Operative Urology

JOHN BLANDY

SECOND EDITION

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Preface to second edition

In the five years since the first edition, I have been astonished to find that almost every sentence has had to be rewritten. New techniques have altered our entire attitude to surgery for stones in the kidney. The revolution in chemotherapy for cancer has entirely changed our approach to the management of cancer of the testicle and bladder. The aim of this second edition is still the same—to tell a trainee surgeon how to follow the steps of an operation and warn him what to watch out for afterwards. The introduction of endoscopic television has made it much easier for a young surgeon to learn endoscopic resection of the prostate and of bladder tumours, and the supremely difficult technique of percutaneous stone surgery is similarly made easier to learn thanks to these new teaching aids. Nevertheless, nothing matches experience in the operating room: it is still the kitchen of surgery, and the cookbook is always a pale echo of assisting and being assisted by the chef.

J.P.B.

Preface to first edition

When I was a registrar I often wished I had a book which would tell me how to do an operation, step by step, and then warn me what might go wrong afterwards. Since then there have been many changes in the style and content of urology, but it is still difficult to find a clear account of everyday operations in a form at once accessible and readable. Current journals are for obvious reasons mainly concerned with new developments and unusual problems, but just how to do quite straightforward operations is left to textbooks, and these do not seem to provide the kind of answers which are needed by the surgeon in training. Of course no cookery book ever made a chef, nor can any surgical text replace time spent in assisting and being assisted at surgical operations. Nevertheless a good recipe has value if it can help a cook avoid repeating the mistakes made by the inventor of a dish, and one of the principal aims of this book is to point out the stupid mistakes the writer has made in the past, and to warn my younger colleagues of the errors and pitfalls which experience has taught me, often at tragic cost. This book is a personal selection of surgical recipes which work in my hands: it is not intended to be a comprehensive encyclopaedia. Some operations are left out because I think better ways have been found to achieve the same ends: others are omitted because there is no indication for them nowadays. Some are rare (notably some of the paediatric procedures) that I cannot write of them with experience. Others are too new to be recommended—notably some of the new prostheses. I have left out house-surgeon's details of pre- and post-operative care, since these are common to all surgical operations and my readers will not need to be reminded of them. In their place I have tried as far as possible to put in those little dodges and tricks which time and experience have taught me can make all the difference between an operation which is easy (and therefore safe) and one which is difficult (and therefore dangerous). For the same reason I have tried to make my drawings as clear as possible—to give a surgeon's-eye view of the essentials, rather than a true-to-life image of the operative field: they are intended to be read like a map, not an artistic landscape. I have tried to provide my registrars with a modern version of the book I wished I could have had 25 years ago. In putting it together it has been a pleasure to work with the tolerant but enthusiastic team at Blackwell Scientific Publications, and I am again happy to acknowledge my debt to Messrs Per Saugman, John Robson and Peter Danckwerts for their never-failing courtesy and skill.

J.P.B.

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Chapter 1
Endoscopy

Today we take for granted that we can examine every part of the inside of the urethra and bladder with light so bright that it allows photography or television, and with lenses so sharp that the mucosae can be examined as if through a magnifying glass. Modern irrigating systems allow us to take a biopsy, crush a stone, catheterize a ureter, coagulate bleeding vessels, and cut out tumours. Flexible baskets allow stones to be removed from the ureter and, when introduced through a nephrostomy, allow the inside of the renal pelvis and calices to be examined. The flexible cystoscope bids fair to replace the rigid one, and the flexible ureteroscope already allows lesions in the ureter and renal pelvis to be seen. It was not always so, and what was visionary a mere five years ago has become commonplace today.

Urology is the oldest of all the disciplines of surgery since it began with the urethral bougie, and there is reason to suppose that gonorrhoea is as old as our species. From the bougie evolved the sound, with which until only a generation ago, stones were detected in the bladder by the unmistakable click of the instrument in the bladder. Skill with bougie and sound was for long the sure sign of the master urologist, and it is by no accident that even today the outgoing Senior Surgeon of St Peter's Hospital hands on to his successor a silver sound, the badge of his office.

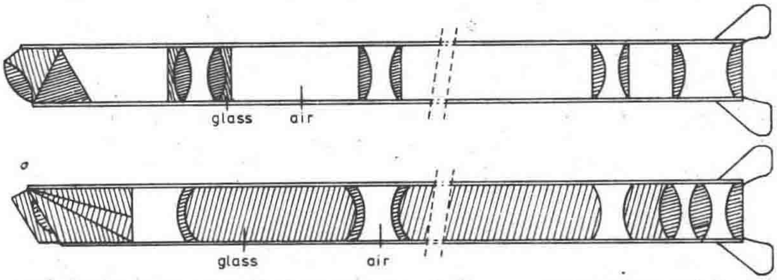
1.1. Direct viewing cystoscopy: from Grunfeld, 1881.

The sound was a clumsy method of diagnosing vesical pathology, and for conditions other than calculus, it was necessary to open the bladder via the urethra and feel round it with the finger—a procedure not to be repeated lightly. The demand for more accurate and more simple diagnosis required a means of looking at the inside of the bladder. First came a simple tube, like the auriscope, giving a limited glimpse of the opposite side of the wall of the bladder (1.1). Many direct-vision cystoscopes were constructed on this principle, and it is remarkable that despite the difficulties, our predecessors were able to catheterize ureters, and see and biopsy cancers. By 1886, von Dittel had added the incandescent Mignon lamp to Nitze's early cystoscope, and before long good irrigating systems, Albarran's deflecting lever, scissors, forceps and catheters were all added to the cystoscopic armamentarium (Blandy 1978).

After the turn of the century, the operating cystoscope changed little except in detail. My generation of surgical assistants were using instruments that Nitze would have recognized as being of his design, though perhaps a little more reliable. Then, in the early 1970s came three inventions that entirely altered the scope and character not only of cystoscopy, but of urology itself (Mitchell & Makepeace 1976).

All these inventions were due to the genius of Professor Harold Hopkins. First was the rod-lens cystoscope. Instead of mounting a row of glass lenses in a telescope tube, Hopkins used a series of glass rods and the air-spaces between them became the lenses. It was much easier to set the rods on a precise optical axis for grinding and blooming. This was a major step forward. A new order of precision was brought to the cystoscope. Ghost images and stray reflections were banished, thanks to multiple coating of the lenses. The surgeon for the first time could use in the bladder an instrument as fine and as precise as the microscope (1.2).

