Laparoscopic radical nephrectomy at the *Instituto Nacional de Cancerología*

Solares-Sánchez Mario Emmanuel, Martínez-Cervera Pedro Fernando, Jiménez-Rios Miguel Ángel.

**ABSTRACT**

**Objective:** To analyze laparoscopic radical nephrectomy results at the *Instituto Nacional de Cancerología de México*.

**Methods:** Retrospective study carried out from October 2006 to May 2010.

**Results:** Twenty-six patients (fourteen women and twelve men) with a mean age of 58.2 years (24-84 year range) were operated on. Mean tumor size by imaging study was 6.8 cm (2.5-10 cm range). Fifteen right nephrectomies and 11 left nephrectomies were performed. Mean tumor size by pathology was 5.8 cm (2-9.7 cm range), mean surgery duration was 176.7 minutes (110-300 min. range), mean calculated blood loss was 365.3 cc. (20-2300 mL range), mean hospital stay was 3.1 days (2-17 day range), and mean follow-up time was 19.5 months (0-43 month range). No patient developed recurrence at port opening level.

**Conclusions:** Laparoscopic radical nephrectomy is a safe and reproducible technique that offers the patient faster recovery. Indication for this procedure is individual and takes into account patient characteristics, clinical stage of tumor, surgeon’s training, and hospital resources.

**Keywords:** Kidney cancer, radical nephrectomy, laparoscopic radical nephrectomy, transperitoneal approach, complications, Mexico.

**RESUMEN**

**Objetivo:** Analizar resultados de nefrectomía radical laparoscópica en el Instituto Nacional de Cancerología de México.

**Métodos:** Estudio retrospectivo entre octubre de 2006 a mayo de 2010.

**Resultados:** Se operaron 26 pacientes, 14 mujeres y 12 hombres, la edad promedio: 58.2 años (24 a 84 años). El promedio del tamaño tumoral por imagen fue 6.8 cm (2.5 a 10 cm). Se realizaron 15 nefrectomías derechas y 11 izquierdas. El tamaño del tumor por patología en promedio fue de 5.8 cm (2 a 9.7 cm). El tiempo quirúrgico promedio fue de 176.7 minutos (110 a 300 minutos). El sangrado promedio calculado fue de 365.3 mL (20 a 2300 mL). La estancia hospitalaria promedio fue de 3.1 días (2 a 17 días). El periodo de seguimiento en promedio fue de 19.5 meses (0 a 43 meses). Ningún paciente desarrolló recurrencia a nivel de los orificios de los puertos.

**Conclusiones:** La nefrectomía radical laparoscópica es una técnica reproducible y segura que ofrece una recuperación más rápida del paciente. La decisión para realizar éste procedimiento es individual, tomando en cuenta las características del paciente, la etapa clínica del tumor, el entrenamiento del cirujano y los recursos del hospital.

Keywords: Nefrectomía Radical, Laparoscópica, Hospital Nacional de Cancerología, México.
INTRODUCTION

The 2003 tumor histopathological register in Mexico reported 1588 cases of kidney cancer (1.44%) (874 men and 714 women) that resulted in 1475 deaths (2.46%) and a mortality rate of 1.4 per 100,000 inhabitants. In the Instituto Nacional de Cancerología (INCan) (the National Cancerology Institute), 747 patients with this neoplasia were treated from 1985 to 2003 and there was a notable increase in incidence starting in 1994. Laparoscopic surgery for organ-confined kidney tumors is currently the most widely used treatment and offers less surgical trauma, better surgical field visualization, and lower blood loss. It is the recommended approach for tumors located at the poles, in stage T1 and stage T2 tumors with normal contralateral kidney, and can include stage T3 tumors in select cases. The learning curve is approximately 30 procedures. Both radical nephrectomy and nephron-sparing surgery carried out laparoscopically are excellent alternatives. In a study comparing the advantages of laparoscopic surgery with conventional surgery, laparoscopic surgery resulted in the use of fewer analgesics, 24 mg vs. 40 mg of postoperative morphine, shorter hospital stay (1.5 days vs. 5 days) and convalescence of 4 weeks vs. 8 weeks. The first reports at 10 years on oncological results show a similar survival rate for both laparoscopic and open radical nephrectomies, but the laparoscopic surgery has a faster postoperative recovery period.

