THE DRETLER STONE CONE: A DEVICE TO PREVENT URETERAL STONE MIGRATION—THE INITIAL CLINICAL EXPERIENCE

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ABSTRACT

Purpose: Retrograde stone migration during ureteroscopic lithotripsy occurs in 5% to 40% of proximal and distal ureteral stone cases. This migration increases morbidity and the need for auxiliary procedures. The Dreter stone cone (Medsource, Norwell, Massachusetts) is a novel device to prevent proximal stone migration and facilitate fragment extraction during ureteroscopic lithotripsy. We assessed the safety and efficacy of the Dreter stone cone in the clinical setting and compared it prospectively with a conventional flat wire basket during ureteroscopy for ureteral calculi.

Materials and Methods: To our knowledge we report the initial clinical use of the Dreter stone cone in 50 consecutive patients with ureteral calculi undergoing ureteroscopic extraction. Calculi were situated above the sacroiliac joint in 24 cases, over the sacroiliac joint in 15 and below the sacroiliac joint in 11. Pneumatic lithotripsy was done in 42 cases. In the remaining 8 cases ureteroscopic (3) or fluoroscopic (5) intact stone extraction was performed. The later 23 cases using the Dreter stone cone were prospectively compared with 20 of ureteroscopic intracorporeal lithotripsy using a standard flat wire basket.

Results: The Dreter stone cone was successfully placed in all 50 cases. In 41 patients it was placed via cystoscopy under fluoroscopic guidance, while 9 impacted stones required ureteroscopic placement. Six patients in whom the Dreter stone cone was used had residual fragments less than 3 mm. No patient required auxiliary procedures. In the prospective trial no patients in Dreter stone cone group had residual fragments greater than 3 mm. or required auxiliary procedures. However, in the flat wire basket group residual stones greater than 3 mm. were present in 6 cases (30%, p < 0.001), while auxiliary procedures were required in 4 (20%, p < 0.01).

Conclusions: The Dreter stone cone represents a new generation of basketry that minimizes proximal ureteral stone migration and allows safe extraction of fragments during ureteroscopic lithotripsy. In our experience it is associated with a lower incidence of significant residual fragments and fewer auxiliary procedures than conventional flat wire baskets.

KEY WORDS: ureter, ureteral calculus, lithotripsy, ureteroscopy, equipment and supplies

Ureteroscopy is a modality commonly used to treat ureteral calculus. Proximal fragment migration during ureteroscopic lithotripsy is a common problem, 1, 2 that is influenced by the pressure of irrigant fluid, type of energy source used for intracorporeal lithotripsy, site and degree of calculous impaction, and degree of proximal ureteral dilatation. Various devices and techniques have been devised for preventing proximal migration. 3, 4 The Lithocatch (Microvasive-Boston Scientific Corp., Boston, Massachusetts) is too large for the ureter, while the Lithocatch (Microvasive-Boston Scientific Corp.,) and Parachute (Microvasive-Boston Scientific Corp.) are too small for many dilated ureters and occupy most of the space of the ureteroscopy working channel. The passport balloon is limited to 12Fr, is easily punctured and its presence in the ureter with a safety guide wire may not allow enough room for ureteroscopy advancement.

The Dreter stone cone is a device that aims to prevent proximal calculus migration and enable safe extraction of small calculi during ureteroscopic lithotripsy. 5 In addition to these uses, the Dreter stone cone substitutes for the ureteral guide wire, thus, maintaining continuous ureteral access and minimizing the use of disposables. To our knowledge we present the initial clinical use of this device and assess its safety and efficacy.

DEVICE

The Dreter stone cone essentially consists of the inner wire and the outer radio-opaque carrying catheter. The inner wire has 3 parts, namely the distal floppy tip, the cone and the proximal wire (Fig. 1). The distal 25 cm. with a mean outer diameter plus or minus standard deviation of 0.038 ± 0.001 inches has the characteristics of a standard 0.038-inch floppy tip guide wire. The cone lies 25 cm. from the tip and consists of a stainless steel strand of wire wound with a strand of nitinol. This double strand is baked in a mold to produce a spiral form. During introduction the portion of the coil lies inside the carrying catheter and, hence, is straight. Advancing the double strand beyond the tip of the carrying catheter deploys the cone. The cone serves to cap the calculus and hold it in place during lithotripsy. Moreover, it also helps to extract significant fragments after adequate fragmentation has been achieved. Current cone diameters are 6, 7 and 8 mm. The size refers to the diameter of the largest coil with the subsequent coil less than 2 mm. smaller and the smallest coil 2 mm. in diameter. The smallest coil has a 1.5 mm. aperture that purposely allows fragments less than 1.5 mm.
to escape cephalad during fragmentation. The proximal wire is identical to a 0.038-inch standard guide wire. The outer carrying catheter is radio-opaque. It has an inner diameter of 0.043 inches and an outer diameter of 0.236 inches or 6Fr. The carrying catheter functions to deploy and straighten the cone as well as provide access to replace the cone with a standard guide wire as required for postoperative stenting.

