

Anaesthesia for renal transplantation: an update

Kathryn Bennett

Nick Pace

Abstract

This article describes the assessment of the patient for renal transplantation, the perioperative management and the aims in the postoperative period. These patients present a unique set of challenges to the anaesthetist, who has a crucial role in the immediate success of the transplanted organ.

Keywords Cold ischaemia time; end-stage renal disease; fluid therapy; induction and maintenance of anaesthesia; monitoring and access; post-operative care; preoperative assessment; renal; transplantation

Royal College of Anaesthetists CPD matrix: 2A03, 2A05, 2A07

Introduction

The past decade has seen significant advances in renal transplantation, both in terms of increasing availability of donor organs due to the acceptance of non-heart beating donors and medical advances. Improvements have been made in surgical technique, immunosuppression and medical management of transplant recipients which have led to transplant becoming the preferred treatment of renal failure of multiple causes. The number of kidney transplants has increased year-on-year to 1930 in 2012–2013.¹ Despite a drop in the last four years, however, the number of patients registered on the active transplant list at 31 March 2013 for a kidney is at 6348, which is 25% higher than in 2004.¹

Recent increases in transplant numbers have been attributed to an acceptance of increased co-morbidities of donors and recipients, increased numbers of living donors, the paired living kidney donation programme and an acceptance of altruistic living kidney donation.¹ In addition, some centres are using kidneys from non-heart beating donors. Approximately 40% of transplanted kidneys in the UK are now from live donors. Despite these advances, approximately 25% of kidney recipient suffer from postoperative delayed graft function requiring renal replacement therapy.² Optimized perioperative management can impact on the immediate function of the graft and it is therefore important that anaesthetists have a good understanding of the particular challenges of transplant surgery and renal patients.

Indications

All patients with end-stage renal disease (ESRD) defined as a glomerular filtration rate of less than 15 ml/min/1.73 m³ should

Kathryn Bennett FRCA is an ST7 Anaesthetist based in the West of Scotland, UK. Conflicts of interest: none.

Nick Pace FRCA FRCP PhD MBA is a Consultant Anaesthetist at the Western Infirmary, Glasgow, Scotland, UK. Conflicts of interest: none.

Learning objectives

After reading this article, you should be able to:

- understand the preoperative issues surrounding renal transplantation.
- know how to undertake a renal transplant.
- appreciate the management of the postoperative renal recipient.

be considered for renal transplantation. A variety of clinical conditions can result in ESRD including diabetes, hypertension, glomerulonephritis and polycystic kidney disease. The UK Renal Association recommends that patients should be placed on the transplant list within 6 months of their anticipated dialysis start date as pre-emptive transplantation improves graft function and reduces mortality compared to transplant on patients already established on dialysis.

When patients have been appropriately selected, renal transplantation offers better long-term survival compared to other renal replacement therapies.³ Most renal dialysis patients are suitable for renal transplantation and the absolute contraindications are few, listed in [Box 1](#).⁴

Multidisciplinary assessment

Prior to being activated on the transplant waiting list, a patient should undergo a comprehensive multidisciplinary assessment by transplant nephrologists, transplant surgeons, anaesthetists and transplant nurse specialists. The nature of out-of-hours work means that any contentious decisions need to be further discussed at departmental level. They should then be reviewed on an annual basis for continued suitability.

Cardiovascular disease is a common co-morbidity associated with renal disease affecting approximately 25% of patients and has the biggest impact on postoperative mortality in this group.⁵ Other co-morbidities associated with chronic renal disease include diabetes mellitus and hypertension. Uraemia can have multisystem effects including hypertension, cardiac failure, pericarditis, pulmonary oedema, delayed gastric emptying, peripheral and autonomic neuropathy, anaemia, coagulopathy and immunological. Other conditions associated with advanced renal disease include hyperparathyroidism, hypercalcaemia, hyperphosphataemia and dyslipidaemia.

The patients should be thoroughly worked up by assessing for associated co-morbidities. It is important to focus on cardiovascular risk by assessing coronary artery disease and cardiac

Absolute contraindications to renal transplantation

- Predicted patient survival of less than 5 years
- Predicted risk of graft loss greater than 50% at 1 year
- Patient unable to comply with immunosuppression
- Immunosuppression predicted to cause life-threatening complications

Box 1

function, and the patient may be sent for: echocardiogram, exercise tolerance test and coronary angiography if required.

