%)
Coordination of organ procurement	15 (16.8%)	71 (83.2%)
Donors with nonbeating heart	39 (45%)	47 (55%)
Conversation with family	24 (28.1%)	62 (71.9%)
Professional position		
Doctors		
Clinical management of donor	36 (19.6%)	146 (80.4%)
Coordination of organ procurement	26 (13.8%)	156 (86.2%)
Donors with nonbeating heart	88 (48%)	94 (52%)
Conversation with family	45 (24.7%)	137 (75.3%)
Nurses		
Clinical management of donor	49 (26.2%)	137 (73.8%)
Coordination of organ procurement	30 (16.2%)	156 (83.8%)
Donors with nonbeating heart	60 (32%)	126 (68%)
Conversation with family	55 (29.5%)	131 (70.5%)

were kidneys (32%), the liver (19%), and corneas (22%). More than half of the respondents did not know if there was a difference in the risk of acute rejection of the kidney taken from the DCD and that harvested from the DBD. A larger percentage of respondents indicated that there were no cases of identifying the donor after irreversible cardiac arrest in their unit in the last calendar year. Ninety percent of respondents expressed their willingness to participate in training, and 70% of them were interested in the subject of the training presented in the questionnaire. Forty percent of respondents declared a willingness to participate in the training for identification of donors with a "beatless" heart. The training in interviewing the potential donor's family was less popular (< 30%). Table 3 presents training preferences with division into sex and professional position. Studies have shown that the optimal training time is 2 to 3 hours as training sessions carried out at the workplace in the morning. A helpful solution proposed by respondents regarding the notification of potential organ donors was social education and training of medical personnel (Fig 1).

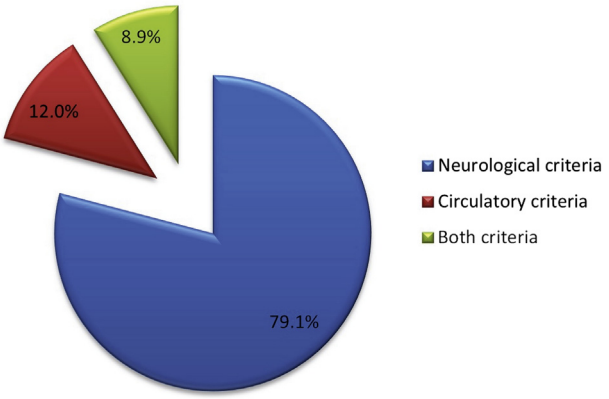

Fig 1. Which criteria are appropriate to diagnose death in case of potential organ donor?

DISCUSSION

The main factors associated with the organ procurement and identification of donors are goodwill, knowledge, and qualifications of employees of intensive care units and intensive cardiac care departments. A training program that was mandatory from 2010 to 2018 was the European Training Program on Organ Donation, which was conducted by PolTransplant, a center specialized in the organization and coordination of transplantation in Poland, included mainly the identification of brain death; identification and qualification of deceased organ donor; the care of deceased donor; conversation with the family of the deceased; and organization, procurement, and transplantation. The program did not include DCDs as a separate group; therefore, insufficient knowledge of medical personnel concerning transplantation and organ procurement from DCDs, despite participation in training, may result from this fact. Concentration on DCDs as a separate group is important because, in contrast to DBDs, in DCDs it is necessary to focus mainly on the speed of organ procurement and logistics. An ordinance by the Minister of Health amended the transplant law of August 9, 2010, to be more specific in the criteria and the formula of declaration of irreversible cardiac arrest. Despite the fact that currently the mentioned law defines the manner and guidelines of diagnosing the irreversible cardiac arrest before proceeding to harvest cells, tissue, or organs and also considers particular situations and contains detailed protocol of diagnosing irreversible detention of circulation, the knowledge about DCD among medical personnel is scarce.

The attitude of medical personnel about the idea of transplantation is extremely important. As far as the psychological approach is concerned, a difficult moment for medical staff is the situation in which the effort made to save the patient's life goes to waste at the time of his death. Referring to the results of research carried out in other European Union countries and other countries around the world, there are noticeable difficulties and significant differences in personal attitudes toward the identification of organs in 2 types of donors: those after the irreversible cessation of brain function and donors after irreversible cardiac arrest. The cohort population was based on the potential donors of a controlled type of DCD in the Donor of the Donation Program of Life, which included eastern Pennsylvania, southern New Jersey, and Delaware. Based on a census from 2000, this area covered 10.2 million Americans or 3.62% of the United States population [14]. The annual survey of 130 out of 21,802 deaths in the 50 studied hospitals were potentially eligible DCDs. Out of these potential DCDs, clinicians identified 108 patients (49 optimal and 59 nonoptimal, 83.1%) before Organ Procurement Organization (OPO) and

