C J Mieny, U Mennen: Principles of Surgical Patient Care - Volume II

Chapter 9: Urology

Chapter 9.1: Urological Trauma

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Renal Injuries

Injuries to the upper urological tract may result in delayed healing with infection and tissue reaction due to extravasated urine, therefore the injury should be diagnosed promptly and the initial management should be executed in the correct manner.

Due to better diagnostic techniques and recent advances in surgical technique, surgical management of injuries that in the past would have been treated conservatively, is now being done with minimal morbidity.

Anatomical Factors

The kidneys are protected against injury by the lower rib cage, lumbar muscles and lumbar vertebrae.

Children are more prone to kidney injury for the following reasons:

- they possess proportionally bigger organs
- their ribs are still soft and pliable
- they have less perirenal fat
- their kidneys are more abdominally located.

There has been a rise in the incidence of renal injuries. This is related to an increase of motor-vehicle traffic and resultant increase in road accidents, as well as to an increase in violent crime.

Classification of Renal Injuries

Renal injuries can be subdivided into penetrating or blunt injuries.
Both types of trauma can be classified anatomically as:
Contusion of the kidney
Minor cortical laceration
Major cortical laceration
Multiple lacerations
Shattered kidney
Pedicle injury.

Penetrating Renal Injuries

The penetrating injuries are usually due to gunshot wounds and stab wounds.

In the case of gunshot wounds it is mandatory to ascertain whether the wound was caused by a high-velocity weapon or not. The typical small entry wound and large excavating exit wound of high-velocity missiles are also helpful.

A detailed history from the patient and eye witness may be helpful in this regard. Missiles detected radiographically inside the body are usually of a low velocity type.

Penetrating gunshot wounds of the abdomen cause renal injury in 8-10% of cases (table 9.1.1).

Penetrating injuries of the kidney are associated with an 80% incidence of injury to intraperitoneal organs (tables 9.1.2 and 9.1.3).

Diagnosis

Penetrating renal injuries often present in critically ill patients. Because of the high incidence of intra-abdominal organ involvement, their prompt management may preclude preliminary diagnostic urographic studies.

If possible, a high-dose excretory urogram should be done before surgical intervention to document the functional integrity of the contralateral kidney.

Treatment

High-velocity penetrating kidney injuries invariably result in nephrectomy.

Penetrating renal injuries with evidence of abdominal cavity penetration justifies an exploratory laparotomy. The retroperitoneal haematoma should be opened and the kidney explored only after control of the renal vascular pedicle has been secured. Depending on the extent of the injury, debridement or partial nephrectomy is performed. Suturing of the located collecting system and meticulous haemostasis are critical. Where the collecting system had been penetrated, nephrostomy drainage after repair is indicated. Retroperitoeal drainage should always be performed after renal exploration.

Stab wounds through the posterior abdominal wall that do not penetrate the abdominal cavity, may be treated conservatively provided that the patient's condition is stable and that no enlarging retroperitoneal mass is detected.

Non-Penetrating Renal Injuries

Any patient with blunt abdominal trauma or trauma to the lower chest or back should carefully be screened for renal injury irrespective of whether haematuria is present or absent.

Etiology

Blunt trauma is usually the result of a blow to the abdomen sustained during a fall during a motor vehicle accident where the injury is caused by being thrown against the dashboard or steering wheel. Sports injuries and acceleration-deceleration trauma is less common.

Minor trauma can also cause major kidney injury. This is especially true where pre-existing renal disease such as hydronephrosis, cystic kidney disease or renal tumour is present.

Diagnosis

Physical Findings

Subtle signs such as lumbar or hypochondrial bruising may be the only clues to kidney injury. Tenderness, muscle spasm and a flank mass are more incriminating findings.

Haematuria

Any blood in the urine, micro- or macroscopic, calls for complete urological investigation. The degree of haematuria is no indication of the severity of the injury.

Radiographic Diagnosis

This is the keystone in the evaluation of renal injury both to ascertain the extent of the injury and to plan the treatment. Nowadays radiographic interventional techniques can also play a major role in the treatment of these injuries.

