CLINICAL CASE

Polymer gel use for preventing migration during lithotripsy in a patient with ureteral lithiasis

E. I. Bravo-Castro\textsuperscript{a,*}, J. G. Campos-Salcedo\textsuperscript{b}, J. J. Torres-Gómez\textsuperscript{a}, J. A. Castelán-Martínez\textsuperscript{a}, J. C. López-Silvestre\textsuperscript{c}, M. Á. Zapata-Villalba\textsuperscript{c}, C. E. Estrada-Carrasco\textsuperscript{c}, H. Rosas-Hernández\textsuperscript{c}, C. Díaz-Gómez\textsuperscript{c} and J. G. Calderón-García\textsuperscript{c}

\textsuperscript{a} Urology Speciality Residency, Escuela Militar de Graduados de Sanidad, Mexico City, Mexico

\textsuperscript{b} Urology Service Management, Hospital Central Militar, Mexico City, Mexico

\textsuperscript{c} Urology Service, Hospital Central Militar, Mexico City, Mexico

Abstract

The results of laser lithotripsy in ureteral stones can be affected by the retropulsion it causes due to the frequency and energy utilized. Different anti-repulsion devices have been tested for the purpose of improving stone resolution rates and eliminating the additional cost produced by stone migration. BackStop™ Gel is a polymer with reverse thermal sensitivity that has been tested in various studies with good results. Our aim was to describe the efficacy and safety of the BackStop™ as an antirepulsion device in a patient presenting with lithiasis in the distal third of the ureter who underwent Holmium laser intracorporeal lithotripsy.

A patient with a stone in the distal portion of the right ureter underwent rigid ureteroscopy and Holmium laser intracorporeal lithotripsy with a 365 nm fiber, 2J of energy, and a frequency of 8 Hz, procedures that were carried out after the application of BackStop™ Gel inside the ureter. The stone was completely fragmented through the lithotripsy; none of the fragments migrated to the cavities and there was no retropulsion. There were no intraoperative complications related to the use of the gel.

The BackStop™ is a safe and efficacious tool for reducing ureteral stone migration in patients undergoing ureteroscopy with laser lithotripsy.

PALABRAS CLAVE
Polímero; BackStop\textsuperscript{TM}; Migración; Litotricia ureteral; México.

Uso de un gel polimérico para evitar migración durante la litotripsia en un paciente con litiasis ureteral

Resumen

Los resultados de la litotripsia láser en litos ureterales pueden verse afectados por la retropulsión que ésta ocasiona, condicionados por la frecuencia y la energía utilizadas. Se han probado diversos dispositivos antiretropulsión con la finalidad de mejorar las tasas de resolución...
de los litos, sin costos agregados producidos por la migración de los mismos. El BackStopTM es un gel polimérico con termosensibilidad reversa, que ha sido probado en varios estudios con buenos resultados. El objetivo de esta experiencia es describir la eficacia y la seguridad del BackStopTM como dispositivo de antiretropulsión, en un paciente con litiasis ureteral de porción distal sometido a litotripsia intracorpórea con láser holmium.

Se sometió a un paciente con litiasis ureteral derecha de porción distal a ureteroscopía rígida a litotripsia intracorpórea con láser holmium, con fibra de 365 nm, con una energía de 2 J y frecuencia de 8 Hz, previa aplicación de BackStopTM dentro del uréter.

Se realiza litotripsia fragmentando en su totalidad el lito, sin presencia de migración de fragmentos a las cavidades y sin presencia de retropulsión, no se presentaron complicaciones transoperatorias durante la utilización del gel.

El BackStopTM es un dispositivo seguro y eficaz para disminuir la migración en litos ureterales, en pacientes que son sometidos a ureteroscopia con litotripsia láser.

**Introduction**

The treatment of choice for ureteral lithiasis is ureteroscopy with intracorporeal lithotripsy, which has displaced extracorporeal shock wave lithotripsy. Nevertheless, ureteroscopy results have been compromised by retrograde retropulsion and stone migration that are caused by the insertion of the ureteroscope itself, irrigation, the laser wavelength, pneumatic lithotripter pulsation, or a spark from the electrohydraulic electrode.

There is a reported 3% to 15% retrograde migration in relation to ureteral stones in the distal portion of the ureter and 28% in its proximal portion. When this occurs, the final result of the ureteroscopy is compromised, increasing the cost of the procedure because of having to convert from rigid to flexible ureteroscopy in order to reach the migrated fragments at a more proximal position. A greater number of procedures, ranging from flexible ureteroscopy to percutaneous nephrolithotomy, are also needed in order to resolve the fragments of significant size.

In response to the problem of retropulsion, different mechanical devices have been developed, such as the Stone Cone™ (Boston Scientific, Boston, USA), Cook N-Trap® (Cook Urological, Spencer, USA) and PercSys Accordion® (Percutaneous System, Palo Alto, USA), reaching a level of efficacy. However, they employ mechanical elements that have the potential risk for ureteral trauma or that interfere with both the adequate functioning of the energy source and the maneuverability of the ureteroscope, without guaranteeing non-migration of the smallest fragments.

The BackStop™ is a next generation antiretropulsion device that uses a water-soluble gel with thermosensitive properties designed to prevent stone migration during ureteroscopy by forming a plug in the ureter. We present herein the initial experience with the BackStop™ in the management of a patient with distal ureteral lithiasis that underwent intracorporeal laser lithotripsy.

