

The Singapore General Hospital Early Clinical Experience with the 7.5F Flexible Ureterorenoscope

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Abstract

Introduction: Reduced instrument size, increased flexibility, coupled with improved optics and larger working channels have enhanced the capabilities of the ureterorenoscope. **Materials and Methods:** We present our initial experience with the new 7.5F flexible ureterorenoscope. A total of 29 flexible ureterorenoscopies were performed from July 1995 to December 1997 by a single surgeon. The indications for flexible ureterorenoscopy was therapeutic in 10 (34.5%) patients (all had urolithiasis) whilst it was diagnostic in 19 patients (65.5%). For the diagnostic cohort, 9 (31.0%) patients had haematuria with radiological upper tract filling defect, 8 (27.6%) had radiological upper tract filling defect alone and 2 (6.9%) had ureteropelvic junction narrowing for evaluation. **Results:** Of the therapeutic cases, all 10 (100%) were stone free at 3 months. Of the diagnostic cases, 12 (63.2%) had normal findings, 4 (21.1%) had urolithiasis and 3 (15.8%) had transitional cell carcinoma (TCC). Of the 3 cases of TCC, one was managed endoscopically. **Conclusions:** The smaller calibre and actively deflectable 7.5F flexible ureterorenoscopes facilitate various endoscopic procedures thus broadening the diagnostic and therapeutic scope of the ureterorenoscope.

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Introduction

Technical advances saw the evolution of the flexible ureterorenoscope from its passive and non-deflectable predecessor to its present actively deflecting model. Furthermore, the older prototypes were mere diagnostic tools not equipped with working channels for the application of endourological instruments. Today's flexible ureterorenoscopes not only have working channels for a whole array of endourological accessories, they are also being progressively miniaturised so as to improve access and increase therapeutic potential. These newer ureterorenoscopes can now gain access to the entire upper urinary tract and thus expanded its diagnostic and therapeutic capabilities. At present, the application of ureterorenoscopy has gone beyond urolithiasis to include numerous procedures of the entire urinary tract including obstruction, lateralising haematuria and superficial upper tract urothelial tumour.

The reported complication rate for flexible ureterorenoscopy used to be 15% to 25%,¹ similar to that noted for rigid ureterorenoscopy. Most of these complications occurred with use of 11.5F and 12.5F flexible uretero-

renoscopes and resulted from the need to dilate the distal ureter in order to pass the ureterorenoscope. The commonest complications were thus ureteral perforation and urinary extravasation. With the advent of 7.5F actively deflectable, flexible ureterorenoscope, the need for vigorous ureteral dilation and its associated complications have diminished.^{1,2}

The 7.5F flexible ureterorenoscopes maintain the standard 3.6F working channel of its larger predecessor, but are smaller in external diameter, thus allowing for easier and less traumatic placement in the upper urinary tract while enabling more complex procedures to be carried out. We present our initial clinical experience with the 7.5F flexible ureterorenoscope at our institution.

Materials and Method

Patient Demographics

We reviewed the results of 29 consecutive patients who underwent diagnostic or therapeutic flexible ureterorenoscopy between July 1995 and December 1997 at our institution. There were 18 (62.1%) male and 11 (37.9%) female patients. The indication for flexible ureterorenoscopy was diagnostic in 19 (65.6%) and therapeutic in 10 (34.4%).

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Endoscope

The 7.5F Storz flexible ureterorenoscope was used in all 28 patients. This instrument has the following features: distal tip diameter of 7.5F (3 cm long), an 8.2F sheath, 2 way, 170/120 degree active deflection, secondary passive deflection and a 3.6F working channel.

Endoscopic Access and Technique

All patients had sterile urine prior to undergoing the procedure. Furthermore, each had perioperative antibiotics: 1 dose of intravenous antibiotic before and 3 to 5 days of oral antibiotic after the procedure. Intravenous general anaesthesia was used for all the patients.

Patient was positioned in a low lithotomy position and after a cystoscopy, a flexible tip, 0.038-inch (0.97 mm) guide wire was positioned in the renal pelvis under fluoroscopic guidance. The ureter was then primed to 8F using ureteric dilators. The ureterorenoscope was advanced over the guide wire and into the ureter under fluoroscopic guidance. The choice of a sufficiently stiff guide wire and fluoroscopy ensured that the guide wire did not buckle during the introduction of the ureterorenoscope. Once the ureterorenoscope was in the ureter, the working wire was removed and the entire pelvicalyceal system could then be inspected using direct vision and fluoroscopic imaging. For patients undergoing therapeutic procedures, a second or safety wire was mandatory.

