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Audit

Flexible ureterorenoscopy: prospective analysis of the Guy's experience

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***Objective*: To report our outcomes with small diameter, actively deflectable flexible ureterorenoscopy from a prospective database.**
***Patients and Methods*: 114 flexible ureterorenoscopies were performed in 105 patients (mean age, 49.5 years; range, 19–85 years; 71 males, 34 females) over a 9-month period. Of these, 101 were for refractory stones following failed ESWL and 13 for diagnostic reasons. An Olympus URF P3 flexible ureteroscope with pressure irrigation was used. Electrohydraulic lithotripsy was used to fragment stones and the fragments were retrieved with Graspit, triradiate graspers or tipless baskets.**
***Results*: Stents had previously been placed in 53% and dilatation of the ureteric orifice was necessary in 15%. In the stone group, the median operating time was 55 min (range, 15–210 min) and the median screening time 2.2 min (range, 0.3–9.1 min). Success was defined as complete stone clearance or good fragmentation to 2 mm or less. Overall success in this group was 72.3%. There was no statistically significant difference between lower and other calyces (P = 0.83 Chi-square test). Successful outcome was achieved in 72% for stone size 10 mm or less, 80% for 11–20 mm and 50% for greater than 20 mm. Two or more procedures were needed in 8 patients. In the diagnostic group, the median operating time was 45 min (range, 20–60 min) and the median screening time 2 min (range, 0.3–8.3 min). The majority were for upper tract filling defects. Access and successful diagnosis was achieved in all cases. The major complication rate was 2.6%. The ureteroscope needed repair once during this series.**
***Conclusions*: Flexible ureterorenoscopy is an effective diagnostic and therapeutic tool in a select group of patients. It should be considered for ESWL-resistant upper tract stones but the results are poor in stones larger than 20 mm and percutaneous nephrolithotomy may be a better option in these patients.**

Key words: Flexible ureterorenoscopy – Stones – Lithotripsy – Prospective analysis

In 1964, Marshall first described the visualisation of a ureteric stone with a 9-F flexible ureteroscope.[1] Subsequently, in 1971, Takagi *et al*.[2] reported on the use of a passively deflectable flexible ureteroscope with a distal end of 6-F. 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. This is mainly because all commercially

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Table 1 Analysis of outcomes according to location of the calculi

Position	Complete clearance	Good fragment-ation	Failure	Comment
Lower calyx	11	12	11	2 failed access
Upper or mid calyx	3	9	5	
Multiple calyces	2	6	3	
PUJ/renal pelvis	1	2	5	1 failed access
Upper ureter	9	9	2	
Lower ureter			2	
Diverticular		1		
Outside collecting system				8

No significant difference between lower and other calyces (P = 0.83 Chi-square test).

available flexible ureteroscopes now have active 2-way deflection along with secondary passive deflection. With improvements in technology, the diameters of the instruments have also reduced without compromising clinical efficacy. In a comparative study, albeit retrospective, Elashry *et al*.[3] found the 7.5-F scope to be as effective as the 9.3-F instrument for diagnostic and therapeutic purposes. The smaller scope was associated with less need for ureteral dilatation, minimal discomfort postoperatively and shorter hospital stay.

Most studies on flexible ureterorenoscopy originate from the US[4–7] with one series so far being reported from the UK.[8] Only few reported results are prospective and retrospective chart review may potentially have allowed the introduction of some bias. We present our outcomes of diagnostic and therapeutic flexible ureterorenoscopy as analysed from a prospective database.

Patients and Methods

Between November 1999 and July 2000, 114 flexible ureterorenoscopies were performed in 105 patients (mean age 49.5 years; range, 19–85 years; 71 males, 34 females). Of these, 101 were for refractory stones following failed ESWL and 13 for diagnostic reasons. All procedures were performed under general anaesthesia. Patients were routinely given intravenous gentamycin with induction and oral ciprofloxacin for 5 days afterwards. Urine was rendered sterile with prior use of appropriate antibiotics if the patient was known to have a urinary tract infection.

