SKILL AND TALENT

Micro-ureteroscopy: Initial experience in the endoscopic treatment of pelvic ureteral lithiasis

J.P. Caballero*, J.A. Galán, A. Verges, A. Amorós, A. Garcia-Segui

Servicio de Urología, Hospital del Vinalopó, Elche, Alicante, Spain

Received 15 August 2014; accepted 25 August 2014
Available online 1 May 2015

KEYWORDS
Ureteroscopy; Miniaturization; Laser; Lithotripsy; Urinary lithiasis

Abstract
Objectives: To present the first case of ureteral lithiasis resolved using a new endoscopic approach, which we call micro-ureteroscopy (m-URS), and attempts to reduce the ureteral damage caused by conventional instrumentation.

Material and methods: We selected a 53-year-old patient with a 16-mm calculus in the right distal ureter. For endoscopic access, we used a 4.8-Fr sheath from the microperc set and fragmented the stone with a 230-micron laser fiber.

Results: Complete fragmentation of the stone was achieved. We placed a JJ catheter due to significant ureteral edema. The surgical time and postsurgical stay were 156 min and 24 h, respectively. There were no complications, the requirements for analgesia were minimal, and the patient was free of residual stones.

Conclusions: The m-URS technique is feasible, simple and effective for the treatment of pelvic ureteral lithiasis in women and optimizes minimal invasion, with results that can be comparable to conventional endoscopic techniques in terms of ease of access and quality of endoscopic vision without affecting the resolution capacity. Larger studies and greater technological development are needed to define the definitive role of this procedure. Currently, its major limitations lie in the treatment of proximal ureteral lithiasis and in the treatment of men. This technique could also be a viable alternative for pediatric patients.

© 2014 AEU. Published by Elsevier España, S.L.U. All rights reserved.

PALABRAS CLAVE
Ureteroscopia; Miniaturización; Láser; Litotricia; Litiasis urinaria

Resumen
Objetivos: Presentar el primer caso de litiasis ureteral resuelto mediante un nuevo abordaje endoscópico que denominamos micro-ureteroscopia (m-URS) y que pretende reducir el daño ureteral que se produce por el instrumental convencional.

Micro-ureteroscopia: Experiencia inicial en el tratamiento endoscópico de litiasis de uréter pelviano


* Corresponding author.

E-mail address: juanpablocaballero@gmail.com (J.P. Caballero).

© 2014 AEU. Published by Elsevier España, S.L.U. All rights reserved.
Introduction

Miniaturization of endoscopic equipment opens new possibilities, both in the diagnosis and in the treatment of renal and ureteral lithiasis. In recent years, the Mini-Perc, Ultra-Mini Perc, and Micro-Perc have been developed as variants of the standard procedure which is percutaneous nephrolithotomy, while retrograde intrarenal surgery is born.

As the different working groups gain experience in these techniques and communicate their results, their respective indications are being defined. One of the most controversial aspects in the treatment of ureteral stones is ureteral injury and its consequences: renal-ureteral colic, ureteral stenosis, analgesic requirements, or the need for subsequent placement of a ureteral catheter.

Our group works to minimize the damage that the working item causes to the ureter without affecting the success of the procedure. We present the first communication worldwide of a new technique for the treatment of ureteral stones in women, using a 4.8-Fr ureteral access that we call micro-ureteroscopy (mURS).

Material and methods

We treated a 53-year-old woman who presented a first episode of renal-ureteral colic secondary to a stone at the right pelvic ureteral level, approximately 3 cm from the ureteral meatus. The measures of the lithiasis (Fig. 1) were 16.2 × 7.9 × 7.9 mm (1011 mm³ total volume). IV 500 mg levofloxacin was prescribed as antibiotic prophylaxis. Informed patient consent was obtained and spinal anesthesia was performed.

We used a Karl Storz Calculase with a maximum theoretical power of 10 W. The fiber selected was 230 μ Karl Storz (Karl Storz, Germany). We opted for the 4.8-Fr ureteral access sheath and 22.5-cm length (Fig. 2).

