Flexible Ureterorenoscopy for Upper Urinary Tract Treatment Using New 7.5 F 270 Degree Deflectable Ureteroscope: Siriraj Hospital Early Experience

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ABSTRACT

Objective: To evaluate the efficacy and report our experience of using a flexible ureterorenoscopy in the diagnosis and therapy for upper urinary tract disease.

Methods: Between September 2005 and June 2008, 21 upper urinary tract procedures were performed with 7.5 F actively deflectable, flexible ureteroscope. Of these 13 were for diagnostic reasons and eight for therapeutic purposes. A retrospective data of these procedures was collected. The indication, diagnostic or therapeutic procedure, operative time, success rate and post-operative course were analyzed.

Results: The procedures were performed in 21 patients (mean age 66.71 years; range, 47-85 years; 11 procedures in males and 10 procedures in females). The indications were lateralizing essential hematuria (2), hematuria with upper tract radiolucent lesions (11), upper tract lesions without hematuria (3) and stones (5). In the diagnostic group, the mean operative time was 50 min (range 15-120). The procedure was completed successfully in all patients. The most common endoscopic finding was urothelial carcinoma in hematuria with upper tract lesions (9/11). In the therapeutic group (stone removal five, tumor fulguration three), the mean operative time was 83.12 min (range 30-160). The success rate of these therapeutic procedures was 62.5% (5/8). There was no intra and postoperative major complication. With an average follow up of 14 months (range 1-33), no patient had a late complication, such as ureteral stricture. The flexible ureteroscope did not need repair during this study.

Conclusion: Flexible ureterorenoscopy is an effective and minimally invasive diagnostic and therapeutic tool for upper urinary tract disease.

Keywords: Flexible ureterorenoscopy, upper urinary tract

E-journal: http://www.sirirajmedj.com

In 1964, Marshall first described the visualization of a ureteric stone with a 9 F flexible ureteroscope.1 Subsequently, in 1971, Takagi et al., reported on the first purposely built flexible ureteroscope.2 The first flexible ureteroscopy was primarily a diagnostic tool with no channel for irrigation or working instruments, and no active deflecting mechanism. This greatly limited their clinical applications and, therefore, flexible ureterorenoscopy was overshadowed by the advent of rigid ureteroscopy. In recent years, there have been major advances in the design and development of these delicate instruments, making the upper tract accessible to the endourologist. These advances include the development of smaller and more durable flexible ureteroscopes with improved optics, incorporation of a working channel, active deflection, as well as improved laser technology. These improvements have expanded the possibilities to diagnose and treat a number of abnormal conditions in the upper urinary tract. However, many studies have concluded that the fragility of the flexible ureterorenoscopy limits its usefulness in general urology practice because of the expense of purchasing the ureteroscope and its
subsequent maintenance and repair required after only a few procedures. 

At our centre a flexible ureteroscope has been introduced for various diagnostic and therapeutic purposes since September 2005. We report our 3 year experience to determine clinical applications, surgical outcomes and durability of ureteroscope with the new generation 7.5 F flexible ureteroscope in a retrospective study. To our knowledge, this is the first report in Thailand.

**MATERIALS AND METHODS**

Between September 2005 and June 2008, 21 flexible ureterorenoscopies were performed at the Urological Division, Siriraj Hospital. Of these, 13 were for diagnostic reasons and eight for therapeutic purposes. All procedures were performed under general or spinal anesthesia. The Karl Storz 11278 A 7.5 F, two way actively deflectable (270/270°), flexible ureteroscope with a 3 F working channel was used. The ureteroscope used in this study was new at the beginning of the study.

**Surgical techniques**

Prior to the introduction of the ureteroscope, the guide wire was advanced into the renal pelvis for patients in the therapeutic group, but to the point below the lesion in the diagnostic group. This was in order to avoid iatrogenic bleeding in the renal pelvis and calyces from the guide wire in those undergoing diagnostic ureterorenoscopy. If needed; the intramural ureter was dilated with a balloon dilator. The instrument was introduced over a ureteric guide wire under fluoroscopy. Once in the renal pelvis, contrast was injected through the flexible ureteroscope to delineate the anatomy and aid examination of the calyces and renal pelvis (Fig 1).

For multiple tumors or a large stone burden a 9.5 F ureteral access sheath was passed over the working guide wire into the distal ureter. This access sheath provided direct access from the urethral meatus to the distal or middle ureter. The flexible ureteroscope could then be passed easily through the sheath until the area of the stone or tumor was reached.

