

Laparoscopic nephrectomy in patients with renal exclusion secondary to urolithiasis. Which factors can predispose conversion to open surgery?

Nefrectomia laparoscopica en pacientes con exclusión renal secundaria a urolitiasis. ¿Que factores pueden predisponer la conversión a cirugía abierta?

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Abstract

Background: The prevalence of urolithiasis is 7-10% and has increased over the past years. Simple nephrectomy is, therefore, indicated when renal exclusion is associated with recurrent urinary tract infections and/or chronic pain. **Objective:** The aim of the study was to describe the surgical experience of laparoscopic nephrectomy (LPN) due to urolithiasis in Mexican South-east and which factors can predispose conversion to open surgery. **Methods:** This was a retrospective study including patients with renal exclusion secondary to urolithiasis, who underwent laparoscopic simple nephrectomy between 2016 and 2019. **Results:** Forty simple LPN for renal exclusion due to urolithiasis was performed between 2016 and 2019. Mean age was 47 ± 10.8 and 82.5% were female. The mean BMI was 30.2 ± 5 kg/m², mean operative time was 165.2 ± 64 . Conversion rate was 12.5% ($n = 5$). Conversion was significantly associated with abnormal hilum vascular anatomy ($p = 0.001$), hilum adherences ($p = 0.001$), and hydronephrosis ($p = 0.001$). **Conclusion:** LPN is a safe surgical technique for renal exclusion due to urolithiasis. Hydronephrosis, abnormal vascular anatomy, and the adherences that involved de hilum are the factors that could predictive conversion to open surgery.

Keywords: Urolithiasis. Nephrectomy. Laparoscopic nephrectomy.

Resumen

Introducción: La prevalencia the urolitiasis es del 7-10% sin embargo a presentado un incremento del numero de casos en los ultimos años. La nefrectomia simple laparoscopica esta indicada en pacientes con exclusión renal asociado a cuadros repetitivos de infecciones en el tracto urinario y o dolor cronico a nivel fosa renal. **Objetivo:** Describir la experiencia de nefrectomia simple laparoscopica en pacientes con exclusion renal secundario litiasis en un hospital del sur de México, y que factores pueden predisponer la conversión a cirugía abierta. **Materiales y metodos:** Estudio retrospectivo que incluyo pacientes con exclusion renal secundario a urolitiasis durante el periodo comprendido entre 2016 y 2019. **Resultados:** Se realizaron 40 nefrectomias simples laparoscopica durante el periodo comprendido 2016 y 2019 en paciente con exclusion renal asociada a litiasis. La media edad 47 ± 10.8 años, el 82.5% de los pacientes fueron del sexo femenino. La media de Indice de masa

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corporal fue de $30.2 \pm 5 \text{ kg/m}^2$. La tasa de conversion fue del 12.5% ($n = 5$), los factores que se asociaron a conversion a cirugía abierta fueron anormalidades dependientes del hilio vascular renal ($p = 0.001$), adherencias dependientes del hilio renal ($p = 0.001$) y hidronefrosis ($p = 0.001$). **Conclusión:** La nefrectomía simple laparoscópica es un procedimiento seguro en pacientes con exclusión renal secundaria a urolitiasis. Hidronefrosis, anormalidades dependientes del hilio vascular renal y adherencias que involucren el hilio renal son factores que pueden predisponer conversion a cirugía abierta.

Palabras clave: Urolitiasis. Nefrectomía. Nefrectomía laparoscópica.

Introduction

The prevalence of urolithiasis is 7-10% and has increased over the past years¹. There is a paucity of epidemiological reports in Mexico, but urolithiasis prevalence has been set around 3-4%. In Yucatan, it reaches up to 5.8% of population according to a report 20 years ago².

Despite is a benign pathology, urolithiasis may cause progressive loss of renal function. This kidney injury is due to recurrent infections and urinary tract obstruction³. Patients with urolithiasis might develop renal exclusion. Simple nephrectomy is, therefore, indicated when renal exclusion is associated with recurrent urinary tract infections (UTIs) and/or chronic pain⁴.

Over the past decades, technological developments on minimally invasive surgery have displaced other approaches in nearly all urology procedures, including laparoscopic nephrectomy (LPN). Since Claymann in 1991 performed the first LPN, surgeons have adopted this approach and are to date the gold standard for nephrectomy³. The LPN is a challenging procedure, specially when facing fibrotic and inflammatory tissue. Nonetheless, LPN has proved some advantages over open surgery, such as; less post-operative pain, better cosmetic outcomes, and shorter recovery⁵⁻⁸.