An Olympus URF P3 8.3-F actively deflectable flexible ureteroscope (Olympus Keymed, UK) with 3-F working channel and pressure irrigation was used. The instrument was introduced over a ureteric guide-wire under fluoroscopy. Prior to introduction of the ureteroscope, the guide-wire was advanced into the renal pelvis for patients in the stone group but only up to the upper ureter 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 ureteroscopy. 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.

Table 2 Analysis of outcomes according to stone size

Stone size (mm)	Success (%)
< 10	72
10–20	80
> 20	50

Success defined as stone fragmentation to 2 mm or less.

Electrohydraulic lithotripsy (EHL) was used to fragment stones and the fragments were retrieved with Graspit, triradiate graspers or tipless baskets (all from Boston Scientific, UK).

In patients with ESWL refractory stones, success was defined either as complete stone clearance or fragmentation to 2 mm or less. These patients were also stone-free on plain X-ray of the urinary tract at 3 months and follow-up of at least 1 year.

Data were prospectively entered into a computerised database. The chi-square test was used for statistical analysis.

Results

Stents had previously been placed in 53% of cases and dilatation of the ureteric orifice using a sheath was necessary in 15%. Ureteral access sheaths were not used as they were not available at the time of this series. In the stone group, the median operating time was 55 min (range, 15–210 min) and the median screening time 2.2 min (range, 0.3–9.1 min). Overall success in this group was 72.3%. Stone location and outcomes of treatment are detailed in Table 1.

Success was also determined according to stone size and is summarised in Table 2. Successful outcome was achieved in 72% of cases for stone size 10 mm or less, 80% for 11–20 mm and 50% for greater than 20 mm. Two or more procedures were needed in 8 patients.

In the diagnostic group, the median operating time was 45 min (range, 20–60 min) and the median screening time 2 min (range, 0.3–8.3 min). Ten were for upper tract filling defects, 2 loin pain haematuria syndromes (1 patient became asymptomatic after 15 years following removal of a small lower pole calculus) and 1 blind ending ureter (Table 3).

The complication rate was 2.6%. These included a patient with a solitary kidney who went into acute renal

Table 3 Diagnoses in patients undergoing diagnostic flexible ureterorenoscopy

Diagnosis	No. of patients
TCC upper tract	6
Renal cell cancer protruding into renal pelvis	1
Malrotated kidney causing abnormal appearance	1
Loin pain haematuria: 1 small stone; 1 undiagnosed bleeding	2
Blind ending ureter	1
No abnormality detected to explain filling defect	2

failure after developing a lower ureteric stricture around a tailed ureteric stent. The stricture was successfully treated by balloon dilatation and insertion of a JJ stent with uniform diameter at both ends. The stent was subsequently removed without recurrence of the stricture. Another patient was re-admitted following discharge from hospital with secondary haemorrhage from a pseudoaneurysm of an interlobar artery. This was treated with percutaneous embolisation. One patient developed postoperative pyrexia of 38.5°C, which settled with intravenous augmentin.

The flexible ureteroscope needed repair only once during this series.

Discussion

This prospective study has clearly shown that flexible ureterorenoscopy is an effective diagnostic and therapeutic addition to the endourologists' armamentarium. Although a 7.5-F scope can be used with sedation analgesia,[3] we preferred general anaesthetic for our larger scope size of 8.3-F. Over 70% of ESWL refractory stones can be treated successfully with a low incidence of major complications. These data are comparable to other retrospective series[8,9] although the stone clearance rate is somewhat lower than that reported with the use of a Holmium laser.[4] In our opinion, flexible ureterorenoscopy is most effective for stones smaller than 20 mm. Clearance of stones larger than this size takes multiple attempts with longer operative times. Consequently, PCNL maybe a better option for this group of patients.

