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B. Łągiewska
M. Pacholczyk
A. Chmura
L. Adadyński
M. Szostek
G. Michalak
K. Ostrowski
J. Wałaszewski
W. Rowiński

In situ perfusion and UW solution used for storage did not decrease the incidence of ATN in kidneys harvested from hemodynamically unstable donors

B. Łągiewska · M. Pacholczyk
A. Chmura · L. Adadyński · M. Szostek
G. Michalak · K. Ostrowski
J. Wałaszewski · W. Rowiński (✉)
Department of General and
Transplantation Surgery,
Warsaw Medical School,
Nowogrodzka 59,
02-006 Warsaw, Poland

Abstract The incidence of acute tubular necrosis ATN after cadaveric kidney transplantation in our centre has been in the range of 50%. A prospective study was carried out in 1991 and 1992 to assess the effect of in situ perfusion and hypothermic storage of kidneys harvested from brain-dead haemodynamically stable and unstable donors. Three litres of Ringer's solution were used for in situ perfusion. In 40 cases, the kidneys were stored in Euro-Collins (EC) solution and in the other 78 cases, in University of Wisconsin (UW) solution. Among the factors that could contribute to ATN, we analysed warm ischaemia time, anastomosis time and cold storage time. Function was considered to be delayed if the patient required posttransplantation dialysis. The donors were considered haemodynamically unstable when hypotension before harvesting was present (BP < 70 mm Hg over 2 h) despite high doses (> 15 μg/kg per minute) of dopamine or when cardiac arrest occurred at the time of harvesting and oliguria had been present for at least 2 h. Haemodynamically stable donors with a BP greater than 80 mm Hg had a normal diuresis. In all donors in this group the dose of dopamine was lower than 10 μg/kg per minute. The study showed that storage in UW solution did not influence the incidence of ATN in kidneys harvested from haemodynamically unstable donors. Differences observed in our study were due to haemodynamic status preceding donor nephrectomy and length of cold storage time.

Key words Transplantation
Kidney preservation · ATN
Donor hemodynamics · UW

Introduction

The influence of preservation methods on the early function of transplanted organs remains an important question in considering factors that lead to the development of ischaemic injury (besides endocrine, metabolic and particularly haemodynamic changes in the preagonal period). Data from most European and American centres show that the use of University of Wisconsin (UW) solution for perfusion and cold storage of cadaveric kidneys has decreased the incidence of posttransplant ATN [2]. However, in most of those cases the donors are haemodynamically stable. On the other hand, in Poland in approximately 70% of all cases kidneys are harvested from haemodynamically compromised donors and, therefore, the incidence of ATN remains very high. The

Table 1 Demographic data and results

Hemodynamic status of donor		Stable BP > 80 mm Hg Dopamine < 10 μg/kg per minute Normal diuresis		Unstable BP < 70 mm Hg Dopamine > 15 μg/kg per minute Oliguria/anuria	
Storage solution		UW	EC	UW	EC
No of cases		47	22	34	18
Age of donors (Y)	$X \pm SD$	30 ±12	29.3±10	29.9±11	29 ±11
Age of recipients (Y)	$X \pm SD$	37.8±11	39 ±11	42.4±10	33.5±9
Warm ischemia time (min)	$X \pm SD$	–	–	6.8±15	7.3±8
Cold ischemia time (h)	$X \pm SD$	25.9±8	29.1±6	26.7±7	31 ±9
Anastomosis time (min)	$X \pm SD$	30.8±8	32 ±11	32.5±8	32.5±10
Immunosuppression[a]		72	68	58.8	88.8
(% of recipients)[b]		25.5	32	38.2	11.1
HLA A+B+DR matches	$X \pm SD$	2.6±0.7	3.4±1	2.8±0.8	2.6±1.1
PRA max (%)	$X \pm SD$	17.8±26	19.4±25	21.4±26	17.3±26
ATN (+) % of recipients		31.9	54.5	61.7	66.6
Days of HD	$X \pm SD$	13.8±7	12.3±8	16.3±7	15.2±8

[a] Azathioprine, cyclosporin, steroids
[b] Azathioprine, cyclosporin, steroids, ATG

aim of this study was to compare the protective value of UW vs. Euro-Collins (EC) solution for cold storage of cadaveric kidneys obtained from haemodynamically stable and labile donors.

Materials and methods

This study was conducted on 121 kidneys harvested from 61 donors (criteria of donor classification in Table 1). Overall, 69 kidneys were procured from stable, and 52 from unstable donors. Harvested kidneys were perfused in situ with 3 l Ringer's solution and afterwards stored in a hypothermic UW solution in 81 cases and EC solution in 40 cases (see Table 1).

Of all recipients, 87 received immunosuppression consisting of cyclosporin, azathioprine and steroids, while in 34 cases the immunosuppression protocol also included ATG. Immediate graft function was defined by the prompt onset of diuresis with diminishing serum creatinine without necessitating haemodialysis with a few days after transplantation. ATN was determined by the need for even a single dialysis during the first 4 weeks after transplantation.

Results

The overall incidence of ATN, regardless of preservation solution, was 52%. Kidneys stored in UW solution took up immediate function in 52% of cases, while those stored in EC solution did so in 40% of cases. Of kidneys procured from stable donors, those stored in UW solution developed ATN in 36% of cases, while in the case of EC storage, 55% of recipients required posttransplantation dialysis. Kidneys from unstable donors, showed ATN in 65% of cases after storage in UW, and this incidence was not significantly different from the occurrence of ATN in kidneys procured from the same group of donors (B) and stored in EC solution (67%). According to the chi-square test, there was a statistically significant difference between kidneys harvested from stable and unstable donors and stored in UW ($P < 0.05$) while no such significance was found for EC preservation. In relation to the cold ischaemia time of transplanted kidneys, we found that in kidneys from unstable donors stored for less than 30 h (29 kidneys), there was a similar incidence of ATN regardless of preservation solution: 52% for UW, 50% for EC. In the case of 23 kidneys obtained from compromised donors and stored for over 30 h, 23% of UW-stored organs took up immediate function while with EC storage, 20% were immediately functioning grafts. In the case of stable donors, despite preservation time exceeding 30 h, the UW-stored kidneys showed immediate function in 53% of cases. There was a clear, statistically significant difference between kidneys procured from stable and unstable donors and stored in UW (40 and 77% with ATN, respectively).

Discussion

The comparison of the protective value of UW and EC solutions in relation to cadaveric kidneys shows little advantage of UW solution over EC solution if the donor is haemodynamically labile, regardless of preservation time [1]. In case of stable donors, UW cold storage solution offered significantly better protection of harvested kidneys. Clinically, one can expect a lower probability of ATN (which delays the diagnosis, and thus the treatment of graft rejection [2]) in kidneys procured from hemodynamically stable donors and stored in UW so-

lution. In conclusion, among the factors affecting early graft function, two should be considered of principal importance: hemodynamic stability of the donor and the time of cold storage.

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