They are limited number of studies reporting outcomes of LPN in patients with renal exclusion secondary to urolithiasis. In this study, we retrospectively evaluated the outcomes of LPN in patients with renal exclusion due to urolithiasis and aimed to understand which factors were associated with conversion to open surgery.

Objective

The aim of the study was to describe the surgical experience of LPN due to urolithiasis in South-east of Mexico and which factors can predispose conversion to open surgery.

Methods

The records of patients with renal exclusion secondary to urolithiasis, who underwent simple LPN between 2016 and 2019 were retrospectively reviewed.

Demographic characteristics, medical history, surgical time, estimated blood loss, rate of conversion to open surgery, post-operative complications, hemoglobin drop, and creatinine, need for transfusion, and length of hospital stay were retrieved from all patients.

Categorical variables were analyzed using Chi-square and Fisher's exact test. To evaluate the association between preoperative, surgical findings, and the risk of conversion to open surgery. Statistical analyzes were conducted with the aid of SPSS Statistics v16.0.

All procedures were carried out by urology residents under supervision and by an expert attending urologist trained in laparoscopic surgery.

Results

Forty simple LPNs for renal exclusion due to urolithiasis were performed between 2016 and 2019.

Demographic characteristics

Simple LPN was performed in 17.5% ($n = 7$) patients due to chronic pain and in 82.5% ($n = 33$) due to UTIs. The right kidney was the most affected (55%, $n = 22$).

Mean age was 47 ± 10.8 and 82.5% were female. The mean BMI was $30.2 \pm 5 \text{ kg/m}^2$ and the 57.5% were obese. Moreover, 67.5% had Type 2 diabetes and 85% high blood pressure.

Preoperative hemoglobin range was 11-13 g/dL, mean serum creatinine baseline was 0.95 mg/dL (Table 1).

Surgical outcomes

Mean operative time was 165.2 ± 64 . The mean operative estimated blood loss was 150 mL, (range 100-200 mL) in the cases that was not necessary conversion

Table 1. Demographic characteristics and pre-surgical test of patients

Variables	% (n)
Age (y)	47.6 ± 10.9
Sex	
Male	17.7 (7)
Female	82.5 (33)
Lithiasis	
Renal	35 (14)
Ureteral	65 (26)
Side	
Left	45 (18)
Right	55 (22)
Indication for surgical procedure	
Chronic Pain	17.5 (7)
Recurrent infection	82.5 (33)
High Blood pressure	67.5 (27)
Mellitus diabetes	85 (34)
BMI (kg/m ²)	30.22 ± 5.19
Serum Cr, baseline (mg/dL)	0.95 (0.79-1.48)
Hb, baseline (g/dL)	12 (11-13)

BMI: body mass index; Cr: Creatinine; Hb: hemoglobin.

to open surgery. The cases were necessary conversion to open surgery, the mean operative blood loss was 650 ml (range 180-1625) (Table 2). Regarding renal hilum vascular anatomy, it was reported as abnormal in six cases (Table 3).

Intraoperative complications included spleen laceration in two patients which were solved by simple laparoscopic coagulation.

Conversion into open surgery was necessary in 5 patients (12.5%), the main cause was vascular injuries and uncontrollable bleeding. Renal artery injury was reported in three patients, injury of inferior mesenteric vein was reported in one patient and one to the inferior cava vein.

Complications were classified following Clavien's system as following: 10 (%) patients with grade ≤2 (nine blood transfusion and one post-operative fever) and one patient with Grade 4 (pulmonary embolism).

A comparison between LPN group to patients who required conversion to open surgery was conducted. Operative time was longer in those who underwent open conversion (152.6 ± 59.3) than those who solely underwent LPN (236.7 ± 49.7 ; $p = 0.002$). Abnormal vascular anatomy was associated with conversion ($p = 0.001$) (Table 4).

Table 2. Surgical outcomes

Variable	Mean ± SD Median (percentile 25-75)
Serum Cr, baseline (mg/dL)	0.95 (0.79-1.48)
Serum Cr, post-operative (mg/dL)	0.94 (0.79-1.33)
Hb, baseline (g/dL)	12 (11-13)
Hb, post-operative (g/dL)	11 (9.25-12)
Hto, baseline (%)	39 (36.2-40.7)
Hto, post-operative (%)	34 (29.5-37)
Surgical time (min)	165.2 ± 64.9
Estimated blood loss (ml)	150 (100-200)
Hto drop (%)	4 (2-8)
Hb drop (g/dL)	1 (1-2)

Cr: Creatinine; Hb: Hemoglobin; Hto: Hematocrit.