Since 1995 the INCan has performed minimally invasive surgery specifically in prostate cancer (CaP) and reported a series of cases of laparoscopic pelvic lymphadenectomy in CaP patients. For different reasons, one of which was the high cost, it was not possible to continue developing this technique. Once again, in 2006, the INCan implemented the program of laparoscopic surgery in urogenital cancer.

OBJECTIVE

To present a case series of patients that underwent laparoscopic radical nephrectomy at the INCan for kidney cancer, analyzing technique variables and the learning curve.

METHODS

Case records were reviewed of patients that underwent laparoscopic surgery at the Urology Department of the INCan during the time frame of October 2006 to May 2010.

Descriptive statistics were used and results were compared with those reported in the national and international literature.

RESULTS

During the time frame of October 2006 to March 2010, 26 patients (14 women and 12 men) underwent laparoscopic radical nephrectomy. Mean age of the patients was 58.2 years (24-84 year range) and mode was 61 years.

Four patients had past medical history of intense smoking, 7 patients were diabetic, 9 had high blood pressure, 5 had undergone surgery of the upper abdomen (1 had previous partial nephrectomy by lumbotomy), and 10 cases had undergone open pelvic surgery.

Patient symptomatology was lumbar pain in 11 patients, hematuria in 13, weight loss in 3, incidental diagnosis in 4, and fever in 2 patients. There was a mean 164-day (8-545 day range) lapse between appearance of symptoms and diagnosis and mean 3.8-month (0-15 month range) lapse between diagnosis and surgery. Body Mass Index (BMI) was not known in 3 patients; from the other patient data mean BMI was 27.24 kg/m² (21.1-33.8 kg/m² range). According to BMI classification 7 patients were considered normal, 9 with overweight, and 7 with mild obesity.

Computed tomography (CT) scan showed tumor location in the lower pole in 10 patients, in the upper pole in 9 patients, and in the mid-kidney in 8 patients. One patient presented with multiple tumor and location...
developed local recurrence 1 year after surgery. Both and then underwent laparoscopic right nephrectomy that had previously undergone open partial nephrectomy recurrence; 1 at 11 months after surgery and the patient recurrence at ports. Two patients developed local recurrence was 19.5 months (0-43 months). No patient developed was drained via laparoscopy. Mean follow-up period was 18 patients, moderate in 6 patients, and 2 patients did measure pain was used, pain was reported as mild in (2-17 day range). Although no visual scale or graph to mean hospital stay was 3.1 days (2-17 day range). No intraoperative complications were grade I splenic injury in three patients and grade I hepatic injury in two patients; these five patients were managed with application of hemostatic material. Three patients presented with bleeding of the renal hilum that was controlled by direct compression and increasing pneumoperitoneum pressure and then stapling the vessels. Conversion to open surgery was not necessary. During the postoperative period 1 patient presented with kidney failure. This patient had a past history of diabetes mellitus and high blood pressure along with chronic consumption of non-steroidal anti-inflammatory drugs and preoperative creatinine of 1.6, but did not require substitution of kidney function in acute failure. This patient was later referred to the nephrology department for treatment. Another patient presented with persistent fever on fourth postoperative day and developed collection at the surgical site that was drained via laparoscopy. Mean follow-up period was 19.5 months (0-43 months). No patient developed recurrence at ports. Two patients developed local recurrence; 1 at 11 months after surgery and the patient that had previously undergone open partial nephrectomy and then underwent laparoscopic right nephrectomy developed local recurrence 1 year after surgery. Both of these patients presented with rhabdoid pattern in the surgical specimen. Another patient developed frontal bone metastasis and was treated with radiotherapy (30 Gy in 10 fractions) 3 months after surgery. And finally, one patient developed recurrence at the pulmonary level and underwent thoracoscopy 3 months after nephrectomy and metastasis was resected.

### DISCUSSION

With the advent of tomography and ultrasound as routine studies in recent years, incidental kidney tumor detection has gone from 15-72% and there is a tendency to find smaller tumors and consequently lower recurrence rates and a lower number of metastases. Contrasting, at the INCan over a period of 10 years (1990-2000), from a total of 460 kidney cancer patients, incidental tumor was detected in 34 patients (7.3%). In the population analysis for the present article, incidental tumor was detected in only 4 patients (15.3%).

