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CASE REPORT

Exocrine drainage into the duodenum: a novel technique for pancreas transplantation

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Summary

Simultaneous pancreas–kidney transplantation is the treatment of choice for patients suffering from type 1 diabetes mellitus and end-stage renal failure secondary to diabetic nephropathy. Until 1995, about 90% of pancreas transplantations were performed with exocrine drainage into the bladder. Since then the proportion of pancreas transplants with enteric drainage increased steadily because of frequency of complications and long-term disadvantages of bladder drainage. However, the use of enteric drainage removes the opportunity to monitor pancreatic allograft function either by measuring urinary amylase or by carrying out biopsy via cystoscopy. We report a new technique of exocrine pancreatic drainage into the recipient duodenum. This modification places the pancreas graft including the duodenal anastomosis in a retroperitoneal location and, importantly, allows easy graft monitoring via gastroscopy.

Introduction

According to the recommendations of the American Diabetes Association, pancreas transplantation is an acceptable procedure for type 1 diabetic patients with severe renal impairment necessitating renal transplantation (simultaneous pancreas–kidney transplantation – SPK, pancreas after kidney transplantation – PAK) [1,2]. Also, diabetic patients with frequent, acute metabolic complications can benefit from a pancreas transplant alone (PTA). The percentage of patients with complicated type 2 diabetes mellitus undergoing pancreas transplantation is increasing [3]. Recent evidence reveals stabilization or even improvement following pancreas transplantation in relation to diabetic retinopathy [4], diabetic nephropathy [5], coronary artery atherosclerosis [6] and neuropathy[7]. Worldwide, the number of pancreas transplantations has increased annually to 1800 transplantations per year in 2003, of which 66% of has been SPK [3]. Despite the complications of transplantation, particularly rejection, graft pancreatitis, intra-abdominal infection, duodenal stump leakage, cytomegalovirus disease, vascular thrombosis and the need for conversion from bladder to enteric drainage (ED) [8], patient and graft survival has improved progressively [3]. Until 1995, the predominant and preferred technique for exocrine secretions was the drainage into the bladder (BD). The most important benefit of BD is the ability of graft monitoring via urinary amylase and lipase analysis as well as the possibility of cystoscopic biopsy of the transplanted organ. However, the longer-term disadvantages of this method include cystitis, urinary tract infection, haematuria, bicarbonate loss and anastomotic leakage [9]. To avoid these complications, an increasing proportion of pancreas transplants have been performed with ED now accounting for about 57% of PTA and to 82% of SPK transplants. ED is performed by anastomosing the donor duodenum to the proximal jejunum of the recipient, with or without the use of a Roux-en-Y limb. The main disadvantage of the ED is the inability to monitor pancreatic allograft exocrine function as a surrogate marker of rejection.

Case report

In June 2006, a 37-year-old woman (57 kg, 157 cm, BMI 23 kg/m^2) with type 1 diabetes underwent SPK transplantation. Her diabetes was diagnosed in 1983, progressing to diabetic nephropathy in 2000 and dialysis-dependence in May 2005 (CAPD). The patient also suffered from diabetic neuropathy and one-sided amaurosis. Pancreas and kidney were allocated from a 26-year-old male heartbeating donor (90 kg, 190 cm, BMI: 25 kg/m^2) being blood group identical and cross-match negative. Perfusion solution was HTK (12 l, aortic only perfusion). SPK was performed following midline laparotomy. After removal of the CAPD-catheter, the right retroperitoneal space was dissected by mobilizing the right hemicolon and caecum. The pancreas was placed vertically with the tail inferiorly and vascular anastomosis was performed – donor portal vein to recipient IVC and donor iliac conduit to recipient aorta (both end-to-side), the cold ischaemia time was 7 h 30 min and warm ischaemia (anastomosis) time 40 min (the recipient had severe aortosclerosis). Reperfusion of the pancreas was homogenous with immediate exocrine secretion. Exocrine drainage was established with a side-to-side duodeno-duodenostomy. This anastomosis was performed to the third part of the duodenum with running sutures 4–0 (monofilament absorbable) using a two layer technique. This technique was preferred in this case to a more standard approach to exocrine drainage into the proximal jejunum via the right mesocolon opening, because of the unusual length of the pancreas. Figure 1 shows the anatomic position of the graft. Thereafter, kidney transplantation was performed on the contralateral side. The cold/warm ischaemia time for the kidney was 9 h 20 min/30 min. Initial function of both organs was excellent with urine production of 200 ml during the first hour and normalization of blood glucose levels. Immunosuppression consisted of tacrolimus (0.15 mg/kg BW bd), mycophenolate mofetil (1000 mg bd) and steroids after intra-operative induction with ATG 1.5 mg/kg BW. Eleven days post-transplantation, relaparotomy was performed because of peripancreatic haematoma (later found to be sterile). The patient was discharged on day 28 post-transplantation with excellent function of both transplanted organs (serum creatinine 0.9 mg/dl, creatinine clearance 77 ml/min; glucose levels at about 80 mg/dl without any need for insulin). During subsequent follow-up, the patient experienced a single candida albicans urinary tract infection, which was successfully treated with ancotil (3 months postoperatively). There were no other complications. Upper gastrointestinal endoscopy was performed at 6 weeks

