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Efficacy of Combining Flexible and Rigid Ureteroscopy for Transurethral Lithotripsy

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Transurethral lithotripsy (TUL) is a common procedure in urology. However, controversy persists about how to deal with stones pushed up into kidney from the ureter during the procedure of TUL. This study investigated the efficacy of combining flexible ureteroscopy and rigid ureteroscopy for pushed-up stones into kidney during TUL. Forty-one patients underwent TUL by a single surgeon from July 2007 to May 2009. Eight cases resulted in pushed-up stones during operation or involved existing kidney stones. We used a Zero-tip[®] or Litho Catch Basket[®] catheter and a flexible ureteroscope to carry these stones in kidney down into the ureter where the rigid ureteroscope could then reach and handle the stone for lithotripsy or being taken away. A Lithoclast[®] system was used for lithotripsy. Five cases involved stones pushed up during surgery and 3 cases involved stones already in the kidney in detail. We pulled the stones down into the ureter in all cases and successfully completed lithotripsy or removed the stone, thus avoiding the performance of additional extracorporeal shock wave lithotripsy (ESWL). In conclusions, combined use of flexible ureteroscopy and rigid ureteroscopy for upper urinary tract stones pushed up into the kidney during TUL or renal stones could be useful for avoiding additional ESWL.

INTRODUCTION

TUL (transurethral lithotripsy) is often performed for ureteral stones (1-3) even though many ureteral stones are accessible for extracorporeal shock wave lithotripsy (ESWL). Generally, ESWL is well tolerated for U1 (upper ureter) or renal stones but sometimes has difficulty dealing with U2 (middle ureter) or U3 (lower ureter) stones. In this situation, TUL is generally often selected for U2 or U3 stones and stones that could not be easily treated with ESWL. During the TUL procedure, surgeons generally use a basket catheter device put just upside stone to prevent stones from being pushed up into the kidney. However, stones are sometimes pushed up because, for instance, some lithotripsy devices such as the LithoClast[®] (Boston Scientific, Natick, Massachusetts, USA) work and are employed for lithotripsy by the direction from lower ureter to upper ureter. In such an event, many physicians choose to switch from TUL to ESWL for pushed up stone even though second line ESWL requires another hospitalization and is typically not covered by insurance in our country.

COMBINING FLEXIBLE AND RIGID URETEROSCOPY FOR TUL

In this study, we demonstrated the efficacy of using flexible ureteroscopy to manage pushed up stones and bring them down into the ureter so lithotripsy could be continued by rigid ureteroscopy.

MATERIALS AND METHODS

Forty-one patients underwent TUL by a single surgeon from July 2007 to March 2009. As a rule, TUL for U1 stone was performed under general anesthesia and for U2 or U3 under general or spinal (lumbar) anesthesia. TUL was done using the LithoClast® (Boston Scientific Natick, Massachusetts, USA) with an 8.5 Fr rigid ureteroscope (Richard Wolf Medical Instruments Cooperation, Vernon Hills, Illinois, USA). A safety guidewire (Sensor Guidewire®, Boston Scientific) was put in the ureter and the ureter was dilated by a UroMax Ultra High Pressure Ballon Catheter™ (4cm or 10cm, 75cm in length, Boston Scientific) through the guide wire before lithotripsy, and then the rigid ureteroscope was inserted into the ureter and positioned to the stone. After confirming the stone's location, a Zero-tip® (2.4/3.0, Segura 2.4/3.0, Gemini 3.0, Parachute 3.1, Boston Scientific) or Litho Catch Basket® (2.2 Fr, 110cm, Boston Scientific), or Escape® (1.9Fr, 120cm, Boston Scientific) catheter was placed just above the stone to prevent the stone being pushed up into the renal pelvis or calyx during the procedure. In addition we weakened the pressure of water flashed from ureteroscope when positioned near the stone to prevent being pushed up. When it was judged that the stone could be pulled down without lithotripsy, we grasped the stone with Zero-tip®, Litho Catch Basket® or Escape® and pulled it down after confirming that it was caught completely and safely without any severe adhesion of the stone to the ureter wall and any injury of ureter wall. When this not possible, lithotripsy was initiated taking care not to push the stone up to kidney. A double J stent (Boston Scientific) was placed in the ureter after surgery and left for several days to several weeks.

If a stone was pushed up into the renal pelvis or calyx during the TUL procedure a flexible uretroscope (6 Fr, KARL STORZ endoscopy Japan, Tokyo, Japan) with Access Sheath® (Cook Medical Inc., Bloomington, Indiana, USA) was used to find and catch the stone and carry it back down into the ureter for further lithotripsy using the rigid ureteroscope.