Hopkins' second invention was the fibre-light cable which permitted light of limitless brightness to be fed in at one end of a flexible



1.2. Above, diagram of conventional cystoscope telescope system; below, rod-lens system designed by Hopkins.

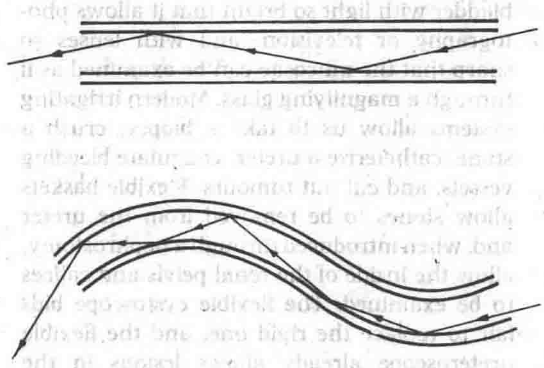
cable, emerging into the bladder at the other end of the cystoscope (1.3). The light was wonderfully bright: there was no Mignon lamp bulb to go out and need to be replaced just at the most critical moment of a transurethral resection (1.4).

To these two major leaps forward can be added a third – only recently adapted to urology – and again largely due to Hopkins. By using the same glass fibres, coated with glass of a different refractive index, winding them on a wheel so that when cut across at the same point on the circumference the fibres are aligned, it is possible to transmit optical images from one end of the flexible cable to the other. Today this invention has transfigured gastrointestinal and colorectal surgery. In urology we have been so content with our rigid endoscopes that we have been tardy in utilizing flexible endoscopes for the urethra, the bladder and the kidney; however, there has been a change in the last five years. Again we must acknowledge the immense debt that urology owes to its instrument-makers, and recognize that our duty to maintain contact with their advances is no less important than keeping up with advances in the recognized urological journals.

The urologist's kit

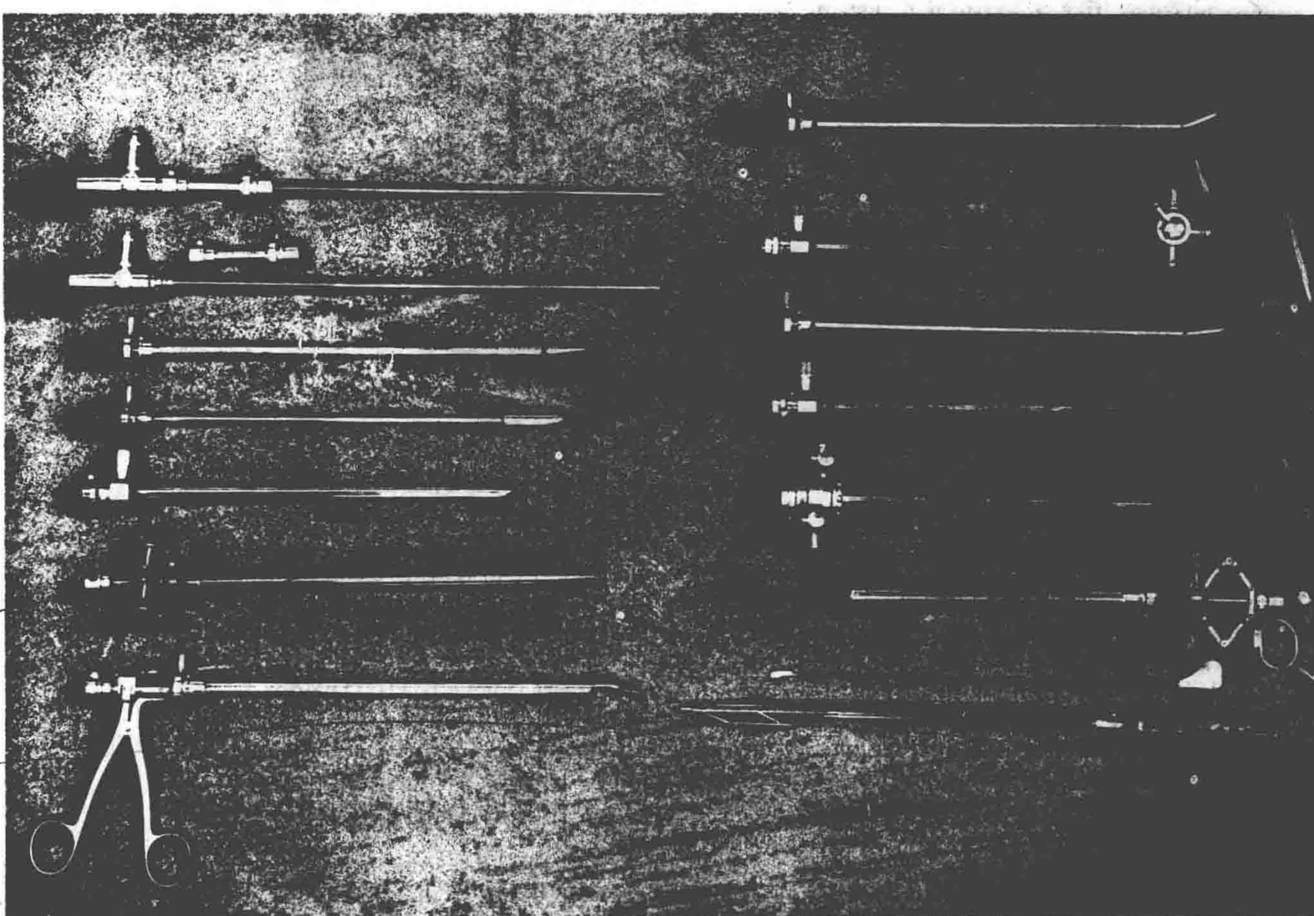
Today we must recognize two types of urological endoscopy. Classical urethrocystoscopy uses rigid instruments; it is always advisable to look well at the urethra *en route* to the bladder, and when inside the bladder, it is often necessary to take a biopsy, catheterize a ureter or do something else. A complete interchangeable kit of instruments is needed. Nothing is more irritating than to have to change the light and water attachments in order to use a biopsy forceps or a resectoscope (1.5).

