Laparoscopic pyeloplasty: Technique and results in 80 consecutive patients

O.A. Castillo\textsuperscript{a,b,*}, W. Cabrera\textsuperscript{a}, E. Aleman\textsuperscript{a}, I. Vidal-Mora\textsuperscript{a}, R. Yañez\textsuperscript{a}

\textsuperscript{a} Departamento de Urología y Centro de Cirugía Robótica, Clínica INDISA, Santiago, Chile
\textsuperscript{b} Facultad de Medicina, Universidad Andrés Bello, Santiago, Chile

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KEYWORDS
Ureteropelvic junction obstruction; Pyeloplasty; Laparoscopy; Anderson-Hynes; Robotic surgery

Abstract

Objective: To present our long-term results with the Anderson-Hynes laparoscopic pyeloplasty, performed by a single surgeon.

Materials and methods: Between August 1999 and December 2009, 79 patients (80 procedures) were operated for primary ureteropelvic junction obstruction. We use the Anderson-Hynes technique by a transperitoneal approach. Patients were evaluated with Ultrasound, Excretory urography and dynamic renal scintigraphy (Mag-3). The perioperative characteristics, complications and results were reviewed.

Results: We performed 80 laparoscopic pyeloplasties in 79 patients. Mean operative time was 93.2 min (60–180). Crossing vessels were found in 38 of 82 (46.3%) renal units. Kidney abnormalities occurred in 4 patients (1 double ureteropelvic system, one associated retrocaval ureter, 1 horseshoe kidney and one pelvic kidney). Complications occurred in 5 procedures (6.5%): an immediately postoperative bleeding (Clavien 3b), 1 cecal volvulus (Clavien 3b), 1 urosepsis (Clavien 4th) and 1 urinary fistula (Clavien 3a). In this series there was neither mortality nor conversion to open surgery. There was recurrence in 3 out of 80 patients (3.7%). They were resolved as follows: 1 percutaneous antegrade endopyelotomy, 1 secondary laparoscopic pyeloplasty and 1 robotic pyeloplasty. There was a 96.3% of primary overall success rate.

Conclusions: Our results show that laparoscopic pyeloplasty compares favorably with the result achieved by open surgery. We believe that laparoscopic pyeloplasty is a good surgical alternative for the management of primary ureteropelvic junction obstruction.

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\textsuperscript{*} Corresponding author.
E-mail address: octavio.castillo@indisa.cl (O.A. Castillo).
PALABRAS CLAVE

Estenosis pieloureteral; Pieloplastia; Laparoscopia; Anderson-Hynes; Cirugía robótica

**Pieloplastia laparoscópica: técnica y resultados en 80 procedimientos consecutivos**

**Resumen**

**Objetivo:** Presentar nuestros resultados a largo plazo con la técnica de pieloplastia laparoscópica de Anderson-Hynes realizada por un solo cirujano.

**Material y métodos:** Entre agosto de 1999 y diciembre de 2009 se operaron 79 pacientes (80 cirugías) por estenosis pieloureteral primaria. Se utilizó la técnica de Anderson-Hynes por vía transperitoneal. Los pacientes fueron evaluados con ultrasonido, urografía excretora y cintellograma renal dinámico (Mag-3). Se realizó un análisis prospectivo de la serie, revisando las características perioratorias, complicaciones y resultados.

**Resultados:** Se realizaron 80 pieloplastias laparoscópicas en 79 pacientes. El tiempo operatorio promedio fue de 93,2 min (60-180). En 38 de 82 (46,3%) unidades renales se encontró como hallazgo vasos polares en proximidad a la unión pieloureteral. Anomalías renales hubo en 4 pacientes (un doble sistema pieloureteral, un uréter retrógrado asociado, un riñón en hendidura y un riñón pélico). Ocurrieron complicaciones en 5 oportunidades (6,5%): sangrado postoperatorio inmediato que se manejó por vía laparoscópica (Clavien 3b), un vóvulo de ciego en el cual se realizó una hemicolecitomía derecha con buena evolución postoperatoria (Clavien 3b), una sepsis urinaria (Clavien 4a) y una fístula urinaria de manejo médico (Clavien 3a). No hubo mortalidad en la serie ni conversión a cirugía abierta. Hubo recurrencia en 3 de 80 pieloplastias laparoscópicas (3,7%), las cuales fueron resueltas de la siguiente forma: endipelotomía percutánea en un caso, pieloplastia laparoscópica en un caso y pieloplastia robótica en otro caso. La tasa global de éxito primario fue de 96,3%.

