

## SURGICAL TECHNIQUE

### Treatment of distal ureteral stricture by laparoscopic ureterovesical reimplantation

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#### KEYWORDS

Ureteric stricture;  
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#### Abstract

**Introduction:** To analyse the results achieved to treat iliac or pelvic ureteric stricture using laparoscopic reimplantation of the ureter in a psoc bladder.

**Material and method:** In a four-year period, we performed laparoscopic ureteral reimplantation in a psoc bladder in 6 patients (right/left 1:1; male/female 1:2; mean age 59.2 years, range 47–87). In 4 cases the lesion was iatrogenic and in 2 cases idiopathic. Ureteral resection with bladder cuff and cystorraphy followed by ipsilateral lymph node dissection was performed in idiopathic cases or those with history of previous urothelial tumour (4 cases in total) before ureteral reimplantation. Bladder was extensively mobilized and fixed to minor psoas tendon before performing ureteroneocystostomy. Mixed intra and extravesical technique with submucosal tunnel (Politano) was used in a case and in the remaining 5 cases extravesical technique with submucosal tunnel (Goodwin) was used. Mean follow-up was 26 months (range 18–34).

**Results:** There was no need to convert to open surgery. Time of surgery was 230 minutes in the case treated with Politano ureteroneocystostomy and 120 (range 75–150) in those treated purely extravesically. The mean hospital stay was 3.2 days (range 2–5). There were no intra or postoperative complications. Histologic assessment always revealed ureteral fibrosis and in 2 cases accompanying granulomatous inflammation and dysplasia. No patient suffered re-stricture or impairment in renal function during follow-up.

**Conclusions:** Laparoscopic ureteral reimplantation is an effective and safe minimally invasive technique to treat benign distal stricture of the ureter. Simplicity of extravesical reimplantation has an advantage over its intravesical counterpart.

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**PALABRAS CLAVE**

Estenosis ureteral;  
Laparoscopia;  
Cirugía reconstructiva

## Tratamiento de la estenosis de uréter distal mediante reimplantación urétero-vesical laparoscópica

**Resumen**

**Introducción:** Analizar los resultados obtenidos para tratar la estenosis de uréter iliaco-pelviano sin tumor activo mediante reimplantación laparoscópica en vejiga psicoica.

**Material y método:** En un período de 4 años hemos practicado reimplantación ureteral laparoscópica en vejiga psicoica a 6 pacientes (derecho/izquierdo 1:1; hombre/mujer 1:2; edad media 59,2 años, rango 47-85). En 4 casos la etiología fue iatrogénica y en 2 idiopática. En los pacientes con causa idiopática o antecedentes de tumor urotelial (4 casos en total) se realizó resección ureteral laparoscópica con rodete vesical, cistografía y linfadenectomía ipsilateral antes de la reimplantación. Se movilizó ampliamente la vejiga y se fijó al tendón del psoas. La reimplantación se realizó mediante técnica mixta intra-extravesical con túnel submucoso (Politano) en un caso, y mediante técnica extravesical con túnel submucoso (Goodwin) en el resto. El seguimiento medio fue 26 meses (rango 18-34).

**Resultados:** No hubo reconversión a cirugía abierta y la duración fue 230 minutos en el caso de la reimplantación tipo Politano y 120 minutos (rango 75-150) para la reimplantación extravesical. La estancia postoperatoria fue 3,2 días (rango 2-5). No se produjeron complicaciones intra o postoperatorias. El estudio histológico mostró en todos los casos fibrosis ureteral sin signos de malignidad y ausencia de metástasis ganglionares. Ningún paciente ha presentado reestenosis ni deterioro de la función renal durante el seguimiento.

**Conclusiones:** En casos seleccionados la reimplantación ureteral laparoscópica es una técnica mínimamente invasiva, eficaz y segura para el tratamiento de las estenosis ureterales distales sin tumor activo. Por su simplicidad de ejecución es preferible la reimplantación extravesical.

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**Introduction**

The aim of the surgical treatment of urethral strictures is to achieve permanent permeability of the collector system. To this end, the surgical principles of maintaining appropriate ureteral vascularization and performing watertight and tension-free vesicoureteral anastomosis must be respected.<sup>1</sup> Different laparoscopic techniques have been described for the treatment of distal ureteral stenoses, ranging from resection of the stenosis and direct uretero-ureteral anastomosis to the performance of reimplantation by means of the Boari flap.<sup>1-4</sup>

We are presenting our series of patients treated with ureteroneocystostomy using psoas-hitch. We have described the surgical techniques we use and we have substantiated our decision to use a pure extravesical technique.