- Ultrasound

As a non-invasive diagnostic method it helps in assessing if a renal injury is present, although it cannot demonstrate minor cortical lacerations.

- Excretory urogram

High-dose urography (2 mL/kg) with tomography should be done because with ordinary excretory urogram, the false negative rate is high with 34% of significant renal injuries having a normal urogram.

- CT scan (with contrast enhancement)

Where available this probably is the best diagnostic method defining the extent of the injury.

- Arteriogram

Selective renal arteriogram is indicated when a pedicle injury is suspected. The pre-operative evaluation of the arterial tree is indicated when conservative surgery is planned.

Arteriography with possible interventional treatment of an intra-renal arterial haemorrhage like transluminal embolization should always be kept in mind.

Surgical Diagnosis

When confronted with an undiagnosed renal injury with retroperitoneal haematoma at open abdomen, the first concern is the existence and function of the contralateral kidney.

When possible an excretory urogram should be performed intra-operatively. If not possible, the existence of the contralateral kidney should be confirmed and after pedicle control has been secured, the haematoma should be opened. Conservative renal surgery should always be attempted in this situation.

Management

The severity of the injury indicates the therapy:

- Renal contusion

Conservative treatment is indicated. This includes bed rest, analgesics and broad-spectrum antibiotics. The patient should be confined to bed until the macroscopic haematuria has subsided. Microscopic haematuria may persist for up to three months.

- Minor cortical laceration

Treatment is the same as for contusion.

- Major cortical laceration

The extravasation of urine associated with this injury usually results in complications if treated conservatively. It is thus recommended that these injuries be surgically repaired.

Access is through a transabdominal incision and after control of the vascular pedicle is secured, all necrotic renal tissue is removed by sharp dissection and the collecting system closed with a running 4/0 chromic suture. Haemostasis should be meticulous and a defect plugged with perinephric fat or renal capsula. Retroperitoneal drainage is mandatory. In a major injury to the kidney it is judicious to employ nephrostomy drainage.

Polar injury should be treated with polar amputation.

- Shattered kidney

This major injury accounts for 2-5% of renal injury and is treated with nephrostomy.

- Vascular pedicle injury

This often results from acceleration-deceleration injuries such as a fall from an excessive height. The pedicle is the most fixed part of the kidney and movement of the relatively mobile kidney causes stretching of the pedicle. This results in complete disruption of the vessels or tearing of the arterial intima with subsequent thrombosis.

Symptoms are frequently minimal and the diagnosis is often not made especially in the case of thrombosis.

Excretory urography usually shows nonhandling of contrast on the affected side and a renal arteriogram defines the extent of the trauma.

The delay in diagnosis invariably results in nephrectomy in these cases, but if surgery can be done within six hours of the injury the kidney may be saved. Some authors advocate revascularization in all cases irrespective of the time lapse as successful surgery has been documented up to nine days after the injury.

Injuries to the Ureter

The small calibre of the ureter together with the subtle symptoms and signs of ureteric injury often result in the injury being overlooked only to be later diagnosed because of the morbidity and complications. These patients then present later due to the complications of the ureteric injury.

Mechanism of Injury

This may be from:

- external trauma
- surgical injury.

External Trauma

Gunshot injuries are responsible for 90-95% of ureteral injuries.

Stab wounds are rarely a cause of ureteric injuries.

Avulsion of the ureter from the pelvi-ureter junction area may occur in acceleration-deceleration injuries.

Major trauma with fractures of the transverse of the vertebrae may also cause ureteral injury.

Surgical Injury

This can usually be avoided by meticulous surgical technique and by always keeping the surrounding anatomy in mind - the principle of actively defining it if not sure.

The vast majority of injuries are after extensive retroperitoneal or pelvic surgical procedures. Haematuria is absent in up to 35% of cases.

Excretory urography may show extravasation but there is also a high incidence of normal studies.

Ultrasound and CT scan may be helpful in cases where there is extravasation. If all diagnostic measures fail prior to surgery and the level of suspicion is still high, retrograde pyelography will verify most penetrating ureteral injuries.

Injury of the ureter during surgery is verified by identifying the severed lumen.