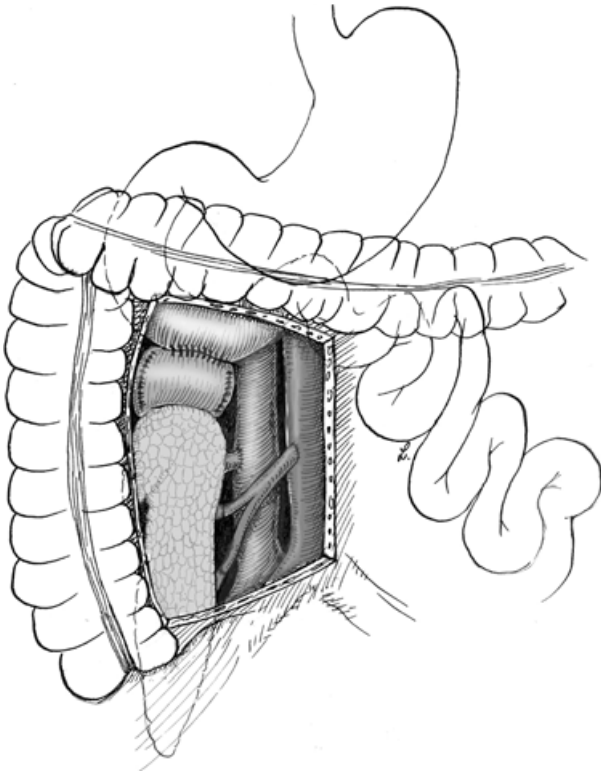

Figure 1 The pancreas graft was placed retroperitoneal in a vertical position. Exocrine drainage was established with a side-to-side duodeno-duodenostomy to part III duodeni of the recipient. For better understanding the mesocolon of colon ascendens is dissected in the picture.

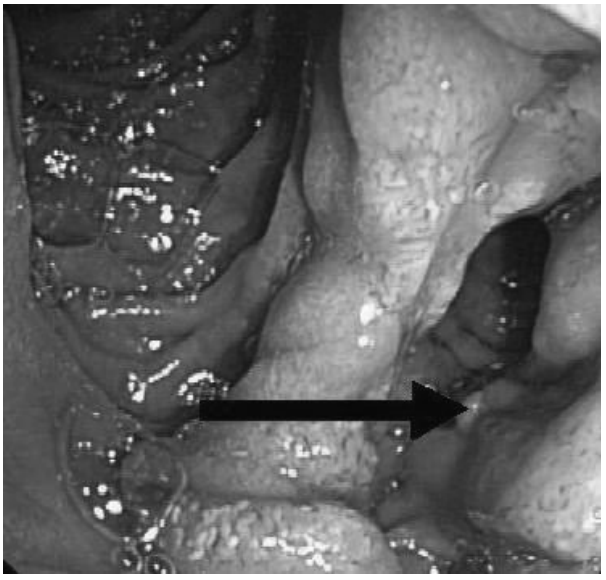

Figure 2 Six weeks after transplantation, a gastroscopy was performed to prove ability of monitoring the graft via enteroscopy. The figure shows the anastomosis and the donors' duodenum (arrow: papilla of donor duodenum).

postoperatively (Fig. 2) and provided an excellent view of the enteric anastomosis and donor duodenum.

