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BJUI Surgery Illustrated – Surgical Atlas
Flexible ureterorenoscopy

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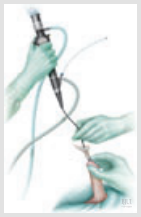
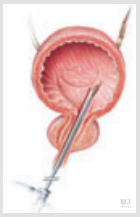

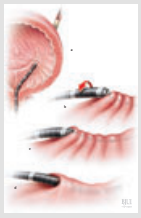


INTRODUCTION

Hugh Hampton Young [1] first reported visualizing the renal pelvis in a young child with a rigid paediatric cystoscope. Thereafter Marshall [2] reported the use of a 3-mm fibrescope passed through a cystoscope to visualize a ureteric stone. The newer developments in endoscopes and optics have increased the indications and applicability of this method. Flexible ureterorenoscopy has revolutionized the treatment of upper urinary tract urolithiasis. The instruments are fragile and costly; therefore it is imperative to employ a proper technique for their use. In this article we describe the indications, patient selection and technique of flexible ureterorenoscopy.

PATIENT SELECTION

The indications for flexible ureterorenoscopy can be divided as:

DIAGNOSTIC

a) Evaluation and localization of haematuria on positive cytology
b) Surveillance for upper tract TCC
c) Evaluation of equivocal imaging findings such as filling defects on contrast enhanced CT

THERAPEUTIC

a) Proximal ureteric stones, stones in the pelvis and lower calyceal calculi
b) Removal of foreign bodies such as migrated stents, broken JJ stents, laser fibres
c) As an adjuvant to percutaneous nephrolithotomy in the management of staghorn calculi

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INSTRUMENTATION AND SET-UP

1) Cystourethroscope
2) Open-end ureteric catheter
3) Glide wire/guide wire
4) Double lumen re-entry catheter (10 F)
5) Flexible ureteroscope (6–8 F)
6) Hand held irrigation pump/pathfinder
7) Light source (xenon)
8) Laser fibre
9) Laser generator
10) Nitinol zero tip basket
11) JJ stent (4.8, 5 and 6 F, 26 cm)

PREOPERATIVE PREPARATION

As with all surgical procedures, the preoperative examination should include proper history (stone disease, associated comorbidities, history of prior surgical intervention). The patient should be asked about any history of fever, UTI or bleeding diathesis.

The preoperative investigations include a complete blood count, serum creatinine, an IVU or CT urography, (we prefer a CT intravenous urogram) and a urine culture.

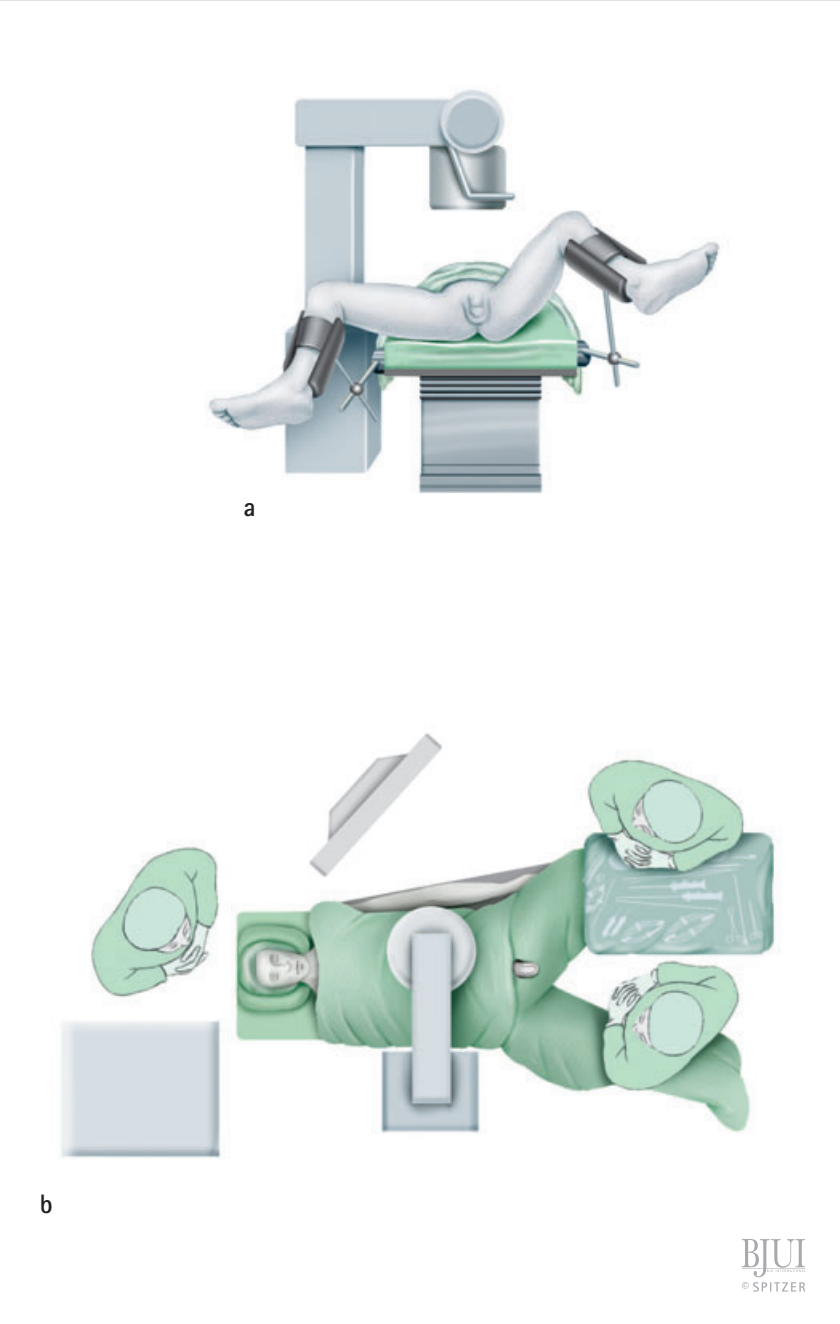
It should be policy that all patients have sterile urine before intervention. If the urine culture is positive for infection it should be treated aggressively with sensitive antibiotics, both preoperatively and postoperatively.