Excessive drainage of clear fluid in the operating area should raise the possibility of drainage of the urine from an injured ureter.

Intravenous injection of indigo carmine or methylene blue which colours the urine blue in about five minutes, may be helpful.

If the injury is not discovered on initial presentation, it will invariably present in the following weeks with complications such as:

- infection of extravasated urine in a urinoma

- urinary fistula with urine draining through the wound or adjacent organs

- hydronephrosis caused by inflammatory reaction round the injured ureter or from an early stricture at the site of injury (table 9.1.4).

Table 9.1.4. Etiologic Classification of Ureteral Injuries

I. Surgical Injury

A. Open surgical procedures
    1. Gynecologic procedures
        (a) Vaginal procedures
            i Vaginal hysterectomy, salpingo-oophorectomy
            ii Cystocele repair
            iii Perianal laceration
            iv Colpocleisis
            v Vesicovaginal fistula repair
        (b) Abdominal procedures
            i Hysterectomy
                a. Supravaginal
                b. Total
                c. Radical

ii Salpingo-oophorectomy
iii Removal of ovarian cyst
a. Twisted ovarian cyst
b. Intraligamentous cyst
c. Paraovarian cyst
iv Drainage of broad ligament abscess
v Myomectomy

2. Obstetric procedures
(a) Vaginal procedures
i Forceps delivery
ii Vaginal hysterectomy
iii Breech delivery
(b) Abdominal procedures
i Cesarean section
ii Cesarean hysterectomy

3. General surgical (intra-abdominal) procedures
(a) Resection of colon
i Anterior sigmoid resection
ii Combined abdominoperineal resection
iii Subtotal or total colectomy
(b) Appendectomy
(c) Herniorrhaphy
(d) Vascular procedures
i Aortic aneurysm
ii Iliac aneurysm
iii Sympathectomy

4. Neurosurgical
(a) Laminectomy

5. Genitourinary procedures
(a) Renal operations
i Pyelolithotomy
ii Ureteropelvic junction repair
iii Renal exploration and drainage of cyst
(b) Ureterolithotomy
(c) Bladder operations
i Diverticulectomy
ii Segmental resection
iii Repair of vesicocolic fistula
(d) Prostatectomy
i Radical retropubic
ii Simple or radical perineal

B. Endoscopic surgical procedures
1. Ureteral catheterization
2. Intraureteral manipulation

II. External trauma

A. Penetrating wounds
1. Gunshot wounds
2. Impalement or perforating foreign bodies

B. Nonpenetrating wounds

1. Severe skeletal injury
2. Avulsion

Miscellaneous Sources of Trauma

A. Foreign bodies in relation to ureter
    1. Intraluminal
    2. Extraluminal
B. Prolonged use of pessary

IV. Irradiation Injury of the Ureter

Management

When a ureteric injury is noted while the patient is still on the operating table, it should be repaired immediately.

Surgical correction depends on the extent and location of the injury.

If ureteral injury has occurred in a patient with numerous life-threatening injuries in whom time for an uretero-ureterostomy is not available, cutaneous ureterostomy or uretereal catheter insertion may suffices as an interim procedure.

Deligation

Due to the crush effect of ligation of the ureter simple deligation frequently results in later stricture formation. Due to necrosis the exception is when the ligature includes a large amount of surrounding tissue.

In all other instances primary surgical repair is indicated.

Ureteral Stent

As the primary and only treatment this type of treatment is only indicated in minor injury with minimal extravasation. This type of injury is usually encountered during endoscopic injury. Endoscopic placement of a double J stent left in for two to six weeks with close clinical and ultrasound follow-up is usually sufficient.

Ureteral Reimplantation

This procedure with an antireflux technique is indicated in lower third ureteral injury.

With extensive loss of the distal ureter or contra-indications to reimplantation such as infection, haematoma or previous irradiation, transuretero-ureterostomy or implantation into a bladder flap is indicated.

Autotransplantation

When nearly the entire ureter is damaged, the kidney may be salvaged by autotransplantation with pelvi-vesicostomy.

Bowel Substitution

With complete ureteric loss during injury, the ureter may also be substituted by small bowel anastomosed to the kideny pelvis and bladder after tapering for the ureteroneocystostomy.

