ORIGINAL ARTICLE

Robotic partial nephrectomy: An initial experience in 25 consecutive cases

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KEYWORDS
Partial nephrectomy; Robotic surgery; Nephron-sparing surgery; Renal tumor

Abstract
Objective: To report our initial experience with robotic partial nephrectomy (RPN) in a series of 25 consecutively operated patients.
Material and methods: A series of 25 consecutive patients who underwent RPN from April 2010 to February 2011 were studied. We used the da Vinci S HD robotic system with transperitoneal approach. Total renal hilum control was used for 22 cases and 3 patients underwent selective renal parenchymal compression with an ad hoc device.
Results: Mean age was 55.8 years (26–77) with a male/female ratio of 2:1. Mean operative time was 117.6 min (54–205) and the warm ischemia time was 20.2 min (9–34). Mean estimated blood loss was 440 ml (20–2000) and the mean tumor size was 3.25 cm (1–5.3). Five patients (20%) had complications, the most frequent being intraoperative bleeding (Clavien II). There was no conversion to open or laparoscopic surgery. Mean hospital stay was 3.5 days (1–7). The pathological study revealed renal cell carcinoma in 19 cases and benign lesions in 6 patients. There were no positive surgical margins and no mortality.
Conclusions: Our preliminary results show that RPN is a feasible surgical approach in small-sized renal tumors.

PALABRAS CLAVE
Nefrectomía parcial; Cirugía robótica; Cirugía conservadora de nefronas; Tumor renal

Nefrectomía parcial robótica: experiencia inicial en 25 casos consecutivos

Resumen
Objetivo: Presentar nuestra experiencia inicial en nefrectomía parcial robótica (NPR) en una serie de 25 pacientes operados de forma consecutiva.
Material y métodos: Se trata de una serie de 25 pacientes consecutivos sometidos a NPR desde abril de 2010 a febrero de 2011. Se utilizó el sistema robótico da Vinci S HD, con abordaje transperitoneal. En 22 casos se utilizó control vascular total del hilio renal y en tres casos se realizó compresión selectiva del parénquima renal con un dispositivo ad hoc.

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Introducción

El hallazgo incidental de tumores renales de menos de 4 cm ha resultado de la frecuente aplicación de la imagen en el estudio de síntomas abdominales no específicos. Este cambio ha resultado en un aumento de la detección de tumores renales de menor tamaño y mejor diferenciación, lo que ha permitido el tratamiento conservador de los mismos.1 Su indicación quirúrgica, entonces, ha evolucionado de la indicación anatómica (Localization of the tumor, L) hacia la utilización de la laparoscopia parcial (Laparoscopic partial nephrectomy, LPN) en lesiones renales de menos de 4 cm.2,3 La cirugía laparoscópica es técnicamente difícil, requiere un largo aprendizaje, y no está exenta de complicaciones. La introducción de la laparoscopia parcial en la clínica en el año 2004, utilizando el sistema da Vinci Surgical System (Intuitive Surgical, Sunnyvale, CA, USA), ha permitido un auge en su aplicación como alternativa al tratamiento conservador.4 La laparoscopia parcial ha sido ampliamente utilizada en pacientes con tumores renales de tamaño pequeño.5 La intención de este artículo es analizar la intervención cirúrgica y la correspondiente investigación clínica y patológica de los primeros 25 casos de laparoscopia parcial.

Materiales y métodos

Entre abril de 2010 y febrero de 2011, se operó a 25 pacientes con tumor renal, todos consecutivos en nuestro centro. El rango de edad fue de 17 a 77 años, con un promedio de 55.8 años. La masa renal medía 27.1 kg/m². Se utilizó el sistema da Vinci S HD (Intuitive Surgical, Sunnyvale, CA, USA) para la intervención, que fue realizada por un solo cirujano (O.A.C.). Los datos fueron recogidos prospectivamente y analizados retrospectivamente. La evaluación preoperatoria incluyó la tomografía computarizada simple y/o la resonancia magnética, con reconstrucción de la fase vascular. Se estudió la localización, tamaño, y el estadio clínico del tumor, el tiempo quirúrgico, el tiempo de claudicación, el estadio patológico, y lasmarginaciones quirúrgicas. Definimos los complejos de la cirugía usando la Clavien modificada.6