The patient should be counselled regarding the predicted success rates, possible complications including bleeding, infection, loss or injury of ureter and kidney, stricture and anaesthesia complications as well as the need for any ancillary procedures.

OPERATING TABLE SET-UP

Organization of this table is the 'key' to rapid and safe surgery. The instruments should be arranged in the order in which they appear during the procedure; for instance, the cystoscope is not required after the initial ureteric access, and hence it should be kept in a less prominent position. All clear liquid (water, saline, contrast) containing bowls should be marked for easy identification and should be at the periphery of the table. After use, the wires should be kept back in the 'loop' and be flushed, particularly the hydrophilic ones. The endoscopes should be on the centre of the table. Once used, the drapes will make space for other instruments.

Figure 1



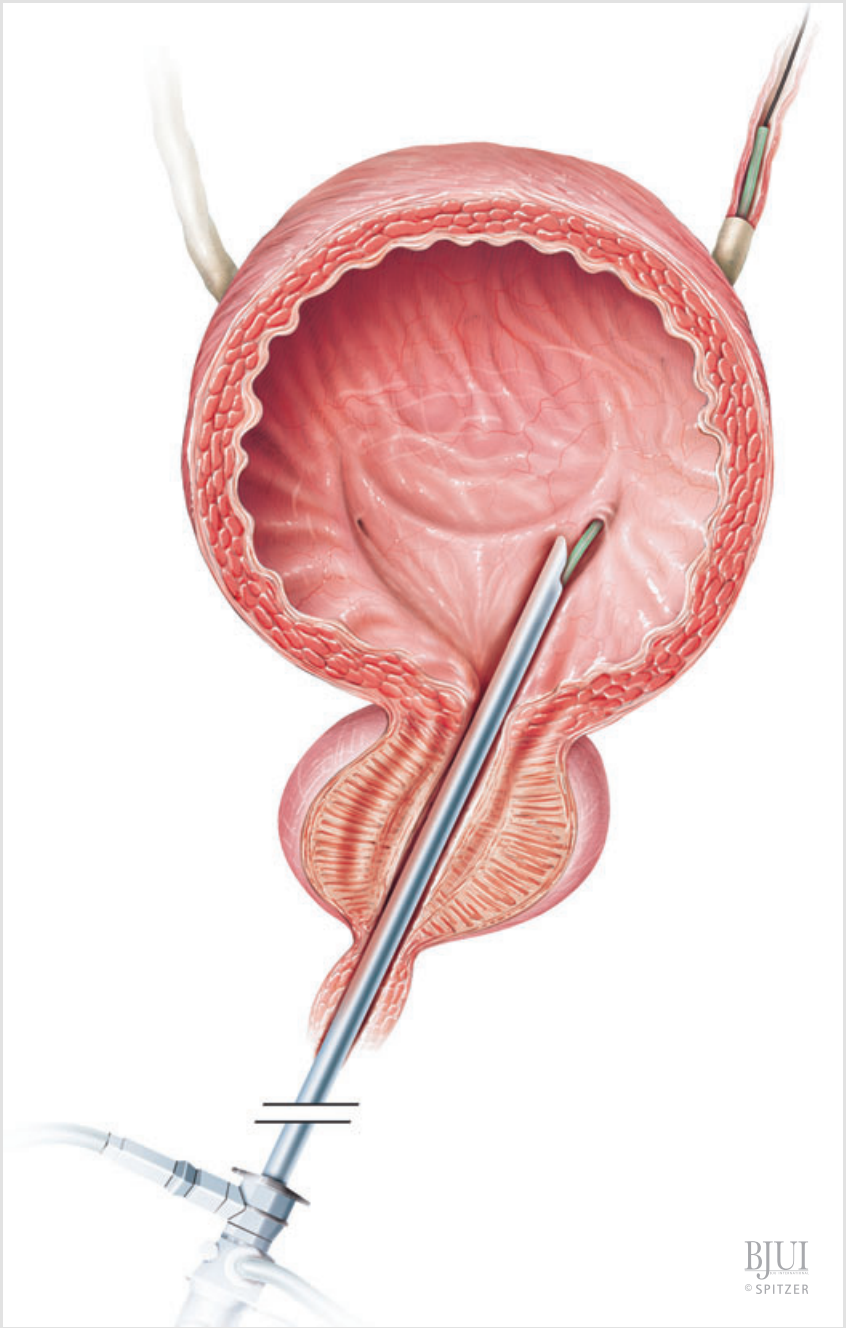
POSITIONING AND ANAESTHESIA

General anaesthesia is preferred over regional anaesthesia. The lithotomy position with padding of the legs at the pressure points is necessary. The leg contralateral to the side to be operated is extended and the hip abducted. The legs should be adequately separated to allow easy access to the penis and urethra. A 'hole' towel drape with irrigation collection pouch may be useful. Once the patient is in position, the endovision screen is adjusted such that the surgeon has unobscured vision. The C-arm comes from the opposite side of the position of the endovision. The instrument trolley is kept between the legs. The assistant stands beside the surgeon. The surgeon stands while performing the procedure.

Figure 2

The flexible ureteroscope is held so that the channel for accessories is easily accessible. While performing flexible ureterorenoscopy, the surgeon holds the ureteroscope with the dominant hand, with the thumb on the deflection lever. The other hand stabilizes the shaft at the meatus; while the assistant holds the penis in stretch. The assistant is responsible for maintaining irrigation and passing the accessories without obstructing the movements of the surgeon.

Figure 3



PROCEDURE

Once a preliminary cystoscopy is done, a guidewire is passed into the ureter. An open-end ureteric catheter helps in obtaining a retrograde ureterogram, which further helps in delineating the anatomy. A guidewire is passed through the open-end ureteric catheter. This open-end catheter helps in stabilizing the guidewire. A double lumen catheter helps in passing a safety wire. One wire acts as a safety wire.

Figure 4

Our preference is to insert a ureteric access sheath 9–12 F. The access sheath is passed with a gentle jiggle motion. If there is any resistance, avoid the temptation to 'push' the sheath. In the authors' experience, in ≈30% of cases the access sheath will not pass.

