

Pretransplant laparoscopic nephrectomy in adult polycystic kidney disease: a single centre experience

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Study Type – Therapy (case series)
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OBJECTIVE

To report our experience with pretransplant laparoscopic nephrectomy in patients with autosomal dominant polycystic kidney disease (ADPKD), as ADPKD often progresses to end-stage renal disease and most azotaemic patients with ADPKD have enlarged kidneys, making graft placement difficult.

MATERIAL AND METHODS

We retrospectively reviewed the medical records of 13 patients with renal failure attributable to ADPKD who underwent pretransplant laparoscopic nephrectomy (21 renal units) from August 2002 to December 2006. Five patients had a unilateral nephrectomy, seven had a staged bilateral

nephrectomy, and one had a simultaneous bilateral nephrectomy. All patients underwent subsequent living-related renal transplantation. The operative duration, haemoglobin decrease, blood transfusion, hospital stay, analgesic requirement and time to receipt of a transplant were compared with those of patients who underwent open pretransplant nephrectomy (14 patients) from 1984 to 2001.

RESULTS

Kidneys of a size to interfere with graft placement were the commonest indication for surgery (eight patients). In comparison with open surgery, the mean (SD) hospital stay at 9.26 (2.9) vs 4.86 (0.9) days, analgesic requirement at 320 (120) vs 221 (120.5) mg of tramadol, blood transfusion rate at 1.3 (0.5) vs 0.9 (0.6) units, period to receive a graft kidney at 29.77 (4.6) vs 9.14 (3.38) days, were significantly less with laparoscopy. The

complications noted were single instances of splenic capsular tear, pleural tear, sub-acute intestinal obstruction and vena caval injury.

CONCLUSION

Pretransplant laparoscopic nephrectomy in patients with ADPKD has all the benefits of minimally invasive surgery such as reduced intraoperative blood loss and minimal postoperative pain leading to early and faster convalescence. These benefits help in decreasing the period between nephrectomy and transplantation. The surgeon needs to have considerable experience in laparoscopy before embarking on laparoscopic pretransplant nephrectomy.

KEYWORDS

autosomal dominant polycystic kidney disease, pretransplant nephrectomy, laparoscopy

INTRODUCTION

Autosomal dominant polycystic kidney disease (ADPKD) is a common genetic disorder (one in 1000 live births) and very often progresses (2–9%) to renal failure (end-stage renal disease) [1,2]. Patients with ADPKD have a variable clinical presentation such as abdominal pain (85%), hypertension (81%), haematuria (50%) and stones (20–30%). Renal failure develops more commonly in patients with more cysts and arterial hypertension [3]. Most azotaemic patients with ADPKD are relatively asymptomatic and do not need nephrectomy in preparation for renal transplantation. However, Rayner *et al.* [4] reported a significantly higher mortality rate secondary to urosepsis in patients who were not nephrectomized before transplantation.

The first laparoscopic nephrectomy was reported by Clayman *et al.* [5], and 6 years

later, the first laparoscopic kidney removal in ADPKD was done [3] Gill *et al.* [6] described their experience in 10 patients with ADPKD who underwent modified laparoscopic retroperitoneal synchronous bilateral nephrectomy. These surgeons achieved a significantly shorter hospital stay, quicker recovery and decreased morbidity. We analysed our series of pretransplant laparoscopic nephrectomies for ADPKD kidneys.

PATIENTS AND METHODS

We retrospectively reviewed the medical records of patients with renal failure secondary to ADPKD who underwent pretransplant laparoscopic nephrectomy from August 2002 to December 2006. In all, 13 patients (21 renal units) were operated on. Five patients had unilateral nephrectomy, whereas seven patients had staged bilateral

nephrectomy, and one patient had simultaneous bilateral nephrectomy. Of the procedures, 19 were done transperitoneally while in two, a retroperitoneal approach was used. All patients were on maintenance haemodialysis until they received live-related renal transplantation.

The indications for nephrectomy are listed in Table 1. The variables analysed included operative duration, haemoglobin decrease, blood transfusion rate, hospital stay, analgesic requirement, and time to receipt of renal transplant (Table 2). We compared the present results with an historical cohort of open pretransplant nephrectomies (14 patients) performed between 1984 and 2001.

