Flexible cystoscopy: a revolution in urological practice

Flexible cystoscopy has revolutionized the field of diagnostic urology. It can be done under local anaesthesia in the outpatient setting and is thus a highly useful tool. Its role in therapeutic urology is more limited but it still has a place in the management of certain conditions.

The evolution of the cystoscope dates back to 1806 when Philip Bozzini, a German urologist, constructed an endoscope, the lichtleiter, using concave mirrors to reflect candle light through an open tube to view the cavities of internal organs. In 1877 another German urologist, Maximilian Carl-Friedrich Nitze, created the first usable cystoscope. The birth of modern endoscopy, however, was delayed until the late 1950s when fibreoptics became available (Morgenthal et al, 2007).

The invention of the flexible cystoscope in 1984 revolutionized diagnostic urology because of its ease of use, patient friendliness and easy maintenance (Kavoussi and Clayman, 1988; Pavone-Macaluso et al, 1992). There are different types of scope available such as the conventional optical scopes and the newer video scopes which can provide better magnified and wide angle images.

Modern flexible cystoscopes are single piece instruments whose mechanical system comprises four different parts: the eye piece assembly in fibreoptic scopes or the electronic control functions in video scopes, the control segment, the insertion tube which is introduced into the bladder, and the light-guiding tube which is connected to the light source.

The eye piece assembly has high quality lenses which can magnify the image up to 30 times. There is also a focusing ring to adjust the image for the individual endoscopist. In video scopes the image is captured by a charge coupled device: a microchip which converts the light into electrical charges using its photosensitive surface. These electrical charges are processed in a complex manner and reproduced as images on a television or video monitor.

The control segment translates the rotational movements generated by the control knob into linear motion in the angulation wires.

The insertion tube is 16 French in size and incorporates two light channels, one suction and filling channel and one working channel. It has three different layers: a plastic outer sheath to minimize friction, a middle metal braid layer to improve instrument control, and an inner metal spiral layer to increase strength and protect the light guide bundles. The end of the insertion tube has a bending section which can be manipulated using the control knob up to 210° upwards and 120° downwards.

The light guiding tube also has two layers: an outer plastic sheath and an inner steel coil sheath for strength. The light guiding tube incorporates the light transmitting optical fibres, and has a plug probe on the end to connect it to the high intensity light source.

The flexible cystoscope has two different optical fibre cable systems, the light and image transmission systems. They both transmit light by the multiple internal reflection principle so there is no loss of transmitted light. In the light transmission system the optical fibre cables are about 50 µm in diameter and arranged in a bundle held at the ends. The fibres of the image transmission system, on the other hand, are only 7–12 µm in diameter and are arranged coherently as each carries a specific part of an image when projected. Peripherals that can be put down the working channel of the flexible cystoscope include biopsy forceps, diathermy and the stent grabber.

Indications

Flexible cystoscopy is used to investigate patients presenting with microscopic and macroscopic haematuria, irritative lower urinary tract symptoms, recurrent urinary tract infections, and also for surveillance of bladder tumours (Kumar et al, 2004).

Uses

The flexible cystoscope can be used for diagnostic, therapeutic or surveillance purposes. Flexible cystoscopy plays an important role in the diagnosis of lower urinary tract cancers. It can also be used to treat low grade superficial bladder transitional cell tumours using diathermy and can assist in cases of difficult urethral catheterization using a guide wire. Procedures such as bladder biopsies, removal of JJ ureteric stents, insertion of ureteric stents and ureteric catheters, as well as simple bladder washouts can also be performed using the flexible cystoscope. More recently, flexible cystoscopy has been used for

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intravesical botulinum toxin injections under local anaesthetic. However, probably the commonest indication for flexible cystoscopy remains its role in the surveillance of lower urinary tract tumours (Grasso et al, 1993; Beaghler and Grasso, 1994; Wedderburn et al, 1999; Cohen et al, 2007).

The differences between flexible and rigid cystoscopy are shown in *Table 1*.

Procedure

Flexible cystoscopy is a technically simple procedure with a short learning curve, which causes minimal discomfort to the patient. The examination is carried out after obtaining informed consent. Urinalysis should be performed before the procedure to exclude active urinary tract infection, which is a relative contraindication because of the small risk of septicaemia (Almallah et al, 2000; Burke et al, 2002). Following preparation of the genitalia using povidone iodine or chlorhexidine solution the area is covered with sterile drapes. Around 10 ml of 1% lidocaine gel is slowly instilled into the urethra in men, while water-based lubricant gel is used to aid scope insertion in women. Some studies have shown that the use of lubricant gel alone without local anaesthetic is satisfactory in men as well (Kobayashi et al, 2003; Patel et al, 2008).

The scope is gently introduced into the urethra with the filling channel in the open position and is advanced carefully through the urethra into the bladder while instructing the patient to relax and to mimic the motions of passing urine. Some authors have found that increasing the hydrostatic pressure by squeezing the fluid bag attached to the scope and allowing the patient to view the monitor helps to reduce discomfort during passage of the scope (Gunendran et al, 2008). The urethra is inspected along its length for any abnormalities such as strictures, growths and false passages. The occlusiveness of the prostate gland can be estimated in men.

