DOI: 10.7860/JCDR/2024/72785.20137

Case Report

Anaesthesia Section

Anaesthetic Management of Simultaneous Pancreas and Kidney Transplant Surgery: A Case Report

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ABSTRACT

End-stage renal disease is commonly attributed to chronic conditions such as Diabetes Mellitus (DM), a primary factor in the development of nephropathy. As awareness of organ donation grows, the availability of transplantable organs has also increased. Multiorgan transplants, such as Simultaneous Pancreas and Kidney (SPK) transplants, have become viable options, though very few cases have been reported, especially in India. The SPK transplant offers freedom from renal replacement therapy and dependence on insulin, drastically improving the quality of life for the patient. This case report discusses a 31-year-old male who was a known case of type I DM and had been on haemodialysis for end-stage renal failure for seven years. He was posted for an SPK transplant. A multidisciplinary approach was adopted, beginning in the preoperative period with the preparation of the patient through haemodialysis, immunosuppression, and optimisation of other co-morbidities. During the intraoperative period, the focus was done on maintaining sufficient tissue perfusion without maximising cardiac filling and managing fluctuations in blood glucose levels and electrolyte abnormalities. In the postoperative period, vigilance and utmost care were prioritised to ensure successful management of this SPK transplant. Given the benefits that SPK transplants can provide to patients, it is likely that this will become the treatment modality of choice for these long-term debilitating conditions. Therefore, in addition to understanding appropriate anaesthesia management for such cases, the importance of good team coordination should be emphasised to enhance graft survival and function, with the ultimate aim of improving the quality of life for transplant recipients.

Keywords: End stage renal disease, Haemodialysis, Insulin dependence, Transplant anaesthesia, Type 1 diabetes mellitus

CASE REPORT

A 31-year-old male who had been living with type 1 diabetes mellitus since the age of three was managing his condition with insulin injections. He was diagnosed with diabetic nephropathy seven years ago when he experienced facial puffiness, pedal oedema, and elevated serum creatinine levels. As a result, he underwent haemodialysis three times a week via a left brachiocephalic fistula. He had been on oral medication for hypertension and hypothyroidism for the past seven years, which included beta blockers, calcium channel blockers, and 50 µg of thyroxine daily.

Ultrasonography revealed chronic renal disease, and a lower limb Doppler study showed bilateral mild atherosclerotic changes. A nerve conduction velocity study indicated sensory, motor, and primary axonal neuropathy affecting the lower limb nerves, suggesting end-organ involvement. Considering his age, the difficulty in controlling blood glucose levels, the involvement of other organs due to DM and his quality of life, the patient was considered for a Simultaneous Pancreas-Kidney (SPK) transplant. Following a thorough preanaesthetic check-up, the patient was cleared for the transplant. Once a suitable donor for both organs was available and the lymphocyte crossmatch was negative, the patient underwent further evaluations and routine investigations, including a haemodialysis session. His posthaemodialysis results indicated normal levels for routine blood parameters, except for creatinine, which was found to be 3.94 mg/dL. Following cardiac and pulmonary clearance, the patient began immunosuppression therapy with an infusion of antithymocyte globulin at 10 mL/h and was prepared for surgery as per protocol.

Preinduction medications of midazolam 1 mg, fentanyl 2 µg/kg, and propofol 1-2 mg/kg were administered intravenously (i.v.), and anaesthesia was induced. The muscle relaxant used was cisatracurium at 0.15 mg/kg. Anaesthesia was maintained using sevoflurane. The right radial artery and right internal jugular vein were cannulated under ultrasound guidance for Intra-Arterial Blood Pressure (IABP) and Central Venous Pressure (CVP) monitoring. Blood Sugar Levels (BSL) were closely monitored hourly, and once the pancreatic anastomosis started, they were monitored every 15 minutes, with insulin infusions adjusted accordingly. Upon reperfusion of the pancreas, the insulin infusions were stopped due to a rapid decrease in BSL. Other medications, including furosemide 50 mg, mannitol 20 g, and methylprednisolone 1 g i.v., were administered at the time of renal graft implantation. An infusion of dopamine at 4 µg/kg/min was titrated and used intermittently to maintain haemodynamic stability. The patient's intraoperative haemodynamics at various times were recorded and is shown in [Table/Fig-1]. Sodium bicarbonate (HCO_3) was administered as needed, with Arterial Blood Gases (ABG) monitored hourly during the procedure. During surgery, the patient received 800 mL of crystalloids, and his urine output was 50 mL. Following the surgery, the patient was extubated without any complications and transferred to the Intensive Care Unit (ICU) for further observation.