OPERATIVE TECHNIQUE

Pneumoperitoneum was created using a Veress needle, with the patient in a modified

Variable	Value	TABLE 1
Total no. of patients/renal units	13/21	Demographic data
Sex, M : F	11 : 2	
Mean (SD, range)		
Age, years	49.1 (6.2, 38–65)	
Body mass index, kg/m ²	26.3 (3.6, 19–31)	
Presentation, n/N		
Pain	10/13	
Recurrent UTI	3/13	
Fever	3/13	
Hypertension	10/13	
Diabetes	2/13	
Hematuria	5/13	
Indications for nephrectomy, n		
Large size	8	
Recurrent UTI; cyst abscess	3	
Calculus	3	
Haemorrhage into cyst; pain	5	
Transperitoneal/retroperitoneal	19 : 2	
Unilateral	5	
Staged bilateral	7	
Simultaneous bilateral	1	
Left : right	11 : 8	

FIG. 1. Position of patient.

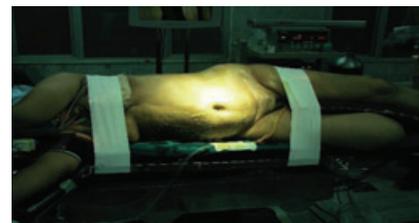


FIG. 2. Position of ports.



FIG. 3. Specimen of polycystic kidneys from a patient who had bilateral simultaneous laparoscopic nephrectomy.



was identified and lifted up to assist exposure of the renal hilum as well as for lateral dissection. The renal vessels were secured as quickly as possible. The kidney was dissected all around with care taken not to rupture the cysts. Any spilled cyst contents were immediately aspirated, and a thorough saline lavage was given at the end of the procedure. The specimen was retrieved through a midline or ipsilateral flank incision (Fig. 3).

RESULTS

In the present series, the commonest indication was massively enlarged kidneys extending into the right iliac fossa making graft placement difficult (eight patients). The other indications included recurrent UTIs (three), calculus disease (three) and haemorrhage into the cyst (five) (Table 1).

Variable	Open	Laparoscopy	P*
N	14	21	
Mean (SD):			
Operating duration, min	157 (34)	190 (67.6)	0.06
Blood transfusion, units	1.3 (0.5)	0.9 (0.6)	0.03
Specimen weight, g	1350 (489.2)	1241.7 (583.7)	0.29
Analgesic requirement, mg of tramadol	320 (120)	221 (120.5)	0.01
Hospital stay, days	9.26 (2.9)	4.86 (0.9)	<0.001
Time to receipt of renal transplantation, days	29.77 (4.6)	9.14 (3.38)	<0.001
Complications, n			
Splenic capsular tear	0	1	
Pleural tear	6	1	
IVC tear	0	1	
Spontaneous AVF closure	1	2	
Prolonged ileus/prolonged RT aspiration	0	2	
Sub-acute intestinal obstruction	0	1	
Open conversion	–	2	
Fever	2	3	

*Student's t-test; AVF, arteriovenous fistula.

flank position (Fig. 1). Ports were placed as per the topography of the kidney. Under anaesthesia, the surface marking of the kidney was done and a Veress needle inserted in the mid-clavicular line, caudal to the lower pole of the kidney, a 12-mm working port was placed at this point. The 5-mm port was

placed at the subcostal margin. The 11-mm camera port was placed more towards the midline (Fig. 2), if required during surgery an extra 5 mm port was placed in the posterior axillary line for retraction. Initial peritoneoscopy was done. Dissection started from the lower pole of the kidney. The ureter

Comparing the open group with the laparoscopy group, the blood transfusion requirement, analgesia requirement, hospital stay and the period between nephrectomy and transplantation were all significantly less for the laparoscopy group (Table 2). The specimen weight was similar in the groups. The complications in both groups are also detailed in Table 2. The major complications included a splenic tear and a pleural tear, which were managed laparoscopically. There were two conversions; one patient had an inferior vena cava (IVC) tear and the other had extensive adhesions. Pyelonephritis was noted in all kidneys histologically (21 kidneys). Three kidneys had calculus pyelonephritis, three had an abscess, and five had haemorrhage into at least one cyst. Comparison with other laparoscopic series and the associated complications are shown in Tables 3 and 4, respectively.

DISCUSSION

ADPKD is a multi-organ disorder usually associated with extrarenal manifestations such as hepatic cysts [7], colonic diverticula, intracerebral aneurysms (10–40% of patients have berry aneurysms), aortic aneurysms, and cardiac valve abnormalities. The indications for nephrectomy in ADPKD include massively enlarged kidneys, staghorn stones, drug-resistant hypertension, persistent UTI with urolithiasis, massive proteinuria, Goodpasture's syndrome, and, rarely, VUR with chronic pyelonephritis [8]. Open nephrectomy, although a 'gold standard', is associated with high morbidity and mortality rates [9]. In azotaemic cases, open surgical removal of these enlarged kidneys requires a large abdominal incision with a resultant increase in morbidity.