For ureteral and renal stones, indications for ureterorenoscopic stone extraction included failed extracorporeal shock wave lithotripsy (ESWL) or co-existing ureteral and renal calculi. Methods of intracorporeal lithotripsy included electrohydraulic and pulse-dye laser lithotripsy.

For urothelial lesions, biopsy had to be taken during the initial pass of the instruments. The flexible forceps was extended from the sheath and opened parallel to the ureteral wall. Once the tissue was within the jaws, the forceps was closed and gently pulled from the ureter. Resection and fulguration of the urothelial lesions was subsequently carried out endoscopically using laser technology.

Upon completion of the endoscopic procedure, a ureteral catheter or stent would be put in place in selected situations i.e., those with significant oedema, gross hydronephrosis or residual stones.

For patients with urolithiasis, postoperative follow-up consisted of a plain X-ray of the kidneys, ureters and bladder within a month. Renal ultrasound or intravenous urogram (IVU) was done to document resolution of hydronephrosis at 3-month follow-up. For patients with upper urinary tract urothelial tumours, follow-up with IVU, renal ultrasound, computed tomography

(CT) and retrograde pyelogram (RPG) with or without ureterorenoscopy were done at 6 to 12 monthly intervals.

Results

In recent years, there has been a shift towards the increased use of the 7.5F ureterorenoscope at our institution. Twenty-nine patients underwent flexible ureterorenoscopy with the 7.5F ureterorenoscope between July 1995 and December 1997 by a single surgeon.

Nineteen patients underwent diagnostic procedures. Of these, 9 (47.4%) had haematuria with a radiological upper tract filling defect, 8 (42.1%) had radiological filling defect alone and 2 (21.1%) had suspicious ureteropelvic junction obstruction. Four of the patients, 1 presented with haematuria and filling defect and 3 presented with filling defects alone, were found to have urolithiasis which were successfully treated endoscopically at the same sitting. Thus, the flexible ureterorenoscope was not only diagnostic but also therapeutic in these 4 patients.

In another case, a 66-year-old man who presented with haematuria was found to have a left upper tract filling defect with a large staghorn calculus in a dilated and non-functioning right kidney (Fig. 1). Flexible ureterorenoscopic evaluation of the filling defect revealed papillary transitional cell carcinoma (TCC), which was successfully biopsied and ablated (Fig. 2). Histology was TaG1 TCC. Follow-up scope has been negative to date and CT scan done 3 years later showed no recurrence. The flexible ureterorenoscope thus made it possible to preserve the solitary kidney in this patient. Two other patients who underwent diagnostic flexible ureterorenoscopy were found to have TCC. They subsequently underwent open nephro-ureterectomy.

The other 12 patients who underwent diagnostic scopes had normal findings. However, even a negative ureterorenoscopic finding proved to be therapeutically significant in 1 patient. This 44-year-old man presented with right loin pain and a filling defect was found on IVU. CT scan revealed a mass lesion highly suggestive of a TCC in the right kidney (Fig. 3). He was thus scheduled for an open nephro-ureterectomy. A decision to proceed with a flexible ureterorenoscopy prior to open nephroureterectomy revealed an entirely normal upper tract and thus altered the clinical management of this patient. Follow-up angiographic assessment revealed the mass to be a large arteriovenous malformation indenting the renal pelvis (Fig. 4). Flexible ureterorenoscopic examination thus obliterated the need for an open operation in this patient.

Ten patients with urolithiasis underwent therapeutic endoscopies with successful outcomes. Two had renal stones and 8 had ureteric stones. The flexible ureterorenoscope proved to be a valuable treatment modality especially for patients who failed ESWL and whose stone

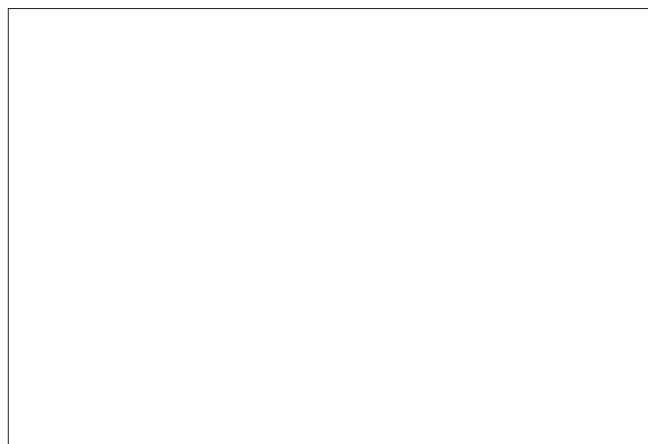


Fig. 1. Left upper tract filling defect.

