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## Donor Characteristics in 1,000 Consecutive Simultaneous Pancreas-Kidney Transplants

Hans W. Sollinger, Jon S. Odorico,  
Glen E. Levenson, Barbara J. Voss,  
and Anthony M. D'Alessandro

*Department of Surgery,  
Division of Transplantation,  
University of Wisconsin,  
U.S.A.*

### 1. Introduction

In 2003, Krieger et al. from our group published a manuscript which investigated the use of pancreas grafts for transplantation in different UNOS regions in the United States (1). It was reported that the utilization of pancreata showed a wide variation depending on the region. To approach some degree of standardization, we calculated the ratio of pancreata used for transplantation with the number of livers procured and transplanted. Using the data from our own institution, we had experienced that at least 70% of liver donors should provide acceptable pancreas grafts. The results of the study, however, demonstrated that in some regions, less than 20% of liver donors yielded pancreas grafts. Ensuing discussion revealed that the lack of established criteria to predict the outcome of pancreas transplantation based on available donor criteria was one of the reasons many centers, in particular less experienced programs, were hesitant to accept donors other than those expected to provide excellent pancreas grafts, and therefore, outcomes. Since then, few publications have addressed the correlation between available donor criteria and short- or long-term outcomes. One single center report analyzing outcomes in 61 simultaneous pancreas-kidney transplants (SPK) was published in 1995 by Douzjian et al. (2), and a multi-center European report by Vinkers et al. (3) attempted to establish a donor quality score. During the preparation of this manuscript, the online version of a large-scale analysis using data from the Scientific Registry of Transplant Recipients (SRTR) in 9,401 transplants from 2000 to 2006 became available for review (4).

The purpose of this manuscript is to report the donor characteristics in 1,000 consecutively performed SPK transplants at a single center. Pancreas-kidney retrieval and donor management, as well as donor evaluation, were performed by the same organ procurement organization (UW OPO). Retrieval was performed by surgeons trained at our institution. Using only donor data easily available to OPO personnel and surgeons, we attempt here to provide straightforward guidelines regarding the acceptability of pancreas grafts. A unique feature of this study is the fact that long-term follow up is available up to 22 years.

## 2. Materials and methods

Between December 18, 1985 and December 3, 2007, 1,000 consecutive donor pancreatectomies were performed by the members of the University of Wisconsin transplant team and the University of Wisconsin OPO. In general, the retrieval team consisted of a transplant surgeon or a Board-certified/eligible surgeon, a transplant fellow and a procurement specialist. Over the 20-year interval, only a small number of surgeons and transplant specialists—all trained at our institution—were involved, keeping the surgical approach standardized. The principles of the donor operation have been previously described in detail (5). Our routine consisted of *in situ* flushing with UW solution (ViaSpan®, Bristol-Myers Squibb, Garden City, NY), after dissection of the pancreas and liver. A point was made not to exceed 2 liters of flush solution. The mesenteric vessels were always ligated. Donor demographics are shown in Table 1. Donor management was conducted by the intensive care staff of the referring hospital in consultation with OPO personnel. No OPO personnel was on site until the retrieval procedure. During organ retrieval, generous use of colloids was used to reduce pancreatic edema. All organs were stored in UW solution. Surgical implant technique, recipient management and immunosuppressive therapy have been previously described (6). It is of note that we never used any systemic anticoagulation in the recipients post-transplant.

Data for analysis was obtained from the UW OPO records and transferred into the UW Transplant database.

Histocompatibility testing was performed prior to all transplants, but no attempt was made to match donor and recipient as closely as possible. The only absolute requirement was a negative T-cell crossmatch using the NIH technique.

### *Statistical Analysis*

For statistical analysis, continuous variables were summarized by reporting mean and standard deviation, and categorical variables were summarized by reporting percentages. Event rates were estimated using methods of Kaplan and Meier and compared between groups using a log rank test.  $P < 0.05$  was considered significant. All analyses were performed using SAS statistical software (SAS Institute, Inc., Cary, NC).

## 3. Results

For reporting purposes, the highest value among donor laboratory values was chosen for our calculations. BMI was determined by weight at the time of admission. Vasopressor use was defined as the use of any vasopressor at any time from the patient's admission to the time of the retrieval procedure. As expected, long-term outcomes for pancreas graft survival correlated with donor age (Figure 1). Donor age as previously reported by others appears to be a major risk factor. As previously reported by Fernandez, et al., young donors do extremely well despite higher technical difficulties (7). The youngest SPK donor in our experience was three years of age. These grafts should be placed into smaller recipients. BMI also had a significant correlation with inferior long-term outcomes (Figure 2). Obese donors, even in the younger age groups, have pancreata which are infiltrated by fatty tissue and respond poorly to preservation. In addition, fat necrosis after transplantation may lead to intra-abdominal fluid collections and subsequent abscess formation. Nevertheless, on

occasion a donor with a high BMI may have a normal-appearing pancreas which can be safely used for transplantation.