For rigid endoscopy all manufacturers today provide interchangeable instruments, individual items fitting each other. The minimum equipment that is needed consists of a narrow tube through which the urethra can be examined with a forward-looking (0°) telescope, and the bladder inspected with a right-angled (70°) telescope. If a stricture is encountered *en route* to the bladder, it is convenient to be able to cut it with an optical urethrotome introduced through the same equipment. If a suspicious area is seen in the bladder, it must be biopsied with cup forceps. If one needs to pass a catheter into a ureteric orifice, a guide with a deflecting Albarran lever should be available. If a cancer is found in the bladder, it



1.3. Fibre-lighting: each glass fibre is coated with glass of different refractive index, ensuring total internal reflexion whether the fibres are aligned (above) as straight lines, or (below) in curves.

1.4. Modern light source for endoscopy (courtesy of Genito-urinary Manufacturing Co. Ltd.).



1.5. Modern interchangeable urologists 'kit': with a complete kit such as this almost any endoscopic operation can be performed without having to change light or water leads. (System designed for the author by the Genito-urinary Manufacturing Co. Ltd.)

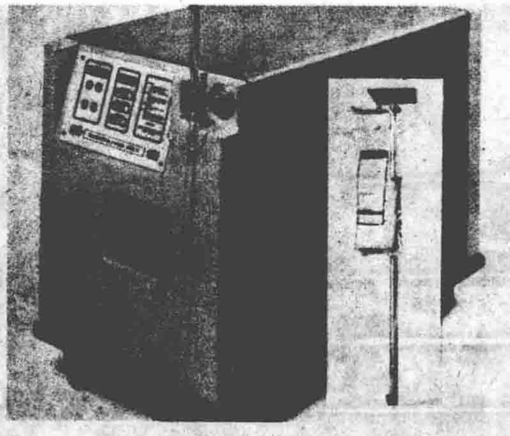
should only be a matter of seconds to replace the cystoscope sheath by a resectoscope and remove the tumour with the cutting loop.

Because of the need to have an interchangeable kit of instruments, an important consideration arises in purchasing equipment. Today none of us lives in a Utopia where the running costs of replacing and maintaining equipment do not concern a surgeon. In a unit where there are several urologists, it is of prime importance that they agree upon the kit that is chosen, and in doing this, should give consideration no less to the availability of service and repair than to the type of instrument itself.

It is equally important to give thought to the way in which urological equipment is to be sterilized. Modern endoscopic equipment is expensive, delicate, and complicated by screws and moving parts. Liquid sterilizing agents reach these parts with great difficulty. Heat is the only truly reliable sterilizing agent, but heat will ruin some plastic parts, and the repeated contraction and expansion of the sheath of a Hopkins rod lens system will ruin it after repeated sterilization by heat. Exposure to a water-bath at 70 °C will kill micro-organisms but not spores or hepatitis virus particles. Adding formaldehyde vapour to steam at this temperature, for example in a low-pressure autoclave with a formalin cycle, gives effective spore-sterilization but takes too long for it to be used between one case and another on a long list of endoscopies. Ethylene oxide gas is as good as formalin but in practice unreliable, and it requires strict quality control. Soaking instruments in glutaraldehyde solution remains our Hobson's choice, but need not be used for the majority of metal instruments which will perfectly well stand up to an autoclave.

Even more important than the sterilization of the instruments, is the sterilization of the large volumes of fluid that are needed in modern urological surgery. As soon as an incision is made in a prostate or a bladder tumour, some irrigating fluid will enter the bloodstream, so it must be sterile, free from pyrogens, and of the same pharmacological purity as any other fluid destined for intravenous injection. Unfortunately it is difficult and expensive to provide large volumes of fluid, and even when an autoclave is used, tragic examples have made hospital pharmacists wary of setting up a system for sterilizing intravenous fluids without very elaborate and expensive systems of quality control.

Today, systems that supply water from the town mains water supply are recognized to be unsafe for urological surgery. A tank is easily contaminated. A continuous filtration system with reversed osmosis to get rid of unwanted ions, and an inbuilt autoclave to sterilize the filtered water (1.6), has the potential advantage that it might be adapted to supply limitless volumes of sterile 2.0% glycine for endoscopic resection at negligible cost.



1.6. Rowater EP550 machine for supplying sterile water or glycine (courtesy of Rowater Medical Ltd.).

Flexible fibrescopes in urology

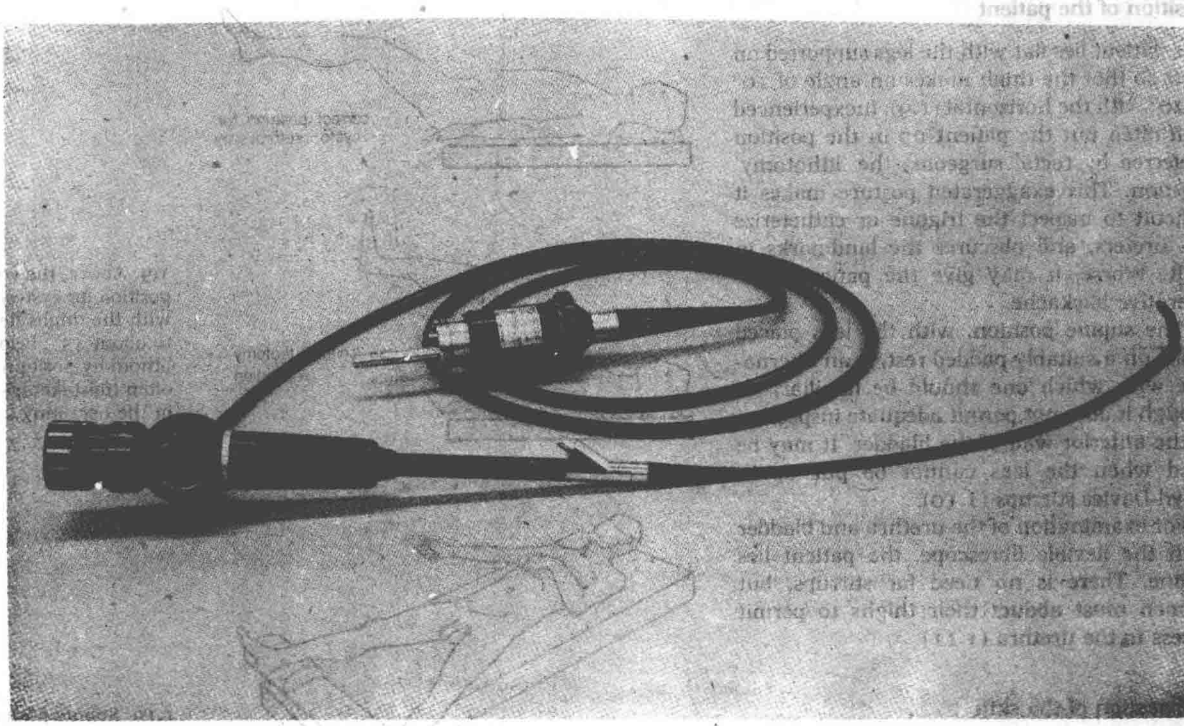
Fowler *et al.* (1984) have shown that the Olympus flexible endoscope designed for the purpose of examining the bile duct (the Olympus choledochoscope) can be used in routine check cystoscopy when it is necessary to examine the bladder at regular intervals after treatment for carcinoma. The instrument, which is 16 Ch, is easily and painlessly passed along the urethra, giving a clear view of the wall of the urethra *en route*. The flexibility of its terminal segment allows a view of the entire lining of the bladder. In more than a hundred endoscopies no mistakes of omission were made when flexible endoscopy was subsequently checked by conventional means (1.7).