**Case presentation**

A man in the fifth decade of life with no past medical history of chronic diseases was admitted to the emergency service for left renal colic secondary to left obstructive ureteral lithiasis in the distal portion of the ureter. The stone was 12 mm in size and had a density of 780 HU, documented by a plain abdominal tomography scan. The proposed treatment was left rigid ureteroscopy with intracorporeal lithotripsy using Holmium laser.

**BackStop™ characteristics**

BackStop™ Gel is a biocompatible water-soluble polymer with inverse thermosensitive properties. In other words, it remains a liquid at temperatures under 16°C and as a soft, but injectable, gel at room temperature. It has a transition phase in which it becomes a viscous gel at body temperature. The product is pre-loaded in 2.5 and 5 mL syringes and is dispensed by an injector through a 3 or 5 Fr radio-opaque catheter. Before fragmentation, the catheter is placed 1 to 2 cm proximal to the stone. The catheter is passed through the working channel of the ureteroscope or the fluoroscopic guidewire and then the polymer is injected, forming a plug that prevents stone migration. Once stone fragmentation is finished, the plug is dissolved with conventional saline solution. The process is faster when the saline solution is cold.

**Procedure description**

Once the patient was diagnosed, the procedure was explained to him and he gave his informed consent. To begin the procedure, the patient was placed in the lithotomy position and urethrocystoscopy was carried out under peridural block, locating the ureteral meatus. It was cannulated with an Open-End™ catheter and the stone position was visualized through retrograde pyelography. The hydrophilic guidewire ascended up to the renal cavities, the bladder was emptied, and the cystoscope withdrawn. The 7 Fr ACMi rigid ureteroscope (Gyrus ACMi, Southborough, MA, USA) with a 5.4 Fr working channel was introduced and
moved upward through the ureter with the 2-guidewire technique. It provided saline solution irrigation through the injector system (Cook N-Trap®). Once the stone was located, the guidewire that was in the working channel of the ureteroscope was removed and the 5 Fr catheter of the BackStop™ was inserted, applying the gel 2 cm proximal to the stone (figs. 1 and 2). The catheter was removed and the complete absence of contrast material passage into the renal cavities was corroborated by retrograde pyelography. Lithotripsy using a Holmium laser was performed with a 365 nm fiber, a potency of 18 W, 2 J of energy, and a frequency of 8 Hz (fig. 3). The stone fragments were extracted with a 4-wire Nitinol basket and the polymer was dissolved with cold saline solution. Another retrograde pyelogram was taken, documenting the adequate passage of contrast medium and the absence of residual fragments or their migration. A 24 Fr double-J ureteral stent and a 16 Fr urethral catheter were then placed, and the procedure was ended.

Results

The procedure duration was 20 minutes, and the effective laser lithotripsy time was 5 minutes. Blood loss was null, there was no stone migration, and no need for any additional maneuver for resolving the stone. The polymer was dissolved with no problems, and the gel did not interfere in any way with ureteroscope maneuverability or visibility or with the functioning of the laser. The patient’s postoperative progression was satisfactory. He was released from the hospital 24 hours after the procedure once the absence of residual stones was confirmed through a kidney-ureter-bladder (KUB) x-ray.

Discussion

Ureteroscopy and extracorporeal shock wave lithotripsy are the most common modalities for treating ureteral lithiasis, increasing the stone-free disease rate and reducing patient morbidity during ureteral lithotripsy. Even with the use of flexible ureteroscopy and laser lithotripsy, treatment failures of up to 25% secondary to proximal ureteral stone migration have recently been described.

Various devices for resolving the problem of retropulsion that conditions stone migration have been introduced, such as Passport™ Balloon, LithoCatch™, Parachute™, Dretler Stone Cone™, and Escape™. It should be mentioned that Passport™ Balloon, LithoCatch™, and Parachute™ do not provide sufficient ureteral occlusion. The Dretler Stone Cone™ is designed to allow the passage of fragments of up to 3 mm in size.

Even though the mechanical elements have shown potential, the development of viscous gels is considered a valuable alternative. In one study, a gel with lidocaine was used in patients with proximal ureteral stones as an antiretropulsion mechanism, obtaining stone-free disease rates of 96% vs. 72% in those cases that did not use the gel.

The BackStop™ was evaluated in a randomized and controlled multicenter study by Rane et al. conducted on 68 patients with ureteral lithiasis. The subjects randomly assigned to the BackStop™ group had a lower retropulsion rate (8.8%, 3 out of 34) than the control group (52.9%, 18 out of 34) and the results were statistically significant (p<0.0002). There were no adverse events in the BackStop™ group and dissolution was successful in all the subjects.

Therefore we believe that BackStop™ is an efficacious alternative for lowering the retropulsion and ureteral stone migration rate, as well as being a device that reduces ureteral trauma secondary to its use, without interfering with the maneuverability of the ureteroscope and even less, affecting its visibility. At the same time, its functioning does not require complex maneuvers. It also has the advantage...
of being thermosensitive, facilitating polymer dissolution once the lithotripsy is finished.

Conclusions

The BackStop™ was a safe and efficacious alternative for decreasing stone retropulsion in our patient that presented with a stone in the distal portion of the ureter, directly affecting the stone-free disease rate, and for reducing the amount of time necessary to perform the lithotripsy.

Conflict of interest

The authors declare that there is no conflict of interest.

Financial disclosure

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References