Once inside the bladder the scope is kept still until the bladder is filled satisfactorily as indicated by flattening of the mucosal folds. Once the bladder is adequately filled the inflow channel is closed. Identifying the presence of the air bubble introduced by the scope at the dome of the bladder is a useful orientation marker, especially for novices. The bladder is then carefully inspected in a systematic manner keeping the air bubble as a landmark. This involves inspection of the anterior, right lateral, left lateral and posterior walls, as well as both ureteric orifices and the trigone in between. The bladder neck and the prostatic impression are examined by performing the J manoeuvre with the scope. Once the inspection has been fully carried out, the scope is gently withdrawn with the filling channel in the open position, as this allows examination of the urethra on the way out as well.

Table 1. Comparison of flexible and rigid cystoscopy

	Rigid cystoscopy	Flexible cystoscopy
Anaesthesia	General or regional	Local
Image quality	High	Average
Light	Coherent	Non-coherent
Irrigation	Continuous	Inflow only
Working peripherals	Multiple	Limited
Risk of lower urinary tract trauma	Low	Very low
Risk of complications (haematuria, urinary tract infection, stricture)	Moderate	Low
Cancer detection	High	Moderate

Scope cleaning and maintenance

Flexible cystoscope cleaning consists of mechanical cleansing, disinfection and rinsing. After use, the scope is washed thoroughly with detergent and leak tested. Then the scope is immersed in chemical solution (glutaraldehyde or sterilox) for around 20 minutes. A special housing mechanism is required to disinfect the scope as the fumes which are generated need to be dispersed. The scope is finally washed with sterile water. Currently, disposable sheaths are being developed so that a single scope can be used on multiple patients without having to be cleaned each time.

When not in use, flexible cystoscopes should be stored at room temperature and preferably hung with the cables straight. If the cables are to be kept curled, care should be taken to avoid curling greater than 150° as this can damage the light and image transmission systems.

Complications

Although the procedure is generally considered safe, it is not entirely without complications. These include haematuria (19%), dysuria (50%), and frequency (37%), all of which are usually self limiting, as well as urinary tract infection (2–3%) (Burke et al, 2002). The risk of urinary tract infection increases if there is a pre-existing infection and can lead to urosepsis in up to 1% of cases. Patients are therefore advised to increase their fluid intake post-procedure and to seek medical attention should they feel unwell with increasing dysuria, rigors or fever. The incidence of acute urinary retention and urethral stricture formation in the long term is low.

Role of antibiotic prophylaxis in flexible cystoscopy

The role of antibiotic prophylaxis with flexible cystoscopy is controversial (Kraklau and Wolf, 1999; Rané et al, 2001; Wilson et al, 2005). In the UK there is no set protocol for this, and individual units have their own guidelines. There is no good evidence that antibiotic prophylaxis is routinely indicated, but it should be considered in those with a proven or suspected urinary tract

infection, those who have had orthopaedic surgery within the last 12 months, and immunosuppressed patients. National Institute for Health and Clinical Excellence (NICE) guidelines suggest that patients with artificial heart valves do not need prophylaxis against bacterial endocarditis (Richey et al, 2008). If prophylaxis is used, the choice, route of administration and duration of use of antibiotic varies based on local microbiological advice.

Recent advances in flexible cystoscopy

Blue light cystoscopy uses hexaminolevulinate (HAL)-generated fluorescence in the presence of a blue light. This has yielded promising results in the surveillance of bladder malignancies, especially of carcinoma in situ which generally has a poor prognosis. The procedure involves instillation of HAL 1 hour before flexible cystoscopy. The bladder is then inspected using white light and, after excluding any obvious lesions, the light is switched to blue light.

Following the instillation of HAL, porphyrins will accumulate intracellularly in bladder wall lesions. These porphyrins are photoactive fluorescing compounds which emit red light on a blue background (Loidl et al, 2005; Grossman, 2007; Witjes and Douglass, 2007). As a result, areas with malignant change show up red under blue light. This technique should not be used in patients with high risk of bladder inflammation (e.g. active urinary tract infection, inter-stitial cystitis), because there is an increased risk of porphyrin build up and increased local toxicity upon illumination, leading to false positives. The study is also contraindicated in pregnancy and lactation, and patients with porphyria or hypersensitivity to any of the contents in the solution.

Conclusions

Flexible cystoscopy has become part of the outpatient armamentarium of urologists, in many aspects of diagnosis, treatment and surveillance of urological conditions. It is simple to perform, quick and relatively painless, and avoids the need for general or regional anaesthesia. The use of blue light cystoscopy will make it even more sensitive in the diagnosis of intravesical lesions. **BJHM**

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KEY POINTS

- Flexible cystoscopy is part of the diagnostic work-up for microscopic and macroscopic haematuria.
- Flexible cystoscopy can be performed without any anaesthesia.
- Procedures such as stent removal and urethral catheterization can be performed using flexible cystoscopic guidance.
- Urinary tract infection at the time of flexible cystoscopy is a relative contraindication.
- Use of hexaminolevulinate blue light cystoscopy can give false-positive results in patients with interstitial cystitis.