At present the flexible cystourethroscope is in the course of being modified, and provided with biopsy and coagulation facilities. Potentially adaptable to the use of a Neodymium YAG laser, it could supplant the rigid endoscope for small recurrent bladder tumours both in follow-up and treatment.

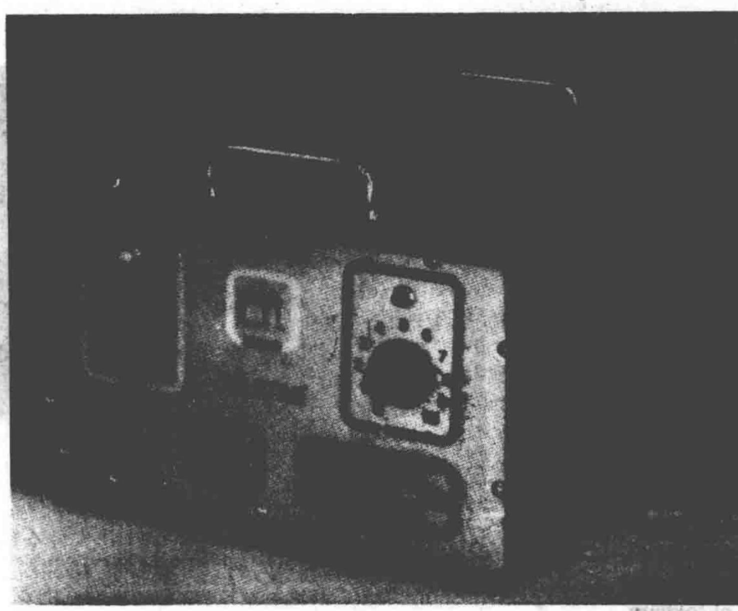
Diathermy

Although diathermy is one of the most commonly used and important instruments in modern surgery, and without diathermy there could be no endoscopic resection, few of us know much about it. It depends upon the simple fact that electricity passing through a conductor heats it. When the pathway for the current is very wide, the heating effect is negligible. When it is small—as under the loop of the resectoscope—one may obtain almost any desired heat from mild coagulation to an arc that severs tissues as by a knife, simply by increasing the current. If direct current is used, then of course the patient will jump each time the current is switched on or off, and an alternating current such as that obtained from the AC mains will give rise to repetitive contractions—the well known effect of Faradism—giving pain as well as sustained tetanic contraction. When the frequency of the alternating current is increased above 10 kHz (10 000 cycles per second) then there is neither pain nor muscle stimulation, and it now becomes possible to make use of the heating effects of a narrow electrode either to coagulate tissue or to cut it.

In the past, confusion arose from the notion that different wave forms produced different physical effects on the tissues. It was believed that one wave form gave cutting, and another gave coagulation. In fact, the different effects were a function of the intensity of the current, though it is true (but to a more limited extent) that the configuration of the wave form does matter in obtaining good cutting and clean coagulation. With modern diathermy machines (1.8) one may choose the wave form and voltage at will. It is more important to realize that when one is cutting under water, a very large current is passed through the tissues. Accidental contact with a small metal contact may allow current to flow to earth through a small area, and cause unwanted and dangerous heating at that contact. In urology there is a specially high risk of accidental burns. The surgeon must always be conscious of this danger: he must ensure that there is always a good *large* earth contact (so that there is hardly any significant rise in temperature under it). As more and more sophisticated monitoring equipment is used during an operation, the surgeon must always be aware of the special dangers that may arise if current finds its way back to earth, via ECG electrodes for example.



1.7. Olympus flexible choledochoscope adapted for use as a flexible urethro-cystoscope (courtesy of Olympus Pty and C.G. Fowler).



1.8. Modern solid-state diathermy machine (courtesy of the Genitourinary Manufacturing Co. Ltd.).

Preparation for endoscopy

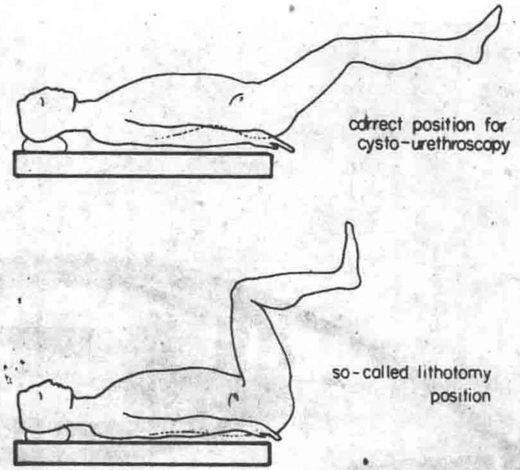
For cystoscopy under local anaesthetic using a rigid endoscope no special precautions are needed. It is more comfortable for the patient if the bladder is not emptied before the examination. With a general anaesthetic the usual precautions are observed and food and drink avoided for six hours beforehand. A suitable premedication is given. There is no need to shave the pubes before endoscopy or transurethral resection.

