Do Donor Age and Cold-Ischemia Time Have a Detrimental Effect on Early Pancreas-Allograft Function?

THOMAS SCHMID, ALFRED KÖNIGSRAINER, EKKEHARD STEINER, JOHANN KOLLER, AND RAIMUND MARGREITER

To study the impact of donor age and cold-ischemia time (CIT) on early graft function, we retrospectively divided the donors of 51 pancreas transplants performed between 1979 and 1987 at Innsbruck University Hospital into four groups according to donor age (>45 yr and <15 yr) and CIT (>8 h and <3 h). All organs were perfused with Eurocollins solution and stored at 4°C. Fasting blood glucose levels and total amount of pancreatic juice produced over the first 3 postoperative days were recorded to assess graft function. No statistically significant difference was found between groups 1 and 2 and between groups 3 and 4. From these data, it is concluded that with the preservation method used, CIT can without a doubt be extended to at least 12 h, and a maximum donor age similar to that for the kidney can be adopted. This might not only enlarge the donor pool but also facilitate distant organ procurement. *Diabetes* 38 (Suppl. 1):4–6, 1989

Significantly improved results of pancreas transplantation have brought about a distinct increase in the number of these transplants (1). To provide every needy diabetic patient with a vascularized graft, it will be necessary to make optimal use of all existing resources. Because many centers have been reluctant to accept elderly donors or longer cold-ischemia time (CIT) (2–4), we have analyzed our pancreas-transplant recipients with respect to donor age and CIT.

MATERIALS AND METHODS

Between December 1979 and December 1987, a total of 51 pancreas transplants were performed at Innsbruck University Hospital. The mean donor age was 26 (7–53) yr, and the mean CIT was 5.5 h (1 h 13 min to 13 h 11 min). To study the impact of donor age and CIT on initial graft function, four groups of donors were selected. Group 1: age >45 yr (n = 6; mean age 48, range 46–53 yr); group 2: age <15 yr (n = 7; mean age 13, range 9–14 yr); group 3: CIT >8 h (n = 6; mean CIT 9 h 43 min, range 8 h 10 min to 13 h 11 min); group 4: CIT <3 h (n = 8; mean CIT 2 h 24 min, range 1 h 13 min to 2 h 54 min). All groups were otherwise well matched with regard to sex, cause of brain death, time spent at the intensive care unit, hemodynamic situation, HLA mismatches, and anastomosis time (Table 1). Because all grafts were perfused in situ with 4 L Eurocollins solution, the first warm-ischemia time was ~0. With the exception of the first 5 transplantations, in which a segment consisting of body and tail was used, all transplants also included major parts of the head of the gland. Graft vessels were anastomosed to the external or common iliac vessels. With respect to management of the exocrine function, four surgical techniques were applied. In our first series, performed in 5 patients, the pancreatic duct was occluded before revascularization with an alcoholic prolamin solution (Ethibloc, Ethicon, Norderstedt, FRG). In the next 11 patients, pancreatic juice was diverted into a Roux-en-Y loop of jejunum; in the next 17 patients the pancreatic duct was occluded after several weeks (5), and in the remaining 18 patients, pancreatic secretion was drained into the bladder. In all other patients, except those with primary duct occlusion, pancreatic juice was temporarily drained to the exterior by a small catheter (feeding tube 8F 105 cm; Pharmaseal, Herstal, Belgium) inserted in the pancreatic duct. Prophylactic immunosuppression consisted of steroids and azathioprine in the first 2 patients; cyclosporin and steroids in the following 14; and cyclosporin, steroids, and azathioprine in the remaining patients. Further details of our surgical techniques and immunosuppressive regimens are described elsewhere (6).

For the assessment of initial graft function, mean fasting blood glucose levels and mean amounts of pancreatic juice were recorded over the first 3 postoperative days. During

From the Department of Transplant Surgery, and the Department of Anesthesiology, University Hospital, Innsbruck, Austria.

