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Renal Autotransplantation and its Anesthetic Management: A Case Series in a Tertiary Hospital

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Abstract

Introduction: Renal autotransplantation (RAT) is an unusual but safe procedure that implies a combination of living nephrectomy and a standard renal transplantation in the same patient. Indications for surgery include treatment of vascular and urologic lesions, and less frequently nephrolithiasis or chronic flank pain.

Objectives: Due to rarity of the procedure there are a few reports published and little is known about anesthetic management of these patients. The goal of this study is to describe all cases of renal autotransplantation, focusing on anesthetic management.

Methods: A retrospective review of the records of all patients who underwent renal auto transplantation from 2002 to 2015 in Centro Hospitalar do Porto was performed. Demographic, anesthetic, surgical and postoperative data were collected.

Results: A total of twenty-four patients underwent renal autotransplantation from 2002 to 2015, including two patients who underwent bilateral RAT. The most frequent indication for RAT was the presence of renal artery aneurysms and most patients underwent laparoscopic nephrectomy. High-grade complications according to Clavien-Dindo classification occurred in 16% of patients. Hypertension was the most frequent comorbidity among patients. Combined anesthetic techniques were used in 52% of cases. Median duration of anesthesia was 423 min. There were no anesthetic complications, apart from one patient with hypothermia at the end of the procedure.

Conclusions: RAT is a reasonable option for selected patients. Others studies are needed in order to provide evidence if anesthetic management influences outcomes.

Keywords: Renal autotransplantation; Anesthetic management; Renal artery aneurysms

Introduction

Renal autotransplantation (RAT) is a unique surgical procedure, performed for the first time in 1963 [1]. RAT remains an unusual procedure due to the associated surgical complexity and the advances in endovascular/endoscopic techniques. Nevertheless RAT has become a safe procedure that can be used in selected cases.

The indications for surgery include treatment of vascular or urologic abnormalities (iatrogenic ureteral injuries, ureteral strictures or intrarenal/ureteral tumors) and can be used in patients with complex nephrolithiasis or chronic flank pain [1-5]. As concerns to vascular causes, renal artery aneurysms remain the most important indication. Renal artery aneurysms are rare, affecting women more often than men, and the indications for intervention include: symptomatic aneurysm, size >2 cm, female gender within childbearing age and refractory hypertension [6]. The debate over criteria for surgical repair exists due to advances in endovascular interventions [6,7].

RAT is a combination of living donor nephrectomy and a standard renal transplant within the same patient.

Early post-operative complications include bleeding from the vascular anastomosis, renal artery or vein thrombosis or urinary leak. Renal artery or vein thrombosis is a rare complication, but potentially devastating due to the possibility of graft loss. Late complications include renal artery stenosis or ureteral obstruction [8].

Given the rarity of the procedure, there are a few reports about this matter and are mainly related to surgical technique and its complications and outcomes. The literature is sparse regarding anesthetic management of these patients with a few case reports published [9,10].

In our institution a multidisciplinary team, involving vascular and urologic surgeons, does the procedure. The different stages of surgical procedure and its anesthetic implications are listed in Table 1. Laparoscopic and open approaches have similar outcomes regarding patient safety or graft function. Open nephrectomy is associated with higher post-operative pain scores and longer convalescence times and hospital stay [11].

Surgical procedures	Anesthetic implications
Stage 1: Open or laparoscopic nephrectomy	**Open:** Higher pain scores. **Laparoscopic:** The insufflation of the peritoneum should be maintained at the lowest pressure feasible not to decrease renal blood flow. Maintenance of renal perfusion pressure: adequate intravascular volume and avoidance of hypotension [12]. Before clamping the vessels consider mannitol/furosemide (promoting graft function and diuresis) [12]. Minimizing warm ischemia time.
Stage 2: Transplant preparation	The kidney is flushed with a preservative solution and kept in ice. *Ex vivo* vascular repair if needed Minimizing cold ischemia time.
Stage 3: Auto-transplant	Iliac fossa is generally preferred Vascular and ureteral anastomosis.

Table 1: Stages of surgical procedure and anesthetic implications.

In our institution, the procedure is usually carried out under general anesthesia alone or associated with an epidural block for intra operative and post-operative analgesia.

The purpose of this study is to describe a series of cases of renal autotransplantation in our institution, focusing on anesthetic management.

Materials and Methods

A retrospective review of the records of all the patients who underwent renal auto transplantation from 2002 to 2015 in Centro Hospitalar do Porto was performed. Demographic, anesthetic, surgical and postoperative data were collected. All patients underwent renal autotransplantation by the same multidisciplinary team of vascular and urologic surgeons. Surgical complications were classified according to Clavien-Dindo classification system, recorded at time of hospital discharge. Quantitative variables are expressed as mean (±SD) for normal distribution and as median (range) for non-normal distribution. Glomerular filtration rate (GFR) was calculated using CDK-EPI equation. Microsoft Excel® was used for statistical analysis.

Results

A total of twenty-four patients underwent renal autotransplantation from 2002 to 2015, including two patients who underwent bilateral RAT. One patient was excluded from the analysis due to missing data. Table 2 shows patient demographic data. Fourteen patients were female (61%). Median age at transplant was 46 years (13-74 years) 70% were ASA II.