Bladder Injuries

Knowledge of the mechanisms of injury together with prompt diagnosis and accurate surgical repair are the keys to successful management of bladder injuries.

Mechanism

Blunt or penetrating injury may cause bladder rupture. The rupture may either be intraperitoneal, extraperitoneal or a combination of both.

Extraperitoneal Rupture

This is usually due to pelvis fractures with the bone fragments penetrating the bladder. The incidence of bladder rupture in pelvic fracture is 5-10%. Gunshot injury is also at times encountered.

Intraperitoneal Rupture

This is found in up to 90% of blunt trauma in which the bladder is injured. The rupture occurs at the weakest point which is the dome of the bladder.

Combined Intra- and Extraperitoneal Rupture

This occurs in only 10% of cases but it has a high mortality rate (60%) due to the associated severe injuries that usually accompany this type of trauma.

The frequency of associate intra-abdominal injury (table 9.1.5) is dependent upon the mechanism of bladder rupture.

Table 9.1.5. Associated intra-abdominal injury

Penetrating:

- Gunshot wounds - 83% - colon, rectum, small bowel
- Stab wounds - 33% - rectum

Blunt:

- Intraperitoneal - 43% - liver, spleen, colon
- Extraperitoneal - 30% - liver, spleen, colon
- Combined - 100% - liver, spleen, colon.

Diagnosis

Gross haematuria is encountered in up to 90% of cases with bladder rupture.

The initial evaluation of a patient with traumatic haematuria is by exclusion of urethral injury. After clinical examination has demonstrated a normally situated prostate, a retrograde urethrogram under sterile conditions should be performed.

Once it is ascertained that the urethra is normal, the catheter is advanced into the bladder and a cystogram is performed with 300 mL of contrast. To exclude posterior vesical rupture a lateral film and a post-voiding film should be obtained. After the cystogram has been completed, the upper tracts should be evaluated with an excretory urogram.

Treatment

The success of management lies in:

- Adequate diversion of the urine from the injured area.
- Prompt surgical repair of the vesical wall.
- Effective drainage of the perivesical area.

In a patient with penetrating trauma a midline lower abdominal laparotomy should be performed. After excluding intraperitoneal damage, the bladder should be opened shortly after developing the space of Retzius.

After evacuation of intravesical clots, the ruptured area is defined visually or by digital palpation. Sharp penetrating bone spicules should be removed.

After debriding the traumatized edges, the defect is closed in two layers of absorbable sutures. Closure of the cystostomy is performed in the same manner. Catheter drainage for 10 days as well as extravesical wound drainage is indicated.

Conservative Treatment of Bladder Rupture

This is only indicated in a select group of patients, ie, a female patient with a small extraperitoneal rupture and no other injuries.

Urethral Rupture

Management is dictated by the location of the injury. For this purpose the urethra is divided into two parts - the anterior urethra (the part distal to the urogenital diaphragm) and the posterior urethra (membranous and prostatic urethra).

Rupture of the female urethra is seldom seen and is usually associated with major pelvic fractures.

Injuries to the Anterior Urethra

This includes the bulbar and penile urethra.

Blunt injury is usually of the Kibimstraddle type or due to a direct blow to the peritoneum. The rupture may be partial or complete. Extravasation of blood and urine are usually confined to the fascial planes.

Diagnosis

This injury should be suspected with any history of trauma to the perineum.

The patient may have difficulty in voiding, haematuria or blood at the tip of the meatus. Swelling or discoloration of the perineum from extravasated blood or urine may be present.

If the patient has not voided, he should be encouraged not to until the integrity of the urethra has been established by retrograde urethrography.

Management

The immediate management depends upon whether there is perineal extravasation of blood and urine that needs drainage. If drainage is not required a suprapubic cystostomy should be performed to diver the urine.

If the rupture is partial, it frequently heals without the need of further therapy. In complete rupture reconstructive urethroplasty can be done in six weeks to three months.

Where extravasation necessitates drainage, primary corrective surgery may be performed. An end-to-end anastomosis after debridement of the urethra is the procedure of choice.