Address correspondence and reprint requests to Thomas Schmid, MD, Department of Transplant Surgery, University Hospital, A-6020 Innsbruck, Austria.

Downloaded from http://diabetesjournals.org/diabetes/article-pdf/38/Supplement_1/4/514006/38-1-s4.pdf by guest on 20 June 2024

TABLE 1
Donor characteristics of each group

	Group 1	Group 2	Group 3	Group 4
n	6	7	6	8
Sex (M/F)	4/2	4/3	3/3	5/3
Cause of brain death				
Trauma	3	3	3	5
CVA	3	4	3	3
Time in ICU (h)	56 (29–142)	60 (24–120)	51 (11–101)	60 (24–120)
Cardiac arrest	1	1	0	2
Transient severe hypotension	1	0	1	0
Positive inotropic support				
None		2	3	0
Low dosage	4	4	2	6
High dosage	2	1	1	2
HLA mismatches				
AB	2,7 (2–4)	2,7 (2–4)	2,8 (2–4)	2,9 (2–4)
DR	1,8 (1–2)	1,6 (1–2)	1,8 (1–2)	1,6 (1–2)
Anastomosis time (min)	28 (15–36)	33 (22–40)	31 (25–39)	31 (25–39)
CIT (min)	211 (73–425)	296 (171–586)	583 (490–791)	144 (73–174)
Age (yr)	48 (46–53)	13 (9–14)	19 (12–26)	29 (14–53)

Group 1, donor age >45 yr; group 2, donor age <15 yr; group 3, cold-ischemia time (CIT) >8 h; group 4, CIT <3 h. CVA, cerebrovascular accident; ICU, intensive care unit.

this period, patients were not allowed oral food intake. For parenteral feeding, 10% glucose with electrolytes was administered according to urinary output and blood chemistry. In two patients, the pancreatic duct was too small for intubation, and in another five patients, early catheter dislocation prevented pancreatic juice collection. This is the reason why quantitative measurement of pancreatic juice was performed in only five patients in group 1, four in group 2, five in group 3, and seven in group 4.

For statistical analysis, the Mann-Whitney *U* test was performed and was supplemented by a correlation analysis (7).

RESULTS

The results are summarized in Fig. 1. In the donor group >45 yr old, mean blood glucose levels were between 78 and 223 (153) mg/dl compared to 72 and 292 (114) mg/dl in the group <15 yr old. Mean blood glucose levels were between 83 and 170 (100) mg/dl in group 3 (CIT >8 h) and between 78 and 245 (129) mg/dl in group 4 (CIT <3 h). The Mann-Whitney *U* test revealed no statistical difference between the groups compared. Similar results were found with respect to pancreatic juice production. The mean amount of pancreatic juice produced over the first 3 days after transplantation was 56–410 (195) ml in group 1, 73–148 (113) ml in group 2, 73–523 (134) ml in group 3, and 93–410 (190) ml in group 4. In this regard, no statistical difference was found between groups 1 and 2 and groups 3 and 4. Additional correlation analysis including all 51 patients did not show any statistical difference.

DISCUSSION

To avoid ischemic damage, many centers have tried to keep CIT as short as possible, at least <8 h (8,9). On the other hand, 50 yr was generally considered as the upper age limit. For these two reasons, the potential donor pool was significantly restricted, because special air transport was not felt to be justified for the pancreas, and therefore distant organ procurement or exchange became very difficult if not impossible. As our results demonstrate, CIT may be prolonged for up to 12 h even when Eurocollins solution is used for initial organ perfusion. This should allow enough time for organ harvesting in a peripheral hospital and surface transport. Because not only extended periods of CIT but also an age of >50 yr did not have any noticeable detrimental effect on early graft function, we would recommend adoption of an upper age limit similar to that for the kidney. Because preservation solution allowing a CIT of up to ≥24 h is already in clinical use (10), simplifying the logistics associated with pancreas supply should soon be possible, thereby enabling

