Case Report

Simultaneous pancreas-kidney transplant for type I diabetes with renal failure: Anaesthetic considerations

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ABSTRACT

Pancreatic grafts have been successfully used in patients with diabetes and are combined with kidney transplantation in patients with renal failure. The propagation of awareness in organ donation in India has increased the donor pool of transplantable organs in the last few years making multi visceral transplants feasible in our country. We present the anaesthetic management of a 32-year-old male with diabetes mellitus and end-stage renal failure who was successfully managed with a combined pancreas and kidney transplantation.

Key words: Anesthesia, kidney, pancreas, transplant, type I diabetes

INTRODUCTION

Pancreatic transplants are performed worldwide for type I diabetes with renal failure and have shown to improve survival and quality of life.[1] Most of the reports are from countries with established organ donation programmes, but increasing awareness on organ donation in India could lead to an increase in the use of multi visceral transplants as a treatment modality in the next few years. The types of pancreatic transplants include simultaneous pancreas kidney (SPK), pancreas after kidney and pancreas alone transplants.[2] The most commonly performed are the SPK transplants usually in young diabetics with renal failure.

CASE REPORT

A 32-year-old male with a history of insulin-dependent diabetes mellitus (IDDM) since 19 years of age presented with uncontrolled blood sugars and pedal oedema. He was detected to have diabetic nephropathy for the previous 2 years when he presented with frothing of urine. His glycosylated haemoglobin A1c was 11.8%, and a continuous subcutaneous insulin infusion with a pump had been prescribed as conventional insulin treatment failed to control his blood sugars. He had end organ involvement from diabetes manifesting both as nephropathy and proliferative retinopathy. He was also hypertensive and hypothyroid for which he was on treatment with a calcium channel blocker and beta blocker and 175 μg of tablet thyroxin per day. His renal functions showed a creatinine clearance of 20–30ml/min, (Class IV chronic kidney disease [CKD])[3] and had not been initiated on haemodialysis. In view of his age, difficult blood sugar control, end organ involvement with diabetes and poor quality of life, a multidisciplinary team decision was to list him for a SPK transplant.

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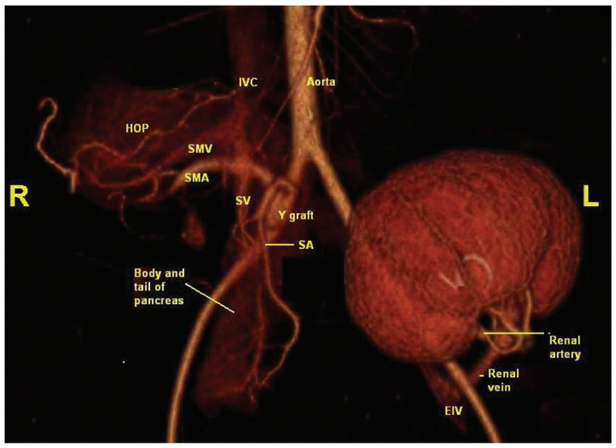
A coronary angiogram was performed in our patient following an inconclusive stress test that revealed mild coronary artery disease. Multi systemic examinations including respiratory, central nervous system and liver were also performed to exclude contraindications for the transplant. After a detailed pre-anaesthesia evaluation, the patient was scheduled for surgery. The challenges anticipated were blood sugar control during the surgery, deterioration of native renal function perioperatively until the function of the new graft picked up, and preparedness of the team at the time of availability of the donor. When a suitable matched donor was identified following brain death, the patient was called in and investigations were performed according to protocols. The insulin pump was disconnected and insulin infusion started according to the protocol. The recipient was taken to theatre once the donor lymphocyte cross match was negative. He was started on infusion of prostaglandin E1 at 0.025 μg/kg/h as a vasodilator to optimise vascular flow and 5000 U unfractionated heparin subcutaneously for thromboprophylaxis. His investigations at the time of surgery were haemoglobin 9.9 g/dl, urea 88.8 mg/dl, creatinine 3.79 mg/dl, albumin 2.58 g/dl, sodium 143 mEq/L and potassium 4.2 mEq/L. Immunosuppression was induced with interleukin 2 receptor blocker basiliximab and protocols for maintenance planned with prednisolone, tacrolimus and mycophenolate mofetil.

Anaesthesia was induced as using fentanyl, midazolam and propofol titrated to the loss of verbal response. Atracurium was used to facilitate endotracheal intubation and an infusion at 0.5 mg/kg/h was used during surgery. The radial artery was cannulated under local anaesthesia and the left internal jugular vein was cannulated with a 7.5 Fr triple lumen central venous catheter after intubation. A minimally invasive cardiac output monitor (Edwards EV-1000) was used to guide fluids and the use of inotropes.

