

Current Practice

Catheterization

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Catheters have been in use for more than five thousand years and are still essential in many diagnostic and therapeutic procedures. Every time a catheter is passed along the urethra it may convey infection into the urinary tract. If this is healthy, infection is virtually impossible to establish,¹ but when there is outlet obstruction,² diabetes,³ anaemia,⁴ or complicated pregnancy,⁵ infection easily follows catheterization. At worst there may be Gram-negative bacteraemia or endocarditis. Not uncommonly there may be protracted urinary infection and pyelonephritis.⁶ While many patients seem to throw off such catheter-induced infections once obstruction to the urinary tract has been overcome, there is little doubt that a proportion remain with permanent damage.^{5 7-10} The indication for catheterization must be balanced in every case against this risk. The mere collection of clean urine for bacteriological investigation is no longer a sufficient reason to pass a catheter in a woman: properly taken, the mid-stream or clean-catch specimen gives equally useful information, thanks to the development of accurate bacteriological techniques.^{11 12}

Preparation

Catheterization should be undertaken with as much care as a lumbar puncture. It is not a task to be carried out single-handed with inadequate light. Strict aseptic precautions must be observed: for this reason the ritual wearing of a surgical mask is as valuable as it is in the operating theatre.^{13 14}

The surgeon or nurse should wear sterile gloves. While it may be possible to introduce a catheter by means of two pairs of sterile forceps without touching skin, as soon as any difficulty is encountered there is an almost overwhelming temptation to handle the catheter. Wearing gloves has the additional important advantage that staff are less likely to spread infection on their hands from one patient to another.

The catheter itself must be adequately sterilized. As it is virtually impossible to clean dried organic matter from the lumen of a catheter it is not desirable to use catheters twice. Rigorous cleansing of such a catheter must be followed by sterilization in an autoclave or by boiling. Chemical antiseptics or the vapour of formaldehyde are not safe. Gum-elastic catheters and formalin cabinets belong in the museum. Cheap disposable plastic and latex catheters sold in sterilized packs are ideal for most purposes and are available in a complete range of shapes and sizes.

Choice of Catheter

Which catheter to use must be governed by the purpose for which the catheter is being inserted. If no difficulty is anticipated in passing the catheter, and if the catheter is to be withdrawn once the bladder has been emptied, a simple Jacques catheter of suitable calibre with a rounded tip should be used.

If difficulty is encountered in a male with prostatic obstruction a rubber Tiemann catheter with a curved soft beak is very useful; the plastic versions are sometimes too stiff to be used with safety. Coudé catheters are available in plastic, but for

such a case a Foley catheter passed on a curved introducer will generally be more useful.

If a catheter is to be left indwelling, Gibbon's catheter¹⁵ has many advantages. Urethral mucus readily finds a way out alongside the narrow plastic tube, whose lumen is as big as that of a latex catheter much wider in external diameter. Disturbed or ambulant patients tend to dislodge these catheters, and for them it is often more useful to insert a Foley catheter. Only latex ones should be used unless the urine is likely to contain clots. In this case the more rigid plastic catheter with a Foley-type balloon should be used, as it allows clots to be aspirated.

Sometimes the Foley balloon will not deflate when the time comes to remove the catheter. A narrow ureteric catheter with its stilette should be passed along the lumen of the side channel to draw off the water in the balloon. It is dangerous and ineffective to attempt to burst modern latex balloons by over-distending them with water.

Other methods of fixing a catheter in the male are less satisfactory. Frenal sutures, catheter tape, or adhesive strapping all lead to the accumulation of drying muco-pus at the meatus. Catheters inserted at operations on bladder or prostate are best secured with the Harris suture, fixed to a button or bar suprapubically.

Antiseptic Precautions

The skin of the glans penis or the vulva should be cleaned. It is open to question whether any useful purpose is served by applying antiseptics. There is no instant "flash-kill" skin antiseptic; alcoholic solutions of iodine or chlorhexidine, which come near this category, are too painful to use in the unanaesthetized patient. Cetrimide has often been found to harbour *Pseudomonas pyocyanea*. Aqueous chlorhexidine is probably as good a compromise as any.

Cleaning the anterior urethra is of more importance. It contains organisms in both men and women. Gillespie *et al.*¹⁶ have shown the practical value of instilling chlorhexidine gel into the anterior urethra before passing a catheter. Since to-day most surgeons would regard it as barbarous to pass a catheter up an unanaesthetized male urethra, it is convenient to combine anaesthetic and antiseptic in one gel. With 1% lignocaine and 0.1% chlorhexidine now available in sterile tubes it is easy to lubricate, anaesthetize, and virtually sterilize the anterior urethra. Women also find catheterization significantly more comfortable after this instillation.

The catheter should then be taken in the gloved hands and introduced through the lubricated, anaesthetized urethra without touching skin on the way. In many women some extra assistance to hold apart the labia is necessary. A good light is essential.