**Conclusiones:** Nuestros resultados con la pieloplastia laparoscópica transperitoneal se comparan favorablemente con aquellos logrados por la cirugía abierta. Creemos que la pieloplastia laparoscópica es una alternativa segura para el manejo de la obstrucción de la unión pieloureteral primaria.

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**Introduction**

Pyeloureteral strictures with secondary hydronephrosis may lead to asymptomatic kidney damage both in children and in adult patients. Anderson-Hynes dismembered pyeloplasty is the classical surgical technique, which is chosen for the management of primary or secondary pyeloureteral strictures. It is traditionally performed via lateral or posterior lumbotomy, its long-term success rate exceeding 90%, by using the steps typically described.1,2

In order to reduce the comorbidity related to the lumbotomy incision, several minimally invasive techniques have been described, the most used being antegrade incision with percutaneous renal access, the endoscopic antegrade approach using rigid or flexible ureteroscopy and endoscopic cold-knife incision of the stricture, hot or laser cutting and balloon and cutting with an electrically charged wire and using a retrograde probe called Acucise. However, the long-term results of these different treatment alternatives have success rates which do not exceed 61–89%, with a risk of secondary hemorrhage.3,4

All these techniques share the same problem: the need to know if there are polar vessels in the kidney or not, which would be associated with pyeloureteral strictures with variable figures depending on the radiological study used. The introduction of selective angiography with computerized axial tomography or magnetic resonance imaging has enabled us to diagnose the presence of polar vessels with greater certainty, but also with increased costs.

Laparoscopic pyeloplasty was first described in 1993, with long-term success rates comparable to those of open surgery,5,6 so it has definitely replaced open surgery at centers with experience in laparoscopy.7

We present a personal series of 79 consecutively operated patients, the surgical technique used, the complications and the long-term results.

**Materials and methods**

Our series comprised 79 patients who underwent laparoscopic pyeloplasties (bilateral pyeloplasty in one case) and who were consecutively operated on with the same surgical technique and by the same surgeon (O.A.C.).

A group of pediatric patients on whom we used a video-assisted technique and who were the subject of a previous publication8 was excluded from this analysis.

Their average age was 33.4 years, and a range of 3–75 years of age, 38 women (%) and 41 men. Pyeloureteral strictures were located on the left side in 31 patients (38.5%) and on the right side in 48 patients. There was a case of bilateral pyeloureteral stricture and the patient was operated on time.

**Surgical technique**

Preoperative preparation consisted of an 8-h fast. The patient is placed in the lateral position, with the same position used for any kind of retroperitoneal laparoscopic
surgery. A nasogastric tube and a bladder catheter are placed after the anesthetic induction.

Pneumoperitoneum is performed using a Veress needle at 15 mmHg and a 3-trocar technique: a 12-mm trocar for the pararectal and paraumbilical 30° scope and two 12-mm and 5-mm trocars in the subcostal area and in the iliac fossa. The position of the 12-mm trocar corresponds to the surgeon’s dominant hand (Figs. 1 and 2).

There is direct access to the pyeloureteral junction, both on the right and left sides. The hepatic flexure of the colon is easily accessible on the right side and a transmesocolic access is performed on the left side, as we previously described. The double J ureteral catheter is not previously placed, since hydronephrosis enables easy identification of the renal pelvis. The mesentery of the colon is sectioned and the ureteral pelvis and the ureter are dissected, achieving rapid identification and preservation of the polar vessels if they do exist.

Before the renal pelvis is sectioned, a Prolene 2-0 suture is placed, with a straight needle, by percutaneous way. Thus, traction is applied on the medial border of the pelvis, which will facilitate subsequent suture.

The renal pelvis is obliquely sectioned, separating the ureter, and if there are polar vessels, anastomosis is performed onto them. The ureter is spatulated on its lateral side and anastomosis of the posterior border is performed.