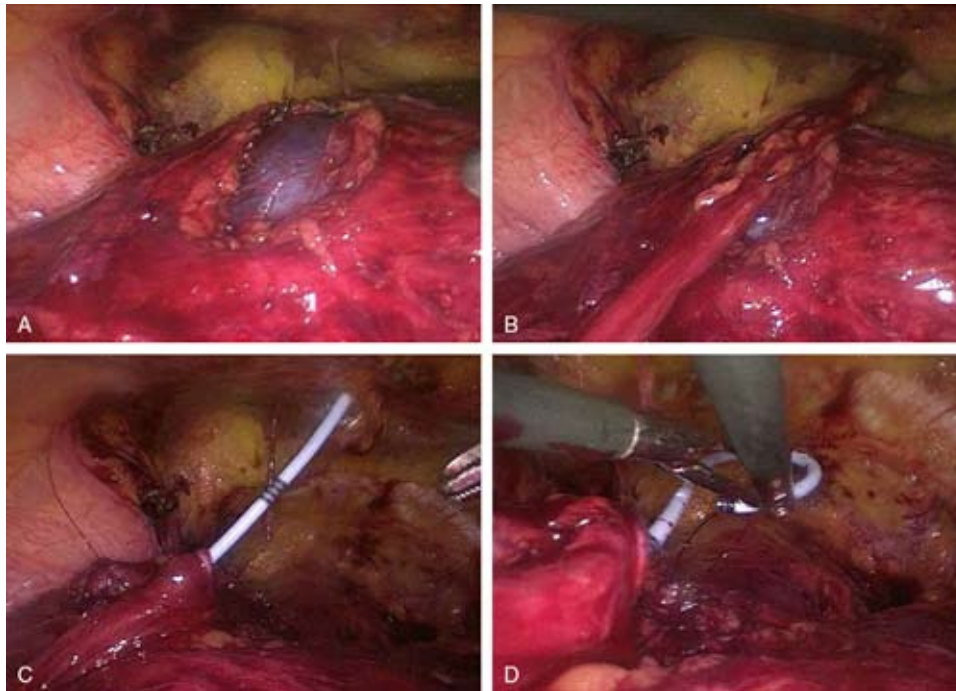
**Patients and methods**

Between May 2006 and December 2008, we subjected six patients with ureteral stricture to ureteral reimplantation with psoas-hitch. Four patients were male and two were female, with an average age of 59.5 years (range 47-87). In three of the cases the stenosis affected the right ureter and in the other three cases the left ureter. The average length of the stricture was 47 mm (range 15-70) (table 1). The etiology was iatrogenic in four cases: ureteroscopy with ureteral avulsion (1 case), hysterectomy with ureteral ligation (1 case) and endoscopic resection of transitional

cell bladder tumour affecting the distal ureter (2 cases). The other two cases were due to primary segmentary stenosis of the iliac-pelvic ureter of unknown etiology with severe parietal inflammation and epithelial dysplasia.

In all the patients, we had previously attempted to resolve the stenosis endoscopically. In two cases (cases 5 and 6), we were not even able to bypass the obstruction and these patients were subjected to a percutaneous nephrostomy. In the other four cases, we were able to perform a flexible ureteroscopy with biopsies and brush cytology cranial to the stricture and biopsy of the stenosis itself (which were all negative for malignancy in the four cases) with subsequent placement of a double-J catheter. In these four cases we performed ureterectomy distal to the stricture with bladder cuff resection, together with a regional lymphadenectomy either due to the patient's oncological history (cases 3 and 4) or to the presence of epithelial dysplasia in the endoscopic biopsies taken in the stricture (cases 1 and 2).

In one case (case 3), we performed an intra-extravesical reimplantation with a Politano-type submucosal tunnel, while in the other five cases, we applied an extravesical technique using a Goodwin-type antireflux mechanism. In all the cases, we left a double-J stent intubating in the ureter for four weeks, and performed an intravenous urography one month after the removal of the catheter. We have monitored the patients for a mean time of 26 months (range 18-34). A description of the surgical steps follows. Common steps and the particularities of both intra-extravesical and purely extravesical techniques are specified.