The surgical procedure involved implantation of the donor pancreaticoduodenal graft in the right iliac fossa through a long vertical midline incision. Vascular inflow anastomosis was made between the graft splenic and superior mesenteric artery through a Y-shaped graft to the right common iliac artery. The outflow was through the graft portal vein to the infrarenal recipient vena cava. Graft duodenum was anastomosed to a Roux limb of jejunum after reperfusion to drain the exocrine secretion from the graft [Figure 1]. Unfractionated heparin at 5000 U



HOP- Head of Pancreas, SA- Splenic artery,
SMA- Superior mesenteric artery, SMV- Superior mesenteric vein,
SV- Splenic vein, EIV- External iliac vein, IVC- Inferior vena cava

Figure 1: Volume rendered technique image of the pancreas and kidney

intravenously was administered at the time of vascular anastomosis. The arterial blood sugars were monitored hourly and confirmed intermittently with laboratory values. Insulin infusions were given as per protocols and the target was to maintain blood sugars between 100 and 150 mg/dl.

Reperfusion of the pancreas is accompanied by a rapid fall in blood sugars needing reduction or cessation of insulin infusions. Our patient remained stable perioperatively, sugar levels normalised 2 h after reperfusion while insulin infusions were stopped immediately after reperfusion [Table 1]. The renal implant was started after the pancreas, the graft being placed extraperitoneally in the left iliac fossa with vascular anastomosis to the external iliac artery and vein. Injections of 20% mannitol (100 ml), furosemide 80 mg and methylprednisolone 500 mg were administered at the time of renal graft implant. Renal reperfusion was completed 2 h following the pancreatic transplant.

Noradrenaline at 0.08 μg/kg/min and vasopressin at 1.8 U/h were used as vasopressors guided by the measurements of systemic vascular resistance. During the surgery, the patient received 2.5 L crystalloids and 2 units of packed cells. Urine output from the native kidney was maintained during surgery (450 ml) and good perfusion of the graft kidney was observed. The patient was electively ventilated until correction of acidosis. He made an unremarkable recovery with normalisation of blood sugars and improvement of renal functions and was shifted from the Intensive Care

Unit by the 6th post-operative day. He was discharged on the 15th post-operative day and has well controlled blood sugars and normal renal functions at 6 months follow-up.

DISCUSSION

The goal in pancreatic transplants is to prevent long-term diabetic complications and ensure normal levels of blood glucose.[4] The progress in pancreatic transplants with improved surgical techniques, better donor and recipient selection and immunosuppression has extended the survival following SPK to 14 years.[5] Majority of SPKs are performed for type I IDDM with nephropathy in whom islet cells are destroyed by auto antibodies; however, a small percentage of type II diabetics also receive SPK.[5] The ideal candidates in our country are the young type I diabetics with renal failure necessitating dialysis or impending dialysis. Pancreatic transplants may halt the progression of diabetic nephropathy and retinopathy and allow glucose control.

Cardiovascular risk is overwhelming in this group and a thorough evaluation is mandated. Therapeutic coronary interventions should be performed if required to improve cardiac perfusion preoperatively. A major problem with pancreatic grafts is venous thrombosis of the pancreatic portal vein,[6] and prophylaxis with unfractionated heparin was commenced preoperatively and again at reperfusion of the graft in our patient. The use of epidural has been described to improve the quality of analgesia,[7] but we had not considered an epidural in view of the on-going heparin use. The patient received an infusion of fentanyl at 0.5 μg/kg/h with intermittent boluses according to haemodynamic responses. Venous thrombi in the legs can form during prolonged surgery, and we had instituted mechanical intermittent pneumatic compression intraoperatively.

The maintenance of temperature during the prolonged surgery was facilitated by the use of Hemotherm®, forced air warming devices and fluid warmers.

We monitored the blood sugars hourly during surgery and infused a 5% dextrose in water solution at 50 ml/h and insulin as an infusion targeting blood sugars in the range of 100–150 mg/dl[8] until reperfusion and half hourly thereafter.

The exocrine pancreatic drainage can be drained into the small bowel [Figure 2] or the urinary bladder [Figure 3]. In the bladder drainage, the graft duodenum is anastomosed to the recipient urinary bladder and allows a post-operative evaluation of graft function by a serial estimation of amylase levels. However long-term complications have led to a trend towards enteric drainage as described in our patient where the graft is anastomosed to a bowel loop.[6]

Classically, most SPK transplants are done on patients with established renal failure requiring haemodialysis. Our patient was in Class IV CKD and was maintained