At this point in time, the 6-Fr double-J catheter is percutaneously placed (the wall is punctured with a 14G venous cannula, through which a hydrophilic guide-wire is pushed using an antegrade approach. The ureteral tutor is slid on it). The anterior side is then sutured, in both cases with Monocryl 4-0, with water containing Rb1. Aspiration drainage is left through a counter-opening.

The bladder catheter is removed after 24 h and the drainage is removed on the following day if there is no leakage. The ureteral double-J stent is removed using outpatient flexible cystoscopy after 2–4 weeks.

Postoperative follow-up is conducted with intravenous urography or CT urography and MAG3 renal scintigram at months 1, 6 and 12 in the postoperative period (Figs. 3 and 4).

Results

Eighty laparoscopic pyeloplasties were performed in 79 patients using the laparoscopic dismembered Anderson-Hynes pyeloplasty. 5 patients who underwent Fenger’s technique were excluded from this series, and so was another patient who had been previously operated on with open surgery, who had complete retraction of the left renal pelvis. Thus, the lower renal pole was resected and laparoscopic uretero-calicostomy was performed.¹⁰
The mean operative time was 93.2 min (range 60–180 min). In 38 of the 80 renal units (47.5%) we found polar vessels close to the pyeloureteral junction. Kidney abnormalities occurred in 4 patients (a patient with double pyeloureteral system, a patient with associated retrocaval ureter, a patient with a horseshoe kidney, and a patient with a pelvic kidney). There were 2 cases of multiple ipsilateral renal stones, which were resolved with removal using a flexible cystoscope and Dormia baskets through one of the ports.

Complications occurred in 5 patients (6.3%): immediate postoperative bleeding (secondary to the damage of the epi gastric vessels) which required re-laparoscopy, thus solving the problem, without conversion (Clavien 3b), a case of cecal volvulus on which a right hemicolectomy was performed with good postoperative evolution (Clavien 3b), a case of urinary sepsis with good response to medical treatment (Clavien 4a), and a case of urinary fistula treated with medical management (Clavien 3a).

There was neither mortality nor conversion to open surgery in the series.

During follow-up, recurrent stenoses occurred in 3 out of 80 laparoscopic pyeloplasties (3.75%), which were resolved as follows: percutaneous endopyelotomy in one case, laparoscopic pyeloplasty in one case, and robotic pyeloplasty in another case.

The overall initial success rate, measured according to clinical course, MAG3 renal scintigram, intravenous urography, and/or computed tomography, was 96.25%.

Discussion

The treatment of pyeloureteral stenosis has experienced a sustained change toward minimally invasive techniques in the last 20 years. Even though open pyeloplasty is regarded as the gold standard, several publications, including meta-analyses and randomized studies, have shown equivalent outcomes for those minimally invasive techniques with additional cosmetic benefits, less pain, and shorter hospital stays.\textsuperscript{11-14}

All the endopyelotomy techniques have not shown favorable long-term results. This is the reason why laparoscopic pyeloplasty has become the alternative of choice versus open pyeloplasty.\textsuperscript{15-17}

The literature shows variable results; however, the analysis of series with over 100 cases, both with transperitoneal and retroperitoneal access, showed a minor complication rate of 7.3% and a major complication rate of 3.1%, with a conversion rate of 0.4%. Although the definition of success varies between series, the reported failure rates range between 2 and 14%, thus producing similar results to traditional techniques.\textsuperscript{18}

The literature in Spanish shows few publications, with a small number of cases, but with comparable results to those series with a larger number of cases published in the literature (Table 1).

Laparoscopic pyeloplasty has been described both via transperitoneal and retroperitoneal access. A recent study compared 22 patients who had been operated on via transperitoneal access with 28 patients operated on via retroperitoneal access. There were significant differences in favor of transperitoneal access in terms of time needed to access the surgical field, suture time, and total operating time. Nonetheless, the approaches were performed by 2 different surgeons.\textsuperscript{26} A meta-analysis which included an analysis of 776 patients revealed similar conclusions, with transperitoneal access showing better operative time and a lower conversion rate.\textsuperscript{27} In our experience, since most of the learning curve for renal surgery involved transperitoneal access, we preferred this approach, which actually provides a better surgical space.