**Figure 1** (A) After fixation of the released bladder to the minor psoas tendon and saline serum is instilled through the urethral catheter, 1.5-2 cm long incision of the pericystium is performed between muscle fibres until the mucosa protrudes. (B) Spatulated ureter is placed over the incision to prepare the anastomosis. (C) Retrograde ureteral JJ stent is placed through a percutaneous needle. (D) Guide wire is removed and caudal J is ready to be inserted into the bladder.

## Surgical technique

Transperitoneal approach using four trocars is preferred. First step implies release of the ureter with identification of the stenotic area. Distal clipping and sectioning of the ureter is performed and followed by ureteral resection, when necessary, with the performance of bladder cuff and cystorrhaphy similar to that performed at the time of laparoscopic nephroureterectomy. Sectioning of the urachus and umbilical arteries is necessary, then releasing the entire moving part of the bladder. Besides, the superior contralateral bladder artery must be clipped and sectioned, with the aim of increasing the movement of the bladder. Finally fixation of the bladder to the minor psoas tendon with one or two sutures is performed. Distal ureter clip is removed and ureteral spatulation is undertaken.

## Intra-extravesical technique

Prior to the fixation of the bladder to the psoas, we make an oblique bladder opening. Subsequent to fixating the bladder, we proceed to perforate the bladder wall up to the mucosa, passing through the ureter to the inside of the bladder, fixating it extravesically by means of reabsorbable stitches. Using a percutaneous needle, we fill the submucosa with serum with the purpose of preparing a dissection plane for the antireflux tunnel. We carve the submucosal tunnel with a dissector and traverse the ureter with it. We fixate the ureter to the bladder mucosa with four reabsorbable stitches after catheterization with a JJ stent. We suture the mucosa at

the ureteral point of entry. Cystorrhaphy with running suture is performed on two planes.

## Extravesical technique

Fixation of the released bladder to the minor psoas tendon is performed, together with percutaneous placement of a retrograde ureteral JJ stent. Filling of the bladder with physiological saline solution instilled through the urethral catheter follows. Incision of the pericystium measuring 1.5-2 cm long is made between muscle fibres until the mucosa protrudes (fig. 1). The bladder mucosa is opened and anastomosed to the ureter by means of 4/0 double running suture. Apposition of the muscle fibres and pericystium above the anastomosed ureter is undertaken, thus creating a 1.5 cm long submucosal tunnel (fig. 2).

## Results

We completed the six cases by laparoscopy without the need to resort to open surgery. The operation lasted 230 minutes in the case of the Politano-type reimplantation, and 120 minutes (range 75-150) in the five cases subjected to extravesical reimplantation. None of the patients required a blood transfusion and blood loss was less than 100 cc in all the cases. Drainage was withdrawn the following day in all the cases. There was no case of paralytic ileus and the post-operative hospital stay was three days.

**Table 1** Descriptive data of the cases treated by laparoscopic ureteroneocystostomy

Case #	Sex	Age	Side	Etiology	Location	Measure	Reimplantation technique	Time of Surgery (min)	Admission (days)	Follow-up (months)
1	Female	87	Right	Primary idiopathic stricture	Pelvic & iliac	5.5 cm	Extravesical	150	5	28
2	Male	47	Right	Primary idiopathic stricture	Iliac & low lumbar	6 cm	Extravesical	135	3	28
3	Male	63	Left	Fibrosis after TUR of urothelial tumour	Iliac	7 cm	Intra-extravesical	225	3	20
4	Female	55	Right	Fibrosis after TUR of urothelial tumour	Pelvic	3 cm	Extravesical	105	2	18
5	Female	48	Left	Iatrogenic after hysterectomy	Pelvic	1.5	Extravesical	75	3	14
6	Female	57	Left	Iatrogenic after ureteroscopy	Iliac	5	Extravesical	120	3	12

The histopathological study showed fibrosis with granulomatous inflammation and severe urothelial dysplasia in the 2 patients with sacropelvic ureteral stricture. The other 2 cases subjected to ureteral resection due to a former history of distal ureteral stricture secondary to TUR of a bladder tumour affecting the distal ureter, were also non-malignant. We did not observe any nodal metastasis in the specimen obtained at the time of lymphadenectomy either.

