ABC of Spinal Cord Injury

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UROLOGICAL MANAGEMENT

Aims of bladder management

Preservation of renal function

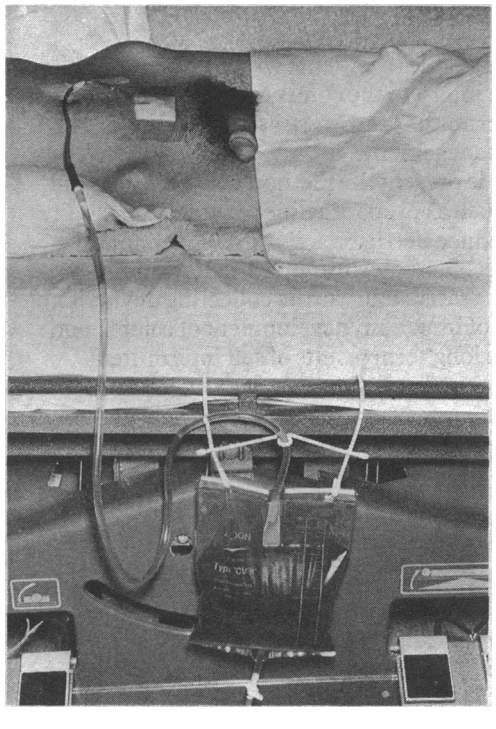
Continence

In 1917 Thomson-Walker stated that almost half of all patients with spinal cord injury died of urinary sepsis within two months, and the total death rate from urinary sepsis was 80%. Despite vastly improved management, urinary tract complications are still the major cause of morbidity and mortality. In recent years clinicians have put more emphasis on achieving continence if at all possible, but the main aim remains the preservation of renal function.

Early management

Intermittent urethral catheterisation

- Strictly aseptic technique
- Catheterise 6 hourly initially (12 FG or 14 FG Nelaton catheter)
- Restrict fluids until voiding occurs
- Treat significant urinary tract infection



Intermittent urethral catheterisation

Once the patient is in a spinal injuries unit the standard method of bladder drainage in the first few weeks is by intermittent urethral catheterisation with a 12 FG or 14 FG Nelaton catheter, using a strictly aseptic technique. This is normally undertaken by a trained nursing team. The fluid intake should be restricted to 1500 ml/24 h until the patient starts voiding. Catheterisation should be repeated regularly, usually every six hours at first, to prevent overdistention of the bladder. The aim is to have a volume of less than 500 ml at each catheterisation.

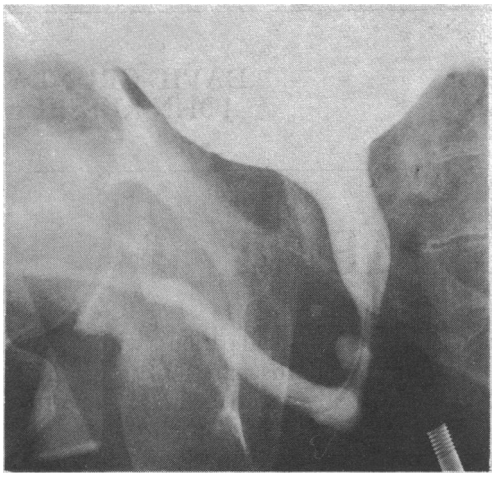
The urine is cultured weekly and at other times if indicated; infection producing systemic effects or the presence of $>10^5$ organisms/ml or >50 white blood cells/high power field is treated with the appropriate antibacterial drug. It is particularly important to eradicate infection with *Proteus sp*, a urea splitting organism, as it is associated with the highest incidence of calculi; these calculi, composed of calcium phosphate and magnesium ammonium phosphate, readily form in infected alkaline urine.