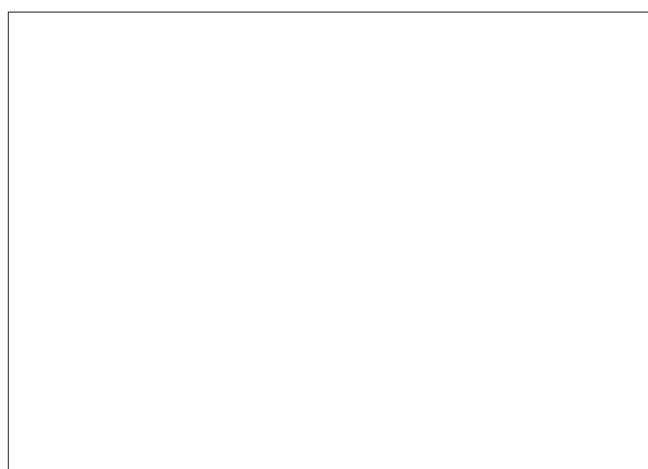


Fig. 3. CT scan suggestive of right TCC.

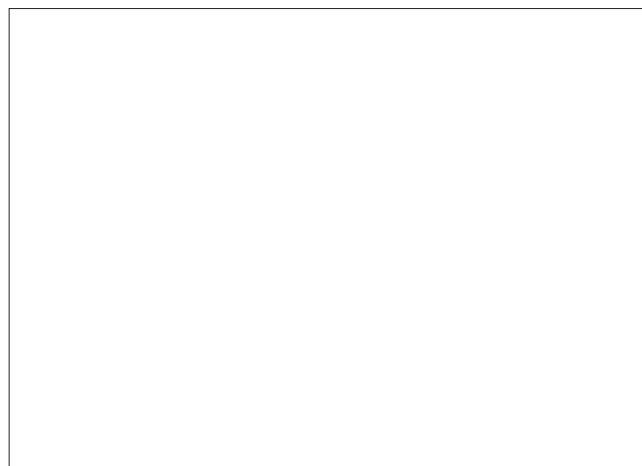


Fig. 2. Papillary TCC successfully ablated endoscopically.

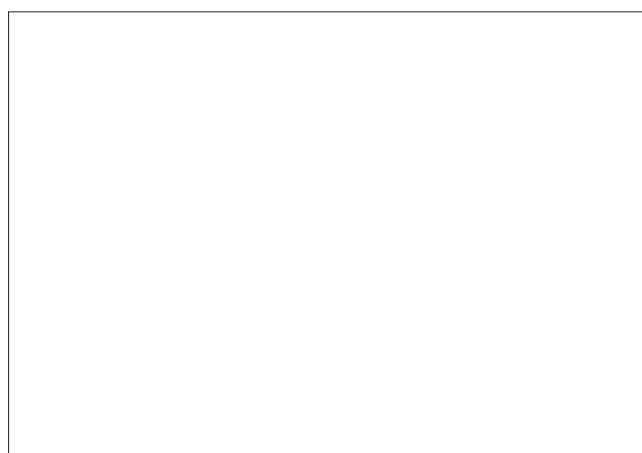


Fig. 4. Large arteriovenous malformation of right kidney.

is too proximal to be reached by a semi-rigid ureteroscope. A ureteral stent was placed in selected patients at the end of the procedure and this was usually removed after 14 days under local anaesthesia.

There was no perioperative mortality or morbidity e.g., urinary tract infection in our series and no failure to introduce the ureterorenoscope into the upper tracts was encountered.

Discussion

Upper urinary tract endoscopy is a natural progression from cystoscopy. Ureteroscopy was first described by Young and McKay in 1929.²⁻⁴ In those early days, this involved the retrograde placement of the rigid paediatric cystoscopes into the ureter. These endoscopes averaged 12F in diameter and to place them into the distal ureter alone required vigorous ureteral dilatation. They were used mainly for the treatment of ureteral calculi, particularly those in the distal ureter. Miniaturisation of the rigid scope was achieved by progression from rod-lens to fiberoptic imaging. By 1989, the fiberoptic-based rigid endoscope

could be placed with ease into the distal ureter without the need for excessive ureteral dilatation.

