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# Transperitoneal Laparoscopic Nephrectomy for Autosomal Dominant Polycystic Kidney Disease

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## ABSTRACT

**Objective:** This study focuses on laparoscopic nephrectomy for autosomal dominant polycystic kidney disease (ADPKD).

**Material and Methods:** We retrospectively reviewed 21 consecutive patients who had previously undergone laparoscopy between 2007 and 2010. Data were compared to that obtained from 19 consecutive patients who had open surgery between 2004 and 2007. Clinical parameters, operative data, perioperative mortality, postoperative complications, and length of hospital stay were compared using $\chi^2$ and Student $t$ tests for qualitative and quantitative variables, respectively.

**Results:** Nephrectomy is usually performed to create space for renal transplantation (81% and 79%, respectively). Operating time was longer with the laparoscopic approach (180 min vs. 128 min, $P = .001$). Blood loss was comparable in the 2 groups (154 vs. 222 ml, $P = .359$) but 3 patients were transfused in the open surgery group as compared with 1 patient in the laparoscopic group. No conversion was needed. There was a trend in the laparoscopic group with respect to lower consumption of analgesics in the postoperative period ($P = .06$). Delay to transit recovery (2.1 d vs 4.1 d, $P < .001$) and hospital stay (5.2 d vs. 8.28 d, $P = .002$) were significantly decreased in the laparoscopic group. The interval from surgery to renal transplantation was lower in patients operated on laparoscopically (3.1 vs. 12 mo). Complications occurred in 33% of the patients in the laparoscopic group as compared with 68% in the open surgery group ($P = .22$). Severe complications were less frequent in the laparoscopic group (9.5% vs. 37%, $P = .04$).

**Conclusion:** Laparoscopic nephrectomy is a feasible and safe procedure for ADPKD. Morbidity is significantly reduced compared with the open approach.

**Key Words:** Kidney, Renal insufficiency, Polycystic kidney, Laparoscopy.

## INTRODUCTION

Autosomal dominant polycystic kidney disease (ADPKD) is a common hereditary disorder, with a prevalence of 1/1000. Progressive renal disease occurs in 45% of the patients by the age of 60, and 10% of renal transplant patients are individuals affected by ADPKD.[1] ADPKD originates from a mutation in either the ADPKD-1 or ADPKD-2 gene, altering the synthesis of polycystin-1 and 2, respectively. Loss of function of these proteins causes the clinical syndrome characterized by the progressive compression and destruction of the renal parenchyma by multiple enlarging cysts.[2]

Massive enlarged polycystic kidneys can become symptomatic and require nephrectomy. Furthermore, surgery may also be needed before renal transplantation, when polycystic kidneys are too large to safely implant a renal transplant in the iliac fossa. Because of the volume of ADPKD kidneys, the open surgery approach has traditionally been used. However, due to the advantages of laparoscopic nephrectomy in terms of reduced hospital stay, postoperative pain, and speed of recovery, laparoscopy for ADPKD kidneys has been reported by some centers. Despite its advantages, this technique is still uncommon.[3–10]

The objective of this study is to describe a technique of laparoscopic ADPKD nephrectomy and compare its surgical outcomes to those of the open approach.

## MATERIALS AND METHODS

### Patient Demographics

Between December 2007 and February 2010, 21 consecutive nonselected patients with polycystic kidneys underwent laparoscopic nephrectomy. None of the patients

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underwent open surgery during this time period. All surgeries were performed by the same surgeon (KB). These patients were compared to a group of 19 patients who had consecutively received open surgery between January 2004 and December 2007, by one surgeon (JJP). The following variables were analyzed: age, sex, ASA score, body mass index (BMI), maximum size of the kidney on the CT scan, indication, operative time, blood loss, cumulative dose of morphine sulphate, time to transit recovery, hospital stay, blood transfusion, postoperative complications, and delay between nephrectomy and renal transplantation. Complications were graded according to Clavien's modified classification.[11]

### Surgical Technique

Each patient received a CT scan preoperatively to evaluate kidney volume and exclude potential renal tumors. Patients were placed on a low-residue diet 3 d before surgery. A urethral catheter was systematically placed. No antibioprophylaxis was administered.