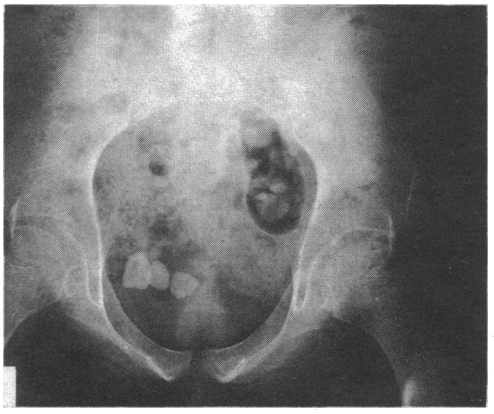
After the period of spinal shock, involuntary reflex detrusor activity (detrusor hyperreflexia) is seen in most patients with a suprasacral cord lesion. In patients who may later be able to manage their bladders by self intermittent catheterisation (see below) catheterisation is performed every six hours but no attempt is made to empty the bladder beforehand. In other patients the suprapubic area is tapped for about 10 to 20 seconds in an attempt to induce a detrusor contraction; this is immediately followed by suprapubic abdominal compression to empty the bladder tapping and expressing.

When the patient begins to void he wears a condom attached to a urinary drainage bag but still continues intermittent catheterisation. The fluid intake is increased, and as the volume of residual urine at each catheterisation falls the frequency of catheterisation is reduced. When the daily residual urine is below 80 ml on three consecutive occasions catheterisation can be discontinued. At this stage, usually about 6 to 12 weeks after injury, bladder training is completed—that is, effective emptying of the bladder has been achieved. The patient continues to wear a condom attached to a urinary drainage bag and is instructed to continue to tap and express the bladder every 2 to 3 hours throughout the day. If poor bladder emptying is suspected later measurement of residual urine by abdominal ultrasound is a useful procedure.

Suprapubic catheterisation

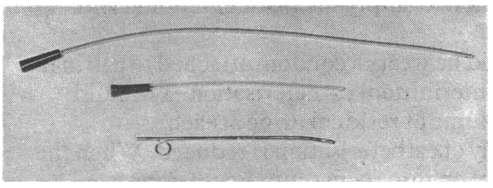
Suprapubic catheterisation using a 10 FG or 15 FG catheter is increasingly used as a method of bladder drainage in the first few weeks after

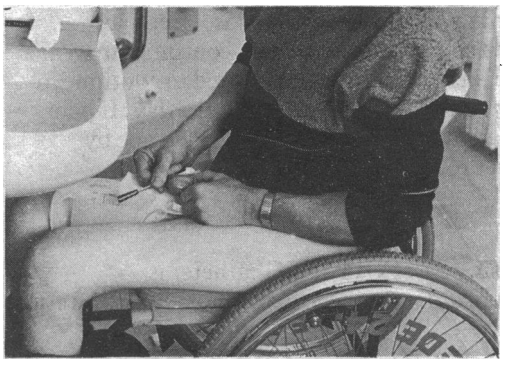




Optimum requirements for self intermittent catheterisation

- Absent or minimal detrusor activity
- High bladder capacity
- Adequate bladder outlet resistance
- Sufficient manual dexterity
- Pain free catheterisation
- Patient motivation





spinal cord injury. It avoids urethral instrumentation, with its risks of periurethral abscess, urethral diverticulum, and fistula formation, and allows a high fluid intake of at least 3 litres every 24 hours. The catheter is clamped at regular intervals to assist in bladder training. However, its use is not entirely trouble free, and the catheter can block with calcareous deposits.

Indwelling urethral catheterisation

If the urine is already infected when the patient is admitted to the spinal injuries unit it is preferable to continue with an indwelling urethral catheter until the urine is cleared of infection and debris, when intermittent urethral catheterisation can be started. If the patient has been transferred after two to three weeks it is wiser to continue with an indwelling catheter until six weeks after injury.

A 12 FG or 14 FG Foley catheter with a 5 ml balloon should be used. A latex catheter should be changed weekly, but a silicone catheter, which is preferable, may be retained for up to six weeks, at which stage bladder training is usually started. Long term urethral catheterisation is the method of choice in many women with tetraplegia and older patients. As patients with indwelling urethral catheters are prone to develop bladder calculi, a weekly or twice weekly bladder washout with Suby-G solution is recommended. Repeated episodes of blocked catheter should be investigated by cystoscopy and treated by litholopaxy if calculi are present.

