Fourteen Years of Experience in Uncontrolled Organ Donation After Cardio-Circulatory Death

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ABSTRACT

Background. Since 1999, a protocol for uncontrolled donation after cardio-circulatory death (DCD) has been carried out in our institution. We aimed at evaluating those 14 years of local experience.

Methods. We reviewed the charts of uncontrolled donors from 1999 till 2013. Potential donors with a no-flow period less than 30 minutes were considered. Kidneys were perfused by the use of a double balloon triple lumen catheter after at least a 2-minute period of no touch. We analyzed grafts outcome and warm and cold ischemia times.

Results. Thirty-nine procedures were initiated: 19 were aborted because of family refusal (n = 7), medical reasons (n = 7), or canulation failures (n = 5) and 20 harvesting procedures were completed. Transplantation was considered for 35 kidneys (cold storage [n = 5] and hypothermic preservation system [n = 30]). The causes of withdrawal from transplantation were mostly macroscopic lesions (poor perfusion, macroscopic parenchyma or vascular lesions, or infectious risk). We transplanted 22 kidneys locally and 3 were shipped to another Eurotransplant center. Mean donor age was 40 ± 13 years. Among the 20 donors, 13 came from the emergency unit and 7 from the intensive care unit. Mean no-flow time for out-hospital management was 8.7 ± 3.6 minutes. Mean time of cardiopulmonary resuscitation was 71 ± 46 minutes. Mean cold ischemia time was 19 ± 5 hours. Primary nonfunction and delayed graft function occurred in 1 and 12 cases (4.5% and 54%), respectively. Graft survival was 86% at 1 year. Causes of graft loss during the entire follow-up were graft rejection (n = 3), ischemically damaged kidney (n = 2), and recurrence of focal segmental glomerulosclerosis (n = 1).

Conclusion. In our experience, uncontrolled donors represent a valuable source of kidney grafts, with a prognosis of graft function and survival similar to the literature. To increase the number of available DCD organs, new techniques, such as the use of Normothermic ExtraCorporeal Membrane Oxygenation (NECMO), as well as improvement of recruitment of out of hospital potential donors have to be considered.

ONE KNOWN answer to increase the number of organ donations is considering donation after cardio-circulatory death (DCD). According to Eurotransplant data, the waiting list for organ transplantation in Belgium is not yet significantly shortened. In 2013, 414 kidney transplantations were performed and 770 patients were still on the waiting list at the end of the year [1].

During the Maastricht symposium in 1995, donors after cardio-circulatory death were classified and most Belgian transplantation centers developed Maastricht category III controlled donation (donation after awaiting cardiac arrest).

In 1999, a protocol for uncontrolled Maastricht category II organ donation (donation after unexpected cardiac arrest) has been implemented in our institution. Kidney donation after sudden cardiac arrest and unsuccessful cardiopulmonary resuscitation (CPR) is a common practice in other European countries but is rarely performed in Belgium.

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This review aimed at evaluating the uncontrolled donation in one of the Belgian transplantation centers. This retrospective study reviewed 14 years of local experience in terms of donor conditions, adherence to procedure, graft survival, and general efficiency.

MATERIAL AND METHODS

We reviewed the charts of uncontrolled potential donors referred to a transplantation coordinator in our academic institution from 1999 until 2013. According to protocol, only patients presenting a refractory cardiac arrest who underwent CPR according to international guidelines without criteria for therapeutic use of extracorporeal membrane oxygenation were eligible. The physician in charge of such patients, either in the intensive care unit or in the emergency room, was the one initiating the procedure by contacting the transplantation coordinator. Potential donors aged younger than 65 years with a no-flow time (time between cardiac arrest and initiation of CPR) less than 30 minutes and a low-flow time (time of CPR) less than 120 minutes were considered. Patients with active cancer, known renal impairment, infectious disease, advanced metabolic disease, or severe atherosclerosis were excluded. The transplantation coordinator investigated donors' characteristics and consulted the national registry. After death certification and a period of no touch of at least 2 minutes, kidneys were perfused with histidine-tryptophan-ketoglutarate (Custodiol) by the use of a double balloon triple lumen catheter. The catheter was surgically inserted in the groin site. Organ procurement was performed after family consent in all cases. The patient was transferred to the operating theater and both kidneys were procured. Before 2005, kidneys were preserved by cold storage. Since 2005, kidneys are routinely preserved using hypothermic machine perfusion (Life Kidney Transporter Organ Recovery System).