Resultados

La edad promedio fue de 55.8 años (26-77), con un ratio hombre/mujer de 2:1. El tiempo operatorio promedio fue de 117.6 minuto (54-205) y el tiempo de claudicación fue de 20.2 minuto (9-34). El sangrado estimado promedio fue de 440 ml (20-2.000). El tamaño tumoral promedio fue de 3.25 cm (1-5.3). Cinco pacientes (20%) presentaron complicaciones, siendo la hemorragia intraoperatoria la más frecuente (Clavien II). No hubo conversión a cirugía abierta o laparoscópica. La estancia media hospitalaria fue de 3.5 días (1-7). El examen patológico de las lesiones reveló carcinoma renal en 19 casos y lesiones benignas en 6 pacientes. No hubo márgenes quirúrgicos positivos ni mortalidad.

Conclusiones

Nuestros resultados preliminares muestran que la NPR es una alternativa quirúrgica factible de realizar en pacientes con tumores renales de pequeño tamaño. © 2011 AEU. Publicado por Elsevier España, S.L. Todos los derechos reservados.
vascular control of the renal hilum was identified: in two cases, there was an accidental displacement of the bulldog clamp and there was inadequate Hem-o-lok® clip placement on Rummel’s elastic loop in the other two. None of these cases required conversion to open surgery or need for nephrectomy. Another patient had a massive hemoperitoneum 12 h after surgery, requiring emergency exploratory laparotomy for hemostasis and kidney repair, without need for nephrectomy and evolving without further incidents (Clavien IV).

The average tumor size was 3.6 cm (1–11.5 cm). Three lesions were larger than 7 cm; an angiomyolipoma of 11.5 cm and two complex renal cysts of 8 and 10 cm. Pathologic examination of the lesions revealed renal carcinoma in 19 cases (76%) and benign lesions in 6 patients (24%) (Table 2). There were no positive surgical margins (Fig. 4).
<table>
<thead>
<tr>
<th>Institution</th>
<th>RPN (n)</th>
<th>Tumor size (cm)</th>
<th>TS time (min)</th>
<th>WIT (min)</th>
<th>EBS (ml)</th>
<th>HS (d)</th>
<th>Complications (Clavien grade)</th>
<th>Positive margin (n)</th>
<th>Urinary loss (n)</th>
<th>Conversion</th>
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HS: hospital stay; RPN: robotic partial nephrectomy; UR: unreported data; EBS: estimated blood loss; TS: total surgical; WIT: warm ischemia time.
The average hospital stay was 3.5 days (range: 1–7 days), excluding the patient who required exploratory laparotomy.

Discussion

Surgery for kidney cancer has undergone an important evolution with the use of laparoscopic approach in the treatment of stage T1 tumors. Today, lesions of 7 cm or smaller are treated conservatively with adequate oncological results, while renal parenchyma is preserved and morbidity decreases.\textsuperscript{10,11} In a comparative study of 1800 partial nephrectomies, 771 LPN vs 1029 OPN, there was a significant decrease in estimated blood loss (300 ml vs 376 ml), in hospital stay (3.3 days vs 5.8 days), and total surgical time (201 min vs 226 min). However, there was longer warm ischemia time (30.7 min vs 20.1 min) and higher incidence of postoperative complications (24.9\% vs 19.2\%). Cancer-specific survival at 3 years was similar: 99.3\% for LPN vs 99.2\% for OPN.\textsuperscript{11}

A study by the Clínica Universidad de Navarra describes a series of 30 LPN with a mean surgical time of 214.4 min, warm ischemia time of 31.3 min, and estimated bleeding of 74.6 ml. Positive surgical margins were obtained in three cases, being converted to open surgery.\textsuperscript{12}