Five patients showed complete recovery of the ureteric morphology in the procedural intravenous urography. A patient showed residual dilation in the pyelogram, with improvement in relation to pre-operative imaging, without symptomatology and with non-obstructive renogram. Possibly this was due to long-standing former dilatation of the ureter. After an average monitoring period of more than 2 years, none of the patients manifested stricture or deterioration of their renal function as compared to the pre-operative study.

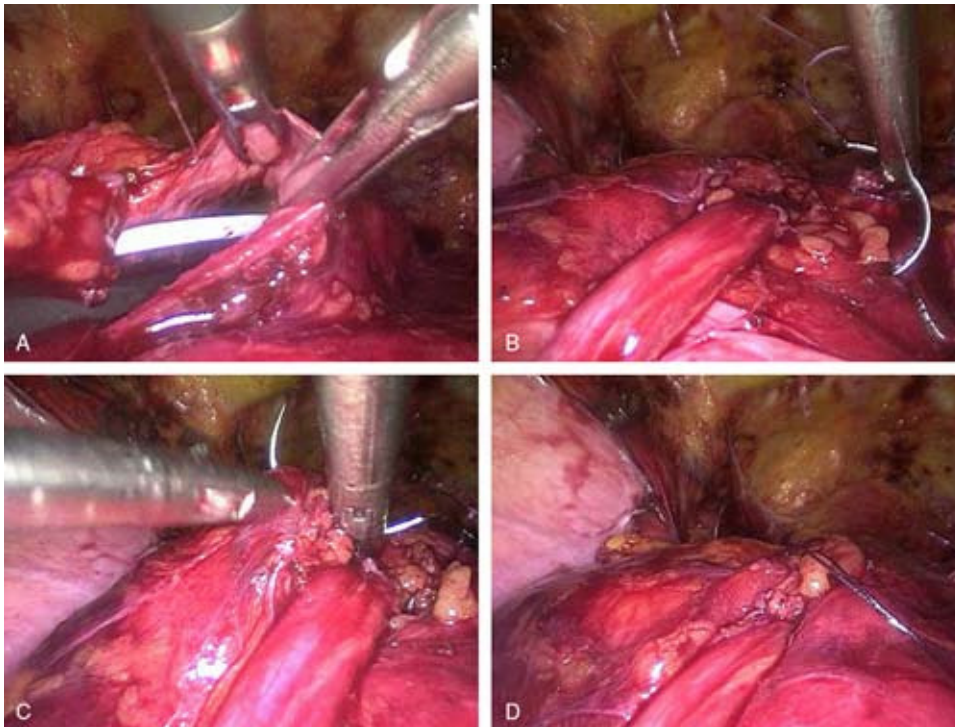
## Discussion

Laparoscopic ureterocystoneostomies are widely performed as definite treatment of vesicoureteral reflux.<sup>5</sup> The laparoscopic use of Cohen-type transvesical reimplantations or Gil-Vernet trigonoplasties in children has been described,<sup>6-8</sup> although due to its ease of performance, the most commonly used technique is the Lich-Gregoire type extravesical nondismembered reimplantation.<sup>9,10</sup> In the case of ureteral stenosis (either neoplastic or iatrogenic), the techniques used must be dismembered, with or without the simultaneous performance of a distal ureterectomy. This makes it necessary to move the ureter and the bladder more.

There is little experience with ureteral reimplantations due to ureteral stricture<sup>1-4,11-13</sup> and very few series compare open surgery to laparoscopic surgery.<sup>1,2</sup> Rassweiler et al compare 10 laparoscopic reimplantations and 10 open surgeries in which the same technique is used (vesicopsoas hitch with or without Boari flap).<sup>2</sup> Simmons et al present their series of laparoscopic ureteral reconstruction for benign stricture of the ureter and compare 12 laparoscopic procedures with 34 open surgeries.<sup>1</sup> They perform 42% of direct uretero-ureteral anastomoses with the laparoscopic approach, and only 9% with the open surgery approach. Although the authors do not explain this difference, it is probable that the lesser need for ureteral movement in laparoscopic access may decrease ureteral ischemia and facilitate performing this technique, which in general does not tend to be used in the open surgery approach of pelvic ureteral stenosis. In our series, only the case of post-hysterectomy ligation would have been suitable, given that the stricture was short, however we preferred to repeat the technique we applied in open surgery.