Instrumentation Injuries

This can usually be managed by introducing a Silastic catheter over a catheter guide taking care not to aggravate the injury. The catheter should be in position for seven to ten days.

Gunshot Wounds

The wound should be debrided and cleaned. If conditions are suitable, a primary repair is indicated. Alternatively, a suprapubic catheter could be placed and definitive repair delayed.

Injury to the Posterior Urethra

These injuries often occur in pelvic fractures. A partial or complete dislocation of the apex of the prostate from the membranous urethra in the urogenital diaphragm is the typical injury.

Diagnosis

All patients with pelvis fracture or diastasis of the symphysis should be investigated for a possible posterior urethral rupture.

There may be blood at the urethral meatus and inability to void. Rectal examination reveals a highriding prostate if the rupture is complete, with a bogginess in the pelvis due to the pelvic haematoma. Any concomitant rectal injury should also be excluded.

The diagnosis is confirmed with retrograde urethrogram using 30 mL of water soluble contrast medium under sterile conditions. Any passage of contrast into the bladder suggests a partial rupture and care should thus be taken to make sure that the bladder is empty prior to the urethrography.

Management

Controversy exists concerning the correct treatment of this injury.

In a partial rupture a suprapubic cystostomy tube is placed and left in for three weeks. Healing is usually complete with no or minimal stricture formation. This can be dealt with endoscopically.

The complete rupture may be dealt with in several ways:

- Modified Turner-Warwick approach

After performing a suprapubic cystostomy with the use of interlocking sounds continuity of the urethra is established and a urethral as well as a suprapubic cystostomy tube is placed.

Light traction on the penile Silastic catheter is advocated.

- Primary urethral anastomosis (Pierce)

At the time of injury primary reanastomosis of the severed ends is performed and a Silastic catheter is left in as a stent.

- Suprapubic cystostomy with delayed repair

People who advocate this technique feel it prevents the haematoma from being infected, thus facilitating reabsorption of the haematoma with minimal scarring.

A suprapubic Silastic tube is placed at the time of the injury and secondary urethral repair is done after three months.

According to Morehouse this approach has several advantages:

- reduced blood loss

- a suprapubic cystostomy is a small surgical procedure which is easily performed

- it can be done quickly leaving more time for the other specialties to attend to the usual attendan injuries

- by avoiding dissection of the retropubic space minimal scarring occurs facilitating later reconstructive surgery

- the incidence of permanent post-operative impotence, incontinence and stricture is small. Strictures can usually be treated easily with endoscopic optical urethrotomy or urethroplasty.

Injury to the External Genitalia

Penile Trauma

Injury to the penis is unusual due to its mobility and well-guarded position.

Anatomy

The penis consists of two corpora cavernosa and the corpus spongiosum containing the urethra. The corpora cavernosa are surrounded by a sturdy tunica albuginea. The three erectile bodies are surrounded by a distinct fascial layer (Buck's fascia), which is attached distally at the corona and proximally at the triangular ligament.

Superficial to Buck's fascia lie Colles' fascia, which is attached posteriorly at the triangular ligament and laterally with the fascia lata at the inguinal ligament. It continues anteriorly as Scarpa's fascia to the level of the coracoclavicular fascia.

Mechanism of Injury

Trauma may affect one or all components of the penis. These may present with:

- Penetrating injury

This may be due to gunshot or stab wounds.

- Avulsion injury

This usually is due to clothing that gets caught in machinery used in farming or industry. Usually the skin is degloved, but a part of the penis may even be involved.

- Fracture of the penis

This results from excessive bending of the penis during intercourse with rupture of the corpora cavernosa.

- Strangulation injury

Ischemia and distal necrosis may result from constricting bands such as condom catheters.

Diagnosis

Physical examination will usually reveal the type and extent of the injury. The extent of extravasation and haematuria is determined by the integrity of Buck's fascia.

Treatment

The specific treatment depends on the part injured.

Skin Injury

All skin proximal to the injury should be saved. The distal skin should be removed because of troublesome lymphoedema that may occur if left in situ.

The skin defect should be covered with a split thickness skin graft as soon as possible.