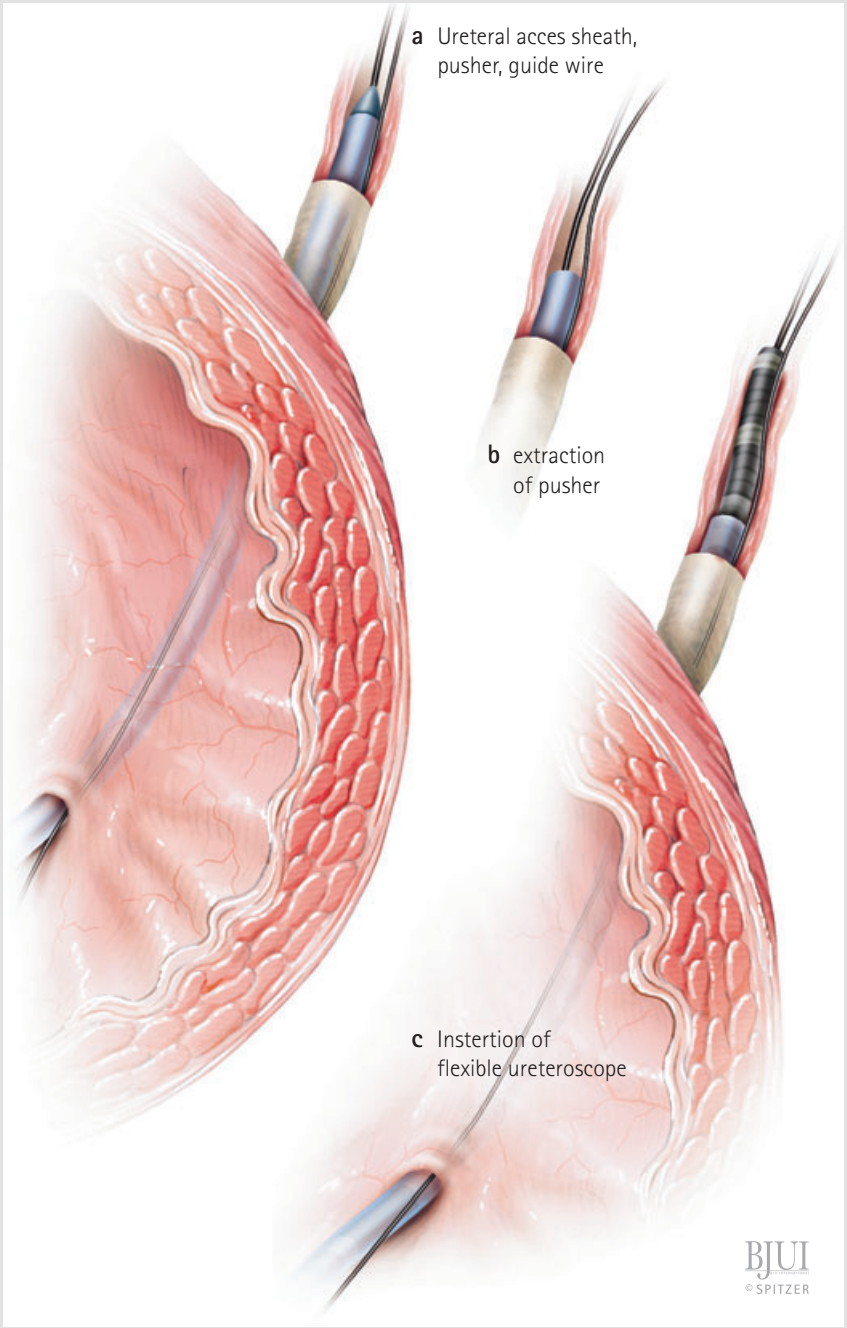


Figure 5

If the ureter snugly admits the access sheath, serial dilatation of the orifice is done to admit the sheath. The dilatation can be done either with serial Teflon dilators or a balloon dilator. If this is not possible, the flexible ureteroscope is directly back-loaded over a wire into the ureter.

Irrigation provides the visibility necessary for the procedure. We prefer normal saline as irrigation. The irrigations should not be pressurized. The authors prefer a hand-held pump. The urologist should remember