Self intermittent catheterisation

Self intermittent catheterisation can start as soon as the patient begins to sit up, intermittent catheters having been passed by nurses up to that time. The patient catheterises himself or herself with the aim of remaining continent between catheterisations and therefore avoiding the need to wear a urinary drainage apparatus. A 12 FG or 14 FG Nelaton catheter or, in some women, a silver catheter, is used. It may be possible to decide at an early stage after injury that self intermittent catheterisation is likely to be the method of choice for long term bladder management, and in these patients fluid restriction may not be appropriate. Indeed, ideally a large capacity bladder is useful so that the number of catheterisations can be kept to a minimum, usually four to five in 24 hours.

The method is particularly applicable to patients with a non-contractile detrusor, usually associated with injury to the conus medullaris or cauda equina. In these patients self intermittent catheterisation is the most satisfactory method of bladder management.

Even if reflex detrusor activity is present the method may be successful, although anticholinergic drugs such as propantheline, oxybutynin, and imipramine may be needed to reduce detrusor activity; imipramine also increases bladder outlet resistance. Self intermittent catheterisation is especially suitable for women, as a satisfactory urine collecting device is not available. As far as the incidence of infection, development of calculi, and renal function are concerned, the long term results of self intermittent catheterisation are excellent and compare favourably with those of other methods of bladder management.

Investigations

Regular measurement of the blood urea or serum creatinine concentrations, urine culture, and estimation of residual urine, using abdominal ultrasound when appropriate, are performed. Intravenous urography is also essential, and videourodynamics should be performed if facilities are available.

Investigations

Blood urea/serum creatinine

Urine culture

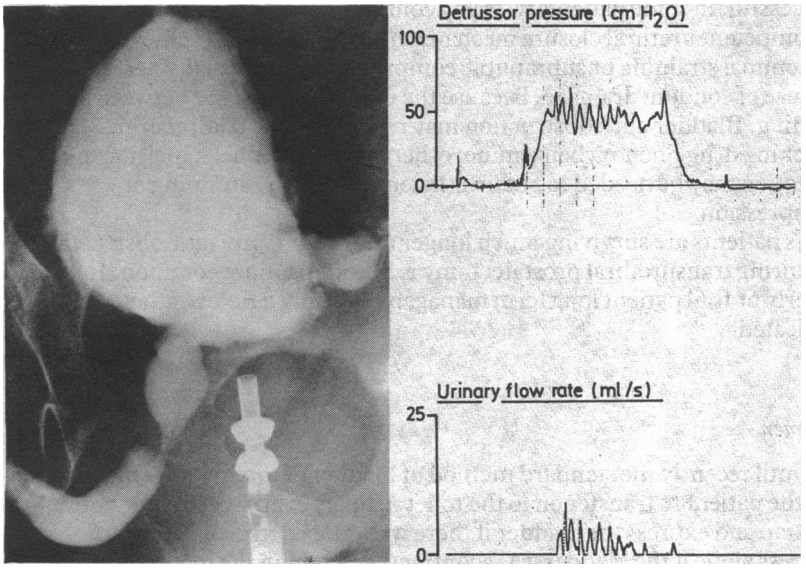
Residual urine

Intravenous urography (Renography)

Videourodynamics

Intravenous urography is performed initially about three months after injury to give baseline information on the urinary tract, although even at this early stage fullness or early dilatation of the pelvicalyceal system and ureters due to bladder outlet obstruction is occasionally seen. The investigation is repeated at intervals, within a few months or a year at first but if bladder emptying remains satisfactory and the patient asymptomatic the time between examinations can be increased to up to three years, particularly in women. However, lifelong urological follow up is still essential, as late bladder outlet obstruction and other complications such as calculi may occur. It must be remembered that because of absent sensation, renal and ureteric calculi may be asymptomatic. If the patient has had adverse reactions to contrast media renography is safer than intravenous urography.