Corporal Injury

Penetrating injury should be suspected, debrided and primary closure of the tunica albuginea performed.

In injuries where the penis has been amputated, reanastomosis should be attempted preferably with microsurgery. If not possible or if ischemic gangrene supervenes, amputation is necessary.

Fracture of the Penis

Where there is a history of injury to the erect penis with immediate impotence, the diagnosis of a penile fracture (rupture of the tunica albuginea) can be made. There is usually a haematoma visible on the shaft.

After coronal incision and proximal telescoping of the skin, the rupture is usually visible and can be repaired.

Injuries to the Scrotum and Testes

Injury may be caused by penetrating missiles (ie, gunshot and stab wounds) or blunt trauma. Penetrating injury that extends deeper than the dartos should be surgically explored.

Gunshot wounds that involve the testes usually result in orchidectomy of the affected organ. If the testis is viable and only a portion of the seminiferous tubules are necrotic and protruding through the laceration, debridement is indicated. The tunica albuginea of the testis is closed with absorbable sutures and the scrotal cavity drained.

Blunt trauma requires individualized treatment.

Ultrasound of the scrotum can accurately determine the extent of the injury, ie, haematocoele or intratesticular haematoma or testicular rupture.

A general rule is that if the intra-scrotal anatomy cannot be clinically distinguished, scrotal exploration is indicated. In a history of minimal blunt trauma the other causes of an acute scrotum should be considered.

Where injury resulted in total loss of scrotal skin, the testes should be implanted into subcutaneous pouches in the thigh. Due to the higher temperature which causes testicular damage, the testes should be transferred to a newly formed scrotal pouch if possible.

Comment

Urological Trauma

J H Naudé

Haematuria: The allegation that the degree of haematuria has no significance cannot be agreed with. In a study of renal injuries at the Johannesburg Hospital (Wilkinson) frank haematuria was found to be higly predictive of an injury to the urinary tract, while microscopic and particularly chemical haematuria was found to have no predictive value.

With regard to urethral injuries, I would question the value of retrograde urethrography. Blood at the external meatus (self evident or expressible) is irrefutable evidence of urethral injury and makes suprapubic diversion mandatory. The retrograde injection of contrast medium serves only to infect a previously sterile haematoma.

Concerning the management of a ruptured urethra, I wholeheartedly endorse the opinion of Morehouse and would advocate suprapubic cystostomy and delayed repair. This is very safe and should be the standard method taught to all registrars. If any consultant's approach differs from this, it should be his responsibility to teach the alternative technique.

The classical teaching of implanting the testes in the thighs necessitates serial surgery and is a nuisance.

In the case of a recent, clean, degloving scrotal injury, immediate split-skin grafting is highly successful.

In the case of an older or contaminated wound, delayed skin grafting is equally successful. In either case the eventual cosmetic result is remarkably good.

Chapter 9.2: Urinary Tract Infections

S Reif

Introduction

Urinary tract infections (UTI) are second only to respiratory tract infections as a problem encountered by the practising physician (internist/paediatrician). On the other hand, the urinary tract is the most common site for hospital-acquired infections (40%).

Definition

Significant bacteriuria (UTI) is defined as the demonstration of 100000 or more of the same organism/mL of urine in a freshly voided, clean catch, mid-stream specimen. Counts of between 10000 and 100000 with associated symptoms of dysuria and frequency are considered by some authors as diagnostic of UTI.

Several factors including diuresis, severe urinary acidity, antibacterial detergents, recent antibiotic therapy and faulty collection and transport of urinary specimens may influence bacterial counts and should therefore be taken into account

Methods of Urine Specimen Collection

Midstream urine specimen (MSU), catheter collection, suprapubic needle aspiration and perineal urine collection bags are the most commonly used techniques for urine sampling. MSU should be the method used routinely whereas suprapubic aspiration is reserved for the problematic cases.

On the basis of a single examination and observation of more than 100000 organisms/mL in a midstream specimen is associated with 15% false positive rate, but this drops to 5% if similar counts are obtained in two consecutive specimens.

A growth of more than 100000 ora/mL in a catheter-collected specimen is 95% accurate while any growth in a suprapubic puncture specimen is significant.

