# CONTRIBUTI DI TECNICA CHIRURGICA E SPERIMENTALI TECHNICAL AND EXPERIMENTAL CONTRIBUTIONS

# Ureterocele fenestration with holmium laser in neonates



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## Ureterocele fenestration with holmium laser in neonates

AIM: To evaluate the effectiveness of holmium-laser fenestration of intravesical ureteroceles in neonatal period.

MATERIAL AND METHOD: We retrospectively analyzed the results of the holmium-laser puncture in ten neonates with intravesical ureterocele, between September 2013 and September 2016. Laser probe was placed through the cystoscope to the lowest and medial portion of the ureterocele, near the bladder floor. Few punctures (4 to 8) were made, until ureterocele has been collapsed.

RESULTS: Mean duration of general anesthesia was 16 minutes (range, 10-24) and duration of hospitalization was 1-3 days (mean, 1.3 days). There weren't complications regarding endoscopic treatment. There was the need for retreatment in one (10%) patient. Obstruction was found in one (10%) patient on ultrasound after one month. After three months there was no obstruction on ultrasound in any patient. In patients in whom VCUG was performed, vesicoureteral reflux was not found three months after the surgery.

DISCUSSION: The relief of the obstruction, prevention of the vesicoureteral reflux and the urinary tract infection are the reasons for the immediate treatment in the neonatal period. In that way, the preservation of renal function is enabled. The reason for laser fenestration was better endoscopic control of the extensibility of the ablation. The moment of ureterocele collapsing can be visualized directly.

CONCLUSIONS: Holmium-laser fenestration is a minimally invasive, highly effective and safe kind of treatment for ureterocele in neonatal period with minimal complication rate. Further clinical studies with a greater number of patients will offer more reliable information regarding this procedure.

KEY WORDS: Fenestration, Holmium-laser, Neonates, Ureterocele

# Introduction

Ureterocele represents a cystic dilation of the distal segment of the ureter <sup>1</sup>. It can be located within the bladder or include the bladder neck and urethra. Ureterocele may reflect insufficient ureteral maturation, the fetal process by which the developing ureteral bud separates from the mesonephric duct and moves to the bladder <sup>2</sup>. Ureterocele may be associated with a single or a duplex system. In most cases it is a duplex system, associated with the upper pole  $^{3}$ .

Prolapse of the ureterocele is a characteristic sign in some patients. The presence of mucosa-covered intralabial masses with difficulty voiding may be a pathognomonic clinical sign <sup>4</sup>. Sometimes, urosepsis may be the first clinical sign of the anomaly. Otherwise, in majority of the patients the state is characterized by the absence of clinical <sup>5</sup>.

The majority of ureteroceles are detected through prenatal ultrasound investigation <sup>6</sup>. Postnataly, ultrasound investigation may confirm the diagnosis. A thin-walled, cystic dilation inside the bladder is a characteristic finding. A large ureterocele may completely fill in a bladder, without urine inside <sup>7</sup>.

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Fig. 1: Endoscopic view of the ureterocele and laser-fenestration.

Magnetic resonance imaging may define the complex anatomy in these patients <sup>8</sup>. Radionuclide renal imaging is the gold standard for renal functional assessment. The function of the upper (rarely lower) pole has to be defined, but the state of the other segments of the urinary tract has to be evaluated <sup>9</sup>. Voiding cystourethrogram (VCUG) has to be performed to define intravesical status and the presence of reflux. Bladder function has also to be evaluated because of the possibility of bladder outlet obstruction <sup>7</sup>.

Endoscopy is the final diagnostic procedure. The cystoscopy should start with little filling and slow increase of bladder volume, because the appearance of the ureterocele should vary with bladder filling <sup>5,10,11</sup>.