### Laparoscopic Technique

The patient was placed in a ¾ lateral decubitus position and secured with adhesive tapes **(Figure 1)**. The table was not flexed and could be rotated in case of conversion. A mini-laparotomy was made at the umbilicus, and a 12-mm optical port was inserted. We used a 10-mm, 30-degree laparoscope in all cases. Under visual control, 3 operating trocars were placed: a 5-mm trocar under the subcostal margin on the midclavicular line, a 12-mm in the iliac fossa, and a 5-mm just inferior to the xiphoid to retract the liver in case of nephrectomy on the right side **(Figure 2)**. The first step was the mobilization of the right colon to expose the anterior surface of the kidney. Attention was paid when mobilizing the duodenum, because of potential adhesions due to cyst infection. Dissection of the vena cava was not performed. At the lower pole of the kidney, the gonadal vein was shifted downward. Gerota's fascia was then incised to find the plane between the psoas muscle and the kidney. At this time, an additional 5-mm trocar was inserted in the flank to lift the kidney and expose the renal hilum. The ureter was identified and sectioned between two 5-mm Hem-o-lok clips. The renal pedicle was progressively dissected until the renal vein was exposed. The renal artery could be viewed behind the vein in all cases. The artery was secured with 10-mm Hem-o-lok clips and cut. The renal vein was sectioned between three 12-mm Hem-o-lok clips. The kidney was completely mobilized in the simple nephrectomy plan. The adrenal gland was spared in all cases. The kidney was removed using a 7-cm Pfannenstiel incision. No retrieval bag was used for the extraction due to the increased size of the polycystic kidneys. If an en bloc extraction could not be made, the specimen was cut into several pieces through the incision.

**Figure 1.** Installation of the patient on the operative table for a right nephrectomy.

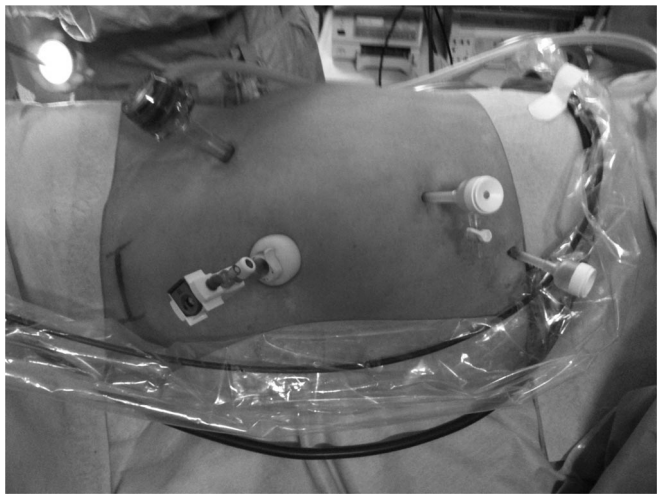

**Figure 2.** Position of the different ports for a right nephrectomy, and the abdominal incision.

### Open Technique

A transperitoneal technique was used in all cases. A subcostal incision was performed from the midline to the flank. After reflection of the colon, the renal pedicle was dissected and sectioned. The kidney was mobilized in a

simple nephrectomy plan and removed, sparing the adrenal gland.

### Data Analysis

Qualitative and quantitative variables were compared using $\chi^2$ and Student $t$ tests, respectively. All analyses were conducted with the statistical package for the Social Sciences version 17.0 (SPSS Inc, Chicago, IL, USA), and P value significance was set at 0.05.