Gender (number/%)	
Female	14 (61%)
Male	9 (39%)
Age (years; median/range)	46 (13-74)
Female	45.5 (20-74)
Male	44.5 (13-70)
BMI (Kg/m²; median)	22.94
Female	23.11
Male	25.94
ASA classification (number/%)	
I	3 (13%)
II	16 (70%)
III	4 (17%)
IV	0 (0%)

Table 2: Demographic data (BMI: Body Mass Index; ASA: American Society of Anesthesiologists).

The most frequent indication for RAT was the presence of renal artery aneurysms (76%) and only three of a total of 25 procedures were due to urologic causes. Table 3 specifies Indications and surgical approach. Most patients underwent laparoscopic nephrectomy (76%) and the mean warm ischemia time was 240 sec (120-420).

Indications	Number
Renal artery aneurysm	19
Renal artery dysplasia	2
Aortic dissection Stanford type B	1
Ureteropelvic junction stenosis	1
Iatrogenic injury during urologic surgery	2
Nephrectomy	0
Open	6
Laparoscopic	19

Table 3: Indications and surgical technique.

Complications were graded according to Clavien-Dindo classification and are shown in Table 4. High grade complications (grade III or greater) occurred in 16% of patients. Three grafts were lost due to renal artery thrombosis. There were no grades IV or V complications.

Fifteen patients (60%) were seen in pre-operative anesthetic consultation. Hypertension was the most frequent co morbidity (61%) and the majority of patients did not have other cardiovascular risk factors. Two patients had Nutcracker Syndrome. 36% of patients had a glomerular filtration rate less than 90 mL/min in pre-operative analysis.

All patients were monitored according to ASA standards, with invasive arterial pressure monitoring, and it was used in all cases monitoring of depth of anesthesia with processed electroencephalogram and neuromuscular blockage with acceleromyography.

Type of anesthesia performed (balanced or total intravenous anesthesia or combined techniques) was decided by the anesthesiologist in charge of each procedure (Table 5).

Combined anesthetic techniques were used in 52% of cases. Epidural block was done before anesthetic induction and was used in

all cases for intra operative analgesia. The drugs used were local anesthetics (Ropivacaine 0.2%-0.375%) alone or with association of opioids (generally sufentanil at the beginning of surgery or morphine at the end).

Grade		Complication	Total
I			0
II		Surgical wound infection	1
		Transfusion support	1
		Peri-renal hematoma/abcess	2
		Refractory hypertension	1
III	A		0
	B	Renal artery/vein thrombosis-Graft loss	3
		Peri-renal hematoma	1
IV			0
V			0

Table 4: Complications according to Clavien-Dindo classification.

Anesthetic technique	Result
General Anesthesia	12
Total intravenous anesthesia (TIVA)	11
Balanced	1
Combined anesthesia	13
TIVA+Epidural block	12
TIVA+TAP block	1
Crystalloids (volume in mL/ median)	3000 (1000-4500)
Colloids (volume in mL/median)	500 (200-500)
Blood loss (mL/median)	350 (100-1300)
Renal protection (nr of patients)	20
Mannitol (mL/median)	150 (125-300)
Duration of anesthesia (min; median)	423 (316-532)
Warm ischemia time (seconds; median)	240 (120-420)
GFR pre-operative (mL/min; median)	102.5 (46.3-147)
GFR day 1 post-operative (mL/min; median)	92.6 (19-152)
Hospital stay (median; days)	8 (3-35)

Table 5: Anesthetic management and post-operative data.

There was no record of anesthetic complications, except one patient with hypothermia (core temperature <35°C) at the end of the procedure.

When general anesthesia was used, postoperative pain was managed using Patient Controlled Analgesia (PCA) with morphine, according to institutional protocol (no baseline perfusion, bolus of 1 mg and lock out of seven min). One patient that had general anesthesia and epidural block, in post-operative period had their epidural catheter dislodged, so pain management was done using a PCA.

Discussion and Conclusion

RAT is an unusual procedure. Nevertheless has become a safe and interesting option for management of a variety of vascular and urologic lesions.

In this study we reviewed all cases of renal autotransplantation during 13 years. In our institution the most frequent indication for renal autotransplantation was renal artery aneurysms. In this study laparoscopic nephrectomy was the approach preferred.

The principal anesthetic implications of the procedure are: maintenance of renal perfusion pressure to ensure optimal graft perfusion and function, normothermia and management of intra-operative and postoperative pain.

There are a few cases published concerning anesthetic management of these patients. Opposing to renal transplantation, which is extensively studied in the past years, there are no studies regarding anesthetic management of these patients neither focusing on factors that influence outcome.

Combined anesthetic techniques were used in 52% of cases. Epidural anesthesia offers the advantages of blockade of peripheral sympathetic nervous system. Nevertheless, this blockade with consequent vasodilation can complicate control of systemic blood pressure and the maintenance of an optimal renal perfusion pressure. For that reason, in our institution, we support the use of analgesic epidural doses with or without opioids during procedure in order to control closely hemodynamic status.

There were 16% of high grade complications (grade III or higher using Clavien-Dindo classification), a similar percentage encountered in other studies. There is only one anesthetic complication registered, nevertheless, this number might be higher due to lack of anesthetic records.

This study as the first one to describe anesthetic management of patients submitted to RAT. Others studies need to be designed in order to provide evidence if anesthetic management influences outcome of this patients.

As limitations of this study we recognize its retrospective nature and a small sample size. Due to the rarity of the procedure, the total number of patients is low to draw robust conclusions.

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