

## CLINICAL SCIENCE

# Laparoscopic nephrectomy for xanthogranulomatous pyelonephritis – Are there predictive factors for success?

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**OBJECTIVES:** Laparoscopic nephrectomy for xanthogranulomatous pyelonephritis is currently associated with great operative difficulty and surgical complications. Herein, we report on our single-center experience and describe predictive factors for successfully accomplishing this procedure.

**METHOD:** Between March 1998 and April 2010, 66 patients (27 men and 39 women) underwent laparoscopic nephrectomy for the treatment of a unilateral nonfunctioning kidney. These patients had previous diagnoses of renal chronic inflammation associated with calculi and previous pyonephrosis. All of the nephrectomies were performed using the transperitoneal approach, and a similar technique was used for radical nephrectomy.

**RESULTS:** Laparoscopic nephrectomy for the treatment of renal chronic inflammation was successful in 58/66 cases (87.9%). Eight cases were converted to the open technique because of difficulty in progression, which was related to the discovery of dense adhesions in the hilar or perirenal region. One major (colonic lesion) and two minor (wound infection) complications occurred in the conversion group. A diagnosis of xanthogranulomatous pyelonephritis was confirmed pathologically for all of the specimens. Of the factors examined, a longitudinal renal length greater than 12 cm (laparoscopy group -  $7.2 \pm 1.8$  cm, versus open group -  $13.6 \pm 1.5$  cm;  $p < 0.05$ ) and time to access the renal vessels (laparoscopy group -  $32 \pm 18$  min, versus open group -  $91 \pm 11$  min;  $p < 0.05$ ) were associated with a higher conversion rate. Although the number of patients in the conversion group was small, the majority of these patients received right-sided nephrectomy.

**CONCLUSIONS:** Laparoscopic nephrectomy for the treatment of xanthogranulomatous pyelonephritis is feasible and associated with low levels of morbidity. Factors including the time required to control the renal vessels, renal length and right-sided nephrectomy were associated with higher chances of conversion into an open procedure.

**KEYWORDS:** Xanthogranulomatous Pyelonephritis; Laparoscopic Nephrectomy; Complications; Treatment.

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## INTRODUCTION

Xanthogranulomatous pyelonephritis (XGP) was first described in 1916 by Schlagenhauser (1) and is assumed to be an uncommon chronic renal infection in which the renal parenchyma is destroyed and replaced by lipid-laden macrophages (2). XGP typically occurs in the presence of chronic obstruction and suppuration and has been shown to account for up to 19.2% of all cases of pyelonephritis in a recent case series (1).

Although there is a consensus that the treatment of choice for this condition should be total nephrectomy (3,4), there

remains no unanimous agreement as to the best surgical approach. The surgical options for such a procedure include open or laparoscopic techniques, which can be performed either with or without robotic assistance (1,4-10).

Initial reports suggested that the benefits of laparoscopic nephrectomy did not extend to patients with XGP (3). However, the majority of recent series have agreed that laparoscopy may enable decreased blood loss, shorter convalescence time and superior cosmesis (1,5,8) and that this technique can be successfully completed in more than 70% of cases (5,7,8).

The conversion rates to either the open approach or the hand-assisted technique vary from 20% to 36% and are generally associated with difficulty in progressing due to severe perirenal adhesions and fibrosis (5,8).

In this study, we report on our single-center experience with nephrectomy for the treatment of XGP and the factors found to be associated with a higher conversion rate of laparoscopic to open surgery.

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No potential conflict of interest was reported.

**MATERIALS AND METHODS**

We reviewed the records for all of the laparoscopic nephrectomies performed between March 1998 and April 2010 at our institution. In total, we examined 262 nephrectomy cases. This study was performed in accordance with the ethical standards of the institutional committee on human experimentation and of the Helsinki Declaration of 1975 (revised in 1983).