The aim of the therapy is to preserve renal function, to eliminate the obstruction, urinary infection and vesicoureteral reflux, and also to prevent urinary incontinence. It is very important to minimize the overall procedural morbidity. The options for surgical treatment are: transurethral incision, excision of ureterocele with (or without) ureterocystoneostomy or ureteroureterostomy, upper pole haeminephroureterectomy. In majority of patients transurethral incision may prevent obstruction and vesicoureteral reflux. Besides that, the necessity for subsequent surgery can be minimized. The endoscopic treatment can be performed with electrosurgery, coldknife and holmium-laser <sup>12,13</sup>.

### Material and Method

We retrospectively analyzed results of holmium-laser ablation of intravesical ureterocele in 10 neonates, treated between September 2013 and September 2016 at our institution. In all patients ultrasound and VCUG were performed in order to confirm the diagnosis. Urinalysis, urine culture and kidney function tests were evaluated. All patients received routine antibiotic prophylaxis. Cystoscope 7.5-F was used for the endoscopic evaluation and the treatment. The source of energy was holmium: yttrium-aluminium-garnet laser (Holmium: YAG laser). We used 230 and 365-microm laser probes for ureterocele ablation. All endoscopic procedures were done under general anesthesia.

After transurethral placing the cystoscope all anatomic conditions were considered: the capacity of the urinary bladder, mucosal appearance, the presence of trigonum and ureteral orifices. Then, the presence of the ureterocele, it's side and size, the tension of the ureterocele and, also, the level of fullfilment of the bladder and, eventually, the propagation into the urethra. Laser probe was placed through the working channel of the cystoscope to the lowest and medial portion of the ureterocele, near to the bladder floor. We used micro laser fibers generating 0.2 to 1 J at a frequency of 5 Hz. A few punctures (4 to 8) were made at the ureterocele wall, while ureterocele has been collapsed. After the puncture we didn't place any stent. If there was a risk of bladder neck obstruction we would place Foley catheter (Fig. 1). Antibiotic prophylaxis was continued in postoperative period. Ultrasound examination was performed first day after the treatment to assess the level of obstruction. Patients were discharged first postoperative day, except two patients with non urinary tract related conditions. Their hospital stay was extended to 2 to 3 days after the surgery. Follow-up our patients included ultrasound examination 1 and 3 months after the surgery to evaluate the degree of decompression and VCUG to evaluate the possibility of reflux. VCUG was not a mandatory procedure in all patients. If there was no urinary tract infection and ultrasound was normal, we performed just observation.

## Results

Holmium-laser puncture of ureterocele was performed in the total number of 11 procedures in 10 neonatal patients. There were 7 (70%) females and 3 (30%) males. Mean age and mean weight were 9.8 (range, 4-28) days and 3.6 (range, 2.2-4.4 kg), respectively. Double and single system ureterocele were found in 7 (70%) and 3 (30%) patients, respectively. In 6 (60%) patients ureterocele was located on the left side and in 4 (40%) patients on the right side. Ureterocele was diagnosed prenatally in 8 (80%) patients and postnatally in 2 (20%) patients (Table I).

Eleven surgical procedures were performed in ten neonates with ureterocele. Mean duration of general anesthesia was 16 minutes (range, 10-24). Duration of hospitalization was 1-3 days (mean, 1.3 days). Complications were not found in any patient. There was the need for retreatment in one (10%) patient. Obstruction was found on ultrasound examination one month after the surgery. After three months there was no obstruction on ultrasound in any patient. In three (30%) patients who underwent VCUG vesicoureteral reflux was not found (Table II).

Table I -	Preoperative	findings	of patients
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N. patients	10
Female	7 (70%)
Male	3 (30%)
Mean age, days (range)	9.8 (4-28)
Mean weight, kg (range)	3.6 (2.2-4.4)
Double system ureterocele	7 (70%)
Single system ureterocele	3 (30%)
Left side	6 (60%)
Right side	4 (40%)
Diagnosed prenatally	8 (80%)
Diagnosed postnatally	2 (20%)