Laboratory determinations such as amylase and lipase ( $p > 0.08$ ) have not shown any correlation with outcomes, as previously reported by Odorico et al. in a smaller cohort (8). In addition, maximum glucose levels have no predictive value. Glucose values often reflect the resuscitation effort and may be skewed by the co-administration of other drugs such as corticosteroids. In an unpublished study by our group, determination of HbA<sub>1c</sub> in 100 consecutive donors did not elicit a single abnormal value which would allow the conclusion that medical history is sufficient to rule out diabetes or pre-diabetes. At the start of our program, we were hesitant to retrieve pancreata from donors with abdominal trauma and prior surgery, which frequently included splenectomy. With growing experience, we have learned to use these donors after careful inspection of the pancreas and duodenum. There is no difference in long-term outcomes ( $p = 0.6585$ ). Pancreatic grafts from young trauma victims are frequently very edematous, but return to normal texture after preservation in UW solution. Furthermore, the use of vasopressors is not associated with inferior long-term survival ( $p = 0.9196$ ).

#### 4. Discussion

Data published by UNOS/SRTR reveal that the number of SPKs performed has not increased despite an increase in the number of potential pancreas donors by an average of 482 per year since 2003 (4). Most of these consented organs have not been recovered. The non-recovery rate among pancreata is at an all-time high of about 72% (4). Among the possible reasons are a) an older donor population; b) allocation criteria which lists kidney recipients and SPK recipients on the same list; and c) surgeons' fears of achieving inferior results, which in turn might result in termination of insurance coverage for the program. These fears are heightened by the fact that few objective criteria for donor selection exist. In 1998, Odorico et al. from our group analyzed donor factors affecting outcome after pancreas transplantation in 240 recipients (8). The relevant conclusions were that pancreata from donors >45 years of age are associated with a higher failure rate. This finding was consistent with the observations of Gruessner et al. reported in 1994 (9). Odorico et al. also conclude that serum amylase and glucose did not correlate with graft failure (8). Furthermore, in a small series of donation after cardiac death (DCD) donors, no difference in short-term outcomes was noted. Douzjian et al. analyzed their single-center experience in 61 SPKs and found that duration of brain death before procurement, length of donor admission and donor age were the major factors associated with inferior outcomes (2). In accordance with our observations, serum glucose and serum amylase did not correlate with outcomes.

Recently, the online version of a manuscript by Axelrod et al. was available for review (10). SRTR data from over 9,401 pancreas donors were used to develop a Pancreas Donor Risk Index (PDRI). As pointed out by Krieger (1), the authors emphasize that pancreas utilization shows great regional variation in the United States and that donor selection is widely used as a key factor to successful pancreatic transplantation. The study is based on retrospective data from multiple centers using a variety of procurement techniques.

The uniqueness of this manuscript is that universal procurement and retrieval techniques were used and that the implant team primarily consisted only of a small group of uniformly trained surgeons. Our message is that the donor surgeon should not be discouraged from

exploring a donor with high amylase, lipase and glucose levels. Also, the use of vasopressors should not be a reason to decline. Data by Bellingham et al. demonstrate that the same criteria apply in DCD pancreas donors (11). Using these simplified criteria (age and BMI) for evaluating prospective pancreas donors, together with visual inspection of the graft, suitable pancreas grafts can be chosen to achieve excellent long-term functional outcomes (12). Adequately trained OPO personnel and procurement surgeons will be able to use these simple guidelines in order to maximize potential utilization of pancreas donors.

	Mean (range)
Age (years)	29 (3-60)
Weight (kg)	72 (15-156)
Amylase (U/L)	99 (2-2,002)
Glucose (mg/ dL)	189 (6 - 824)
Pancreas cold storage time (hours)	15 (0-43)
	N (%)
Gender: Male Female	604 (62.5%) 363 (37.5%)
Race: Caucasian African-American Asian Native American	944 (97.5%) 16 (1.7%) 6 (6.2%) 1 (0.1%)