RESULTS

All the patients' backgrounds were shown in Table I. In them, 8 patients had pushed-up stone to renal pelvis during surgery or existing renal stones. All 8 patients had U1 stones with or without renal stones with a median diameter of 5-19 mm. Their detailed backgrounds are shown in Table II. In 5 patients with pushed up stones, one stone was pushed-up during observation by ureteroscope before lithotripsy, one pushed-up during ureteral dilation, and 3 were pushed up during lithotripsy. If the pushed-up stone was so small that it is considered to be excreted naturally, we did not act on it any more, but if the stone was thought too large to excrete, we switched to a flexible ureteroscope and retrieved the stone. All 5 pushed-up stones were successfully found by flexible ureteroscopy. Some stones were directly extracted with the flexible ureteroscope and others still required lithotripsy after being brought back down into the ureter and additional use of rigid ureteroscopy. After additional lithotripsy, those stones were successfully removed. No patients retained any stones which needed further surgical treatment based on kidney-ureter-bladder X-ray (KUB) the day after TUL and none showed any apparent adverse events like major ureteral injury or pyelonephritis.

Table I. Patients' backgrounds

N	41
Age (median)	24-86 (60)
male	29
female	12
Renal (R) stone	4
Ureter (U) stone	33
R+U stone	4
Right	17
Left	22
Bilateral	2
needed flexible Us* for further Treatment	8

*Us: Ureteroscopy

Table II. Patients' backgrounds with combined use of flexible and rigid ureteroscopy

N	8
Age	47-79 (65.5)
male	6
female	2
Renal(R) stone	1
Ureter(U) stone	5
R+U stone	2
Stone diameter (longest, mm ³) (median)	5-19 (11)
event (Why?)	pushed up during lithotripsy 3
	pushed up during observation 1
	pushed up during ureteral dilation 1
	to renal stone 3
needed lithotripsy	5

DISCUSSION

Treatments for urinary tract stone have improved due to the spread of better medical devices such as thinner uretoscopes and LithoClast[®] system. For TUL, there are several methods available including the LithoClast[®], which uses an air pressure system, and SONOP[®], which uses water pressure, as well as the laser system (4-7). Despite the effectiveness of ESWL, TUL is still advantageous for ureteral stones (4, 8). In addition, in our country medical insurance generally does not permit duplication of TUL and ESWL for the same stone, meaning mono-therapy for the same stone is necessary not only for the patients' physical benefit but also for medical economical issues. Needless to say, the decision of which treatment (ESWL or TUL) to select becomes very important and the completion of treatment by a single method is also essential. We therefore studied the efficacy of combining the use of the flexible ureteroscope and the rigid ureteroscope to deal with the stones pushed up into the kidney during TUL.

Fiberoptic-TUL (f-TUL) using a laser and a flexible ureteroscope is also a successful technique (8, 9), but the flexible ureteroscope generally has smaller diameter than the rigid ureteroscope and it can have difficulties to maintain the visual field during the procedure because the volume of flowing water might decrease especially once one of the channels available for manipulation is used for the laser for instance. In addition, the laser system is still expensive and it is not available in all hospitals where stone diseases are treated. The f-TUL is also technically difficult and needs a level of training that may not be available in many general hospitals that do not specialize in stone diseases. Even though the efficacy of laser TUL is well established, in practice it is not always the first option for treatment due to the reasons above.

Our method using flexible ureteroscope for observation and grasping the stone but not for lithotripsy except with laser does not need any special lithotripsy facilities and is practical for any urologists taking care of stone disease patients. Our method, the LithoClast[®] system, uses air pressure for lithotripsy (2, 10) as mentioned above, and remains one of the most relevant tools for TUL (6). The Zero-tip[®] or basket catheter may be comparatively safe for picking up stones in the ureter or renal pelvis or renal calyx (11). We chose which to use Zero-tip[®] or Litho Catch Basket[®] or Escape[®] according to stone size or position (12), and we did not experience any major injuries to the ureter or renal pelvis membrane under safe procedure in our cases. However, major ureteral injury during TUL has been reported (7, 13) and therefore all such procedures should be done very carefully with strict confirmation under a clear visual field that the ureteral membrane is not being damaged.

We had one case involving both a renal and a ureter stone, and completed treatment of both stones in the same procedure without additional ESWL. To our knowledge, there are no reports describing this method for treating stones pushed up into the kidney or renal stones already in the kidney using the combination of flexible and rigid ureteroscopy without laser device; however, this procedure is safe and uses the surgical techniques already available in any general urological department. We plan to conduct a larger study with a greater number of cases and especially a greater number of renal stone cases in the near future. In conclusions, we introduced the combined use of the flexible ureteroscope and the rigid ureteroscope for stones pushed up into the kidney during TUL or renal stones. This method will be useful for safely avoiding the performance of additional ESWL available in any general hospital.

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