A baseline videourodynamic investigation is performed after intravenous urography and consists of a study of the pressure-volume relations of the bladder during slow filling with contrast medium, combined with radiographic screening of the bladder and urethra during both the filling and the voiding phases of micturition. The state of detrusor muscle activity is shown, and detrusor-sphincter dyssynergia (see below), other causes of bladder outlet obstruction, and vesicoureteric reflux are also easily detected. Measurements of urethral pressure are particularly useful in assessing bladder outlet obstruction after external urethral sphincterotomy.



Sustained uninhibited detrusor contraction with poor intermittent urinary flow in a tetraplegic with a suprasacral bladder. Dilated bladder neck and prostatic urethra seen above the tight external urethral sphincter. There is also bilateral vesicoureteric reflux. Transurethral sphincterotomy relieved the obstruction and the reflux.

Later management

Long term prevention of urinary tract infection

- High fluid intake if possible
- Ensure effective bladder emptying
- (Acidification of urine)
- (Administration of urinary antiseptics)

Drugs in management of the neuropathic bladder

Action	*Drug*
To increase detrusor activity	Carbachol, bethanicol orally, distigmine bromide intramuscularly
To reduce detrusor activity	Propantheline, oxybutynin, imipramine orally
To increase bladder outlet resistance	Imipramine orally
To reduce bladder outlet resistance	Phenoxybenzamine orally, phentolamine intravenously or intramuscularly

After the initial investigations bladder management may be modified as necessary. The possible options should be discussed with the patient. The aims are to preserve renal function and if possible achieve urinary continence.

The introduction of self intermittent catheterisation has enabled these aims to be met in an increasing number of patients, both men and women, particularly in those with an acontractile bladder, and the method is on the whole preferred by patients. In hospital a new catheter is used for each catheterisation, but at home self intermittent catheterisation becomes a clean though not necessarily sterile technique, and a catheter can be reused several times.

Despite satisfactory bladder emptying, some patients suffer recurrent urinary tract infections, and for these acidification of the urine using a non-effervescent ascorbic acid preparation, or the use of a urinary antiseptic such as hexamine, may be beneficial. Whenever possible a high urinary output of at least 3 litres in 24 hours also helps to minimise infection.

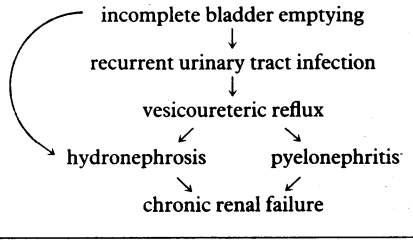
There is little place for urinary diversion procedures such as an ileal conduit in patients with spinal cord injuries.

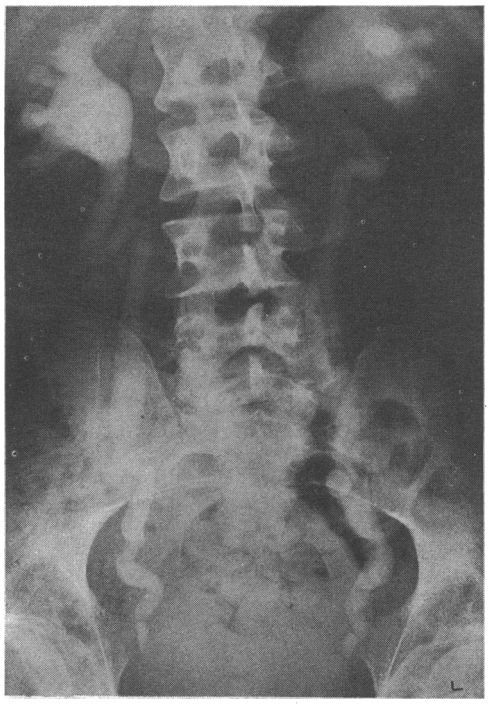
Men

A minority of male patients refuse to try self intermittent catheterisation, feeling that condom drainage will be less troublesome. If self intermittent catheterisation is not possible because of insufficient hand function or if the patient, after several weeks' trial, cannot stay dry between catheterisations, the bladder should be managed by condom drainage. In practice, most patients are still managed by this method.