that irrigation should be optimal for visualization, keeping in mind the risk of pyelovenous backflow and fluid absorption.

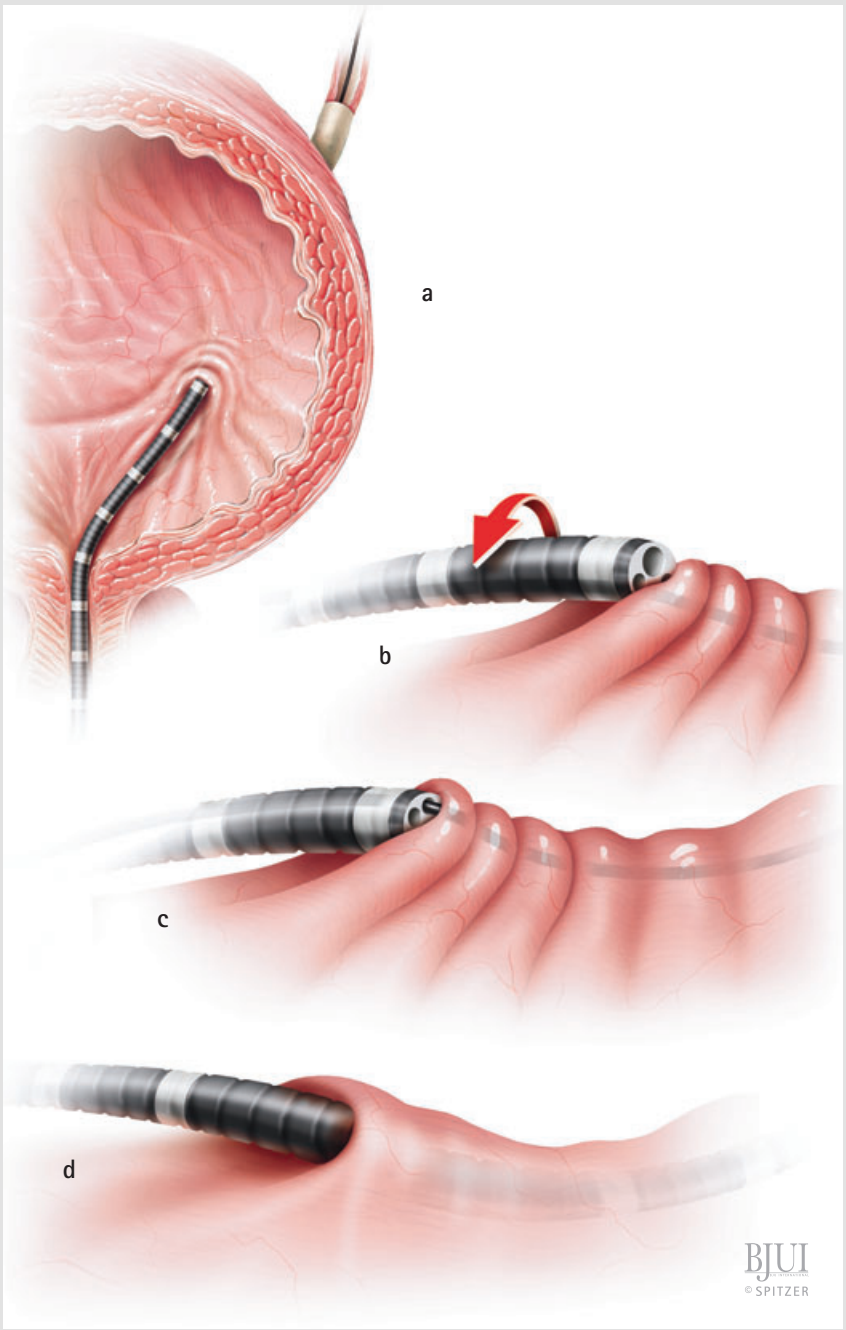


Figure 6

Depending on the anatomy of the collecting system and the diameter of the ureter, a flexible 6/8.8 F ureteroscope with active secondary deflection is used. Passive deflection implies to the segment of the ureteroscope which lies proximal to the active segment. This mechanism is useful if, despite full deflection, the flexible ureteroscope does not reach the desired lower pole calyx.