Position of the patient

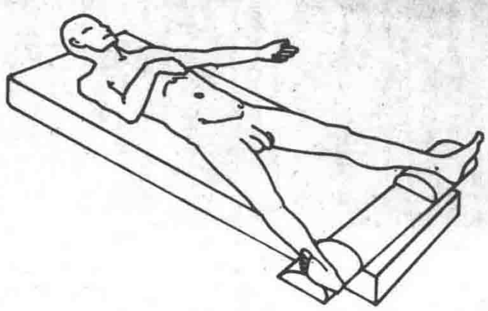
The patient lies flat with the legs supported on rests so that the thigh makes an angle of 10° to 20° with the horizontal (1.9). Inexperienced staff often put the patient up in the position preferred by rectal surgeons—the 'lithotomy' position. This exaggerated posture makes it difficult to inspect the trigone or catheterize the ureters, and obscures the landmarks in TUR. Worse, it may give the patient post-operative backache.

The supine position, with the legs placed apart on a suitably padded rest, is an alternative with which one should be familiar, although it does not permit adequate inspection of the anterior wall of the bladder. It may be used when the legs cannot be put up in Lloyd-Davies stirrups (1.10).

For examination of the urethra and bladder with the flexible fibrescope, the patient lies supine. There is no need for stirrups, but women must abduct their thighs to permit access to the urethra (1.11).



1.9. Above, the correct position for cystoscopy, with the thighs flexed to about 45°; below, lithotomy position often (mistakenly) used in the operating theatre.



1.10. Supine position with legs apart, supported on padded board.

Preparation of the skin

One may use betadine or chlorhexidine solution to prepare the skin, using swabs held in forceps in the usual way.

Rigid endoscopy in the male

Preparation of the urethra

The urethra must be lubricated before any instrument is passed and an antiseptic such as 0.25% chlorhexidine is added to prevent infection. Commercial sterile preparations are available containing chlorhexidine and lubricant, usually with 1% lignocaine, which is a satisfactory local anaesthetic for passing rigid or flexible instruments. The gel is applied from a tube or concertina bottle with a sterilized nozzle (1.12). After putting the gel into the urethra of a male, a soft penile clamp is applied transversely just behind the glans to keep it in the urethra for a full four minutes (1.13). Never use any force in injecting the local anaesthetic, and never use lignocaine solution stronger than 1% for fear of toxicity.

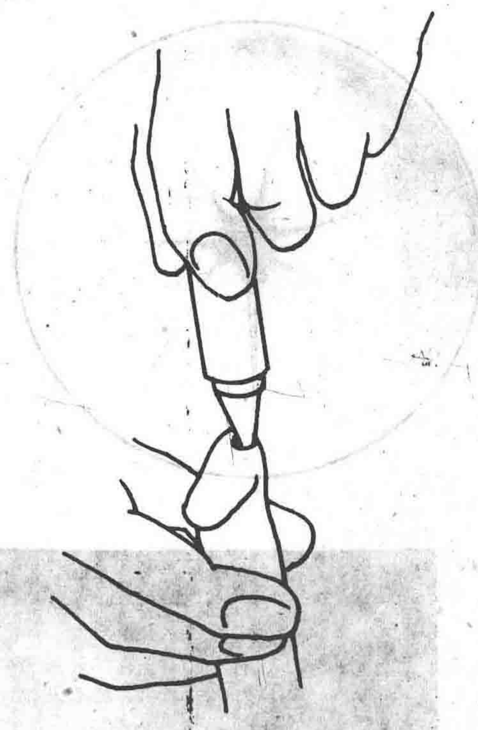
1.11. The fibre optic cystourethroscope is easily inserted into the urethra under local anaesthesia, and passed into the bladder. There is noticeably less discomfort for the patient than when using the rigid conventional instrument (courtesy of Mr C.G. Fowler and Olympus Pty).

Urethroscopy

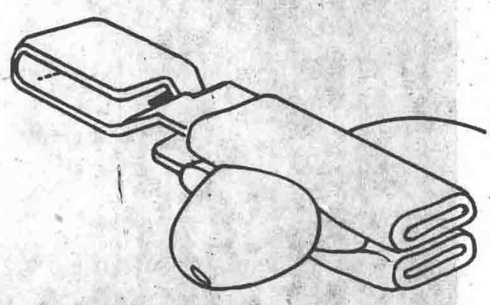
Nowadays, urethroscopy always precedes passage of the cystoscope; blind passage of the cystoscope without examining the urethra has been given up.

The narrow (17 Ch) sheath and 0° telescope are placed inside the meatus and gently advanced down the urethra under direct vision as the water flows to allow clear vision. The curve of the urethra is followed, as in sigmoidoscopy or oesophagoscopy: force is never needed (1.14).

The previous instillation of lubricant and chlorhexidine causes some dilatation of the submucosal vessels of the normal anterior urethra. The openings of the urethral glands can be seen, sometimes more prominent as one approaches the bulb (1.15). The bulbar urethra becomes wider and shows helical submucosal rings like the barrel of a rifle. Follow the roof of the urethra, and swing the urethroscope down gently until the external sphincter is seen. This looks rather like the anus, occluding the lumen, but it easily dilates before the advancing endoscope. If the patient is being examined under local anaesthesia and is frightened, it may be difficult to relax the