Patients with histopathological diagnoses of XGP were included, which resulted in a total of 66 nephrectomy cases. All of these patients had a history of fever, lithiasis treatment and urinary infection and had been administered parenteral antibiotics until one year before the procedure. <sup>99m</sup>Tc-DMSA scintigraphy was performed for all of the patients, and the results indicated an average relative kidney function of 8±3%. All of the nephrectomies were performed using an extrafascial technique in which the dissection was maintained outside of Gerota’s fascia, which is similar to that performed for renal malignant conditions. Organ tissue was removed *en bloc* for pathological examination through a mini Pfannenstiel incision.

The subjects were divided into two groups based on the full accomplishment of the procedure by laparoscopy (Group I) or the need for open conversion (Group II). The decision to perform a conversion procedure was made by the surgeon.

All of the specimens had a confirmed histological diagnosis of XGP without concurrent malignancy or multicystic dysplasia. The XGP specimens were characterized by the presence of a focal or diffuse process with foam-laden macrophages within a background of chronic inflammation.

Data concerning patient demographics, preoperative computed tomography (CT) scan features, time to securely clamp the hilum vessels, total operative time, conversion rate, total blood loss and hospital stay were accessed.

These data were analyzed using the non-paired Student’s t test. A level of significance below 0.05 was adopted.

**RESULTS**

Pure laparoscopic nephrectomy for renal chronic inflammation was successfully accomplished in 58 of 66 cases (87.9%). Eight cases (12.1%) were converted to the open technique because of difficulty in progressing, which was related to the discovery of dense adhesions in the hilar or perirenal region. No differences were observed regarding age, body mass index (BMI) or gender distribution between the conversion and no conversion groups (*p*>0.05) (Table 1). However, significant differences were detected concerning the mean operative time (122.5±15.8 versus 215.6±38.3 minutes, *p*<0.05); total blood loss (191±96.5 versus

300.2±142.4 mL, *p*<0.05) and total hospital stay (2.1±1.4 versus 4.3±2.3 days, *p*<0.05) between the conversion group and the pure laparoscopy group, respectively (Table 2).

One major (colonic lesion) and two minor (wound infection) complications occurred in the conversion group. The colonic lesion was promptly identified and repaired with primary suturing without further complications (grade II, according to the Clavien Classification of Surgical Complications) (11). The wound infection was treated with oral first-generation cephalosporin antibiotics (grade I, according to Clavien Classification of Surgical Complications) (11).

Of the factors assessed, a longitudinal renal length greater than 12 cm (7.2±1.8 versus 13.6±1.5 cm, *p*<0.05) and the time required to securely isolate the renal vessels (32±18 versus 91±11, *p*<0.05) were associated with a higher conversion rate. Although the number of patients in the conversion group was small, the majority of these patients underwent right-sided nephrectomy (6/8, 75% - Table 1).

**DISCUSSION**

For XGP kidneys, nephrectomy is recommended as the definitive treatment due to the extensive destruction of the parenchyma in these cases and because the differential diagnosis with renal malignancy is often difficult (3,4).

The benefits of laparoscopy, compared with traditional open surgery for the treatment of XGP, have been well established in recent case series (1,5,7,8). However, even among experienced surgeons, close to 30% of all cases require conversion to open surgery due to technical difficulties and failure to progress (5,8).

In the last decade, significant advances have been made in the field of minimally invasive surgery, especially regarding laparoscopic, endourologic and robotic technologies. However, it is important to note that these technologies involve high-cost materials, and the cost effectiveness of these techniques is directly related to their ability to successfully accomplish their surgical purpose without perioperative complications or the need for retreatment. These benefits are translated into shorter hospital stays, fewer hospital readmittance and a more rapid return to work, which ultimately represent financial savings for the medical system.

For these reasons, it is important to judiciously select the cases that are more likely to be successfully resolved with minimally invasive techniques, especially for conditions such as XGP, for which there is controversy regarding the most suitable approach.