Table 3. Characteristics of abnormal renal hilum anatomy

Variable	% (n)
Hilar supernumerary renal artery originating from Renal Artery	84 (5)
Supernumerary renal artery originating from abdominal aorta	16 (1)

Table 4. Characteristics pure laparoscopic procedure versus converted

Variable	Laparoscopic	Converted	p-value
BMI (kg/m ²)	30.20 ± 5.05	30.30 ± 6.44	0.967
Serum Cr, baseline (mg/dL)	0.98 (0.79-1.50)	0.86 (0.76-1.97)	0.726
Serum Cr, post-operative (mg/dL)	0.96 (0.79-1.33)	0.82 (0.72-2.94)	0.526
Hb, post-operative (g/dL)	11 (10-12)	9 (7.7-11)	0.041*
Hto, post-operative (%)	34.5 (30-37)	28 (25.7-32.5)	0.021*
Surgical time (min)	152.6 ± 59.3	236.7 ± 49.7	0.002*
Estimated blood loss (ml)	150 (100-200)	650 (180-1625)	0.003*
Transfusion rate	88.2	16.7	< 0.001*
Hb drop (g/dL)	1 (0.7-2)	2 (1.7-3.7)	0.041*
Abnormal vascular anatomy (%)	5.9	66.7	< 0.001

BMI: body mass index; Cr: creatinine; Hb: hemoglobin; Hto: hematocrit.

Surgical findings and conversion

Conversion was significantly associated with abnormal hilum vascular anatomy ($p = 0.001$), hilum adherences ($p = 0.001$), and hydronephrosis ($p = 0.001$).

Post-operative outcomes

The mean hospital stay was 3.55 ± 2.5 days (2-14). The patient that post-operative present pulmonary embolism was management in UCI for 8 days and 6 days in hospital stage. Pathologic assessment revealed chronic pyelonephritis in 92.5% ($n = 37$) and 5% ($n = 3$) xanthogranulomatous pyelonephritis.

Discussion

The relationship between urolithiasis and renal function impairment has been documented. Such damage to the kidney is secondary to recurrent UTIs or urinary tract obstruction³.

Overall, urinary stones are more common in men⁷; however, in our study, we observed a higher prevalence of nephrectomies in females but that does not have relationship with risk factor for conversion.

In South-east of Mexico, kidney stone was the leading indication about of 60% of nephrectomies⁸.

There are indications to perform simple LPN in patients with poor renal function, the most important are recurrent UTIs and chronic pain⁹.

In our study, recurrent UTI was the main cause for LPN, accounting for 82.5% of the cases, similar to other reports.

One of the most important studies was done by Zelhof and collages, reporting patients who underwent LPN for benign pathology, the group of patients that have concomitant urolithiasis had higher risk for conversion to open surgery¹⁰. Pareek and collages report a higher complications rate in the simple nephrectomy group (20 vs. 10.7) than in that of patients that underwent radical LPN¹¹.

Factors such as xanthogranulomatous pyelonephritis, colon adherences, history of renal abscess, vascular injuries, and obesity have been identified as predisposing for conversion to open surgery¹²⁻¹⁷.

In our study, the surgical findings that were associated with conversion to open surgery were hydronephrosis and adherences involving renal hilum, whereas obesity and colon adherences were not associated.

Conversion rate open surgery reported by other authors was found around 1.6-9%^{8,16,17}.

The conversion rate in our study was 12.5%. The most important factor to convert to open surgery was vascular injury.

The complications during procedures were secondary to spleen injury in two patients that were solved by simple coagulation and five vascular injuries that were the main reason to convert to open surgery, having global conversion rate of 12.5%, with no mortality.

The length hospital stay is lower than that reported in the literature. Cem Yucel et al., reported a hospital stay of 3.86 ± 1.4 days, and Angerri et al., reported 5.4 days. Our study found a hospital stay of 3.28 ± 1.58 days^{7,17}.

This study acknowledge limitations, first, the retrospective nature, second, the relatively small sample of patients, and lastly, some outcomes were retrieved from surgical records as reported by surgeons.

Conclusion

Simple LPN is a safe technique for patients with renal exclusion secondary urolithiasis; however, it can be in some cases challenging due the presence of adherences and fibrosis, especially in patients with history of recurrent infections. The laparoscopic approach has many advantages as compared to open surgery. In our study, hydronephrosis, abnormal vascular anatomy, and hilum's adhesions were the factors associated to open surgery conversion, although renal hilum abnormal vascular anatomy is an unclear factor, since renal hilum's or adjacent fibrosis may bring difficulties in the proper identification of the vascular structures and the discrimination of a true vascular abnormality from a complex renal hilum. Therefore, prospective studies evaluating renal vascular anatomy are needs. Moreover, the conversion rate was low and the technique suggesting the technique is safe.