The in and outpatient charts of all patients were reviewed retrospectively. Preoperative, operative and post-operative data were collected. The patients’ characteristics, indication, diagnostic or therapeutic procedure, operative time, success rate and post-operative course were analyzed.

This article was submitted for consideration before the announcement of the new instructions for authors and the study had not been subjected for the approval by the institutional review board because it was considered as a retrospective review on the experience using a medical instrument. More importantly, throughout the study, good clinical practice guidelines were followed and the presentation did not reveal any identifiable data, so that there was not any violation of privacy, breach of confidentiality, or any ethical concern on human research subjects.

**RESULTS**

Twenty-one ureterorenoscopies (11 left and 10 right) were performed on 11 males and 10 females. The mean age was 66.71 years (range 47-85). The indications were lateralizing essential hematuria (2), hematuria with upper tract radiolucent lesions (11), upper tract lesion without hematuria (3) and stones (5). Ureterorenoscopy was performed under general anesthesia in 17 patients and spinal anesthesia in 4.

Balloon dilatation of the intramural ureter was necessary in only two out of 16 procedures for retrograde access. A total of 14 procedures were done without dilatation. However, in four of those cases indwelling ureteric stents had been pre-placed, which provided some degree of dilatation. Five additional procedures were performed via antegrade access through a percutaneous nephrostomy tract (1), ileal conduit (1) and exploratory ureterotomy (3). The ureteral access sheath was used in 47.6% (10/21) of procedures.

For diagnostic procedures, ureterorenoscopic findings were shown in Table 1. Hematuria with upper tract radiolucent lesions were at greatest risk for malignancy. In contrast, among those patients who presented with upper tract lesions without hematuria, ureterorenoscopic examinations revealed no malignancy. Eight patients received therapeutic procedures (stone 5, tumor 3). The small stones were simply retrieved by the basket. The larger stones were broken using the Holmium laser and the fragments were retrieved by using

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**Fig 1A.** Radiographic picture showed active deflecting ureteroscope within intrarenal pelvis.

**Fig 1B.** Endoscopic view of flexible ureteroscopy showed intrarenal collecting system.
the basket. Three patients with urothelial carcinoma were treated with electric fulguration.

Among the patients undergoing ureterorenoscopy for diagnostic procedures, the mean operative time was 50 min (range 15-120). The procedure was completely successful in all patients for the diagnostic group. In the therapeutic group, the mean operative time was 83.12 min (range 30-160). The therapeutic procedures were unsuccessful in 37.5% (3/8) of cases. Two patients had upward migration of the stone into an inaccessible lower calyx precluding endoscopic lithotripsy. One patient had bleeding interfering with vision during introduction through exploratory ureterotomy.

There was no peri-operative death or major complication. Three patients had a minor complication consisting of low grade fever (38 to 38.5°C) in two and macroscopic hematuria for longer than 48 hours in one. All minor complications were treated conservatively and no patient required additional intervention. With an average follow up of 14 months (range 1-33), no patient had a late complication, such as ureteral stricture. The two patients with lateralizing essential hematuria had no recurrent bleeding at the last follow up time (32 and 6 months). The flexible ureteroscope did not need repair during this study.

**DISCUSSION**

Flexible ureterorenoscopy has particular unique capabilities that render its usefulness in selected patients. Flexibility and maneuverability allow passage into portions of the collecting system inaccessible to rigid endoscopes. These enhancements have been paralleled by the advanced technology in accessory instruments; so that flexible ureterorenoscopes are currently not only for diagnostic but also for therapeutic purposes. In our series flexible ureterorenoscopy was performed for a wide range of indications in all areas of the upper urinary tract examination, stone removal, tissue biopsy and tumor fulguration.

Regarding anesthetic consideration, a small 7.5 F scope can be used with sedation analgesia. However, the conversion from this method to general anesthesia was reported due to patient discomfort. With our initial experience, we preferred to use general or regional anesthesia. All procedures were performed without anesthetic problems.

A number of techniques have been developed to stabilize the ureteroscope for introduction into the ureter, either using a guide wire or a ureteral access sheath. Using a guide wire seems to be the simplest but an experienced assistant is needed to hold the guide wire under tension while the ureteroscope is being advanced. The technique we used most often was to advance the instrument over a guide wire. Although we have found it easier to advance the flexible ureteroscope over a guide wire, some patients need the use of a ureteral sheath to direct the scope from the urethra to the ureter. This ureteral sheath has been especially useful when multiple excursions into the ureter are anticipated. A randomized controlled trial has also found the use of a ureteral access sheath during ureterorenoscopy to be time and cost effective.