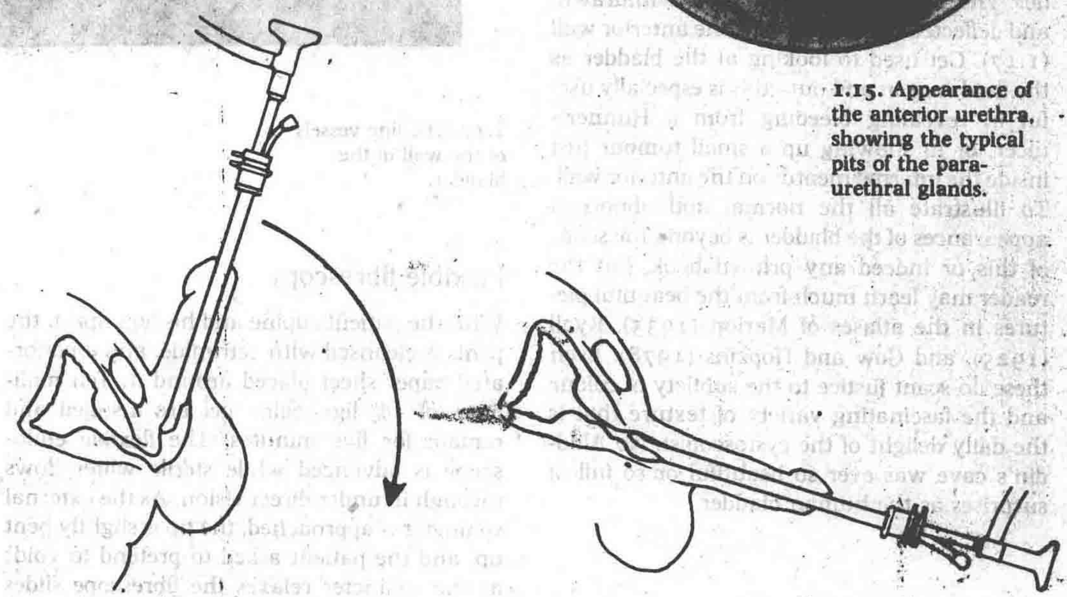


1.12. Before passing any instrument the urethra is filled with lignocaine-chlorhexidine gel to lubricate and sterilize it.



1.13. A penile clamp is applied transversely to retain the lubricating gel.

1.15. Appearance of the anterior urethra, showing the typical pits of the para-urethral glands.



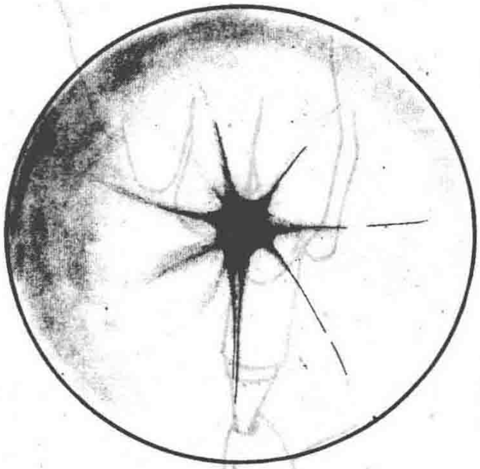
1.14. In introducing the urethroscope or cystoscope under direct vision, follow the curve of the urethra, swinging the instrument downwards round the bulbar urethra.

sphincter. Ask the patient to breathe in and out deeply, or pretend to urinate—this may allow the sphincter to relax and permit the instrument to slip into the prostatic urethra (1.16).

The normal prostatic urethra is usually red and granular, with exuberant frills on either side of the crest of the verumontanum. Often, little black flecks can be seen on the floor of the prostatic urethra in the vicinity of the verumontanum. Biopsy shows that these are innocent collections of lymphocytes and cystitis cystica.

The salient feature of the prostatic urethra is the verumontanum, distinguished by its central pit—the utriculus masculinus—vestige of the confluence of the Müllerian ducts. Opening on either side of the utriculus are the orifices of the ejaculatory ducts. Above the verumontanum rises the neck of the bladder and, in older men, the middle lobe of the prostate. Be very cautious when interpreting the appearance of the bladder neck. There is a very wide range of normality and appearance alone is never sufficient to diagnose obstruction.

Once past the bladder neck, the endoscope enters the bladder. The 0° telescope shows the trigone and ureteric orifices, and to study the rest of the interior of the bladder this telescope is exchanged for one with a 70°, that is nearly right-angle, view.



1.16. The external sphincter is easily recognized by its star-shaped appearance and its characteristic feel.

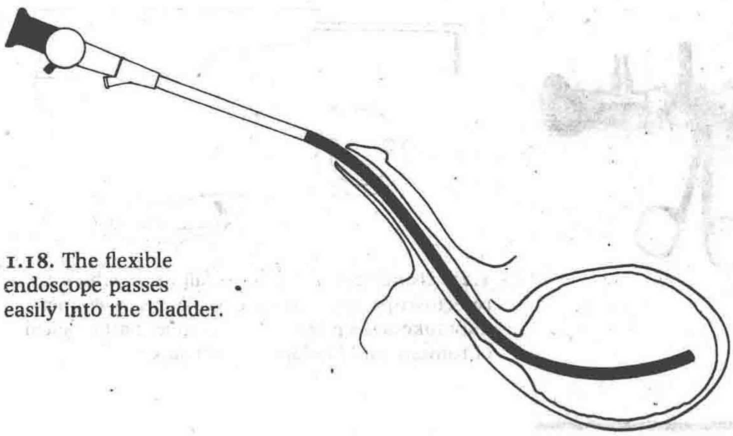
1.17. The fine vessels of the wall of the bladder.

Cystoscopy

At cystoscopy it is possible and necessary to examine every part of the interior of the bladder. The 70° telescope is rotated, withdrawn, and deflected in order to view the anterior wall (1.17). Get used to looking at the bladder as the fluid runs in and out—this is especially useful in revealing bleeding from a Hunner's ulcer, or in showing up a small tumour just inside the internal meatus on the anterior wall. To illustrate all the normal and abnormal appearances of the bladder is beyond the scope of this or indeed any printed book, but the reader may learn much from the beautiful pictures in the atlases of Marion (1935), Ryall (1925), and Gow and Hopkins (1978). Even these do scant justice to the subtlety of colour and the fascinating variety of texture that is the daily delight of the cystoscopist. No Aladdin's cave was ever so beautiful or so full of surprises as the human bladder.