When kidney cancer is symptomatic it presents with greater clinical stage, aggressiveness, and histological grade at the time of diagnosis, and this has also been observed at the INCan. The time lapse between appearance of symptoms and diagnosis was a mean 164 days (8-545 day range), a figure associated with more advanced disease and larger tumors. This made routine indication of laparoscopic nephrectomy difficult in the present study population. Nevertheless some cases were able to undergo laparoscopic nephrectomy with no complications despite tumor size.

In 1990 Clayman performed the first laparoscopic nephrectomy at the University of Washington. At the INCan, laparoscopic pelvic lymphadenectomy was begun in 1995. Experience with laparoscopic radical nephrectomy was recently begun here, 16 years after initial reports in the international literature.

There are two types of laparoscopic approaches: retroperitoneal and transperitoneal. Retroperitoneal approach provides quicker access to the renal hilum, dissection is simpler in the obese patient, peritoneal irritation is avoided, and there are fewer ventilation and hemodynamic function repercussions. Among the limitations of this technique is the difficulty of placing the kidney in the bag (13% of transabdominal conversions) and it has a longer learning curve.

Transabdominal approach has the advantages of being the more well-known approach and has a shorter learning curve. Disadvantages include the possibility of intestinal perforation and postoperative ileus. Transabdominal technique has been developed at the INCan because it received a training program and because this technique facilitates specimen extraction. This surgical approach was able to be carried out in 16
overweight patients with no technical difficulties. The results of the present authors were compared with and similar to the results of initial experience in series published in the international literature (Table 1).9,10

Gill et al10 carried out a learning curve analysis by comparing the first 50 surgeries with the next 50 surgeries. The only significant variable between the two groups was a decrease in surgery duration (P = 0.02). In the present series, the authors observed a tendency towards decrease in surgery duration at patient 14 of the 26 patients (Image 1). There was an increase in surgery duration in some patients; in those in whom hem-o-lok clips were used instead of vascular stapling for hilum control because hem-o-lok clips require greater surgical control during dissection and thus longer surgery duration. Similar to other publications,9,10 extraction of the intact specimen, as was done in the present series, enables the determination of microscopic variables and pathological staging, including capsular penetration. It is important to mention that, at that moment, pathological staging is not a factor that indicates the need for adjuvant treatment and therefore some groups recommend morcellation for specimen extraction.

A variant of laparoscopic surgery is the “hand-assisted” technique that allows for greater sensitivity during dissection in addition to facilitating specimen extraction. There are special devices for this technique, raising its cost, and thus making it often inaccessible for populations such as the present authors. However, in the cases reported here, a 6 cm incision in the homolateral iliac fossa was made, sectioning the aponeurosis and separating the muscles, directly introducing the hand with no device and placing two surgery tweezers around the wrist with which to seal the spaces between the skin, avoiding pneumoperitoneum loss. This procedure has also been reported on in Chile.1,3

Laparoscopic radical nephrectomy is considered to be a treatment mainstay for T1 tumors (under 7 cm). Its advantages over open surgery are shorter hospital stay, fewer analgesics, shorter recovery time, and scant blood loss. Laparoscopy's role in relation to larger tumors is still being evaluated. Laparoscopic experience at the INCan began with larger-sized tumors, the largest being 9.7 cm. It is important to keep in mind that when the tumor is larger there is an increase in technical problems because the work space is reduced, making dissection more difficult for the surgeon and thus increasing the risk of damaging adjacent organs. In large tumors there is greater blood vessel neoformation and so surgical specimen extraction is more difficult.

Hand-assisted laparoscopic nephrectomy is useful in performing nephrectomy when tumors are large (9.7-12.3 cm). Open nephrectomy is recommended for tumors larger than 15 cm.14 Another study that compared open surgery with laparoscopic surgery on T2 tumors reported similar intraoperative and postoperative complication rates and longer surgery duration with the laparoscopic procedure, with no adverse effects for the patient and no increase in cost. When tumors are voluminous, care must be taken during dissection of the renal hilum and the tumor's newly-formed vessels, as well as the exophytic component in the anteromedial direction, in order to reduce the risk of transgressing oncological principles or causing important vascular damage. The success of laparoscopic surgery on large tumors depends on the surgeon's experience with advanced laparoscopy that provides better instrument control and orientation.15

In the series reviewed, mean tumor size was 5 cm while mean size in the present study was 5.8 cm.