Lateralizing essential hematuria can pose diagnostic difficulties and flexible ureterorenoscopy can offer help in establishing a diagnosis. The majority are discrete lesions such as hemangioma and focal papillary erythema, which are benign. However, recurrent bleeding is likely caused by diffuse lesions or no definitive diagnosis is reached on ureterorenoscopy. Our finding was hemangioma on a renal calyx in one patient and no lesion was found in another. There was no recurrent bleeding in these patients until the last follow up time.

Hematuria with filling defect of the upper urinary tract often poses formidable diagnostic and at times therapeutic challenges. Flexible ureterorenoscopy was performed successfully in all of our patients. Of note, urothelial carcinoma was found in the majority of these patients. Due to the high accuracy observed in our study, flexible ureterorenoscopy is currently used early in our evaluation of radiological filling defects in the upper urinary tract.

The therapeutic potential of the small size, actively deflectable, flexible ureteroscope allows minimally invasive endoscopic treatments in a variety of upper urinary tract pathological status patients. Of our 8 patients who underwent therapeutic procedures, urothelial carcinoma was found in 3 and upper urinary tract stones in 5. The endoscopic treatment of selected patients is a reasonable option for managing upper tract urothelial carcinoma. Flexible ureterorenoscopy with tumor fulguration was treated successfully in all these patients of our series.

The flexible ureteroscope currently is more commonly used for upper urinary tract stones treatment. Urinary stones at or above the middle ureter level, refractory to treatment with ESWL, remain the main indications. In our series three out of five patients had undergone ESWL with failure of the calculus to fragment or to clear. With the 7.5 F flexible ureteroscope we achieved an initial success rate of 40% (2/5) for stones treatment. Our result is lower than the 72.4% success rate reported recently by Dobosg F, et al. In two patients, the stone migrated into an inaccessible calyx, despite the stone being in view, the auxiliary instruments could not be advanced towards the stone and the procedure was abandoned in favour of ESWL. A tipless nitinol basket can be used to reposition calculi to a more accessible calyx prior to intracorporeal lithotripsy. However, this instrument was not available at our centre at the time of study. Our success rate may increase as continued endoscopic experience and as

**TABLE 1. Diagnoses in patients undergoing diagnostic flexible ureterorenoscopy.**

<table>
<thead>
<tr>
<th>Indication diagnosis</th>
<th>Upper tract lesion with hematuria</th>
<th>Lateralizing essential hematuria</th>
<th>Upper tract lesion without hematuria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urothelial carcinoma</td>
<td>9</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Stones</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Hemangioma</td>
<td>-</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>Stricture ureter</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>No abnormality detected</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

| Indication Upper tract lesion with hematuria Lateralizing essential hematuria Upper tract lesion without hematuria |
|-------------------------------------------------|----------------------------------|----------------------------------|-------------------------------------|
| Urothelial carcinoma                           | 9                                | -                                | -                                   |
| Stones                                          | -                                | -                                | 1                                   |
| Hemangioma                                      | -                                | 1                                | -                                   |
| Stricture ureter                                | -                                | -                                | 1                                   |
| No abnormality detected                         | 2                                | 1                                | 1                                   |
more accessory devices become available. We found 15% of minor complications in our series. There were no ureteric perforations or extravasations. No patient developed late ureteric stricture. The low complication rate was similar to those of other reports.\textsuperscript{6,14-15} Complications were higher in an earlier series where 9.8 F to 10.8 scopes were used probably because of the larger diameters of the instruments.

Previous investigators reported that the ureteroscopes required repair after an average of six to 15 uses.\textsuperscript{16} The major cause of repair was loss of deflection. After 21 procedures, our 7.5 F flexible ureteroscope did not need any repair. We suggest a number of reasons why our ureteroscope has lasted much longer. It was looked after by a dedicated team of experienced nurses and used only by the same group of endourologists. It never left the department for use elsewhere, thereby ensuring delicate handling. Recently Traxero, et al. reported a number of 50 procedures with the same generation Karl Storz 11278 AU1 Flex-X before repair was needed.\textsuperscript{18} They proposed that the common use of ureteral access sheaths may reduce ureteroscope fatigue by reducing stress on the tip of the endoscope. In our study the procedure has a ureteral access sheath use rate of 47.6%.

CONCLUSION

Our experience of flexible ureteroscopy has shown it to be highly effective tool for diagnosis of upper urinary tract lesions. With continued advances of accessory devices and more endoscopic experience, the role of flexible ureterorenoscopy in the therapeutic purpose of upper urinary tract pathology should continue to grow. The durability of ureteroscopes and costs of these procedures will still remain a key factor in achieving wide use of the flexible ureterorenoscopy.

REFERENCES