We found a number of stones to be lying outside the collecting system, which needed no further treatment. One of the advantages of flexible ureterorenoscopy is that it can differentiate between a small calyceal stone and renal parenchymal calcification.[10]

With experience, the lower pole can usually be accessed using secondary deflection. In this series, there was no statistically significant difference in results between the lower pole and other calyces. In a contemporary study of 90 patients, success with lower pole calculi was achieved only in 45% of stones greater than 20 mm in largest diameter although this rose to 82% after a second treatment.[5] A tipless nitinol basket can be used to re-position lower pole calculi to a more accessible calyx prior to intracorporeal lithotripsy.[11] In an *in vitro* study, the Graspit and tipless nitinol baskets had minimal influence on scope deflection.[12] We have employed this technique a number of times successfully but find the Graspit to be a more useful tool in this situation. Flexible ureterorenoscopy can be used to treat small-to-medium sized stones in diverticulae associated with upper or middle calyces. The calyceal neck, if narrow, often needs balloon dilatation or incision with laser. For larger stones in posteriorly placed diverticulae, PCNL is a better option while anteriorly placed calculi may be approached laparoscopically.[13]

The flexible ureteroscope is introduced over a guide-wire. Two guide-wires can be inserted if a number of excursions to remove stone fragments are expected. Recently, the technique of using a dual-lumen ureteric catheter and safety guide-wire for ureteric access has been described.[14] A randomised-controlled trial has also found the use of a ureteric access sheath during ureteroscopy to be time- and cost-effective.[15] However, being a tertiary referral centre, more than half of our patients had stents inserted in their parent hospitals, which made access less difficult due to stent induced ureteric dilatation.

Flexible ureterorenoscopy, tumour biopsy and laser fulguration can effectively treat upper tract transitional cell carcinomas.[16] The technique is also useful for surveillance since a number of recurrent tumours are missed radiographically and only seen by endoscopy.[16] Benign lateralising haematuria can pose diagnostic difficulties and flexible ureterorenoscopy can often help in establishing a diagnosis.[17] The majority are discrete lesions such as haemangioma and focal papillary erythema, which can be treated by electrocoagulation. However, recurrent bleeding is likely if the lesions are diffuse or no definitive diagnosis is reached on ureteroscopy.[18]

The low complication rate is similar to that in other reports.[4–6] Complications were higher in older series where 9.8-F to 10.8-F scopes were used probably because of the larger diameters of the instruments.[19] One patient with a solitary kidney developed a lower ureteric stricture. There were no ureteric perforations or extravasation. Prolonged delayed bleeding from a pseudoaneurysm is exceedingly rare and is a result of electrohydraulic lithotripsy rather than flexible ureterorenoscopy.

Perhaps one of the most remarkable observations of this study is the longevity of the flexible ureterorenoscope that we used. Most other units report the life-span of these instruments to be around 30 procedures.[4] A single-centre evaluation of the durability of flexible ureteroscopes smaller than 9-F showed that they need repair after 6–15 uses.[20] 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, thus ensuring delicate handling. Damage to the fibre-optics was probably less with the use of EHL as compared to laser. The EHL probe was always inserted with the ureteroscope straight and deflection was attempted only after the probe or any other stone-retrieving device was well outside the tip of the instrument. Furthermore, we ensured the EHL probe to be projecting well beyond the tip of the scope prior to its activation. Adhering to these simple measures has undoubtedly made this a cost-effective project. Our report contradicts the finding of McDougall *et al*.[21] who concluded that it is the arduous nature of upper tract stone surgery that determines how long these scopes last. The recently described method of advancing a 200 µm laser fibre through a 2-F catheter placed in the working channel of the scopes could potentially enhance their durability.[22] In addition, the use of ureteral access sheaths may reduce damage to the ureteroscope.

Conclusions

Our prospective experience of flexible ureterorenoscopy has shown it to be a valuable tool both in the treatment of renal stones refractory to ESWL and also for diagnosis of upper tract pathology. It has a low complication rate and requires short in-patient stay. We hope that the use of Holmium laser may improve our stone fragmentation rates although this may be to the detriment of scope longevity.

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