Conflicts of interest

The authors declare not having any conflicts of interest.

Ethical disclosures

Protection of human and animal subjects. The authors declare that no experiments were performed on humans or animals for this study.

Confidentiality of data. The authors declare that no patient data appear in this article.

Right to privacy and informed consent. The authors declare that no patient data appear in this article.

References

1. Abufaraj M, Xu T, Cao C, Waldhoer T, Seitz C, D'andrea D, et al. Prevalence and trends in kidney stone among adults in the USA: analyses of national health and nutrition examination survey 2007-2018 data. *Eur Urol Focus*. 2021;7:1468-75.
2. Medina-Escobedo M, Zaidi M, Real-de León E, Orozco-Rivadeneyra S. Prevalencia y factores de riesgo en Yucatán, México, para litiasis urinaria. *Salud Pública Mex*. 2002;44:541-5.
3. Keddis MT, Rule AD. Nephrolithiasis and loss of kidney function. *Curr Opin Nephrol Hypertens*. 2013;22:390-6.
4. Kurt O, Buldu I, Turan C, Yazici CM. Does laparoscopic transperitoneal simple nephrectomy for inflammatory and non-inflammatory kidneys differ? *Springerplus*. 2016;5:1358.
5. Kercher KW, Heniford BT, Matthews BD, Smith TI, Lincourt AE, Hayes DH, et al. Laparoscopic versus open nephrectomy in 210 consecutive patients: outcomes, cost, and changes in practice patterns. *Surg Endosc*. 2003;17:1889-95.
6. Gülpınar MT, Akçay M, Sancak EB, Akbaş A, Tepeler A, Reşorlu B, et al. Comparison of transperitoneal laparoscopic nephrectomy outcomes in atrophic and hydronephrotic kidneys. *Turk J Urol*. 2015;41:181-4.
7. Alelign T, Petros B. Kidney stone disease: an update on current concepts. *Adv Urol*. 2018;2018:3068365.
8. Medina-Escobedo M, Martín-Soberanis G. Nefrolitiasis como indicación de nefrectomía. Estudio multicéntrico Nephrolithiasis as a nephrectomy surgical indication. A multicentric study. *Rev Med Inst Mex Seguro Soc*. 2009;47:29-32.
9. Angerri O, López JM, Sánchez-Martín F, Millán-Rodríguez F, Rosales A, Villavicencio H. Simple laparoscopic nephrectomy in stone disease: not always simple. *J Endourol*. 2016;30:1095-8.
10. Zelhof B, McIntyre IG, Fowler SM, Napier-Hemy RD, Burke DM, Grey BR, et al. Nephrectomy for benign disease in the UK: results from the British Association of Urological Surgeons nephrectomy database. *BJU Int*. 2016;117:138-44.
11. Pareek G, Hedician SP, Gee JR, Bruskewitz RC, Nakada SY. Meta-analysis of the complications of laparoscopic renal surgery: comparison of procedures and techniques. *J Urol*. 2006;175:1208-13.
12. Danilovic A, Ferreira TA, Vicentini FC, Torricelli FC, Marchini GS, Mazzucchi E, et al. Laparoscopic nephrectomy for urolithiasis: when is better to avoid it. *Rev Col Bras Cir*. 2019;46:e20192092.
13. Gabr AH, Elsayed ER, Gdor Y, Roberts WW, Wolf JS Jr. Obesity and morbid obesity are associated with a greater conversion rate to open surgery for standard but not hand assisted laparoscopic radical nephrectomy. *J Urol*. 2008;180:2357-62; discussion 2362.
14. Hsiao W, Pattaras JG. Not so "simple" laparoscopic nephrectomy: outcomes and complications of a 7-year experience. *J Endourol*. 2008;22:2285-90.
15. Peña PA, Torres-Castellanos L, Patiño G, Prada S, Villarraga LG, Fernández N. Minimally invasive nephrectomy for inflammatory renal disease. *Asian J Urol*. 2020;7:345-50.
16. Liao JC, Breda A, Schulam PG. Laparoscopic renal surgery for benign disease. *Curr Urol Rep*. 2007;8:12-8.
17. Yucel C, Ulker V, Kisa E, Koc G, İlbey YO. Laparoscopic transperitoneal nephrectomy in non-functioning severe hydronephrotic kidneys with or without renal stone. *Cureus*. 2018;10:e3729.