## RESULTS

Twenty-one patients were enrolled in the laparoscopic group and 19 in the open group. They were comparable in terms of age, sex, body mass index (BMI), kidney maximum diameter, and ASA score **(Table 1)**. Seventeen laparoscopic (81%) and 15 open surgery patients (79%) underwent nephrectomy to allow sufficient space prior to transplantation. Characteristics of the patients are depicted in Table 1. In terms of surgical parameters **(Table 2)**, there was no difference regarding estimated blood loss between the 2 groups (154mL vs. 222mL, $P = .359$), but more patients received blood transfusions in the open group (1 vs. 3 patients in the open group). Operating time was longer with the laparoscopic approach (180 min vs. 128 min, $P = .001$). Lower amounts of analgesics were administered in the laparoscopic group, although the differences were not significant (17 vs. 27 mg, $P = .06$). Time to transit recovery (2.1 vs. 4.1 d, $P < .001$) and duration of hospital stay were significantly shorter in the laparoscopic group (5.2 vs. 8.28 d, $P = .002$). No conversion to open surgery was needed in the laparoscopic group. The specimen had to be morcellated in 12 cases. No malignant tumors were found upon pathological analysis in both groups. A lower number of complications was found in the laparoscopic group, but the overall difference was not significant (33% vs 68%, $P = .12$). Severe complications (grade ≥3 according to Clavien classification) were significantly more frequent in the open nephrectomy group (9.5% in the laparoscopic group vs 37% in the open group, $P = .04$). Details of complications are reported in Table 3. Postsurgical complications (2 wound dehiscences) only occurred in the open group with a mean follow-up of 12 mo. The time interval between nephrectomy and renal transplan-

**Table 1.**
General Characteristics of the Population Studied

| Variables | Laparoscopy (n=21) | Open (n=19) | P |
|---|---|---|---|
| Sex: | | | .218 |
| Women | 13 | 9 | |
| Men | 8 | 10 | |
| Mean age (years) | 53 [41–71] | 53 [40–71] | - |
| Mean BMI | 25 [16–34] | 23 [18–27] | .120 |
| Mean largest size of the kidney on CT scan (cm) | 23.5 [17–30] | 26.8 [15–48] | .13 |
| ASA score | | | .342 |
| 2 | 3 | 1 | |
| 3 | 18 | 18 | |
| Dialysis | 16 | 16 | .787 |
| Preliminary transplantation | 2 | 3 | - |
| Arterio-veinous dialysis fistula (AVF) | 18 | 17 | .72 |
| Surgical indication: | | | |
| Before transplantation | 17 | 15 | |
| Symptomatic patient | 4 | 3 | |
| Flank pain | 4 | 1 | |
| Intracystic hemorrhage | 1 | 0 | |
| Intestinal disorders | 3 | 0 | |
| Urinary lithiasis | 0 | 2 | |

**Table 2.**
Operative and Perioperative Parameters

| Variables | Laparoscopy (n=21) | Open (n=19) | P |
|---|---|---|---|
| Mean operative time (min) | 180 [90–310] | 128 [100–170] | .001 |
| Estimated blood loss (mL) | 154 [0–700] | 222 [10–500] | .359 |
| Mean cumulative dose of morphine sulphate use (mg) | 17 [0–56] | 27 [0–60] | .068 |
| Mean hospital stay (days) | 5.2 [3–11] | 8.28 [5–24] | .002 |
| Delay between nephrectomy and renal transplantation (months) | 3.1 | 12 | |
| Mean time to transit recovery (days) | 2.1 [1–3] | 4.1 [2–10] | <.001 |
| Post-operative transfusion | 1 | 3 | |
| Surgical conversion | 0 | - | - |

**Table 3.**
Postoperative Complications According to Clavien Classification[11]

| Complications | Laparoscopy (n=21) | Open (n=19) | P |
|---|---|---|---|
| | 7 (33.3%) | 13 (68.4%) | |
| Blood transfusion | 1 | 3 | |
| Bowel injury | 1 | 0 | |
| Adrenal injury | 0 | 1 | |
| AVF thrombosis | 2 | 3 | |
| Retroperitoneal hematoma | 1 | 0 | |
| Urinary tract infection | 1 | 1 | .12 |
| Diarrhea | 1 | 0 | |
| Prolonged ileus | 0 | 1 | |
| Digestive hemorrhage | 0 | 1 | |
| Ischemic cerebrovascular accident | 0 | 1 | |
| Wound dehiscence | 0 | 2 | |
| Clavien 1–2 | 5/21 (23.8%) | 6/19 (31.6%) | .6 |
| Clavien 3–4 | 2/21 (9.5%) | 7/19 (37%) | .04 |

tation was shorter in the laparoscopic group (3.1 vs. 12 mo).