Matching

The patient should undergo immunological investigations such as ABO blood group determination, tissue matching and cross-matching. Tissue matching relates to six specific antigens, called major histocompatibility complexes, of which a six-antigen match represents the best compatibility. Long-term outcomes are dependent on the degree of matching, with a six-antigen match having the lowest risk of rejection. Finally, cross-matching is a very sensitive test that predicts how a transplant recipient may respond to donor protein. If the cross-match is positive, the recipient has responded to the donor and there is an increased risk of rejection. However, modern immunosuppression has improved to such an extent where even low tissue matches and positive cross-matching appear to survive similarly, and successful transplants have taken place.⁶

Allocation of kidneys is based both on matching to recipients and waiting time on the list. The function of the graft is dependent on graft perfusion following transplantation, the state of the kidney pre-donation, the warm ischaemic time (harvest and transplant time) and cold ischaemic time (storage).⁷

Preoperative assessment

When a donor kidney becomes available, the aim is to limit the cold ischaemic time to less than 24 hours. There is strong evidence that the earlier the kidney is transplanted the better the outcome. The cold ischaemic time is measured from when the kidney is cooled during harvesting to implantation when core temperature is reached and perfusion is restored. The potential recipient is contacted and must attend hospital in order for urgent review by the nephrologist, transplant surgeon and anaesthetist. The time available for preoperative investigations is often limited, hence the importance for a thorough work-up in advance.

It is vital during the preoperative visit to establish a rapport and try to alleviate the patient's anxiety, who may have been anticipating this life-changing surgery for a long time. Many of these patients will have had multiple general anaesthetics in the past and much useful information can be found in previous anaesthetic charts.

A full anaesthetic preoperative assessment should take place with particular focus on any renal replacement therapy that the patient undergoes. It is important to know when the patient was last dialysed, the type of dialysis (peritoneal or haemodialysis) and the dry weight of the patient to allow an estimation of the preoperative fluid status of the patient. Associated co-morbidities should be thoroughly re-assessed as although the patient will have been extensively worked up, several years may have passed since those investigations were performed. History should focus on assessing any cardiovascular risk and end-organ damage.

Anti-hypertensive medication is frequently withheld on the day of surgery in order for 'permissive hypertension' for allograft perfusion. The unpredictable nature of organ availability frequently means that patients arrive having taken their medication for that day, including ACEIs and ARBs. It is important to

know if these drugs have been taken and that the anaesthetist is prepared for refractory hypotension that may follow induction.

The presence of any arterio-venous (AV) fistulas or dialysis lines should be noted along with a history of intravenous (IV) access, including any previously stenosed or thrombosed vessels.

Examination should include a routine anaesthetic assessment of the airway and also focus on assessment of fluid balance (which can range from severe hypovolaemia to hypervolaemia), and the cardiovascular system, in particular blood pressure and signs of left ventricular hypertrophy (LVH).

Preoperative investigations should include urea and electrolytes (in particular, potassium and bicarbonate), full blood count, coagulation screen and an ECG on the day of surgery. There is currently no evidence to support the routine use of haemodialysis immediately prior to surgery. If the patient is diabetic, serum glucose should be checked and a variable rate insulin infusion commenced as intraoperative hyperglycaemia is associated with delayed graft function.⁵

Pre-medication

Pre-medication, whilst not commonly required, may include an anxiolytic such as temazepam orally (10–20 mg) before surgery. Delayed gastric emptying and reflux are a common result of diabetes and autonomic neuropathy, and an H₂ receptor antagonist, metoclopramide or sodium citrate may be given orally.

Immunosuppression to prevent graft rejection is commenced in the preoperative period and the regimen will vary between centres. Typically they will consist of a calcineurin inhibitor (e.g. tacrolimus), an antiproliferative agent (e.g. mycophenolate) and a corticosteroid which will be continued into the postoperative period.⁸

Perioperative anaesthetic management

Monitoring and access

Routine monitoring including oxygen saturations, ECG (ideally with ST segment analysis), non-invasive blood pressure (NIBP) and capnography are mandatory as per AAGBI guidelines. The routine use of an arterial line is no longer considered essential and should be avoided unless indicated for patient co-morbidities as it poses a threat to future fistula sites. IV access and the NIBP cuff should be sited on the opposite arm to any existing fistula. If it is necessary to place the NIBP cuff on the leg because of fistula sites, it is advisable to place it on the side opposite to where the allograft will be sited as the iliac vessels on this side will be clamped for a proportion of the procedure. Core temperature should also be monitored using an oesophageal temperature probe. A urinary catheter should be placed and urine output monitored following reperfusion of the graft.

Measurement of the central venous pressure (CVP) is important to maximize intravascular volume and optimize kidney perfusion pressure, and a benefit in CVP-targeted fluid administration has been demonstrated.⁹ In addition, the transplanted kidney function might be delayed, thus leading to the need for postoperative dialysis. If the patient has no arterio-venous (AV) fistula a dialysis line is required, which can also be used to measure CVP. These should be placed under ultrasound guidance as patients frequently have distorted anatomy or thrombosed vessels because of previous lines as well as being

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