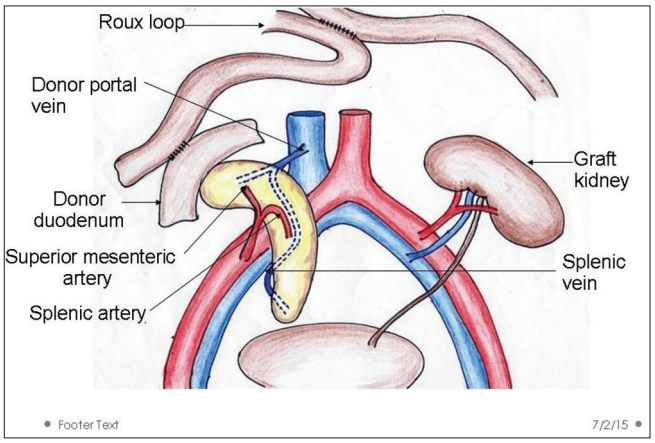


Figure 2: Simultaneous pancreas–kidney transplant with enteric drainage

Table 1: Intraoperative haemodynamics and metabolic profile

Variables	Baseline	Pancreas reperfusion	Post-reperfusion	Kidney reperfusion	Shifting
HR/min	79	65	62	62	76
BP mmHg	112/60	98/57	96/60	117/68	115/60
pH	7.40	7.32	7.31	7.25	7.25
PCO_2 mmHg	33	33	34	37	38
HCO_3 mmol/L	20	17	17	16	16
Lactate mmol/L	1.3	1.9	1.8	1.3	2.1
Glucose mg/dl	201	214	183	137	134
Insulin U/h	2	3-stopped	-	-	-
Inotrope		NA	NA, VP	NA, VP	NA, VP
CO L/min	7.3	6.0	5.8	6.7	7.3
SVR dyn/s/cm^{-5}	757	880	880	826	807

HR – Heart rate; BP – Blood pressure; CO – Cardiac output; SVR – Systemic vascular resistance; NA – Noradrenaline; VP: vasopressin

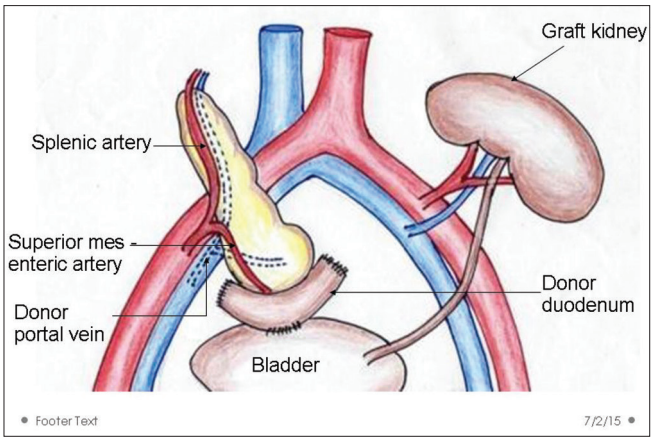


Figure 3: Simultaneous pancreas–kidney transplant with bladder drainage

without haemodialysis, although an imminent need for haemodialysis had been explained. We had secured a jugular venous dialysis access prior to surgery, but in view of reasonable urine output and acceptable serum electrolytes in particular potassium, we had proceeded with surgery without initiating dialysis. This patient had maintained urine output throughout and careful attention had been given to avoid hypotension during surgery. Oliguria or anuria prior to kidney graft reperfusion may have predisposed him to volume overload during surgery or pulmonary oedema. Surgical problems anticipated in the immediate post-operative period were bleeding from anastomotic sites, portal venous thrombosis, non-functioning graft, bowel leaks and infections. Our patient had an uncomplicated recovery of both renal and pancreatic functions and was put on regular follow-up after discharge from the hospital.

CONCLUSION

SPK transplants could offer insulin-free blood glucose control with an improved quality of life and protection against long-term diabetic complications in type I diabetic patients. Refinements in techniques and improvements in immunosuppression can prospectively lead to improved survival with fewer complications. We have presented this case to bring out anaesthetic concerns and suggestions for protocols in the management of an uncommon surgical procedure in our country.

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Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. van Dellen D, Worthington J, Mitu-Pretorian OM, Ghazanfar A, Forgacs B, Pararajasingam R, *et al.* Mortality in diabetes: Pancreas transplantation is associated with significant survival benefit. Nephrol Dial Transplant 2013;28:1315-22.
2. Monroy-Cuadros M, Salazar A, Yilmaz S, McLaughlin K. Bladder vs enteric drainage in simultaneous pancreas-kidney transplantation. Nephrol Dial Transplant 2006;21:483-7.
3. KDOQI CKD Guidelines – National Kidney Foundation. Available from: http://www2.kidney.org/professionals/KDOQI/guidelines_ckd/toc.htm. [Last accessed on 2015 May 05].
4. Gruessner AC. 2011 update on pancreas transplantation: Comprehensive trend analysis of 25,000 cases followed up over the course of twenty-four years at the International Pancreas Transplant Registry (IPTR). Rev Diabet Stud 2011;8:6-16.
5. Redfield RR, Scalea JR, Odorico JS. Simultaneous pancreas and kidney transplantation: Current trends and future directions. Curr Opin Organ Transplant 2015;20:94-102.
6. Banga N, Hadjianastassiou VG, Mamode N, Calder F, Olsburgh J, Drage M, *et al.* Outcome of surgical complications following simultaneous pancreas-kidney transplantation. Nephrol Dial Transplant 2012;27:1658-63.
7. Pichel AC, Macnab WR. Anaesthesia for pancreas transplantation. Contin Educ Anaesth Crit Care Pain 2005;5:149-52.
8. Shokouh-Amiri MH, Stratta RJ, Latif K, Gaber O. Glucose control during and after pancreatic transplant. Diabetes Spectr 2002;15:49-53.