Variable	Baseline	Pancreas anastomosis	Kidney anastomosis	End of surgery
HR/min	86	92	121	101
BP mmHg	130/90	132/92	100/80	130/94
pH	7.4	7.36	7.34	7.36
pCO_2 mmHg	39	38	37	38
HCO_3 mmol/L	24.8	21.5	20	21.5
BSL mg/dL	129	116	125	132

[Table/Fig-1]: Intraoperative Haemodynamics.
HR: Heart rate, BP: Blood pressure, BSL: Blood sugar level

The patient was monitored in a separate chamber in the ICU, taking into account all medical and surgical complications. Fluid balance, oxygen therapy, analgesia with opioids, immunosuppression, and acid-base management were considered. His BSL remained stable

without the need for insulin from Postoperative Day (POD) 1, and the transplanted kidney began functioning well from POD 3. He was shifted to the ward on POD 8 and discharged on POD 20 with controlled fasting blood sugars of 135 mg/dL and normal renal function, with a creatinine level of 2.5 mg/dL. On one-year follow-up, the creatinine was found to be 1.45 mg/dL, and HbA1c was 5.4, with the patient being free from haemodialysis and insulin.

DISCUSSION

The majority of SPK transplants are performed for individuals with type 1 insulin-dependent DM (IDDM) and nephropathy, where islet cells are destroyed by autoantibodies [1]. Young diabetics with renal failure benefit the most from SPK transplants, as this procedure mitigates the risk of long-term complications associated with diabetes and helps maintain stable BSL. Furthermore, studies have revealed positive outcomes in managing complications such as neuropathy and retinopathy associated with type 1 DM [2,3]. As the number of reported cases regarding anaesthesia in SPK transplants is limited, it is significant to discuss the anaesthesia management in such cases [4,5].

Cardiovascular System (CVS) involvement, along with electrolyte abnormalities, hypoproteinaemia, gastroparesis, glucose control, anaemia, and coagulopathy, are some of the major anaesthetic concerns in patients undergoing SPK transplants. Diabetes and dyslipidaemias contribute to the acceleration of arteriosclerosis, while hypertension and cardiomyopathy are typically caused by both volume and pressure overload. Volume overload results from expanded extracellular fluid, increased blood flow through arteriovenous fistulas, and anaemia, while pressure overload is a result of hypertension. IABP monitoring is crucial due to potential rapid fluctuations in blood pressure. Normovolemia is ensured when the clamps are released from the iliac vessels, as reperfusion may lead to a decrease in systemic vascular resistance, potentially jeopardising the grafts [6,7]. However, arterial and venous catheter placement may be challenging due to oedema; thus, ultrasound-guided placements are preferred to avoid complications.

Kumar L et al., reported a case involving a 32-year-old male who underwent SPK transplant, describing the surgical procedure and emphasising the need to reduce or cease insulin infusion during pancreatic anastomosis, as profound hypoglycaemia is expected [5]. Therefore, blood glucose should be checked every 15 minutes during this time [8]. Hyperkalaemia, which can result in cardiovascular instability, is commonly observed at this stage, necessitating close electrolyte monitoring. Regular Arterial Blood Gas (ABG) analysis is required to monitor acid-base balance, as acidosis commonly occurs in these patients. Overzealous ultrafiltration during haemodialysis can cause significant intravascular depletion preoperatively. When maintaining fluids, crystalloids (potassium-free) may be preferred to colloids due to concerns that colloids may exacerbate graft oedema after surgery [7]. Temperature regulation is another concern in these patients; warm intravenous (i.v.) fluids and warming devices should be used to prevent hypothermia. A case series reported by Ebrahimnia Milani S et al., emphasised the importance of a thorough preanaesthesia evaluation, the conduction of general anaesthesia with midazolam, fast-acting fentanyl, cisatracurium besilate, and propofol, along with the appropriate use of invasive monitoring methods for the successful management of three SPK transplants [4].

It can be challenging to measure urine output both before and during surgery. Mannitol and frusemide were administered at the time of renal graft implantation to promote urine production [9]. Mannitol also has the added benefit of scavenging free radicals [10]. Opioids are the primary method for providing pain relief both perioperatively and postoperatively. Simple analgesics, such as paracetamol, are also used as additional measures. Non Steroidal Anti-Inflammatory Drugs (NSAIDs) are avoided not only because they can cause gastrointestinal and surgical bleeding, but more importantly, because they inhibit prostaglandin synthesis, which is integral to renal blood flow and glomerular filtration rate autoregulation [11].

CONCLUSION(S)

The SPK transplants offer patients with Type 1 DM the benefits of insulin-free blood sugar control, improved quality of life, and protection against long-term diabetic complications. Advancements in techniques and immunosuppression have the potential to improve survival rates and reduce complications. Successful outcomes require the collaborative efforts of surgeons, anaesthesiologists, and intensivists.

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PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: Jun 25, 2024
- Manual Googling: Aug 05, 2024
- iThenticate Software: Sep 03, 2024 (5%)

ETYMOLOGY: Author Origin

EMENDATIONS: 6

AUTHOR DECLARATION:
- Financial or Other Competing Interests: None
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. NA

Date of Submission: **Jun 20, 2024**
Date of Peer Review: **Aug 01, 2024**
Date of Acceptance: **Sep 04, 2024**
Date of Publishing: **Oct 01, 2024**