Table 1. Donor demographics

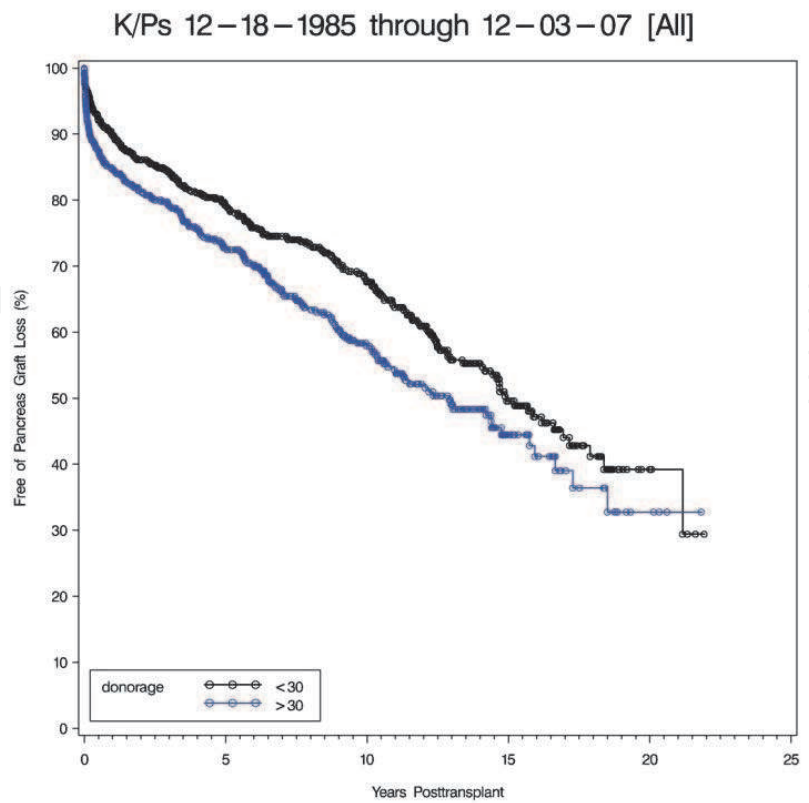


Fig. 1. Age and pancreas transplant outcome

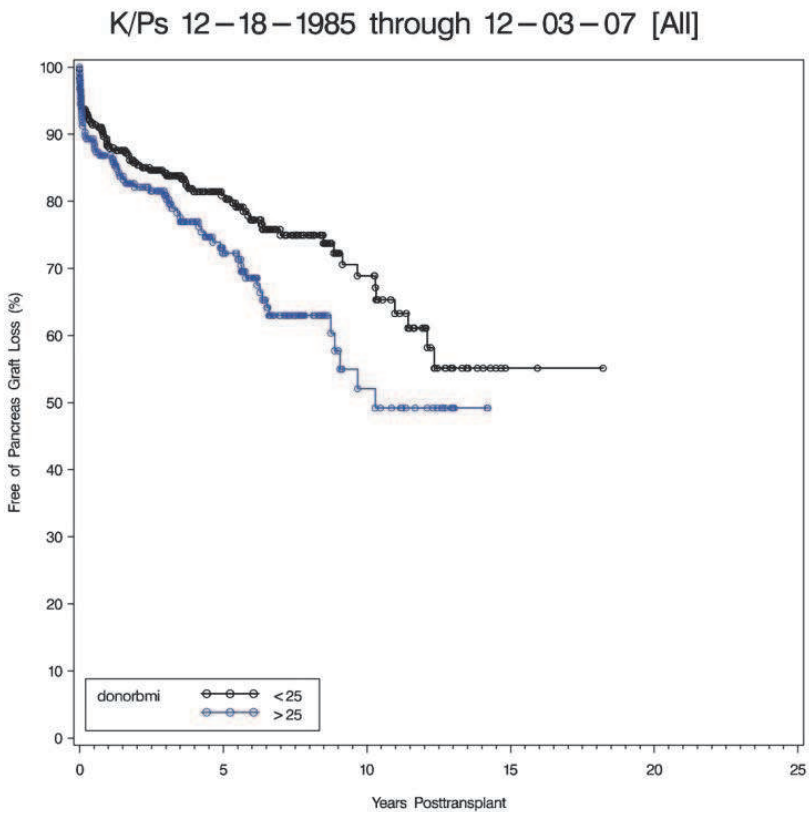
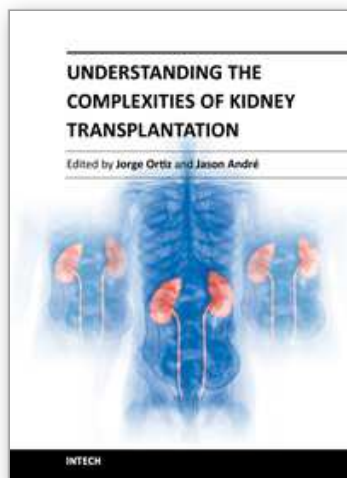


Fig. 2. BMI and pancreas transplant outcome

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## **Understanding the Complexities of Kidney Transplantation**

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Kidney transplantation is a complex field that incorporates several different specialties to manage the transplant patient. This book was created because of the importance of kidney transplantation. This volume focuses on the complexities of the transplant patient. In particular, there is a focus on the comorbidities and special considerations for a transplant patient and how they affect kidney transplant outcomes. Contributors to this book are from all over the world and are experts in their individual fields. They were all individually approached to add a chapter to this book and with their efforts this book was formed. Understanding the Complexities of Kidney Transplantation gives the reader an excellent foundation to build upon to truly understand kidney transplantation.

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