The LPN is technically difficult, with a long learning curve, which explains why the traditional open surgery is still dominant on LPN in the treatment of stage T1 renal lesions.\textsuperscript{5} The da Vinci robotic system was introduced in urological practice in the hope of reducing the gap between advanced laparoscopic surgery and open surgery. The first study on the feasibility of robotic partial nephrectomy (RPN) was conducted at the Mayo clinic, experience published by Gettman et al. in 2004. Thirteen carefully selected patients, with small exophytic renal tumors (average size of 3.5 cm), underwent RPN. The mean operative time was 215 min, the warm ischemia time 22 min, the average bleeding 170 ml, and there was a case with positive surgical margin (7.7\%).\textsuperscript{6}

A recent article reviews 3622 urological surgeries conducted by the Fundación Puigvert over a period of 10 years, performing an analysis of the evolution of open to laparoscopic/robotic surgery. Excluding endoscopic surgery, they found 67.75\% open, 26.17\% laparoscopic, 2.29\% perineal, and 3.78\% robotic surgeries. They observed an increase of the laparoscopic approach over the last 12 months compared to the first 9 years of follow-up; in partial nephrectomies, it increased from 31.3 to 87\%, comparing open with laparoscopic surgery, but in this study, no mention is made about robotic surgery.\textsuperscript{13}

The only study with larger number of cases corresponds to a multi-institutional comparative work between RPN and LPN performed consecutively (129 RPN and 118 LPN), reported by Benway et al.\textsuperscript{10} This review shows a reduced warm ischemia time (19.7 min vs 28.4 min), decreased estimated blood loss (155 ml vs 196 ml), and length of hospital stay (2.4 days vs 2.7 days) for RPN, being statistically significant even when it is a type 2 evidence.

In a multi-institutional study, Rogers et al. confirmed the safety and feasibility of RPN in 148 patients, with results comparable to those obtained with OPN and LPN.\textsuperscript{14} To date, the largest multi-institutional experience with RPN has recently been reported by Benway et al., who described the functional and oncological outcomes in 183 patients. The mean surgical time was 210 min, the warm ischemia time 23.9 min, and the positive margin rate was 2.7\%.\textsuperscript{15}

In an analysis of 147 consecutive LPNs conducted by a single surgeon, Castillo et al. emphasize that the considerations that must be made in relation to LPN have to do with the possible complications related to the procedure. This surgery incorporates a delicate treatment of control of the renal pedicle, which is essential to obtain the renal ischemia required during tumor resection. This step represents the first vascular phase of the operation. Once the tumor is resected, the second vascular phase of the procedure is started, which corresponds to the renal parenchymal hemostatic closure, which must also ensure a secure closure of the pelvicalyceal system, often affected during resections in search of oncological safety margins.\textsuperscript{7} In our series, complications were secondary to poor control of the renal pedicle in 4 cases, resulting in a mean blood loss of 1750 ml (1500–2000 ml). So, it was observed that the arterial clamp had been released (accidental displacement of the bulldog clamp in two cases, and inadequate placement of the Hem-o-lok® clip on Rummel’s elastic loop in the other two), which determined poor ischemia during the tumor resection, even when conversion was not necessary.

Table 3 summarizes a comprehensive review of the literature with 14 series of RPN (n = 660), in which an average surgical time of 191 min, average warm ischemia time of 24 min, average estimated blood loss of 194 ml, and hospital stay of 3.2 days\textsuperscript{6,10,15–24} are shown. Compared to the average of the mentioned series, we observed that in ours, the average total surgical time was shorter (117.6 min), as well as the warm ischemia time (20.2 min), even when the estimated bleeding was higher (440 ml).

The RPN has become a minimally invasive alternative of conservative surgery with good oncological outcomes. We practiced 25 RPNs with results comparable to previous studies, and very similar to those obtained with OPN and LPN. Based on our experience, RPN is currently our technique of choice for minimally invasive conservative treatment of renal tumors.

Conclusions

We present the first series of RPN in Spanish literature. Our preliminary results show that RPN is a viable alternative in the minimally invasive conservative management for patients with renal tumors.

Conflict of interest

The authors declare that they have no conflict of interest.

References