In order to avoid a large incision for specimen extraction that could jeopardize the laparoscopic results, transvaginal specimen extraction by means of colpotomy has been recommended.16 In a study by Gill et al, the procedure was successful in 10 patients. Vaginal extraction procedure duration was 35 minutes and blood loss was minimal. Mean tumor size was 3.6 cm (2.4-7.4 cm range), mean weight was 327 g (152-484 g range), and there were no intraoperative complications. One patient presented with slight postoperative hematocele drainage that was spontaneously resolved.17 In the present study all patients had a 6 cm incision from one of the ports, through which specimen was extracted intact. Postoperative pain was minimal.

Previous kidney surgery, tumors in the mid-portion of the kidney, and locally advanced tumor are all contraindications for laparoscopy. In the present study, laparoscopy was performed on a patient with previous partial nephrectomy and despite adherences the surgery was able to be carried out successfully through careful dissection. T3a and T4 tumors must be approached with great care because even though there are no formal contraindications concerning their dissection, there have been a greater number of intraoperative and postoperative complications with poor oncological results.18 The incidence of pT3 tumors in the series reviewed was from 6-22.4% and at the INCan was 11.5%.

The learning curve for laparoscopic nephrectomy is considered to be 20 procedures and a report by Gill et al states that 9-14% of complications take place during this period. Sixty-seven per cent of complications are expected to occur within this training time.10 In the present series, the 20-procedure learning curve was surpassed and a decrease in surgery duration was observed from procedure 14 (half of the study sample). With the exception of 1 patient, all minor intraoperative complications occurred with the first 13 patients.
<table>
<thead>
<tr>
<th>Variable</th>
<th>University Hospital Charite Humboldt-University Berlin July 1999-March 2003</th>
<th>Urological Institute, Cleveland Clinic Foundation, Cleveland, Ohio August 1997</th>
<th>Hospital DIPRECA Hospital San Juan de Dios Sede Occidente Universidad de Chile July 2001-August 2004</th>
<th>Instituto Nacional de Cancerología Mexico City October 2006-May 2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of cases</td>
<td>125</td>
<td>100</td>
<td>50</td>
<td>26</td>
</tr>
<tr>
<td>Transperitoneal approach</td>
<td>125</td>
<td>100</td>
<td>15 hand-assisted</td>
<td>2 hand-assisted</td>
</tr>
<tr>
<td>Intact specimen extraction</td>
<td>125</td>
<td>100</td>
<td>50</td>
<td>26</td>
</tr>
<tr>
<td>Conversion</td>
<td>2 (1.6%) (bleeding, intestinal injury)</td>
<td>2 (2%)</td>
<td>1 (2%)</td>
<td>1 (3.8%)</td>
</tr>
<tr>
<td>Intraoperative complications</td>
<td>3 (2.4%)</td>
<td>14 (14%) major</td>
<td>3 (6%) major</td>
<td>8 minor liver, spleen, renal hilum</td>
</tr>
<tr>
<td>Postoperative blood loss</td>
<td>2 (1.6%) 210 mL (50-900 mL)</td>
<td>212 mL</td>
<td>176 mL (20-2000 mL)</td>
<td>365.3 mL (20-2300)</td>
</tr>
<tr>
<td>Surgery duration</td>
<td>200 min (90-435 min) learning curve of five surgeons</td>
<td>2.8 hr.</td>
<td>143 min (45-300)</td>
<td>176.7 min (110-300)</td>
</tr>
<tr>
<td>Hospital stay</td>
<td>6 days (4-9 days)</td>
<td>1.6 días</td>
<td>2.7 días</td>
<td>3.1 days (2-17 days)</td>
</tr>
<tr>
<td>Perioperative mortality</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Tumor size</td>
<td>5.1 cm (2-14 cm)</td>
<td>5.1 cm weight: 564.3g</td>
<td>5.4 cm</td>
<td>5.8 cm (2-9.7 cm)</td>
</tr>
<tr>
<td>Pathology result</td>
<td>pT1a 78 (62.4%), pT1b 12 (9.6%), pT2 28 (22.4%), pT3a 7 (5.6%)</td>
<td>37 (74%), 7 (16%), 3 (6%)</td>
<td>3 (11.5%), 14 (53.8%), 4 (15.3%), 3 (11.5%)</td>
<td>3 (11.5%), 2 (pieloxanto and oncocytoma) (7.6%)</td>
</tr>
<tr>
<td>Metastatic lymph nodes</td>
<td>3 (2.4%)</td>
<td>Not reported</td>
<td>Not reported</td>
<td>Not reported</td>
</tr>
<tr>
<td>Negative margins</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Local recurrence</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>(11 and 12 months both with rhabdoid pattern)</td>
</tr>
<tr>
<td>Recurrence at ports</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Follow-up</td>
<td>23.5 months (3-50)</td>
<td>16.1 months</td>
<td>11.3 months (1-37)</td>
<td>19.5 months (0-43)</td>
</tr>
<tr>
<td>Disease progression</td>
<td>3 (2.4%) 6, 11, and 12 months</td>
<td>2 metastases</td>
<td>1 death at 11 months</td>
<td>1 metastasis 1 bone metastasis (4 months) 1 pulmonary metastasis (3 months)</td>
</tr>
</tbody>
</table>
The incidence of tumor implant at laparoscopic ports is 0.7%, similar to that reported on colorectal surgery (0.85%). In all the series reviewed, there was 0% seeding at the ports, coinciding with the results of the present study. In the reports where there was seeding at the ports, large tumors, Fuhrman grade IV tumors, sarcomatoid elements, and ascites were associated risk factors. In the present series, two patients developed local recurrence, both with rhabdoid pattern.