However, to gain access to the more proximal ureter and intrarenal collecting system, the flexible ureterorenoscope was needed. The application of the flexible ureterorenoscope was first documented in 1964 by Marshall,⁵ who passed a 9F fibrescope into the ureter to visualise an impacted ureteral calculus. In 1966, Tagaki et al^{6,7} placed a similar endoscope through a ureterotomy to visualise the papillae. The earliest flexible ureterorenoscopes were not easily manoeuvrable and had no working channels; thus, their use was limited to diagnostic procedures.

In the early 1980s at the University of Chicago, Bagley, Huffman and Lyon⁸⁻¹⁰ began developing an improved flexible, fiberoptic ureterorenoscope. Three major changes were introduced: firstly, the addition of a working channel which allowed placement of endoscopic accessories and passage of irrigant; secondly, active tip deflection which permitted the endoscope to be steered to areas of interest; and thirdly, secondary deflection which facilitated lower

pole intrarenal access. These first actively deflectable, flexible ureterorenoscopes were naturally bulky, but by the late 1980s, optical fibre miniaturisation and improved geometrical pixel packing produced a smaller fibreoptic bundle and thus a smaller diameter endoscope. Miniaturisation of the flexible ureterorenoscope broadened the therapeutic potential of these endoscopes.

The 7.5F ureterorenoscope represents a new milestone in the development of endoscopic instruments. This instrument combines the smaller outer diameter with a 3.6F working channel and allows for both active and passive deflection. Compared to its bulkier predecessors, it is easier to place into the upper urinary tract and once in place is simpler to manoeuvre in the pelvicalyceal system. This allows for a shift from purely diagnostic ureterorenoscopy to therapeutic endoscopy. Trauma to the upper urinary tract and major complications have also decreased. This lower complication rate and greater clinical applicability are, however, counterbalanced by the increased fragility of the more delicate 7.5F ureterorenoscope. On average, a total of 30 procedures can be performed before repair of the ureterorenoscope needs to be carried out.² Thus, it has been suggested that a warranty is obtained on purchase of the ureterorenoscope to ensure that the maintenance cost is kept to a minimum.

Today, the scope of ureterorenoscopy has broadened to include both diagnostic and therapeutic procedures. With regards to urolithiasis, ureterorenoscopy plays a role in the removal of lower ureteral stones, upper ureteral or renal stones following failed ESWL.¹¹ Ureterorenoscopy can also facilitate the placement of a catheter for obstruction or fistulae, removal of foreign bodies, resection of certain tumours and dilation of ureteral strictures. It is used to evaluate radiographic filling defects or obstruction, unilateral macroscopic haematuria and unilateral malignant cytology. It can also be employed in surveying the urinary tract after conservative treatment of an upper urinary tract tumour.¹² Flexible ureterorenoscopy is not contraindicated in pregnant or paediatric patients.

Significantly, the greater application of the active and passive deflecting flexible ureterorenoscope is not coupled with an increased complication rate. Complications such as ureteral perforation, creation of false passage, ureteral avulsion and ureteral stricture arise chiefly from the need to dilate the distal ureter in order to pass the ureterorenoscope. The placement of the 7.5F ureterorenoscope require only the gentle dilation of the ureter to 8F with no detrimental effect on the structure or function of the ureteric orifice.

At our institution, the 7.5F flexible ureterorenoscope was used mainly for the treatment of upper third ureteric stones in patients who had failed ESWL (as it is not

uncommon that our semi-rigid mini ureterorenoscopes are unable to reach and treat these stones especially in male patients) and evaluation of upper tract radiological filling defects. We achieved 100% introduction of the flexible ureterorenoscope into the upper tracts with no complication. This marks our continued progress in the field of ureterorenoscopy. In our 2 previous series published in 1987 and 1994,^{13,14} the rigid ureterorenoscopes were used solely for the purpose of endoscopic stone removal especially the lower half ureteric stones. These ureteroscopes were limited when it comes to assessing upper tract filling defects and removing proximal stones. With the rigid ureterorenoscopes, ureteric dilation was a pre-requisite rather than a preference, and failure of scope introduction (4%)¹⁴ and ureteral perforations (1.3%)¹³ were encountered at our institution.

In conclusion, the 7.5F flexible ureterorenoscope, compared to its predecessors, has become smaller while improving its optical quality and maintaining a standard working channel size. It thus allows the endoscopist to perform a whole spectrum of diagnostic and therapeutic procedures in the most minimally invasive method.

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