In normal voiding a detrusor contraction is accompanied by relaxation of the external urethral sphincter. However, in many patients with a suprasacral cord lesion using condom drainage the external urethral

Possible effects of detrusor-sphincter dyssynergia





sphincter fails to relax completely or actively contracts during a detrusor contraction—that is, there is detrusor-sphincter dyssynergia. This often results in poor bladder emptying, leading to recurrent urinary tract infection, vesicoureteric reflux, and hydronephrosis. Impaired detrusor activity may contribute to poor emptying, and in these circumstances cholinergic drugs may be useful in selected cases. If videourodynamics is performed early detrusor-sphincter dyssynergia can be readily detected before damage occurs. About a third of patients with a suprasacral cord lesion and reflex bladder emptying require an endoscopic external urethral sphincterotomy.

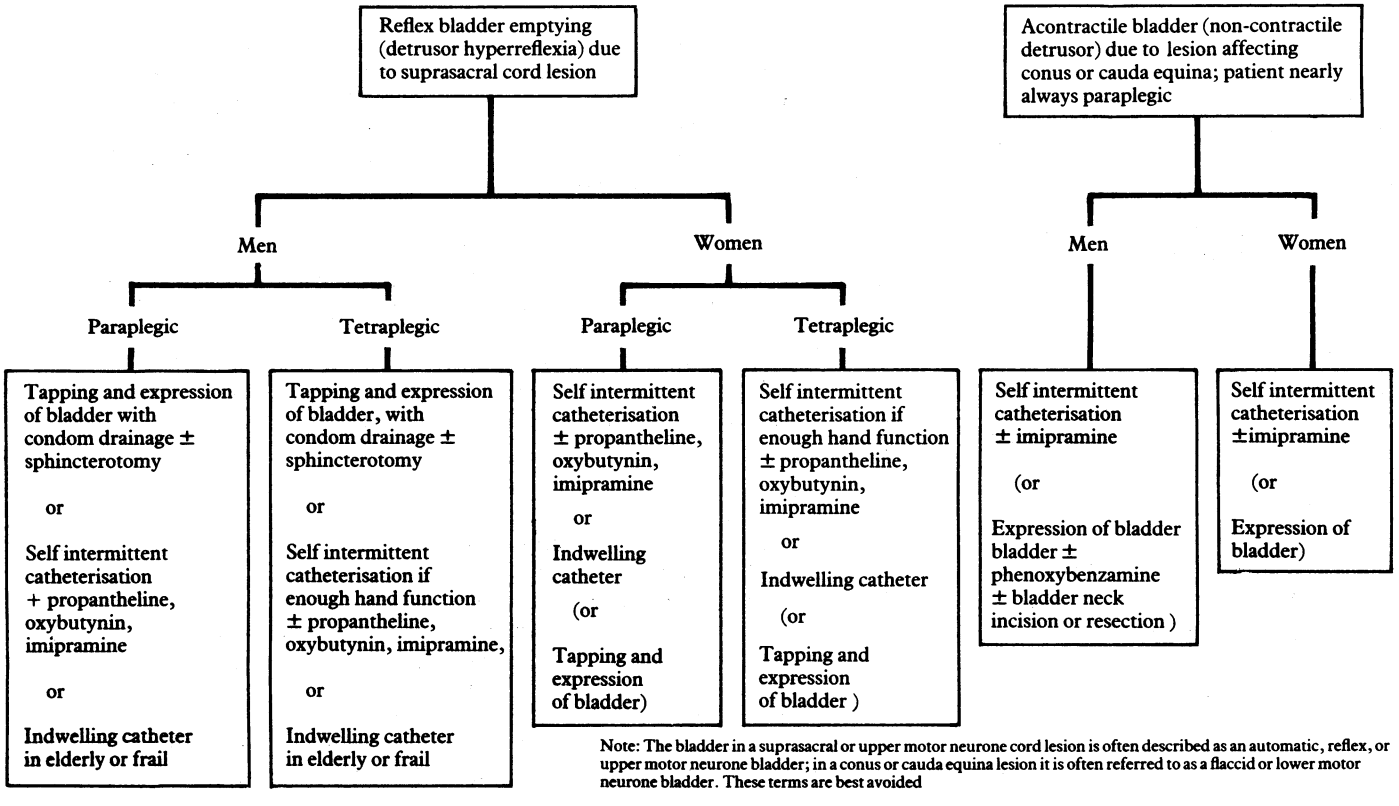
Obstruction of the bladder neck is uncommon but if present may be useful in maintaining continence when the patient is being managed by self intermittent catheterisation. Although self intermittent catheterisation is so successful, in some patients with an acontractile bladder and an incompetent urethral closure mechanism emptying is best achieved by abdominal straining or suprapubic compression. This usually necessitates the use of condom drainage, because the patient leaks urine between acts of voiding. Bladder neck obstruction may respond to the α adrenergic blocking drug phenoxybenzamine; otherwise bladder neck incision or resection may be needed to obtain efficient voiding by straining or compression.

