ELSEVIER

Three Types of Simultaneous Pancreas and Kidney Transplantation

T. Kobayashi, A.C. Gruessner, T. Wakai, and D.E.R. Sutherland

ABSTRACT

Purpose. The purposes of this study were to study and compare clinical and functional outcomes after simultaneous deceased donor pancreas and kidney transplantation (SPK DD), simultaneous deceased donor pancreas and living donor kidney transplantation (SPK DL), and simultaneous living donor pancreas and kidney transplantation (SPK LL).

Methods. From January 1, 1996 to September 1, 2005, 8918 primary, simultaneous pancreas and kidney transplantation (SPK) procedures were reported to the International Pancreas Transplant Registry. Of these, 8764 (98.3%) were SPK DD, 115 (1.3%) were SPK DL, and 39 (0.4%) were SPK LL. We compared these 3 groups with regard to several endpoints including patient and pancreas and kidney graft survival rates.

Results. The 1-year and 3-year patient survival rates for SPK DD were 95% and 90%, 97% and 95% for SPK DL, and 100% and 100% for SPK LL recipients, respectively ($P \geq .07$). The 1-year and 3-year pancreas graft survival rates for SPK DD were 84% and 77%, 83% and 71% for SPK DL, and 90% and 84% for SPK LL recipients, respectively ($P \geq .16$). The 1-year and 3-year kidney graft survival rates for SPK DD were 92% and 84%, 94% and 86% for SPK DL, and 100% and 89% for SPK LL recipients, respectively ($P \geq .37$).

Conclusions. Patient survival rates and graft survival rates for pancreas and kidney were similar among the 3 groups evaluated in this study.

SIMULTANEOUS deceased donor pancreas and kidney transplantation (SPK DD) is currently the standard method for treating uremic diabetic patients [1], and according to recent worldwide data, SPK DD is performed more commonly than pancreas after kidney (PAK) and pancreas transplantation alone (PTA) procedures [2]. Accordingly, SPK DD is associated with better long-term survival for uremic type 1 diabetic patients than any other therapy [3].

Simultaneous living donor pancreas and kidney transplantation (SPK LL) was performed for the first time in March 1994 [4]. Since then this procedure has been promoted for several reasons: possibility for lower doses of immunosuppression, fewer rejection episodes (over long-term follow-up, in particular), and optimal timing for transplantation [5,6]. Moreover, SPK LL can expand the donor pool in a context whereby 6.6% of diabetic patients die annually waiting for pancreas and kidney transplantations in the United States [7].

The University of Minnesota initiated simultaneous deceased donor pancreas and living donor kidney transplantation (SPK DL) [8], and since then, it has been used elsewhere [9]. This was a relatively new approach for uremic type 1 diabetic patients, and as a single procedure, SPK DL has obvious advantages over the standard living donor kidney transplantation followed by PAK. Moreover, because the SPK DL kidney is from a living donor, there may be both short-term and long-term benefits over SPK DD transplantation [10]. Potential benefits of SPK DL for type 1 diabetic uremic patients include a shorter waiting time for transplantation and better early- and long-term renal graft function.

From the Division of Digestive and General Surgery (T.K., T.W.), Niigata University Graduate School of Medical and Dental Sciences, Niigata, Japan; College of Public Health (A.C.G.), University of Arizona, Tucson, Arizona, USA; and Department of Surgery (D.E.R.S.), University of Minnesota, Minneapolis, Minnesota, USA.

Supported by Grant-in-Aid for Scientific Research No. 25462104 from the Ministry of Education, Culture, Sports, Science and Technology of Japan.

Address reprint requests to Takashi Kobayashi, MD, PhD, Division of Digestive and General Surgery, Niigata University Graduate School of Medical and Dental Sciences, 1-757 Asahimachi-dori, Chuo-ku, Niigata, 951-8510, Japan. E-mail: kobataka@med.niigata-u.ac.jp

0041-1345/14/$–see front matter
http://dx.doi.org/10.1016/j.transproceed.2013.11.058

Thus, there are 3 types of simultaneous pancreas and kidney transplantation (SPK DD, SPK DL, and SPK LL) for uremic type 1 diabetic patients. The purpose of this study was to examine various endpoints in a group of uremic, diabetic recipients treated using these 3 different procedures. Specific endpoints examined included short- and long-term patient and graft survival rates, technical failure rates, immunologic graft loss rates, and waiting times. Our goal was to determine if there were any differences among these 3 groups.

MATERIALS AND METHODS

From January 1, 1996 to September 1, 2005, 8918 primary, simultaneous pancreas and kidney transplantation (SPK) procedures were reported to the International Pancreas Transplant Registry (IPTR). Of these, 8764 (98.3%) were SPK DD, 115 (1.3%) were SPK DL, and 39 (0.4%) were SPK LL. We compared these 3 groups with regard to several endpoints, including patient and transplanted graft survival rates, technically successful pancreas graft survival rates, technical failure rates, immunologic graft loss rate, and waiting times.