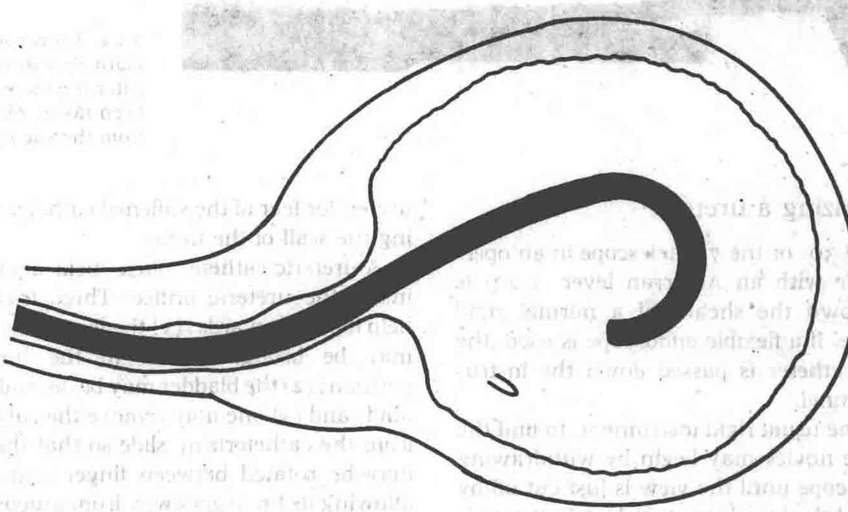
Flexible fibrescopy

With the patient supine and his legs apart, the penis is cleansed with cetrimide, and a perforated paper sheet placed around it. Ten millilitres of 1% lignocaine gel are instilled and remain for five minutes. The flexible endoscope is advanced while sterile water flows through it, under direct vision. As the external sphincter is approached, the tip is slightly bent up, and the patient asked to pretend to void; as the sphincter relaxes the fibrescope slides



1.18. The flexible endoscope passes easily into the bladder.

into the prostatic urethra, which can be fully inspected with the flexible tip before advancing it over the middle lobe into the bladder. There the bladder is systematically inspected (1.18) and at the end, by curving the tip fully upon itself, a remarkable retrograde view of the bladder neck—or prostatic cavity—may be obtained (1.19). The operating channel of the instrument is big enough to allow passage of a biopsy forceps, ureteric catheter or diathermy electrode.



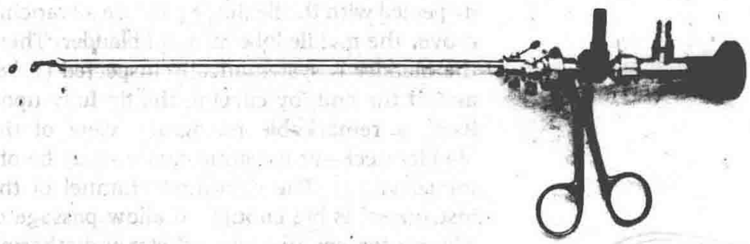
1.19. By manœuvring the flexible tip of the endoscope a unique retrograde view of the internal meatus, or the resected prostatic cavity, may be obtained.

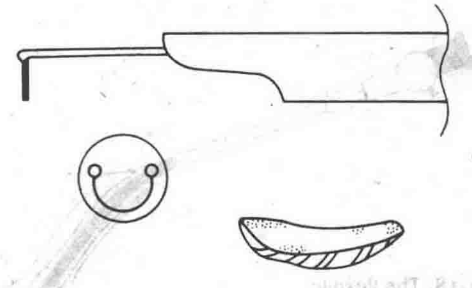
1.20. Cystoscopic cup forceps.

Biopsy

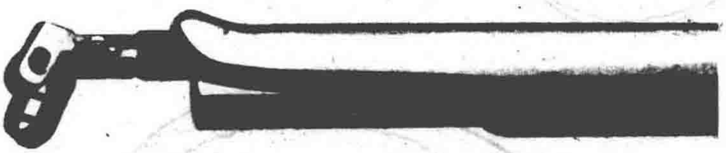
Whether a rigid or a flexible endoscope is used, it is often necessary to take a biopsy, and indeed one should make it a rule always to biopsy any feature that is not easily recognized. Cup forceps make it easy and safe to take a small piece of mucosa and underlying muscle for histological examination. The more the forceps is pushed into the wall of the bladder, the deeper it will bite (1.20). The forceps is plunged straight into formalin for immediate fixation. If the site of the biopsy bleeds, touch it with a diathermy electrode. Rigid biopsy forceps are available which allow diathermy at the same time, without deforming the tissue in the forceps (1.21).

In most solid bladder tumours it is necessary to take tissue from deeper in the wall of the bladder than cup forceps allow; in such cases one uses the resectoscope loop (1.22).





1.22. Using the resectoscope loop one may take a deep bite of tumour and bladder wall upon which to make an assessment as to its pathological (P) stage.



1.21. Tauber insulated diathermy forceps. After the biopsy has been taken, bleeding from the site can be sealed with diathermy without damage to the specimen (courtesy of Messrs Richard Wolf, UK Ltd.).

Catheterizing a ureter

Either the 30° or the 70° telescope in an operating slide with an Albarran lever (1.23) is passed down the sheath of a normal rigid endoscope. If a flexible endoscope is used, the ureteric catheter is passed down the instrument channel.

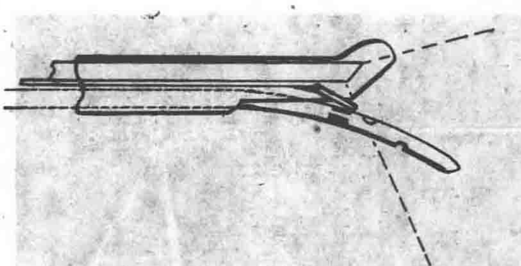
With the usual rigid instrument, to find the ureter the novice may begin by withdrawing the endoscope until the view is just cut off by the neck of the bladder at 6 o'clock in the midline posteriorly. Rotate the cystoscope through 45° and advance it for 2 cm. This will reveal (usually) one or other ureteric orifice. Its companion is found by rotating the telescope through a right angle, or by following the whitish streak that marks the hypoteneuse of the trigone (1.24).

Chromocystoscopy

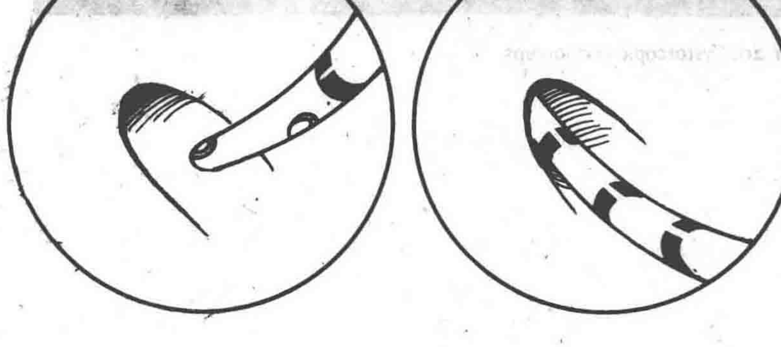
If 4 ml of indigocarmine are given intravenously, after four minutes a puff of inky blue dye emerges from the ureteric orifices. This can be useful in revealing the site of a ureter that has been obscured by oedema or inflammation.