TABLE II - TOSIOPETALIDE JUNALINGS OF PALLENIS	Table	Π	-	Postoperative	findings	of	patients
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N. procedures	11		
N. retreatments	1/10 (10%)		
Mean anesthesia, min. (range)	16 (10-24)		
Mean hospitalization, days (range)	1.3 (1-3)		
Complications	None		
Obstruction (after one month)	1 (10%)		
Obstruction (after three months)	None		
Vesicoureteral reflux	None		

#### Discussion and Commentary

Ureterocele is an inborn anomaly of the urinary tract which is most often associated with other disorders of that system. Duplicated ureter, megaureter, a certain degree of renal parenchyma damage, renal dysplasia, vesicoureteral reflux in lower pole ureter, contralateral agenesia - are the most common associated anomalies. That means that the treatment of ureterocele mandatory means the treatment of all these disorders <sup>3-5</sup>. After the total assessment of the patient, the treatment of the ureterocele should be performed. The relief of the obstruction and prevention of the vesicoureteral reflux and the urinary tract infection are the reasons for the immediate treatment in the neonatal period 7. In that way, the preservation of renal function is enabled. Nowadays, there are the options for prenatal treatment, which is well documented. Persico and al. and Torres Montebruno and al. reported successful prenatal cystoscopic laser surgery for fetal ureterocele 14,15.

In a current literature a few options for the endoscopic ablation of ureterocele are described: electrosurgery incision, cold-knife incision and laser incision. Most authors suggest transferse incision through the full thickness ureterocele wall <sup>10,12,13</sup>. The other option is to make few separate punctures on the ureterocele wall, until ureterocele collapses. We decided to perform the second option, using holmium-laser. The reason for doing so was better endoscopic control of the extensibility of the ablation. The moment of ureterocele collapsing can be visualized directly. We have assumed that moment as the moment of relieving the obstruction. On the ultrasound examination after one month after the surgery there was the obstruction only in one patient. On the second ultrasound control after three months there was no obstruction in any of the patients. Most series have reported the rate of decompression between 70% and 90%<sup>16,17</sup>.

Vesicoureteral reflux after the ureterocele transurethral incision is well documented. It is reported that the incidence of new reflux ranges from 0% to 50% <sup>16,18</sup>. Larger extensiveness of transureteral incision may lead to reflux. That's why we decided to perform laser puncture. The moment of collapsing the ureterocele was the sign to stop making the punctures. We conclude that the new punctures may lead to occurrence of reflux. Vesicoureteral reflux was not seen in any of our patients who underwent VCUG three months after the holmi-um-laser puncture.

Retreatment has to be performed if there is no ultrasound proof of decompression: the reduction of the upper urinary tract dilation and collapse of ureterocele. It is reported that 10% to 30% patients need retreatment <sup>10,17,18</sup>. We had only one patient (10%) in which the upper urinary tract dilation persisted after the initial treatment and ureterocele did not collapse. The retreatment was necessary in that patient. During the second surgical procedure we made few new punctures on the ureterocele wall with laser beam, until ureterocele collapsed, in the same way as in initial treatment. On the control ultrasound examination there were no signs of obstruction.

Since this relates to newborns, it is important that the duration of surgical procedure has to be as short as possible. Pagano et al. reports mean duration of general anesthesia 23 minutes <sup>19</sup>. In our series that time was only 16 minutes.

Many authors report that most patients with ureterocele are treated as outpatients. Prolonged hospital stay is reserved for patients which general state and coexisting disorders implies longer postoperative followup <sup>10,18,20,21</sup>. During the period of our research one patients was hospitalized two days because of febrile condition after the surgery (upper respiratory tract infection, without urinary infection) and one patient three days because of complications regarding congenital heart disease.

Possible complications after endoscopic treatment of ureterocele are: new vesicoureteral reflux, persistent obstruction, urinary tract infection, incontinence, forming of calculus, etc. <sup>3,4,10,18,23</sup>. Obstruction and VUR were already discussed. Urinary tract infections may occur for many reasons. In any case, stasis of urine contributes the occurrence of UTI. The appearance of incontinence is rare in ureteroceles, except in extravesical ureteroceles. The data are very necessitous about complications after the endoscopic treatment of ureteroceles (except obstruction and VUR). There was no complication after the holmium-laser puncture of ureterocele in our series.