As to the use of the double J catheter – when compared with retrograde placement before surgery – intraoperative percutaneous antegrade placement decreases operative time. This was demonstrated by El-Feel et al. by comparing 15 patients via a retrograde approach with 32 patients via an antegrade approach. The authors concluded that antegrade
placement was technically feasible and enabled a better dissection, especially in patients with high ureteral insertion and secondary ureteropelvic junction obstruction. However, the long-term outcomes were comparable in both groups. Gamarra Quintanilla et al. proposed an interesting variation in patient positioning for laparoscopic pyeloplasty procedures which also enables the placement of the catheter via retrograde route, derived from the Galdakao-modified supine Valdivia positioning for percutaneous surgery. In our experience, we believe that an antegrade approach enables better dissection of the renal pelvis and easier visualization of the site of obstruction because the pelvis remains distended, especially for its location at the time of left-sided pyeloplasty using a transmesocolic technique.

An important point to emphasize is the training needed to perform reconstructive laparoscopic surgery. Laparoscopic pyeloplasty is a technique which requires advanced management of knots and intracorporeal sutures. In 2008, Ramachandran et al. described an animal model using esophagus and stomachs from chickens, thus simulating the ureter and the renal pelvis, respectively. The operative time showed a marked reduction from the second attempt to the fourth one. Besides, there was significant improvement in the quality of anastomosis. After the 4 attempts, all the participants successfully completed a urethral anastomosis. In the same vein, Valero et al. showed that this animal model of training was cost-effective, reproducible, easily available, and enabled the development of laparoscopic skills and also of the skills required for reconstructive surgery.

The current trend, at well-equipped centers, is to shift toward robotic pyeloplasty.

A recent meta-analysis showed a success rate of around 88–100%, with most of the series above 95%, and a low complication rate.

The co-operative group of laparoscopic and robotic pyeloplasty, in a multi-institutional study of 865 patients from 15 centers, revealed, according to the Kaplan–Meier curves, success rates without secondary procedures of 97.2% after a year and of 94.5% after 2 years.

In our initial experience of only 16 cases, not published yet, we observed a clear trend toward decreased surgical times, even when follow-up was still too short to determine its real success rate.

### Table 1  Laparoscopic pyeloplasty series published in Spanish.

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>No. patients</th>
<th>Technique</th>
<th>Complications</th>
<th>Success</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valdivia-Uría</td>
<td>2002</td>
<td>13</td>
<td>Anderson-Hynes</td>
<td>Urinary fistula (2/9)</td>
<td>77.7% (7/9)</td>
</tr>
<tr>
<td>Del Valle Gonzalez</td>
<td>2004</td>
<td>14</td>
<td>Anderson-Hynes</td>
<td>NS</td>
<td>92.85%</td>
</tr>
<tr>
<td>Gamarra Quintanilla</td>
<td>2007</td>
<td>12</td>
<td>NS</td>
<td>Urinary fistula (2/12)</td>
<td>NS</td>
</tr>
<tr>
<td>Bestard Vallejo</td>
<td>2009</td>
<td>15 OP</td>
<td>Anderson-Hynes</td>
<td>5/15 (33.3%) OP</td>
<td>93.3% LP</td>
</tr>
<tr>
<td>Garcia Aparicio</td>
<td>2010</td>
<td>14 (years)</td>
<td>Anderson-Hynes</td>
<td>NS</td>
<td>100%</td>
</tr>
<tr>
<td>Garcia Galisteo</td>
<td>2011</td>
<td>33 LP</td>
<td>Anderson-Hynes</td>
<td>NS</td>
<td>93.9% (31/33) LP</td>
</tr>
<tr>
<td></td>
<td></td>
<td>17 RP</td>
<td>Anderson-Hynes</td>
<td>NS</td>
<td>94.1% (16/17) RP</td>
</tr>
</tbody>
</table>

NS: not specified; OP: open pyeloplasty; LP: laparoscopic pyeloplasty; RP: robotic pyeloplasty.

### Conclusion

Our results with transperitoneal laparoscopic pyeloplasty compare favorably with those published in the literature. We believe that laparoscopic pyeloplasty is the method of choice for the management of primary pyeloureteral obstructions. From a technical point of view, the transperitoneal approach and the antegrade placement of an urethral catheter decrease the operative time without affecting functional results. Although we estimate that this technique will be replaced in the future by robotic surgery, it is still indicated at those centers where this technology is not available.

### Conflict of interest

The authors declare that they have no conflict of interest.

### References