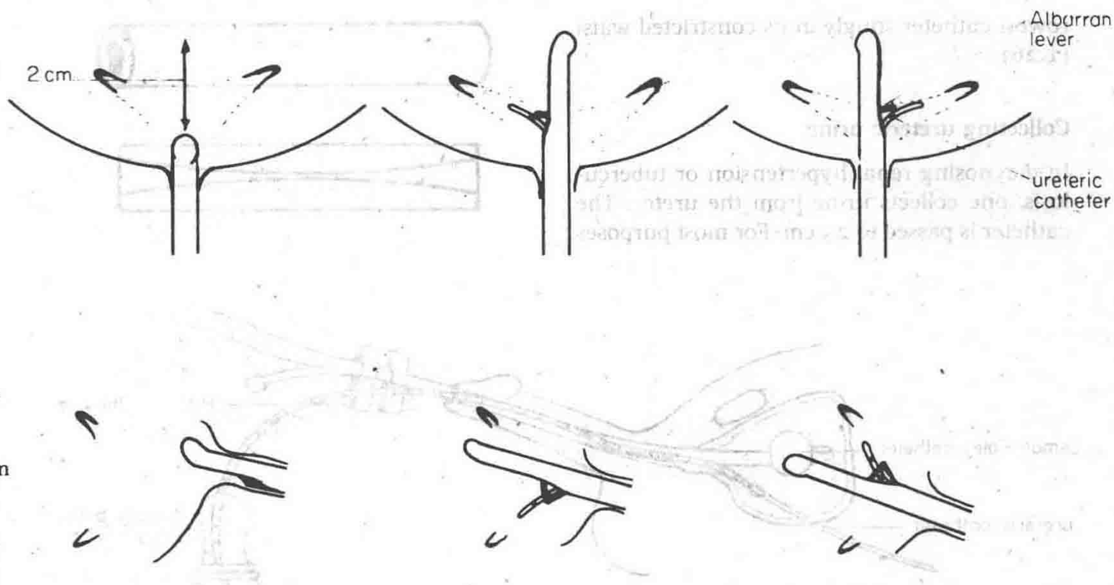
Having found the ureter, a catheter may be advanced up the cystoscope until its tip emerges in the field of view. Bending it down with the Albarran lever, the tip of the catheter is placed gently in the ureteric orifice and advanced as far as necessary towards the kidney. The wire stylet is useful to stop the catheter jamming in the cystoscope, but it must be withdrawn as soon as the catheter enters the ureter, for fear of the stiffened catheter lacerating the wall of the ureter.

A ureteric catheter often sticks about 1 cm inside the ureteric orifice. Three tricks may help it pass onwards: (1) the legs of the patient may be brought down to the horizontal position; (2) the bladder may be distended with fluid; and (3) one may remove the rubber teat from the catheterizing slide so that the ureter may be rotated between finger and thumb, allowing its tip to get away from mucosal folds



1.23. Using the catheterizing slide on the cystoscope with its Albarran lever, the ureteric catheter can be moved up and down, facilitating its introduction and passage up the ureter.





1.24. Finding the ureteric orifices. Above, the cystoscope is advanced 2 cm inwards from the bladder neck, and then rotated through 45 first on one side and then on the other.

in the ureteric wall and slip upwards towards the kidney.

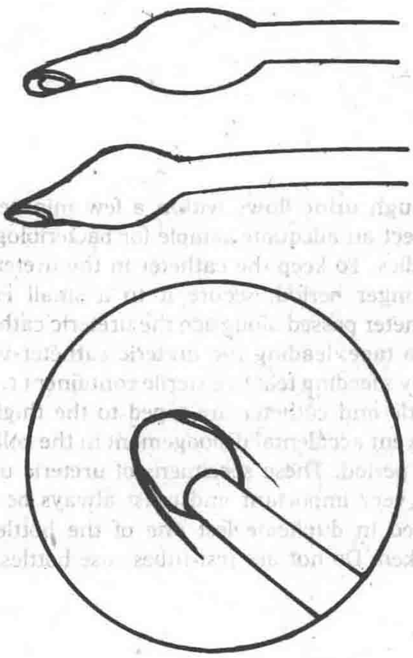
Centimetre marks on ureteric catheters mark how far it has entered the ureteric orifice: at 25 cm, five broad lines tell you that it has reached the kidney.

Ureterography

Today it is only necessary to pass a catheter right up to the kidney if facilities are not available for image intensification. A bulb-ended (Chevassu) catheter is usually gently lodged in the ureteric orifice (1.25), contrast injected, and the column of dye watched on the image-intensifier screen. Without this modern apparatus, a fair second-best image may be obtained by still X-ray photography if 10 to 15 ml of contrast is injected as the catheter is withdrawn.

Retrograde urography

Even less often should one need to perform classical retrograde urography, when facilities for good high-dose conventional urography are available. Nevertheless occasions still arise when it is necessary to pass a catheter right up into the renal pelvis. A film is taken when 2 ml of the contrast medium has been injected, as the patient's respiration is interrupted. If the anaesthetist does not know how to effect this interruption, ask him to over-ventilate the patient for five or six breaths; the resulting apnoea affords ample time to take an X-ray and muscle relaxants are unnecessary. Take another film after injecting another 3 ml. See both X-rays before removing the catheter. If you need to display the ureter as well, inject another 10 ml of contrast medium while withdrawing the catheter, and expose a third X-ray film when the catheter is removed. The inconvenience of finding a needle and adapter to fit the ureteric catheter is solved by the Thomson-Walker waisted rubber adapter which fits a Luer-Lok syringe, and jams all but the nar-



1.25. (a) Braasch- and (b) Chevassu-type bulb-ended ureteric catheters for obtaining a ureterogram. The bulb is gently jammed into the ureteric orifice (c).