As patients are surviving much longer than before prostatic obstruction requiring transurethral prostatectomy is becoming more common. In the elderly or frail patient long term management using a Foley catheter may be indicated.

Women

Until recently the standard method of bladder emptying for women was for the patient to transfer on to the toilet, usually every two to four hours, and tap and express the bladder if there was reflex detrusor activity or express alone if the bladder was acontractile. Though the method is still advocated, the patient often remains wet between acts of voiding and has to wear incontinence pads, and therefore self intermittent catheterisation is preferable.

Long term bladder management (methods in parentheses less satisfactory)



Note: The bladder in a suprasacral or upper motor neurone cord lesion is often described as an automatic, reflex, or upper motor neurone bladder; in a conus or cauda equina lesion it is often referred to as a flaccid or lower motor neurone bladder. These terms are best avoided

The female patient

- Satisfactory urine collecting device not available
- Greater emphasis on self intermittent catheterisation, or indwelling catheter in tetraplegic
- Bladder function commonly disturbed during menstruation and pregnancy
- Renal failure rare

Autonomic dysreflexia

Pounding headache

Profuse sweating

Flushing or blotchiness above level of lesion

Danger—intracranial haemorrhage

Treatment of autonomic dysreflexia

Remove cause

Nifedipine 5-10 mg sublingually

Glyceryl trinitrate 250 μg sublingually

Phentolamine 5-10 mg intravenously

Spinal or epidural anaesthetic

Sphincterotomy

In the tetraplegic with insufficient hand function to perform self catheterisation an indwelling Foley catheter can revolutionise a patient's quality of life and should be offered. As in male patients it is also applicable to the elderly or frail and others who cannot remain continent.