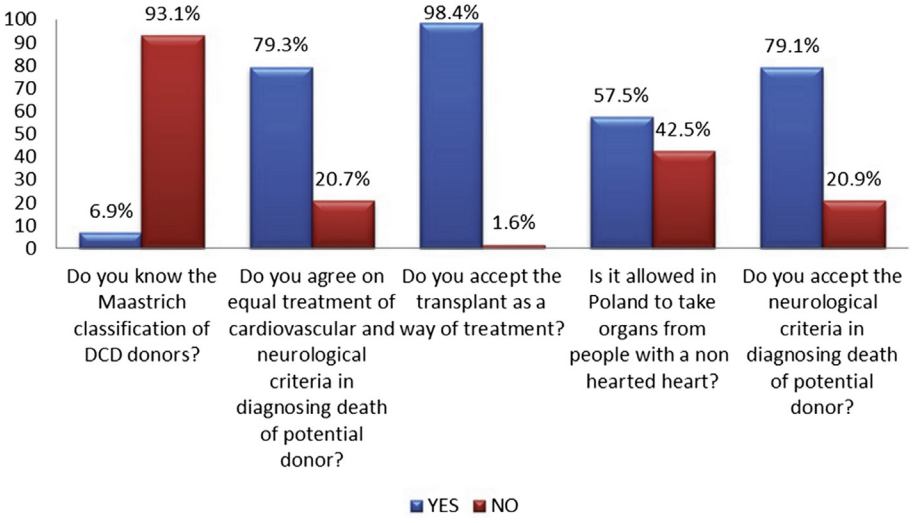

Fig 2. Research about knowledge medical personnel on DCDs.

before discontinuing life-support therapy. Among 108 potential DCDs who were identified and sent back, 108 organs were actually transplanted from 50 donors (2.16 organs per donor). The lack of transplantation from the other 58 identified potential donors was due to family refusals or because the organs were considered unsuitable for transplantation at the time of recovery [15]. In Belgium, Vincent and his colleagues from University Libre de Bruxeles carried out a study using a short questionnaire that defined the attitudes and feelings of nursing staff in the intensive care unit with reference to established donors after the program of cardiac death. Despite several educational sessions, only 3% of nurses felt that they were adequately informed about DCD. Thirty-eight percent of nurses were less comfortable with DCD than with donation of DBD organs. Seventy-six percent of nurses needed additional information about DCD procedures [16,17]. With regard to the pilot study of Zellweger et al [18] on the experiences of the nurses and medical staff at university hospitals in Geneva, Polish medical staff answering open questions also focused on psychological aspects. Difficulties were related to family contact and criteria for the identification of a DCD (Figs 2 and 3).

CONCLUSION

In presented research, a general reluctance of medical personnel to training, regardless of professional position or sex of those surveyed, is noticeable. This fact may result from a complicated procedure connected with DCD procurement. There is no doubt that both more formalized and restrictive procedures may discourage personnel from these

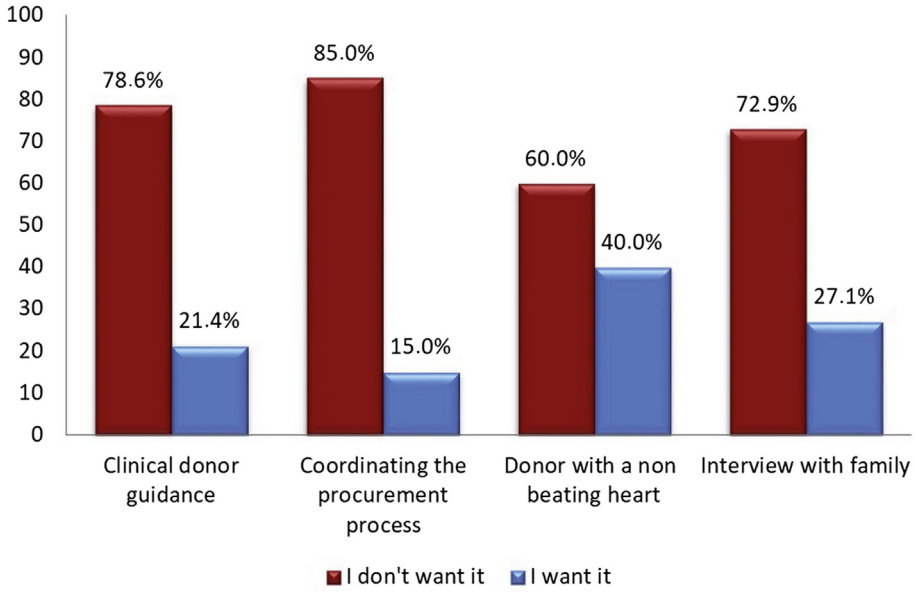

Fig 3. Percentage of responses willing to participate in trainings.

kinds of transplants. However, at a time of such immense need for organs and such a huge disparity in the number of donors and recipients, the DCD type of transplantation may be an alternative for patients whose waiting time for donation from DBD would total a few years. As research suggests [12], 1 of the most important aspects of transplantation from DCDs is the elaborate selection of donors and recipients and avoiding other risk factors. When all conditions are fulfilled, the survival rate of patients after DCD transplants is comparable to those after DBD transplants.

The success of the transplantation is based on the cooperation and professional knowledge of medical personnel involved in the process of identification and allocation of DCD. Regular training and psychological support is required for medical personnel so that they can feel suitably qualified. It will significantly increase comfort and affect the confidence in making decisions. Emphasis should be placed, above all, on the transparency of procedures to avoid possible doubts [18]. A detailed analysis of the requirements in terms of staff knowledge and training has created the need to prepare training sessions to disseminate knowledge about DCDs and organ transplantation from these donors. It is also necessary to familiarize staff with the procedures regarding the identification of them. The study also indicates the need for psychological support for medical personnel involved in the process of identification of DCDs.

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