The present data suggest that the laparoscopic approach shortens the interval between nephrectomy and renal transplantation. On comparing the open with the laparoscopic approach, the hospital stay, blood transfusion rate, and analgesic requirement were significantly less. Shorter and earlier convalescence leads to better preoperative preparation for transplantation. The concerns about the laparoscopic approach include proper positioning and placement of ports for meticulous surgical dissection. We select the port positions with the aid of preoperative CT.

TABLE 3 Summary of published series

Variable	Reference			
	Gill <i>et al.</i> [6]	Jenkins <i>et al.</i> [10]	Dunn <i>et al.</i> [11]	Present study
Nephrectomy (n)	B/L simultaneous	B/L simultaneous	U/L (7) B/L (2)	U/L (5), B/L (7), B/L simultaneous (1)
Approach	RP	HAL	TP (10), RP(1)	TP (19), RP (2)
N	10	4	9/11	13/21
Mean (range):				
Operative duration, h	4.4	4.8	6.3 (3.4–8.8)	3.16 (1.5–6)
EBL, mL	150	338	153 (50–500)	192 (50–500)
Kidney weight, g	3014	1582	769 (132–2200)	1241 (180–2600)
Incision length, cm	10.5	9.5	7–12	10 (7–12)
Morphine equivalents, mg	34.2	139	33	221 (tramadol)

B/L, bilateral; U/L, unilateral; RP, retroperitoneal; TP, transperitoneal; HAL, hand-assisted laparoscopic; EBL, estimated blood loss.

TABLE 4 Complications in published series

Complication	Reference			
	Dunn <i>et al.</i> [11]	Gill <i>et al.</i> [6]	Bendavid <i>et al.</i> [12]	Present study
N	11	10	22	21
IVC tear	1	0	1	1
Splenic injury	1	0	0	1
Pleural tear	0	0	0	1
Bowel injury	0	1	1	0
Brachial plexus injury	1	0	0	0
Spontaneous closure of AVF	1	0	2	2
Pulmonary embolism	1	0	0	0
Retroperitoneal haematoma	0	2	0	0
Prolonged paralytic ileus	0	1	0	2
Incisional hernias	2	1	2	0

AVF, arteriovenous fistula.

It is crucial to dissect in the correct surgical plane to avoid cyst rupture. We had two patients with gross spillage of cyst contents; both had prolonged ileus leading to increased morbidity. Every attempt should be made to prevent rupture of the cysts containing noxious fluid, which leads to chemical peritonism [6].

Thorough lavage is used to clear all cyst fluid from the peritoneal cavity. Aspiration of large cysts, to reduce the amount of noxious material entering the peritoneum, should be considered, as this manoeuvre decreases infective complications as well as the kidney size, assisting specimen retrieval. One patient had a splenic capsular tear with a pleural tear sustained during dissection of the densely

adherent upper pole. The capsular tear was managed with Surgicel wrapping, while the pleural tear was closed laparoscopically along with placement of intercostal drainage. Open conversion was required in two patients, one for extensive adhesions and the other for an IVC tear during dissection of hilar adhesions. Two patients had spontaneous closure of an arteriovenous fistula (which were constructed preoperatively for haemodialysis), due to transient hypotension in the immediate postoperative period. One patient developed subacute intestinal obstruction, which was managed conservatively.

We have seen intestinal adhesions during laparoscopy for subsequent staged nephrectomy, leading to difficulty in

dissection. Hence, it is better to perform simultaneous bilateral nephrectomy, whenever it is feasible [6], as we did in our last case. Our experience suggests that laparoscopic retrieval of these large kidneys is a potentially morbid procedure and should be undertaken only after gaining adequate experience in laparoscopy.

Crucial points to be considered are:

1. Proper preoperative assessment, which includes CT of the abdomen.
2. Adequate preoperative haemodialysis.
3. Proper positioning and placement of the ports for comfortable dissection.
4. Dissection plane should be between the cyst and Gerota's fascia.
5. Avoidance of rupture of the cysts. If inadvertent rupture of a cyst occurs, thorough peritoneal lavage is necessary at the completion of the procedure.
6. Slow and meticulous dissection to prevent adjacent organ injury.
7. Bilateral simultaneous nephrectomy whenever possible.

In conclusion, pretransplant laparoscopic nephrectomy in patients with ADPKD has the benefits of minimal invasive surgery such as reduced intraoperative blood loss and minimal postoperative pain, leading to early and faster convalescence. These benefits, in turn help to decrease the period between nephrectomy and transplantation. The surgeon needs to have considerable experience in laparoscopy before embarking on laparoscopic pretransplant nephrectomy.

CONFLICT OF INTEREST

None declared.

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Abbreviations: ADPKD, autosomal dominant polycystic kidney disease; IVC, inferior vena cava.