We lubricated the urethra and emptied the bladder with a 12-Ch urinary catheter placed that we left placed throughout the procedure. In order to access the ureter, we used the 4.8-Fr access sheath which is connected to a piece called 3-port LuerLock, and to it by one of the side channels, a Touhy Borst adapter. Through the straight channel of the 3-port LuerLock we introduced the lens and through another channel we infused the saline.

We identified without difficulty the trigone and the right ureteral, orthotopic, straight, and thin lip meatus. Access was made without resistance to visualize the lithiasis. The

Material y métodos: Seleccionamos a una paciente de 53 años de edad con una litiasis de 16 mm en el uréter distal derecho. Para el acceso endoscópico empleamos la vávula de 4,8 Fr del set de micro-Perc y fragmentamos la litiasis con una fibra láser de 230 μ. Resultados: Se consiguió la fragmentación por completo de la litiasis. Colocamos un catéter JJ debido al importante edema ureteral. El tiempo quirúrgico fue de 156 min y la estancia posquirúrgica de 24 h. No hubo complicaciones, los requerimientos de analgesia fueron mínimos y la paciente quedó libre de litiasis residuales. Conclusiones: La m-URS es una técnica factible, sencilla y eficaz en el tratamiento de litiasis ureteral pelviana en mujeres, que optimiza la mínima invasión con unos resultados que pueden ser equiparables a las técnicas endoscópicas convencionales en cuanto a la facilidad del acceso y la calidad de visión endoscópica sin afectar la capacidad resolvente. Se requiere de estudios más potentes y de un mayor desarrollo tecnológico para definir el rol definitivo de este procedimiento. Las mayores limitaciones actuales residen en el tratamiento de litiasis en el uréter proximal o en varones. Podría ser una buena alternativa también en pacientes pediátricos. © 2014 AEU. Publicado por Elsevier España, S.L.U. Todos los derechos reservados.
Micro-ureteroscopy: Initial experience in the endoscopic treatment of pelvic ureteral lithiasis

![Image](http://www.elsevier.es)

**Figure 2** 1. Semi-rigid lens of 0.9 mm in diameter, 120° in vision and 27 cm in length. 2. 8-Ch nephrostomy catheter. 3. 230 μ laser fiber. 4. 3-port LuerLock and Touhy Borst adaptor. 5. 4.8-Fr ureteral access sheath.

lithiasis was affected, it completely occupied the ureteral lumen and was accompanied by a significant edema around. We practiced an ascending pyelography in which we identified the ureteral obstruction and a significant ureteropyelocalicial dilatation. We removed the lens and tried unsuccessfully to place a 0.035 nitinol security guidewire.

In order to perform the lithofragmentation, the 230 μ laser fiber was inserted through the third channel of the LuerLock key. The stone was fragmented at a shooting frequency of 8 Hz and 0.8 J (6.4 W) of energy. Once we managed to partially fragment the stones, the 1–2 mm safety guidewire was placed. Fragmentation was continued until obtaining 1–2 mm fragments. These fragments were passed spontaneously to the bladder during the procedure.

Subsequent ascending pyelography showed no signs of contrast extravasation or residual fragments. Due to the significant ureteral edema existing before the procedure, we placed a double-J ureteral catheter, open-open, 26 cm long and 6 Ch. The bladder catheter was removed at 18 h.

**Results**

The duration of the intervention was 156 min. The patient was hospitalized for 24 h. Pain control was optimal, with minimum analgesic requirements. There were no complications and we observed no macroscopic hematuria.

The ureteral catheter was removed one week after surgery, and there was no evidence of residual stones in a urinary tract X-ray and a urological ultrasound. After surgery, the patient remains asymptomatic at 4 months of follow-up.

The procedure was as comfortable and effective as conventional ureteroscopy, without presenting any further difficulty due to the use of m-URS, maintaining the quality of vision.