Before insertion of a flexible ureteroscope the following points should be noted:

1) Make sure that you use the ureteroscope with the mechanism you are comfortable with. It may be intuitive (up is up) or counterintuitive (up is down).
2) The optics should be tested on the table, a white balance is done and the light source and illumination checked.
3) The laser should be set at optimal setting considering the stone composition. Generally, pulse energy of 0.6–1.2 J is chosen. The pulse settings are begun at 0.8 J with a frequency of 8 Hz. If the stone is suspected to be hard, the power is increased to 1.0 J at 10 Hz. Make sure there is no breach in the insulation of the fibre and that the insulated fibre remains under vision.

The bladder should be emptied at this point, particularly if the procedure is going to be prolonged, this can be done with a feeding tube inserted per urethrally. The ureteroscope should be advanced without any attachments in the line of the wire. After the ureteroscope reaches the pelvis the safety wire can be removed.

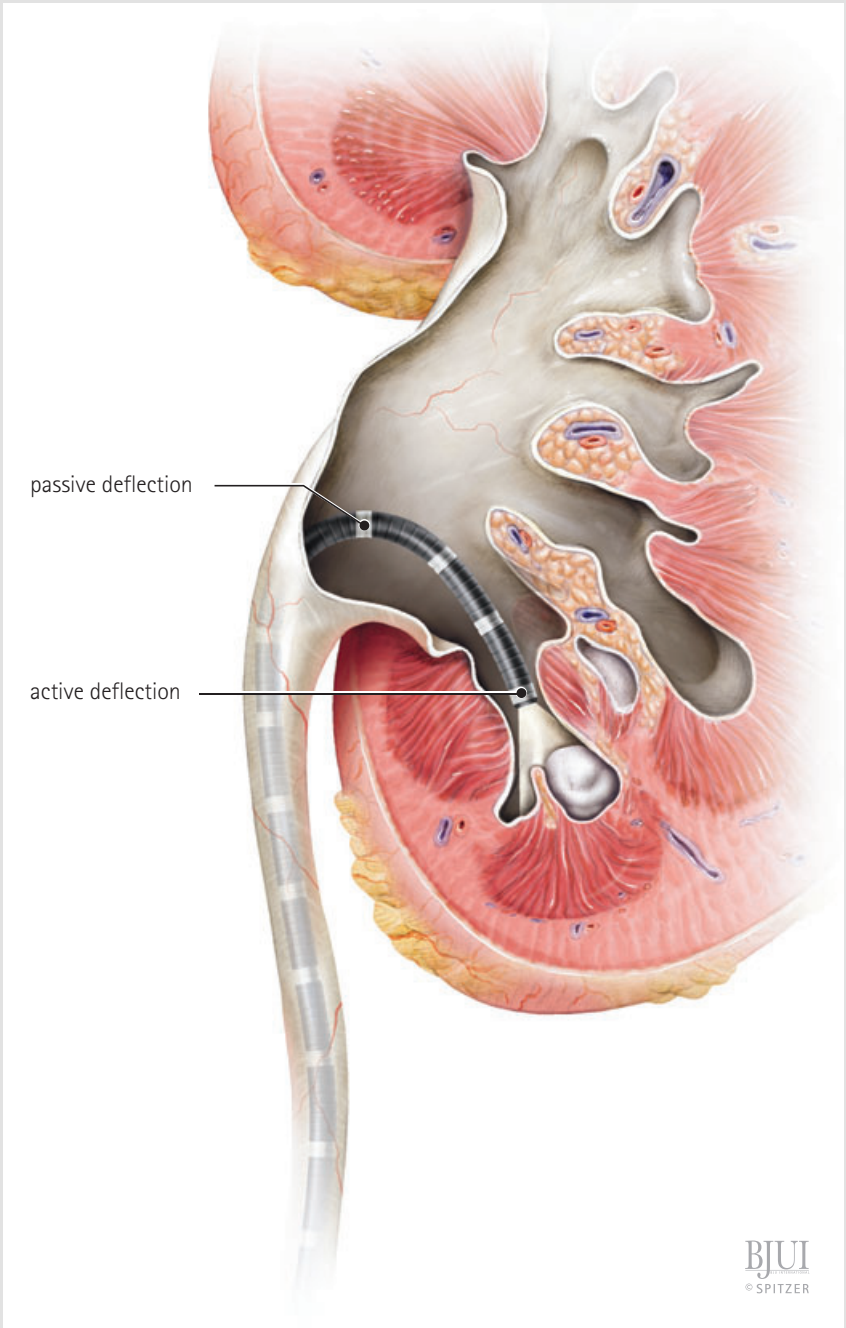
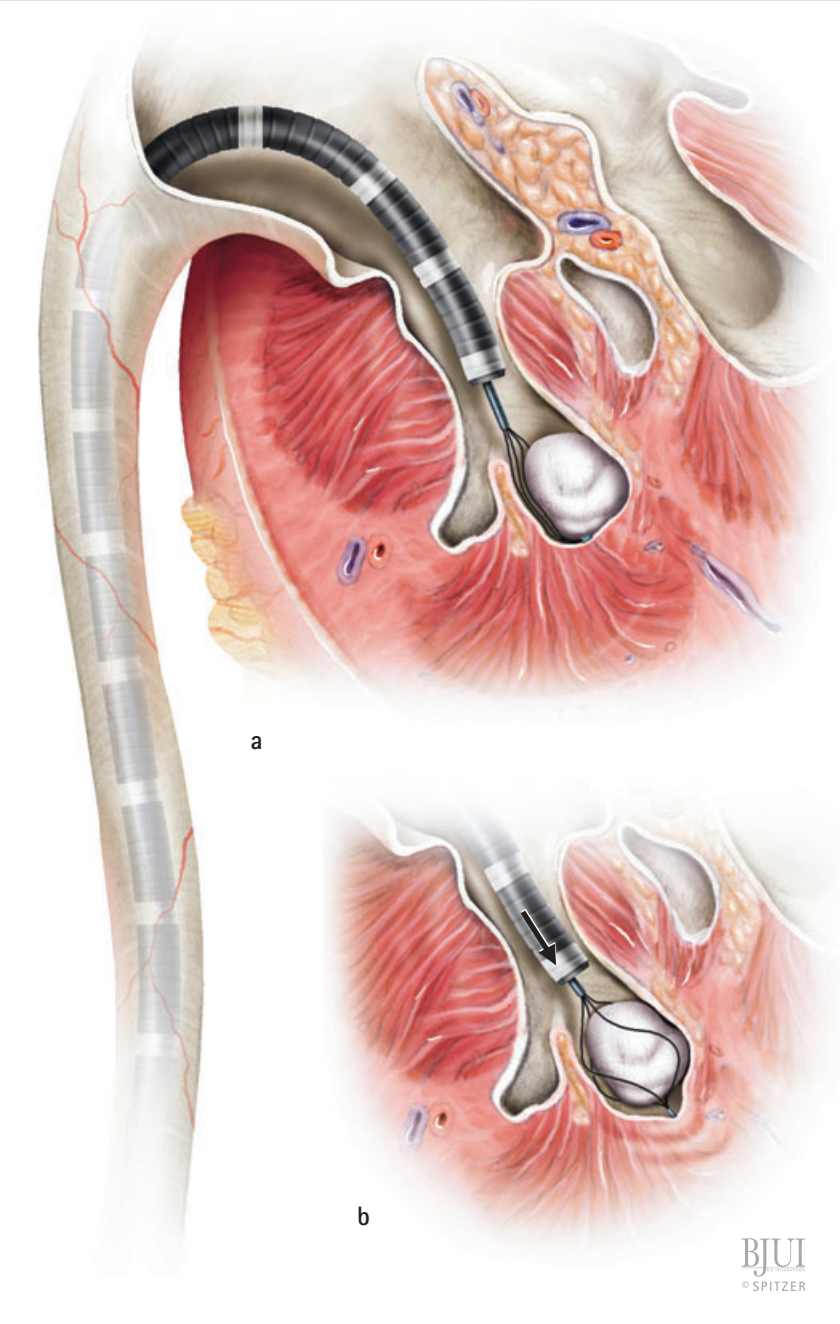