Because of the uncontrolled characteristics of donation, a good appreciation of the graft and strict criteria were needed to use the procured kidney for transplantation.

We analyzed characteristics of the donor population, comparing the harvested procedures to the aborted ones. We evaluated warm ischemia time (time from cardiac arrest to cold flush), cold ischemia time (time from cold flush to kidney revascularization), and morbidity and mortality factors of the recipients.

Data are expressed as mean with standard deviation and/or percentages. All statistical analyses were performed using SPSS 20.0 (SPSS Inc, Chicago, Ill, United States). The statistical analysis consisted of a comparison using the chi-square test (for categorical variables) or Mann-Whitney *U* test (for continuous variables). Significance was accepted at $P < .05$.

RESULTS

During 14 years, from 1999 to 2013, 39 procedures were initiated either in the emergency room (n = 31) or in the intensive care unit (n = 8). Twenty-three (59%) potential donors underwent out of hospital management. Mean age of potential donors was 37 ± 13 years. Cause of death, no-flow time, and low-flow time are shown in Table 1.

Among the 39 initiated procedures, 19 (49%) were aborted: 7 (37%) family refusal (untraceable [n = 2], refusals [n = 5]); 7 (37%) medical reasons (long estimated ischemia time [n = 2], post-traumatic lesions [n = 5]); and 5 (26%) canulation failure. The other 20 procedures were harvesting procedures (Table 2). The donor conversion rate (effective donors/potential donors) was 51%. From the 40 potential kidneys evaluated for transplantation, 3 (8%) were discarded before removal (infectious risks [n = 2], ischemic lesion [n = 1]) and 12 (30%) were not transplanted after removal (infectious risks [n = 2], ischemic or parenchymal lesions [n = 10]). Among the 40 potential kidneys, 35 (88%) were preserved either by cold storage (n = 5) before 2005 or by hypothermic machine perfusion (n = 30) afterward. Finally, 25 (63%) kidneys were used for transplantation, 22 locally and 3 in another Eurotransplant center. Those were lost for follow-up.

Table 1. Characteristics of Uncontrolled Potential Donors (n = 39)

Age (y)	37 ± 13
Cause of death n (%)	
Trauma	20 (51.3)
Cardiac arrest	17 (43.6)
Cerebral hemorrhage	2 (5.1)
No-flow time (min)	5.5 ± 7.2
Low-flow time (min)	69.8 ± 43.2

According to charts, the kidneys conversion rate (transplanted kidneys/potential kidneys) was 32%.

Recipients' characteristics are shown in Table 3. Of the 22 kidneys locally transplanted, none were lost for follow-up. Mean recipient age was 52 ± 14 years; 15 were males and 7 females. The causes of initial renal disorders were mainly polycystic kidney disease (n = 6), focal segmental glomerulosclerosis (n = 3), glomerulonephritis (n = 3), severe arteriosclerosis (n = 2), or undetermined (n = 2). Isolated causes were interstitial nephritis, Cacchi Ricci disease on a unique kidney, lymphoma, vasculitis, diabetic nephropathy, and malformative syndrome. Outcome was analyzed according to morbid-mortality factors. Mean cold ischemia time was 19 ± 5 hours. Total ischemia time was 22 ± 5 hours. Mean length of follow-up was 4.9 ± 3.4 years. We experienced 1 patient with primary nonfunction (5%) and 12 with delayed graft function (55%). The mean value of recipient renal function evaluated based on creatinine level

Table 2. Comparison Between Donors: Harvested Procedures and Aborted Procedures

	Harvested Procedures (n = 20)	Aborted Procedures (n = 19)	*P*
Age (y)	40 ± 13	32 ± 12	.065
Before 2005 n (%)	4 (26.7)	11 (73.3)	.035
Since 2005 n (%)	16 (66.7)	8 (33.3)	
ER n (%)	13 (41.9)	18 (58.1)	.057
ICU n (%)	7 (87.5)	1 (12.5)	
Out of hospital* n (%)	10 (43.5)	13 (56.5)	.399
Cause of death n (%)			
Trauma	9 (45.0)	11 (55.0)	.627
Cardiac arrest	10 (58.8)	7 (41.2)	.613
Cerebral hemorrhage	1 (50.0)	1 (50.0)	.491
No-flow time (min)	8.3 ± 3.6	9.5 ± 11	.319
Low-flow time (min)	71 ± 46	67 ± 39	.910

Abbreviations: ER, emergency room; ICU, intensive care unit.
*Out of hospital management.