Oncological results of a study on 157 patients showed a 91% disease-free status. Gill reported 2 recurrences in 42 patients at 13-month follow-up. Ono reported recurrence in 2 patients out of 60 at 24-month follow-up. In a review of three centers with mean follow-up of 54 months and 4.5 cm tumors, Dunn compared 64 laparoscopic nephrectomy patients with 69 open nephrectomy patients. There was 98% disease-free survival in the laparoscopy patients and 92% disease-free survival in the open surgery patients, with no statistical significance.

**Cost-benefit analysis:** In First World countries, laparoscopic surgery has become standard treatment for patients with T1 and T2 tumors, and open surgery is indicated in only 5% of these cases. The cost of laparoscopic procedures is on average $2000.00 USD more expensive than open procedures but this increase is compensated by faster recovery, reduced use of analgesics, and shorter period of convalescence. Health expenditure is 14% of the Gross Domestic product (GDP) of the United States. New techniques or technology have to be evaluated in order to be accepted as effective in relation to their financial implications.

In a retrospective study of 381 patients surgically treated for cortical kidney tumors from 1998-2003, laparoscopic surgery was initially more expensive. For 2003, laparoscopic surgery cost less than open surgery ($5157 USD vs. $5808 USD, respectively). Just one high clinical stage was associated with an increase in cost of the procedure (P <0.0001), so that laparoscopic surgery has had a decrease in cost in the last six years, enabling it to be established as the standard treatment for cortical tumors.

In a Mexican study carried out in the government ISSSTE hospitals, the cost of open radical nephrectomy with 5-day hospital stay is $57,250.00 MXN while the cost of laparoscopic procedure with 3-day hospital stay is $60,350.00 MXN.

In an analysis of costs at the INCAn, open radical nephrectomy can cost the patient from $0-$60,334 MXN, depending on the socioeconomic level of the patient established by the institution’s department of social work and from $0-$9322 MXN for laparoscopic surgery. In the present study population cost would be higher due to the necessity of laparoscopic trocars ($3680 MXN), vascular stapler ($6900), vascular cartridge ($2817 MXN), and use of hem-o-lok clips ($300 MXN). So, the patient can spend from $10,880 MXN-$13,697 MXN for laparoscopic consumables which, when added to the cost of the surgery itself, is still far below the cost of open surgery (Table 2).

**CONCLUSIONS**

Laparoscopy definitely plays an important role in the treatment of urological cancer and its development in Mexico depends on early tumor detection for ideal cases, obtaining better oncological control with lower morbidity, and mastering laparoscopic techniques. Laparoscopic radical nephrectomy is a safe and reproducible technique that offers faster patient recovery. However, the decision to carry out this procedure is made on an individual basis, taking into consideration characteristics of the patient, tumor clinical stage, the surgeon, and the hospital.

In institutions such as the present authors’, laparoscopic radical nephrectomy enables vanguard techniques to be developed that are basic for human resource training in relation to malignant tumors of the genitourinary tract, there is shorter hospital stay, and morbidity and cost are similar to those of open surgery.

**BIBLIOGRAPHY**