Figure 7



OPTIONS FOR DISINTEGRATING THE STONE

Once the flexible ureteroscope is introduced the stone can be tackled either by lasing or 'basketing'.

The basket has the property of opening and closing. Most baskets advance as they are opened and retract as they close. The wire operator should be aware of the movement of the basket. The basket can be placed under or by the side of the stone, so that when the wire spreads, the stone falls into the widest portion of the basket (a).

The baskets should be slightly pushed while closing to keep the stone trapped (b).

Figure 8

The stone can be grasped with a basket and extracted *in toto*, which is an option for small stones. Very small stones can be extracted through the access sheath.

An option for bigger stones may be to grasp the stone and relocate it into a more favourable calyx. This is particularly helpful for stones in the lower calyx that need to be relocated because of the awkward bend of the lower calyx.

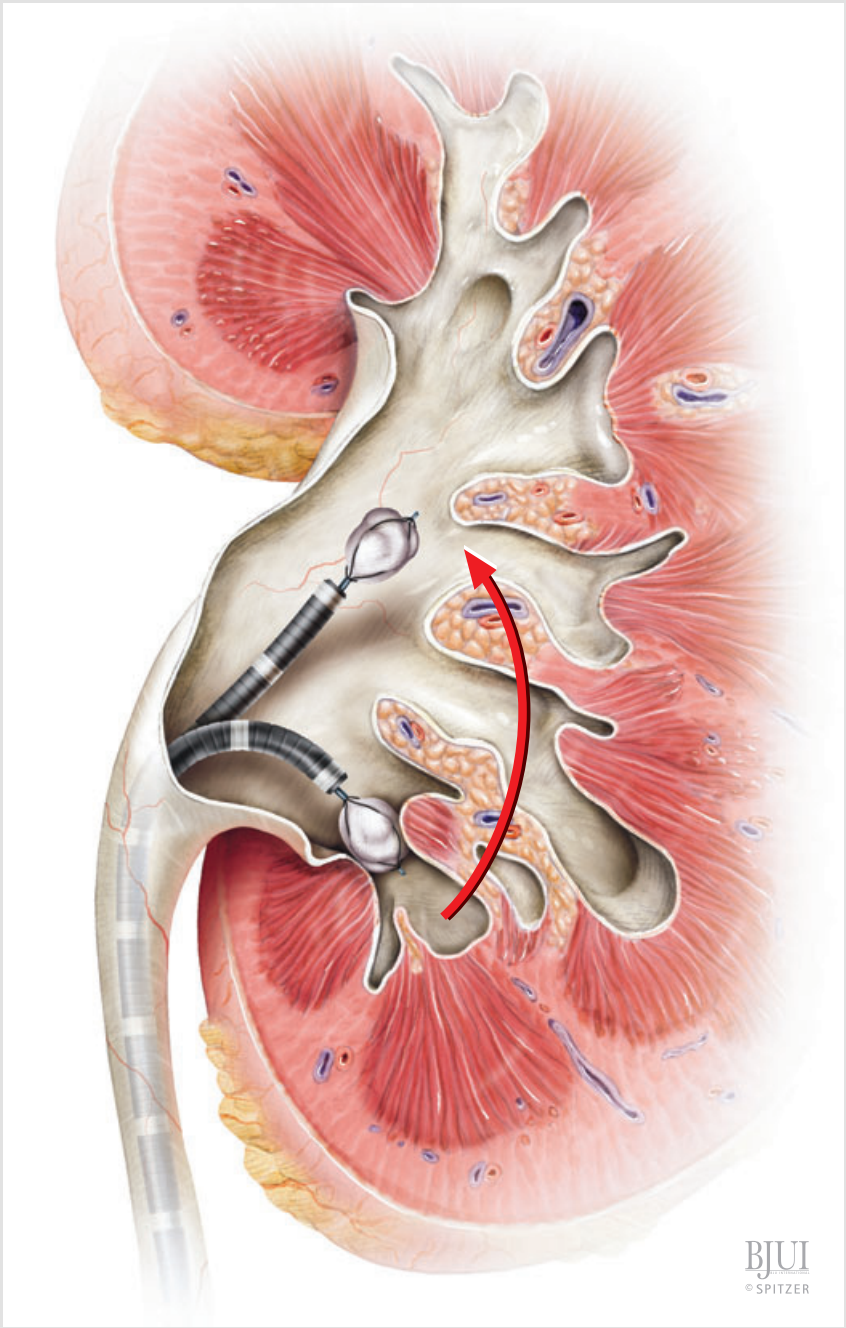


Figure 9

The lasing can be done in three ways. Firstly, 'painting'; this is done if the stone is soft. The laser vaporizes the surface of the stone to dust and this helps to keep the stone in one piece while the fragmentation proceeds (a). Secondly, if the stone is hard it requires 'drilling', wherein the stone is cored through and generated into pieces. The stone can be 'pinned' against the mucosal wall and pulverized to prevent migration of the stone into a different calyx (b). Finally the stone can be 'pop-corned' after complete fragmentation (c).