The current study represents the largest XGP case series to date, and the results identified three aspects that may

**Table 1 - Demographic data.**

	Group I	Group II	p-value
<b>N</b>	58	8	
<b>Age</b>	41.5±8.2	42.5±9.6	<i>p</i> >0.05
<b>BMI</b>	26.2±4.1	25.6±4.2	<i>p</i> >0.05
<b>Gender</b>	34 F (58.6%) 24 M (41.4%)	05 F (62.5%) 03 M (37.5%)	<i>p</i> >0.05
<b>Side</b>	26 Right (44.8%) 32 Left (55.2%)	06 Right (75%) 02 Left (25%)	

Abbreviations: BMI = body mass index; F = female; M = male.

**Table 2 - Intraoperative data.**

	Group I	Group II	p-value
<b>N</b>	58	8	-
<b>Surgical time (min)</b>	122.5±15.8	215.6±38.3	<i>p</i> <0.05
<b>Blood loss (cc)</b>	191±96.5	300.2±142.4	<i>p</i> <0.05
<b>Hospital stay (days)</b>	2.1±1.4	4.3±2.3	<i>p</i> <0.05
<b>Renal length (cm)</b>	7.2±1.8	13.6±1.5	<i>p</i> <0.05
<b>Time to secure renal vessels (min)</b>	32±18	91±11	<i>p</i> <0.05

Abbreviations: min = minutes; cc = cubic centimeters; cm = centimeters.

have a causal correlation with higher conversion rates to open surgery when treating XGP by nephrectomy.

One of the factors identified to be associated with a higher conversion rate was a longitudinal renal length greater than 12 cm, which is compatible with an enlarged kidney. Furthermore, the following computed tomography findings can be used to diagnose XGP: nephromegaly, obstructive uropathy, densities varying from 215 to 110 UH, rim-enhancing multiple fluid-filled cavities, the presence of a staghorn calculus or other large calculus in the collecting system, thickening of Gerota's fascia and infiltration of the perinephric space, such as the psoas muscle (3,4,7).

Our findings corroborate the hypothesis that nephromegaly is associated with a higher conversion rate. Moreover, this condition is associated with enlarged kidneys, demonstrating more severe renal inflammation and, therefore, more severe perirenal adhesions. These factors may justify the difficulty of progressing in these cases, as the kidney becomes bulky, and the working space diminishes regardless of the use of the transperitoneal approach.

The difficulty associated with dissecting in narrow spaces becomes especially challenging on the right side, where the proximity to the vena cava requires extra care to avoid vascular injury. Regarding the conversion group examined in the current study, the majority underwent right-sided nephrectomy. When considering the XGP scenario, both the previously mentioned fibrotic adhesions and the existence of lymphadenomegaly as a result of ganglionic inflammation and subsequent enlargement impose additional difficulty. Under these circumstances, the dissection and ligation of the renal pedicle may not be possible laparoscopically.

Moreover, the history of pyonephrosis or renal abscesses in the conversion group further supports the hypothesis of extensive local inflammation in this region.

In addition, the time required to securely isolate the renal vessels was shown to be associated with a higher rate of conversion to open surgery. Thus, considering the obstacles previously mentioned, these results are the first to suggest a realistic time limit related to a greater likelihood to fail in the full laparoscopic approach.

Although we should note the limitations of our study, especially its retrospective nature, it should be kept in mind that XGP is an unusual presentation and as such, more expressive data and additional evidence would only be achievable if a multicenter study was performed. Furthermore, we believe that our complication rate was low due to the experience and careful technique of the authors who performed the surgeries.

Laparoscopic nephrectomy is the definitive treatment for XGP and is feasible and associated with low levels of morbidity. Factors including the time required to control the renal vessels, renal length and right-sided nephrectomies were associated with higher rates of conversion to the open procedure.

## AUTHOR CONTRIBUTIONS

Lima M designed and conceived the study, collected, analyzed and interpreted the data and drafted the manuscript. Miyaoka R and Moro J collected, analyzed and interpreted the data and revised the manuscript. D'Ancona C revised the manuscript.

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