## DISCUSSION

Indications for ADPKD nephrectomy are intolerable pain, adjacent organ compression, or the need to create space for the renal transplant prior to transplantation.[1] Open surgery is currently considered the gold standard in this field, though it requires a large subcostal incision or lumbotomy that can cause significant morbidity. Bennett et al.[12] reported a complication rate of 38% and a mortality rate of 3% in a series of 31 patients treated by bilateral nephrectomy. More recent publications report comparable rates, ranging between 36% and 40%.[1,4,13,14] In terms of morbidity, the current study showed an obvious advantage with the laparoscopic approach as compared with open nephrectomy. Patients treated laparoscopically had less pain, faster bowel recovery, and were discharged twice as fast from the hospital. They also had less severe complications. Although only a few studies are available on laparoscopic ADPKD nephrectomy, they all report this technique to be safer and more feasible.[5,6,8] The advantages of laparoscopic nephrectomy over the open approach are now well established for kidneys and localized tumors.[15] All series report shorter hospital stays, lower morbidity, and decreased wound complications.[16,17] Laparoscopy has not been widely used, because of the increased size of ADPKD kidneys, and remains restricted to a few centers with laparoscopic expertise. The current series shows that laparoscopy can be used safely even in the case of enlarged kidneys. The complication rate was 33%, which is comparable to previously published series.[4–6] Minimizing blood loss is particularly important in ADPKD patients to avoid transfusions that could cause allo-immunization. In this case, patients would receive heparin during their dialysis, increasing the risk of postoperative bleeding. No significant differences were found in terms of blood loss between the 2 groups, although a lower number of patients required transfusion in the laparoscopic group. The current findings are in accordance with previous studies, that show decreased blood loss and less frequent transfusions with the laparoscopic approach.[4,5,7–9,11] In this study, a transperitoneal approach was exclusively used, while 2 previously reported series describe a retro-

peritoneal approach.[4,18] No difference has ever been observed between the intraperitoneal and retroperitoneal approach in terms of morbidity and mortality in kidney cancer.[19] Nevertheless, in the case of ADPKD, characterized by increased kidney size, the transperitoneal route is more convenient because of the large space it offers. Mobilizing the kidney and dissecting the pedicle facilitated the procedure. A potential pitfall of laparoscopic ADPKD nephrectomy is morcellation of a specimen harboring a kidney tumor, posing a low risk of tumor seeding. In the current series, all patients underwent a CT scan before surgery, and no tumoral lesions were found upon histological evaluation. The incidence of renal cancer in ADPKD patients is similar to that observed in the general population.[20] Only one renal tumor case discovered after surgery has been reported.[7] ADPKD cysts can become infected, posing a risk of sepsis in the peritoneal space during dissection and extraction of the specimen.[4] We did not observe any peritonitis or wound infection, and to our knowledge, no cases have ever been reported. There are alternatives to surgery in ADPKD patients, and the most common is arterial embolization.[21,22] This approach yields a 50% kidney size decrease after 12 mo of follow-up, improving quality of life.[22] This technique is usually offered to dialyzed patients with a decreased performance status, but has side effects including flank pain and fever. In addition, the time of kidney size reduction can last up to 6 mo, delaying the time on the transplant waiting list. Patients operated on laparoscopically waited significantly less for a transplant compared with those undergoing open surgery (3 mo versus 12 mo). The reasons of this difference are currently unknown, although they may be related to faster recovery after surgery. Nevertheless, subsequent management of the patients did not seem to be influenced by the laparoscopic approach. Another explanation could be the change in the rules of transplant distribution in France over the past 2 y. The present study has some limitations. It is a retrospective and relatively small series, as shown by the lack of statistical significance for morbidity, bleeding, and complication rate between the 2 surgical groups. A prospective, multicentric evaluation should be conducted to assess the advantages of the laparoscopic approach. In addition, both open and laparoscopic nephrectomy techniques were performed by 2 different surgeons at different times; therefore, the variations may also reflect practice change.

## CONCLUSION

The current study shows that laparoscopic nephrectomy for ADPKD is safe and technically feasible. Morbidity is significantly reduced when compared with the open approach and may reduce waiting time for renal transplantation.

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