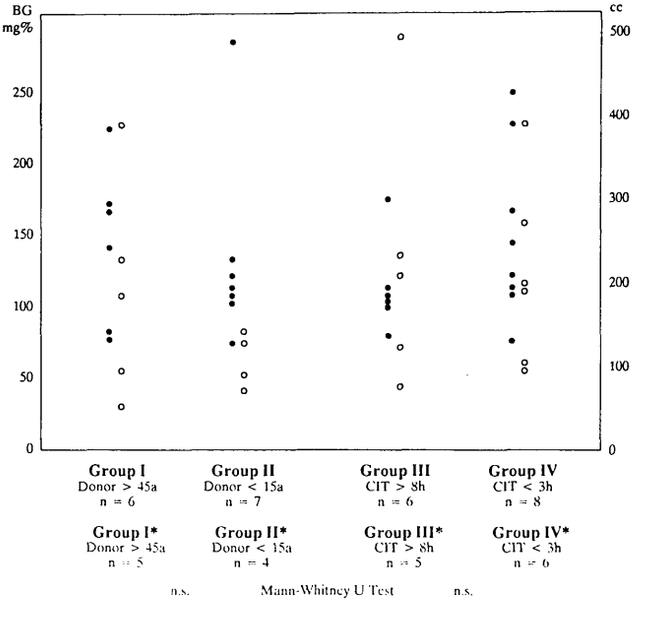

FIG. 1. Mean blood glucose (BG) levels of groups 1–4 (I–IV) (●; in mg/dl) and mean amount of pancreatic juice (○; in ml) of all groups (I*–IV*). CIT, cold-ischemia time. Comparisons were not significant by Mann-Whitney *U* test.

Downloaded from http://diabetesjournals.org/diabetes/article-pdf/38/Supplement_1/4/514006/38-1-s4.pdf by guest on 20 June 2024

the medical community to meet the steadily increasing demand for this organ.

REFERENCES

1. Sutherland DER, Moudry KC: Pancreas transplant registry report 1986. *Clin Transplant* 1:3–17, 1987
2. Dafoe DC, Campbell DA Jr, Merion RM, Rosenberg L, Rocher LL, Vinik AI, Vine AK, Turcotte JG: Pancreatic transplantation—University of Michigan. *Transplant Proc* 19 (Suppl. 4):55–62, 1987
3. Land W, Landgraf R, Illner WD, Abendroth D, Kampik A, Jensen U, Lenhart FP, Burg D, Hillebrand G, Castro LA: Clinical pancreatic transplantation using the prolamine duct occlusion technique—the Munich experience. *Transplant Proc* 19 (Suppl. 4):75–83, 1987
4. Sollinger HW, Stratta RJ, Kalayoglu M, Belzer FO: The University of Wisconsin experience in pancreas transplantation. *Transplant Proc* 19 (Suppl. 4):48–54, 1987
5. Margreiter R, Königsrainer A, Steiner E, Schmid T, Pernthaler H: Improved results of pancreatic transplantation with the delayed duct occlusion technique. *Transplant Proc* 20 (Suppl. 1):889–90, 1988
6. Margreiter R, Steiner E, Königsrainer A, Spielberger M, Aigner F, Schmid T: Pancreas transplantation—the Innsbruck experience. *Transplant Proc* 19:33–6, 1987
7. Sachs L: *Angewandte Statistik*. Berlin, Springer-Verlag, 1979
8. Frisk B, Hedmann L, Andersson C, Blohmé I, Karlberg I, Nyberg G, Persson H, Brynger H: The pancreas transplant program—Gothenburg, Sweden. *Transplant Proc* 19 (Suppl. 4):29–32, 1987
9. Munda R, First MR, Weiss MA, Alexander JW: Pancreas transplantation—University of Cincinnati. *Transplant Proc* 19 (Suppl. 4):17–23, 1987
10. Belzer FO: Principles of organ procurement. *Transplant Proc* 20 (Suppl 1):925–27, 1988

Downloaded from http://diabetesjournals.org/diabetes/article-pdf/38/Supplement_1/4/514006/38-1-s4.pdf by guest on 20 June 2024