Pancreas grafts were considered functional for as long as the recipients were insulin independent, and death with a functioning graft (DWFG) was considered as a graft failure if not stated differently. In some analyses, technical failure and pancreas graft primary nonfunctioning cases were excluded (the remaining cases were considered technically successful transplantations), whereas DWFG cases were censored at the time of death to describe the immunologic outcome of the transplant. The technical failures included primary early graft losses attributed to vascular thrombosis or removal because of bleeding, anastomotic leaks, pancreatitis, or infection.

Kidney grafts were considered functional for as long as those patients on dialysis before transplantation were dialysis-free after the transplantation, or for as long as the post-transplantation serum creatinine level remained less than the pretransplantation level in patients who were not on dialysis before transplantation.

In univariate models, P values were calculated using the Wilcoxon (WC) and log-rank (LR) tests and refer to the significance of differences between the overall survival curves and not to differences among individual time points. The WC test primarily reflects the probability that early differences are significant, whereas the LR test is weighted to detect the significance of late differences. When P was $<.05$ by both WC and LR analysis, the highest of the values is given. When both are $>.05$, the lowest of the values is given or the differences are designated as nonsignificant (NS). When one of the P values was $<.05$ and the other was $>.05$, both are given.

In addition to an analysis of outcome based on single variables, we performed logistic and Cox multivariate regression analyses using multiple-variable models, without selection procedures. Log-log survival plots were applied to check the validity of the proportional hazard assumption for all variables.

All statistical analysis was conducted using the SAS statistical program software package Version 9.1 (SAS Institute, Cary, NC, USA) or SPSS 12.0 (IBM, Armonk, NY, USA).

RESULTS

Table 1 details the demographic data for the 3 groups of recipients.

Mean recipient age was comparable among the 3 groups ($P = .33$). Significantly more female recipients underwent SPK LL (vs SPK DD or SPK DL; $P = .02$). The percentage of white, African American, and other recipients (American Indian, Asian, Hispanic, Pacific Islander, and multiple race) were 80%, 12%, and 8% for SPK DD, 96%, 2%, and 2% for SPK DL, and 84%, 8%, and 8% for SPK LL, respectively.

Mean pancreas donor age was significantly higher for SPK LL (vs SPK DD and SPK DL) recipients ($P < .0001$), with a significantly higher percentage of female donors for SPK LL recipients ($P = .001$). There were also more female donors of pancreas allografts for SPK LL than for SPKDD or SPKDL. Pancreas preservation time was the longest for SPK DL recipients (vs SPK DD and SPK LL; $P < .0001$). Number of HLA mismatches with pancreas donor and recipient was significantly lower for SPK LL (vs SPK DD and SPK DL; $P < .0001$).

Mean kidney donor age was significantly lower for SPK DD (vs SPK DL and SPK LL) recipients ($P < .0001$), with a significantly lower percentage of female kidney donors for SPK DD (vs SPK DL and SPK LL) recipients ($P < .0001$). The percentage of recipients on dialysis was also significantly higher for SPK DD procedures (vs SPK DL and SPK LL; $P < .0001$).

Table 1. Demographics for SPK Recipients

Variable	SPK DD	SPK DL	SPK LL	*P*
Total no. of recipient	8764	115	39	
Recipient age (mean ± SD, y)	39.8 ± 8.0	39.3 ± 8.2	38.1 ± 8.6	.33
Recipient gender (% female)	40%	39%	62%	.02
Recipient ethnicity (% white)	80%	96%	84%	–
Pancreas graft				
Donor age (mean ± SD, y)	26.8 ± 11.1	25.1 ± 10.4	41.5 ± 9.8	<.0001
Donor gender (% female)	33%	37%	61%	.001
Preservation time (mean ± SD, h)	13.2 ± 5.5	19.1 ± 7.4	1.8 ± 5.8	<.0001
HLA mismatch (mean ± SD)	4.5 ± 1.3	4.2 ± 1.4	2.3 ± 1.8	<.0001
Kidney graft				
Donor age (mean ± SD, y)	26.8 ± 11.1	43.6 ± 11.0	41.5 ± 9.8	<.0001
Donor gender (% female)	33%	58%	61%	<.0001
Percentage on dialysis	79%	40%	54%	<.0001
Diabetic duration (mean ± SD, y)	25.9 ± 7.8	26.7 ± 8.6	24.6 ± 8.7	.35
Waiting list time (median, mo)	8.1 (0–133.6)	1.7 (0–24.8)	4.1 (0–32.0)	<.0001