TECHNIQUE

Initially retrograde ureteropyelography is performed and the width of the ureter above the stone is measured to determine appropriate Dretler stone cone size. When the degree of impaction prevents adequate opacification of the proximal ureter, ureteral width on preoperative ultrasound of the kidney guides the size of the coil to be used. The Dretler stone cone is introduced through a cystoscope under fluoroscopic control. During introduction the coiled portion of cone is collapsed within the carrying catheter. Initially the floppy part of the wire is passed beyond the calculus into the pelviccaliceal system. Subsequently the carrying sheath is advanced over the wire beyond the calculus. After the tip of the carrying catheter is beyond the calculus into the proximal dilated ureter advancing the wire through the carrying catheter deploys the cone (fig. 1, A). The carrying sheath is removed and the cone is then gently pulled back to cap the calculus. The ureter below the stone may be balloon dilated over the proximal wire as required and ureteroscopic lithotripsy can then be done (fig. 1, B). Since the gap between successive coils is less than 2 mm., the cone retains all fragments of significant size.

After the stone is satisfactorily fragmented the cone is pulled caudad to extract all small fragments. As a safety measure, if there is significant resistance while the cone is pulled down the ureter, the coil unwinds, warning the operator and preventing ureteral injuries (fig. 2). This unwinding also allows the release of fragments. The device may be redeployed in the proximal ureter within the carrying sheath and the fragmentation of large fragments is completed. For placing a Double-J stent (Medical Engineering Corp., Now York, New York) the carrying catheter is pushed over the cone beyond the previous calcilus site and the inner wire is replaced with a standard guide wire. The cone can also be used for intact fluoroscopic extraction of small nonimpacted calculi. In occasional cases in which the floppy tip of the Dretler stone cone cannot be negotiated beyond a densely impacted calculus the Dretler stone cone can be passed through the working channel of an 8Fr ureteroscope under direct vision after partial stone disintegration.

MATERIALS AND METHODS

We used the Dretler stone cone in 38 male and 12 female consecutive patients with ureteral calculi undergoing ureteroscopic extraction between April and December 2000. Mean patient age was 47 years. Mean calculous length was
et al reported 40% ureteral calculus migration from the proximal ureter and 5% from the distal ureter.1 Robert et al reported 48% calculus migration from the proximal ureter when pneumatic intracorporeal lithotripsy was done.2 Recently Chow et al noted that despite the use of modern techniques, such as laser lithotripsy and flexible ureteroscopy, a 25% failure rate was associated with ureteroscopy for proximal ureteral calculi.3 Various devices have been created to prevent proximal calculus migration and each has limitations.4,5 The Dretler stone cone is a novel device that aims to avoid these problems. Dretler designed and reported the laboratory results of the device.6 We studied the safety and efficacy of the device in the clinical setting.

The device is easy to introduce, similar to the introduction of a standard guide wire. We introduced the distal floppy end of the wire beyond the calculus in most patients. Because of stone impaction, 9 patients required direct passage through the side channel of the 8Fr ureteroscope. The cone is deployed when the radio-opaque marker is beyond the calculus. In our series the cone successfully prevented migration of all significant fragments greater than 3 mm. After an appropriate size cone is selected there is no space between the ureteral wall and largest colic. Moreover, the space between 2 adjacent coils is less than 2 mm. Thus, only fragments less than 2 mm would potentially migrate proximal through the central hole, which is a significant advantage over most flat wire baskets. In flat wire baskets there is enough space between adjacent wires to allow upward migration of significant fragments, thereby, potentially necessitating an auxiliary procedure.