There is little evidence that administration of antibiotics to prevent catheter-induced infection is of any use,^{17 18} and it may even be detrimental¹⁹ by promoting colonization of the

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urinary tract with resistant organisms. Antibiotics are no cover for slipshod aseptic technique.

Indwelling Catheter

In women an indwelling catheter tends to ride up and down in the urethra, carrying vulval organisms into the bladder with each movement. Gillespie *et al.*¹⁰ suggest that a plastic-foam collar soaked in chlorhexidine obstetric cream should be placed around the stem of the Foley catheter, fitting snugly enough to prevent its to-and-fro movement, and providing a barrier against the entry of vulval organisms.

In men there is less obvious need to keep the meatus moistened with antiseptic. If modern self-retaining catheters are used it is only necessary to clean the meatus from time to time with a little chlorhexidine solution to get rid of the crust of mucus which dries there.

Of much more importance than the entry of organisms alongside the catheter in the film of urethral mucus is the wholesale transport of organisms into the bladder up an indwelling catheter. Organisms may either swim upstream against the current of urine in the catheter²⁰ or they may be floated up in bubbles.¹⁰ Catheters left open into a bottle in the bed, or spigoted and released at intervals, give rise to infection in virtually every patient.²¹⁻²³ If the urine is led from the catheter by plastic tube to a plastic urinal the position is no better: infection is just as frequent.²⁴ The urine must be collected in a bottle containing some antiseptic sufficiently powerful to stop organisms breeding in urine at room temperature (e.g., 100 ml. of 40% formaldehyde). The system must be a closed one, and a simple large flask with a bung containing two tubes, one for the catheter-tube, the other, protected by cotton-wool, allowing egress of air, is all that is necessary (see Fig.). Plastic bags which do not contain antiseptic are soon teeming with organisms, and when they are used for continuous catheter drainage infection rates have been found to be as high as with open drainage into a bucket beside the bed.²⁴ If an antiseptic is put into a plastic bag there is a danger that it may accidentally run back into the bladder. A new type of bag, with a non-return valve to prevent this danger, is currently undergoing trial, and appears promising, but for the time being for routine use a large glass bottle which can be regularly cleaned and autoclaved should be employed. Whenever the bottle is changed, strict aseptic pre-

cautions are essential. Any break in the continuity of tubing from catheter to bottle is potentially dangerous and should be avoided whenever possible.

It has been shown repeatedly that for practical purposes all catheter-induced infections in hospital are cross-infections. Introduction of closed methods of collecting urine, together with adequate antiseptic preparation of the urethra and effective sterilization of catheters, reduces the rate of infection and controls outbreaks in the ward.^{21 25 26}

Certain modifications of strict closed drainage techniques may be called for, particularly after operations on the bladder or prostate. If irrigation is necessary to prevent blockage of the tube by clot, it should be done by inserting a Y connexion, one limb going to the bottle of sterile irrigating fluid, the other to the closed-drainage bottle. By adjusting two clamps irrigating fluid is run into and out of the bladder.

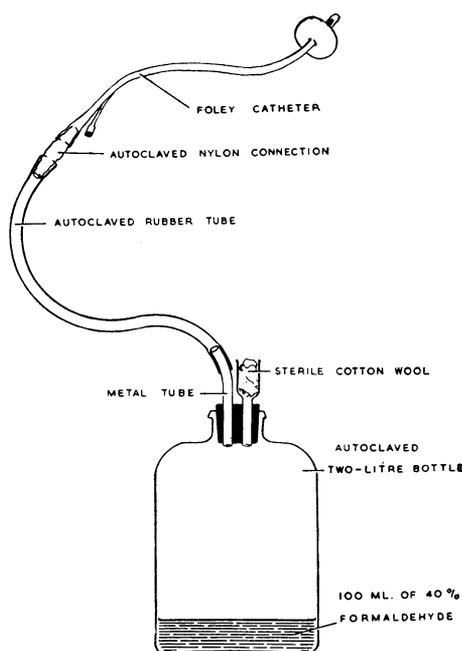
If at any time the closed drainage system has to be "broken," or if by accident a connector comes away from the rubber tube, infection is very likely to follow. Roberts *et al.*,²⁴ following Paterson *et al.*,²⁷ recommend that 60 ml. of 1:5,000 aqueous chlorhexidine should be instilled into the bladder and retained there for at least five minutes before a new sterile closed drainage system is set up.

There is no general agreement about the best method of getting clots out of the bladder: for most purposes "milking" the rubber drainage tube will keep the urine running. If this fails (and it may be impossible if P.V.C. tube is used rather than rubber) the bladder may have to be irrigated with a sterile syringe and saline. The standard bladder syringe is easily contaminated on the barrel unless handled with sterile gloves—a Dakin's syringe is free from this danger.

By using careful aseptic and antiseptic methods it has been shown that catheters may be passed and left indwelling even in those cases which are specially susceptible to infection. But catheterization should not be delegated to inexperienced staff; every breach of aseptic technique should be regarded seriously; and every catheter-induced infection should be noted and regarded for what it is, a reproach no less shameful than a wound infection after operation.

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Closed drainage for indwelling catheters.