![Image](http://www.elsevier.es)

**Figure 3** Image of the distal end of the endoscopic instrument which compares the dimensions of the micro-URS versus conventional URS.

**Discussion**

Ureteroscopy is the technique of choice for the treatment of pelvic ureter stones, for its ability to resolve them in a single procedure with low probabilities of complications.

This article is, as far as we have recorded, the first communication worldwide of the use of the micro-percutaneous material for handling stones in the distal ureter.

M-URS offered an image quality and comfort similar to the one we have with the Storz 8–13.5 Ch telescoped semi-rigid ureteroscope that exists in our center, but with a 40% lower diameter (Fig. 3).

The ureteral access in women seems simple without needing to use meatus dilators or guidewires, in parallel or coaxial. We chose a woman to avoid the length and tortuosity of the male urethra. The length of the lens and the access sheath allows for the treatment of lithiasis separated by less than 22 cm from the urethral meatus, main limitation of the procedure. It could also be developed for its use in children, both due to the diameter and the length.

We did not identify ureteral mucosa injury related to the 4,8-Ch access sheath. It has been studied that the ureteral damage is proportional to the time that a ureteral catheter should be left in place postoperatively to prevent subsequent reno-ureteral colic. With instruments of smaller caliber, lower ureteral tissue damage occurs (fig. 4), the risk of hematuria, bacteremia and need for postoperative ureteral catheter is reduced. The aim is to achieve less postoperative pain, shorter hospital stay, and fewer readmissions due to poor tolerance to ureteral catheter or for withdrawal
thereof. With this technique we could increase the number of patients we treated on an outpatient basis and decrease the time until their return to work.

Our group treats the reno-ureteral colic urgently in case of refractoriness of pain; we have performed urgent ureteroscopies since 2010 without managing to avoid using posterior ureteral catheter in a high percentage of patients.15 M-URS could be an interesting option in the urgent management of reno-ureteral colics rebel to conservative treatment.

The smaller size of the sheath and the low laser power supposedly produce a lower retrograde pressure, reducing both the risk of bacteremia and the retropulsion of stone fragments.

Another limitation is that it does not allow for the use of forceps or small baskets inside the working channel during the procedure, so it is essential to spray the stone. The same as it was done with the security guidewire, we could place a device to prevent retropulsion (e.g. StoneCone™, N-trap™, or BackStop™ gel), which would be outside the working channel, in selected cases.

Previous insertion of a safety guidewire can be useful to align and expand the meatus, especially in men. The use of a second working guidewire could facilitate access in certain cases. In this sense, it seems feasible to perform the procedure in men, but we are investigating the best way to carry it out.

Surgical time was elevated for it being the first time we practiced the art and we had to adapt to the material, both in its preparation and in its use. In any case, both the large size of the stone and the maximum laser power lengthened the procedure.

The development of m-URS would make it possible to do without the semi-rigid ureteroscope, since with the same material we could conduct percutaneous renal and ureteral procedures and significantly reduce the use of ureteral dilators and/or ureteral catheterizations. These potential advantages make m-URS an attractive technique, both in terms of morbidity-mortality and cost-effectiveness.

**Conclusion**

M-URS is a feasible, simple, and effective technique in the treatment of pelvic ureteral stones in women, which optimizes the minimal invasion with results that can be comparable to conventional endoscopic techniques in terms of ease of access and quality of endoscopic vision, without affecting the response capacity. It could be a good alternative in female patients with small and distal lithiasis, but requiring urgent management for poor pain control. This technique may also be interesting in pediatric patients.

The current limitations are its use in men and stones located more than 22 cm from the urethral meatus.

More experience, prospective and comparative studies, and further technological development are required to define the definitive role of this procedure in the treatment of more proximal ureteral stones.

**Conflict of interest**

The authors declare that they have no conflict of interest.
Acknowledgements

The authors thank the Department of Anesthesiology, especially Dr. Stephanie Boix and nurses, María Franchini, Laura Pardo, and Alicia Cascales, for their help that was essential to develop this work.

References