Why we decided to perform laser-puncture of ureterocele rather than the other endoscopic surgical procedures? There are publications about laser treatment of ureterocele, actually with a smaller number of patients. Most papers report holmium-laser incision <sup>19,24</sup>. Precisely, holmium-laser puncture of ureterocele has not been sufficiently discussed <sup>21</sup>. On the other hand, the effectiveness of laser beam in other urinary tract disorders is well documented, especially in the treatment of urolithiasis <sup>25,26,27</sup>. A laser beam penetrates the soft tisuue to a depth of 0.5 mm <sup>25</sup>. Bearing in mind our experience in holmum-laser lithotripsy, we decided to perform controlled use of laser beam in the endoscopic puncture of ureterocele <sup>27</sup>.

#### Conclusion

Holmium-laser fenestration is a minimally invasive, effective and safe kind of treatment for ureterocele in neonatal period. Complication rate is very low. Further clinical studies with a greater number of patients will offer more reliable information regarding that surgical procedure.

## Riassunto

L'ureterocele è costituito da una dilatazione cistica del tratto distale dell'uretere. Può essere localizzato all'interno della vesical, o comprendere il collo vescicale e l'uretra. Esso potrebbe derivare da uno sviluppo insufficiente del processo fetale nel corso del quale la gemma ureterale in evoluzione si separa dal dotto mesonefrico e si dirige verso la vescica, e può associarsi con sistema ureterale singolo o doppio.

Nella maggioranza dei casi si tratta di un sistema doppio derivante dal polo superiore.

Per lo più gli ureteroceli vengono diagnosticati nel periodo prenatale, d dopo la nascita la diagnosi puà essere confermata dalle indagini con gli ultrasuoni o con RMN.

Il reperto caratteristico è quello di una dilatazione cistica a pareti sottili all'interno della vescica. Bisogna eseguire un cistouretrogramma (VCUG) per definire la situazione intravescicale e la presenza di reflusso. Lo scopo della terapia è quello di preservare la funzione renale, di eliminare l'ostruzione, l'infezione urinaria ed il reflusso vescico-ureterale, e per prevenire l'incontinenza urinaria. Nella maggioranza dei casi l'incisione transuretrale consente di preservare l'ostruzione ed il reflusso vescico-ureterale.

Abbiamo esaminato retrospettivamente i risultati dell'ablazione con holmium-laser di un ureterocele intravescicale in 10 neonati, trattati tra il settembre 2013 e settembre 2016 nel nostro istituto.

Per la valutazione endoscopica è stato usato il cistoscopio 7,5-F, e come fonte di energia l'Holium:YAG laser (holmium: yttrium-aluminum-garnet laser), procedendo endoscopicamente in anesthesia generale.

La durata media dell'anestesia è stata di 16 minuti (da 10 a 24 minuti) e la durata della degenza da 1 a 3 giorni (in media 1,3 giorni), senza complicanze riferibili al trattamento endoscopico, ma in un paziente è stato necessario ripetere la procedura, perché dopo un mese è stata rilevata ecograficamente una ostruzione. Dopo tre mese nessun paziente presentava ostruzione né reflusso vescico-ureterale.

La necessità di un trattamento immediate nel periodo neonatale si è reso necessario per eliminare l'ostruzione e prevenire il reflusso vescico-ureterale e l'infezione. In tal modo la funzione renale viene preservata.

La ragione per procedere alla fenestrazione con il laser è per il migliore controllo endoscopico delle estensione della resezione, e si può visualizzare direttamente il collasso dell'ureterocele.

La fenestrazione con Holmiium-laser è una tecnica mini-invasiva, efficace e sicura per il trattamento dell'ureterocele nel periodo neonatale, con rara incidenza di complicazioni.

Un'esperienza casistica più numerosa potrà offrire in futuro informazioni più affidabili riguardo a questa procedura chirurgica.

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