Discussion

Combined pancreas and kidney transplantation is the best option for patients with type 1 (and increasingly type 2) diabetes mellitus and secondary diabetic nephropathy. Throughout the history of pancreas transplantation, the most challenging technical problem has been the management of exocrine function. Techniques including duct ligation [10], duct injection [11], duct open drainage [12] and enteric/gastric drainage have been tried but mostly abandoned. In the early days of ED, there was a high rate of intra-abdominal sepsis, which was presumed to be because of duodenal rejection. BD became popular because of the ability both to monitor graft function by urinary enzyme levels and to reduce the risk of sepsis. [9]. However, BD is associated with frequent complications including urinary infections, haematuria, metabolic acidosis, dysuria, reflux-pancreatitis that often (9% at 1 year and 17% at 3 years) necessitate conversion to ED [3,13,14]. With the development of new immunosuppressive agents and regimes, the rate of graft loss for reasons of rejection decreased by four- to fivefold until 2002/2003 (2% rejection loss rate in SPK) [3]. Most of the units now use induction therapy, a calcineurin inhibitor, mycophenolate and steroids [9]. Because of the much lower risk of rejection, it is now feasible to prevent rejection in most cases and, therefore, to replace BD with ED as the preferred technique in exocrine management of the pancreas graft. The ED is routinely performed by duodenojejunostomy with or without a Roux-en-Y limb. Patient survival is slightly better for ED versus BD in SPK (multivariate analysis with an increased hazard ratio of 1.57 for BD transplants), whereas the technical failure rate is slightly higher ($P = 0.05$) in ED versus BD because of a higher rate of pancreas graft thrombosis [3,15]. Pancreas graft survival rate was slightly higher with BD than ED, but this difference is not statistically significant. Looking at the venous drainage, there is no significant difference in the overall graft survival rates for systemic versus portal vein drained transplants [3,15]. Besides the obvious advantages of ED, there are still some challenges to be overcome in patients undergoing SPK with ED.

Technical failure remains with 13.1% the most frequent reason for graft loss following pancreas transplantation. Thrombosis is, in this context, the most common cause for graft loss with 52% [16]. To avoid such complication, anastomosing the (normally ligated) splenic vessels to renal vessels to create an 'en-block' pancreatico-renal composite graft in SPK, which is implanted left-sided retroperitoneally in a straight position has been described [17]. Others showed a reduction in vascular thrombosis rate by placing the pancreas right-sided retroperitoneally in an upright position with porto-enteric venous drainage [18]. The common features of these two techniques are short vascular interposition-grafts leading to straight vascular anastomoses without the risk of kinking. Therefore, we assume a possible reduction in vascular complications using the described right-sided retroperitoneal positioning of the graft.

Further, retroperitoneal placement of the pancreatic graft imitates the physiological position of the organ. Surgical complications with need for re-intervention are not increased using this technique [18]. We describe, in contrast to the previous studies, a combination of retroperitoneal positioning and ED of the graft by duodeno-duodenostomy. Since the 1980s, the technique of either side-to-side duodenostomy or end-to-end-duodenostomy has been described as a feasible method in treating children with duodenal atresia. These techniques were reported not to be inferior to duodeno-jejunostomies [19,20]. Therefore, one can postulate no direct disadvantage by using this type of positioning and anastomosis. We take into account that in case of leckage or the need for graft removal because of complications, it might be technically challenging to deal with the recipient's duodenal defect. This problem could possibly be solved by a Rouy-en-Y limb on the defect itself or proximal to it after segmental resection of the duodenum.

The main disadvantage of standard ED is the difficulty of rejection monitoring. Pancreas rejection in SPK patients occurs simultaneously with kidney rejection in many cases [21] and, therefore, kidney monitoring (creatinine and biopsy) can be used as a surrogate marker for pancreas rejection. On the other hand, solitary pancreatic rejection episodes have been described and to prove this, percutaneous biopsy of the pancreas is necessary [22,23]. Eighty-five to eighty-eight per cent of those biopsies are adequate for histological examination. However, the complication rate of percutaneous biopsy is about 3–12% including a low number of required surgical interventions. According to a recent report, double-balloon enteroscopy seems to be feasible to visualize the graft in recipients of pancreatic transplant with proximal jejunal ED [24]. The described technique of exocrine drainage into the recipient's duodenum provides the ability to visualize the donor graft via simple gastroscopy and easy access for donor duodenum or pancreas biopsy.

In summary, retroperitoneal location of the pancreas transplant combined with ED into the recipient duodenum seems to be a feasible option with definitive advantages concerning vascular complications and rejection monitoring of the transplanted organ. Whether the described approach carries actual advantages over

intraperitoneal graft placement remains to be determined by future comparative studies.

Authorship

RH: wrote the paper, collected data, analysed data; ML: contributed important reagents; HHW: performed research/study; NS: contributed important reagents; JGB: designed research/study, performed research/study, analysed data.

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