The Dretler stone cone is also effective for extracting smaller fragments. However, when the volume of the calculus being extracted is larger than what may be extracted safely, the coils of the cone begin to unwind, starting from the largest coil (fig. 2). This unwinding indicates that excessive force is being applied and serves as a safety guide. We performed intact calculus removal using the Dretler stone cone in 8 cases, including 5 exclusively under fluoroscopic control. Removing stones using baskets under fluoroscopic control may be extremely dangerous.7 Because of its tendency to unwind even under moderate traction, the Dretler stone cone provides a margin of safety that may decrease the incidence of ureteral wall injury. This ability to perform safe fluoroscopic extraction of ureteral calculi, especially small, nonimpacted lower ureteral calculi, may help to decrease the morbidity and cost involved in ureteroscopic use. The Dretler stone cone also traps stones more effectively than the basket. Moreover, when traction is applied on the wire, the coils of the Dretler stone cone tend to rotate, thereby, separating the ureteral mucosa from the surface of the calculus to unscrew the stone from the orifice. Essentially cone unwinding produces less tension on the ureter than direct traction. In our series the device was safe and we noted no major complications. Minor abrasions occurred in 5 cases and the wire was submucosal in 1 of an impacted stone.

The wire of the Dretler stone cone also functions as a guide wire. It maintains access to the kidney throughout the procedure. We successfully used the portion of the wire distal to the cone for balloon dilation as required. The ability of the Dretler stone cone to substitute for a guide wire decreases the amount of ureteral manipulation. Currently we find it difficult to pass a Double-J stent over the cone. However, the stent can be placed when necessary by replacing the inner wire with a standard guide wire through the carrying catheter. Our prospective comparison of use of the Dretler stone cone during ureteroscopy for proximal ureteral calculi versus the flat wire basket showed a statistically significant advantage for the former in terms of residual fragments and the need for auxiliary procedures. Thus, the Dretler stone cone appears to be a useful addition to the endourological armamentarium.
CONCLUSIONS

The Dretler stone cone is a versatile device that effectively prevents proximal stone migration and enables safe extraction of fragments during ureteroscopy. Its single step introduction as a single assembly decreases repeat ureteral manipulations. The Dretler stone cone also appears to have advantages over conventional flat wire baskets during ureteroscopic lithotripsy in terms of a lower incidence of significant residual fragments and need for auxiliary procedures.

REFERENCES


### Table 2. Prospective comparison of Dretler stone cone in 23 patients with flat wire basket in 20 during ureteroscopic lithotripsy

<table>
<thead>
<tr>
<th></th>
<th>Stone Cone</th>
<th>Flat Wire Basket</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. pts.</td>
<td>23</td>
<td>20</td>
<td>Not assessed</td>
</tr>
<tr>
<td>Calculus sacroiliac joint location:</td>
<td>14</td>
<td>13</td>
<td>Not assessed</td>
</tr>
<tr>
<td>Above</td>
<td>9</td>
<td>7</td>
<td>Not assessed</td>
</tr>
<tr>
<td>Mean mm. calculus size (range):</td>
<td>11 (7–14)</td>
<td>9 (8–13)</td>
<td>Not assessed</td>
</tr>
<tr>
<td>Width</td>
<td>10 (6–12)</td>
<td>11 (97–18)</td>
<td>Not assessed</td>
</tr>
<tr>
<td>Length</td>
<td>11 (7–14)</td>
<td>9 (8–13)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>No. proximal calculus migration (%)</td>
<td>0</td>
<td>4 (20)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>No. residual fragments (%)</td>
<td>5 (21.7)</td>
<td>9 (45)</td>
<td>&lt;0.1</td>
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<tr>
<td>3 Mm. or less</td>
<td>0</td>
<td>6 (30)</td>
<td></td>
</tr>
<tr>
<td>Greater than 3 mm.</td>
<td>0</td>
<td>4 (20)</td>
<td></td>
</tr>
<tr>
<td>No. auxiliary procedures (%)</td>
<td>0</td>
<td>4 (20)</td>
<td></td>
</tr>
</tbody>
</table>

### Conclusions

The Dretler stone cone is a versatile device that effectively prevents proximal stone migration and enables safe extraction of fragments during ureteroscopy. Its single step introduction as a single assembly decreases repeat ureteral manipulations. The Dretler stone cone also appears to have advantages over conventional flat wire baskets during ureteroscopic lithotripsy in terms of a lower incidence of significant residual fragments and need for auxiliary procedures.

### References