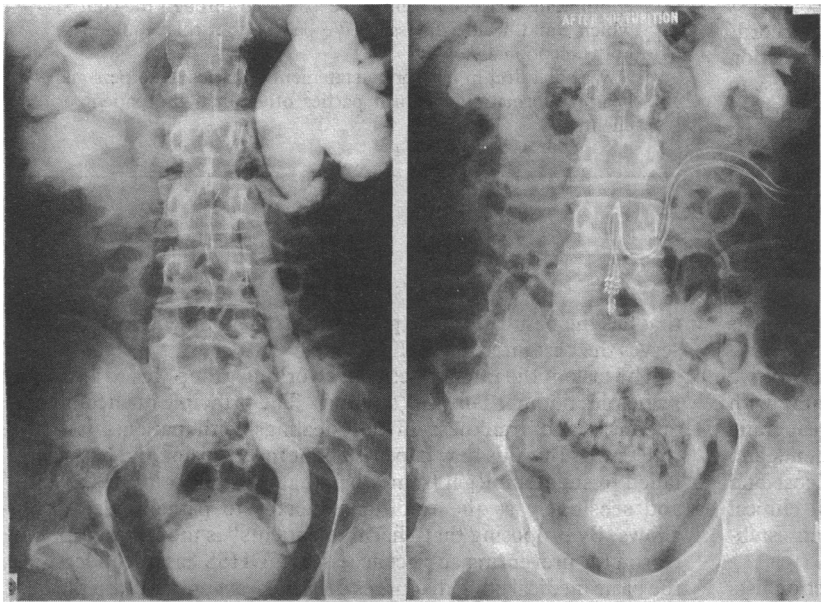
Autonomic dysreflexia

Autonomic dysreflexia is seen particularly in patients with cervical cord injuries above the sympathetic outflow but may also occur in those with high thoracic lesions above T6. It may occur at any time after the period of spinal shock and is usually due to a distended bladder caused by a blocked catheter, or to poor bladder emptying as a result of detrusor-sphincter dyssynergia. The distension of the bladder results in reflex sympathetic overactivity below the level of the spinal cord lesion, causing vasoconstriction and systemic hypertension. The carotid and aortic baroreceptors are stimulated and respond via the vasomotor centre with increased vagal tone and resulting bradycardia; but the peripheral vasodilatation which would normally have relieved the hypertension does not occur because stimuli cannot pass distally through the injured cord. Characteristically the patient suffers a pounding headache, profuse sweating, and flushing or blotchiness of the skin above the level of the spinal cord lesion. Without prompt treatment intracranial haemorrhage may occur.

Other conditions in which visceral stimulation can result in autonomic dysreflexia include urinary tract infection, bladder calculi, a loaded colon, an anal fissure, ejaculation during sexual intercourse, and labour.

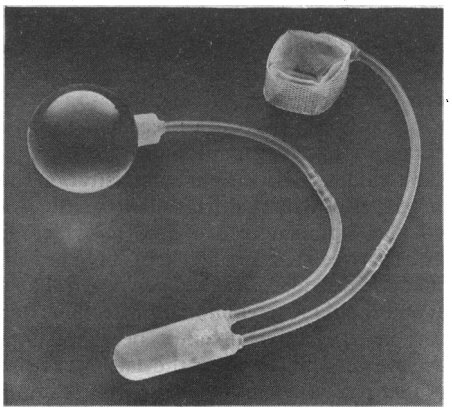
Treatment consists of removing the precipitating cause. If this lies in the urinary tract catheterisation is often necessary. If hypertension persists nifedipine 5 to 10 mg sublingually, glyceryl trinitrate 250 μg sublingually, or phentolamine 5 to 10 mg intravenously is given. If inadequately treated the patient can become sensitised and develop repeated attacks with minimal stimuli. Occasionally the sympathetic reflex activity may have to be blocked by a spinal or epidural anaesthetic. Later management may include a sphincterotomy if detrusor-sphincter dyssynergia is causing the symptoms; performed under spinal anaesthesia, the risk of autonomic dysreflexia is lessened.

Other methods of bladder management



Above left: gross bilateral hydronephrosis and hydroureter before implantation of sacral anterior root stimulator. Right: after insertion of stimulator

In recent years the artificial urinary sphincter has been increasingly used for treating neuropathic incontinence. It is particularly suitable for patients with an acontractile bladder or minimal detrusor activity with adequate bladder capacity and normal renal tracts. Another recent advance, applicable to some patients with a suprasacral cord lesion, is the anterior sacral nerve root stimulator, in which the patient has a radiolinked implant to stimulate the S2, S3, and S4 anterior nerve roots. By activating the implant the patient can empty the bladder at will, reduce the residual volume, and possibly achieve continence.



Right: artificial urinary sphincter. Inflatable cuff is normally placed around bladder neck. Control pump, placed in the scrotum in men and in the labium in women, controls the flow of fluid between reservoir (in the prevesical space) and cuff. To void the fluid is transferred from cuff to reservoir.

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