One of the fundamental principles of a ureteroneocystostomy is to achieve tension-free anastomosis. To this end, we had to appropriately move the ureter, preserving the periureteral fat for the purpose of preventing ischemia, and also appropriately move the bladder. Laparoscopy allowed us to easily release the bladder, both from the Petzis space and from its lateral sides. In some cases, in order to achieve greater bladder





**Figure 2** (A) Bladder opening is ready for anastomosis to the ureter by means of 4/0 double running suture. (B & C) Apposition of the muscle fibres and pericystium above the anastomosed ureter is undertaken, thus producing the second plane of cystorrhaphy while creating a 1.5 cm long submucosal tunnel. (D) Extravesical antireflux mechanism is finished and saline serum is instilled to confirm water-tight anastomosis.

movement, it was necessary to section the contralateral superior vesical artery, which allowed us to relieve stenosis up to 6-7 cm without the need to resort to a Boari flap. The performance of a longitudinal bladder opening, as in the case of intra-extravesical reimplantation, allowed gaining 2 or 3 additional centimetres of release. However, we do not consider this intra-extravesical approach the technique of choice, as it is far more complex than the purely extravesical one. It might be a good option though in very long strictures or in those affecting the lower lumbar ureter. Other series prefer to routinely use the laparoscopic Boari flap;<sup>4,13</sup> however, given the technical descriptions these authors provide, it is an even more complex technique than intra-extravesical reimplantation and must only be used in cases of strictures that cannot be cured using other techniques.

In all our cases, we performed anastomosis using a JJ stent inserted through a percutaneous needle. Some series prefer not to place a JJ stent and do not mention an increase in the appearance of urinary fistulae.<sup>3,12</sup> In spite of this, we believe that placing a JJ stent is fast and easy, which is why we perform it routinely without any complications and with no urinary fistula appearing in our series.

The performance of the antireflux technique in ureterocystostomy is probably the most complex technical part of this procedure. Although some authors do not perform it,<sup>14</sup> most of the series favour some antireflux mechanism.<sup>1,2,12</sup> In intra-extravesical techniques, the mucosa must be dissected from the submucosa. To this end, it is convenient to inject serum under the mucosa. Some authors apply this injection cystoscopically.<sup>15</sup> The only

case in which we performed an intravesical anastomosis, we injected the serum through the same percutaneous needle through which we subsequently placed the JJ stent. After dissecting the mucosa off the submucosa, we created the submucosal tunnel and advanced the ureter through it. In the only case in which we used this procedure, the tunnel was partially torn and had to be reconstructed. In the extravesical technique, we created the tunnel using the position of the bladder muscle fibres above the anastomosis, which significantly simplified the surgical procedure. In our series, we performed a cystography in four cases without any vesicoureteral reflux in any of them. In other larger series, the reflux rate after laparoscopic reimplantation was also very low, between 5% and 10%.<sup>1,12</sup>

Although it is important to prevent vesicoureteral refluxes in patients treated because of ureteral obstruction, without any doubt the main priority of this technique is to resolve the obstruction permanently. Following ureteral reimplantation, the majority of the cases that suffer re-stricture occur during the first year of monitoring.<sup>16</sup> Although our series was short, with a mean follow-up of more than two years re-stricture did not occur in any of the cases. Our results of effectiveness in relation to obstruction tally with those published by other authors, who achieved a rate of between 90% and 100% of permanent ureteral permeability.<sup>1,2,12,13</sup> These good results regarding the resolution of ureteral stricture, with a low reflux rate and scarce perioperative morbidity allow us to consider laparoscopic ureteroneocystostomy as a good therapeutic

alternative in those cases of distal ureteral stricture that is unresponsive to endourologic treatment.

## Conclusions

Laparoscopic ureteroneocystostomy due to distal ureteral stricture pursues a high rate of resolution of the stenosis with a minimally invasive approach. We believe that the extravesical technique has advantages in comparison to the intra-extravesical technique, because it is easier to perform and has good results. We could consider laparoscopic extravesical reimplantation as an effective alternative for the treatment of lower ureteral stricture following the failure of endourological procedures. We believe intra-extravesical techniques and also the Boari flap should be reserved for very long strictures in which the bladder has to be severely mobilized and anastomosed with the lumbar ureter.

## Conflict of interest

The authors declare that they have no conflict of interest.

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