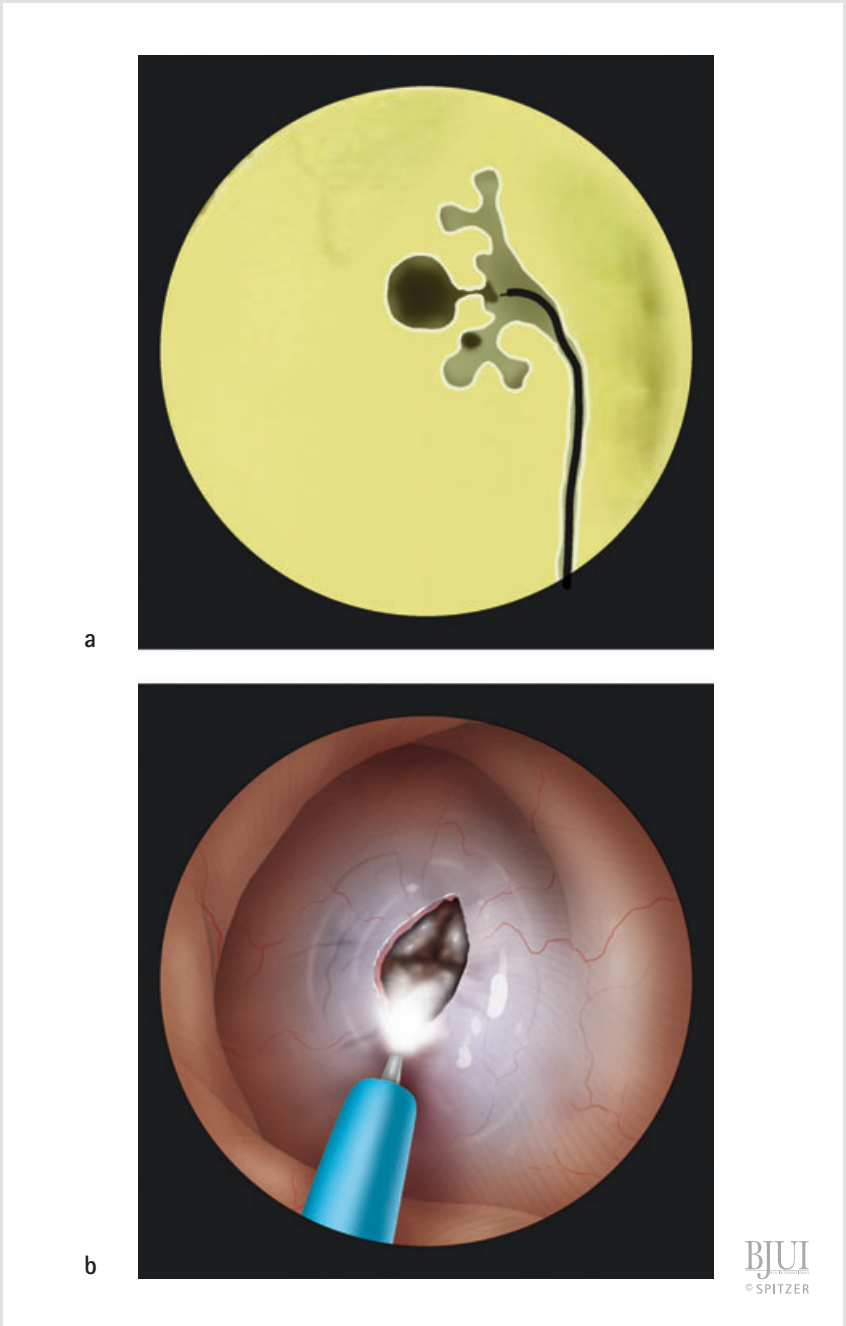
TECHNIQUE OF LASING

A few important tips while fragmenting the stones are:

1) A sheath around the laser fibre helps in protecting the instrument.
2) The laser fibre sheath should be seen throughout the lasing. An aiming beam should be on the 'on mode' at all times. The intensity of the aiming beam should be optimal; otherwise it might obscure vision.
3) The laser fibre should not be advanced in a deflected position of the flexible ureteroscope.
4) The laser should be operated by the operating surgeon.
5) The integrity of the laser fibre should be seen before commencing the procedure.
6) The fibre should be fixed while lasing to avoid damage to the scope.
7) Synchronized lasing should be done with respiratory movements. This will avoid injury to the mucosa.
8) The laser should be on standby mode before its withdrawal from the instrument.

Figure 10

Diverticular stones require identifying the proper calyceal infundibulum. This is identified by a bulge or a bluish hue, the infundibulotomy is done with a laser, the laser settings range from 1.2 J to 1.5 J. Once the calyx with the stone is seen, the infundibular opening is enlarged to fragment the stone.



SURGEON TO SURGEON

The literature is divided regarding the need for preoperative JJ stenting. The authors prefer to counsel the patient that a single-stage procedure would be planned. However, if we should find the ureter to be tight for admitting the smallest possible flexible ureteroscope, a JJ stent would be placed and the procedure re-scheduled for a few days later.

It is a matter of surgeon's preference as regards the use of access sheaths. Ureteric access sheaths are definitely beneficial but should not be considered a 'must' for all flexible ureterorenoscopies. They should not be used in narrow ureters whenever a diagnostic procedure is contemplated. In our opinion, an access sheath helps to straighten the ureter, reduce the wear and tear of instruments and facilitates intrarenal manipulations. In the authors' opinion, they should be used particularly when multiple ureteroscope passages may be required, such as large volume and multiple stones.

One of two situations requiring special consideration is flexible ureteroscopy in diverticular stones, such a situation requires identifying the proper calyceal infundibulum. This is identified by a bulge or a bluish hue. The infundibulotomy is done with a laser, the laser settings range from 1.2 J to 1.5 J. Once the calyx with the stone is seen, the infundibular opening is enlarged for stone fragmentation (Figure 10).

The second situation requiring special consideration is flexible ureteroscopy for stones in ectopic kidneys. This requires a few issues to be tackled for gaining access. Due to the peculiar position of the kidney and the natural curves to be negotiated, placing a preplaced JJ stent may be helpful at times. Placing a ureteric access sheath may be helpful in these cases as it straightens the ureter and simplifies multiple passes in these kidneys.

POSTOPERATIVE CARE

The authors prefer to keep a JJ stent in large stone bulk, a tight ureter, evidence of extravasation, perforation and solitary kidneys. A Foley catheter is kept *in situ* for 24 h and the patient discharged the next day with antibiotics. The patient is re-assessed after 3 weeks with ultrasonography of the kidney, ureter and bladder.

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