A meticulous regime gives reasonably reliable results with perineal urine collection bags, but unfortunately even with well-trained staff the risk of false positive results is high.

Note should be taken of the fact that lactobacillus in the female patient and corynebacterium in uncircumsized boys could lead to incorrect microscopic interpretation.

Organisms in the Urinary Tract

Proximal to the external urethral sphincter in men and proximal to the bladder neck in women, the urine is sterile. Staphylococci, streptococci and diphtheroids inhabit the male urethra below the external urethral sphincter. The prostate secretion is sterile but is often contaminated during specimen collection by the abovementioned urethral flora.

Lactobacilli, staphylococcus (mostly epidermidis), diphtheroids and streptococci make out the common bacterial flora of the female introitus (female urethra, vaginal vestibule and vagina).

The urethra, prepuce, labia and vaginal vestibule constitute the most common source for urine specimen contamination.

Gram-negative aerobic bacilli found in the gastrointestinal tract are mostly responsible for urinary tract infections. While *E. coli* is the most commonly found organism in uncomplicated UTIs, *Proteus, Klebsiella* and *Pseudomonas* predominate in patients with underlying structural or metabolic anomalies (uncomplicated UTIs).

Gram positive organisms are responsible for UTIs in the minority of cases.

Classification of UTI

According to Stamey (1975) infections in the urinary tract can be divided into one of four simple categories:

--> First infection
--> Unresolved bacteriuria during therapy
--> Bacterial persistence - "recurrent" urinary infections
--> Reinfections - "recurrent" urinary infections.

First Infection

Initial infections in non-hospitalized females are usually sensitive to most antimicrobial agents. Of these patients 25% will experience a recurrence in the next few years.

Unresolved Bacteria During Therapy

This indicates that the initial therapy has been inadequate. The most common cause of unresolved bacteriuria during treatment is the presence of organisms resistant to the antimicrobial agent selected to treat the infection. Tetracyclines and sulfonamides are notorious for producing resistance in the fecal bacteria.

Other causes may be azotemia, papillary necrosis from analgesic abuse or where the "critical mass" of sensitive bacteria is too great for antimicrobial inhibition, ie, in giant staghorn calculi.

Bacterial Persistence

Once the bacteriuria has resolved (ie, the urine sterilized for several days and the antimicrobial agent has been stopped), recurrence with the same organism can arise from a site within the urinary tract that was excluded from the high urine concentrations of the anti-microbial agent. Infection stones, chronic bacterial prostatitis, vesico-vaginal and vesico-intestinal fistulas, congenital anomalies and various other conditions are identified as abnormalities that cause bacteria to persist within the urinary tract between episodes of recurrent bacteriuria. Note that most of these conditions are correctable.

Reinfections

Ninety-nine per cent of all recurrent infections in females are reinfections. In female patients the underlying cause of these reinfections might be the fact that the female urethra is very short and thus permits relative easy entry to fecal *E. coli.* Poor habits (toilet, intercourse, bubble baths, etc) may play a significant role.

Diagnosis of a Urinary Tract Infection

Clinical Symptoms and Signs

The most commonly encountered symptoms are frequency, urgency and dysuria while suprapubic tenderness may be the only clinical sign. A small percentage of patients with UTI may be asymptomatic.

Males with significant bacteriuria are rarely asymptomatic while in the age group 5-14 years 1% of girls and in young adulthood 4% of females have asymptomatic bacteriuria. Hereafter the incidence in women increases by 1-2%/decade. Of these "infections" 57-80% clear spontaneously while 50% of these patients will have reinfections.

Population screening for asymptomatic bacteriuria is not indicated as these infections do not lead to kidney damage. A notable exception, however, is asymptomatic bacteriuria in pregnancy (see later).

It should be noted that females especially are prone to "attacks" of dysuria and frequency without significant bacteriuria (dysuria/frequency syndrome) many conditions are implicated, ie, cervicitis, fissuro in ano, allergies, exogenous agents (ie, deodorants and bubble baths), diabetes mellitus, poor sexual habits (dry intercourse), atrophy of distal urethra due to post-menopausal oestrogen deficiency and psychological causes. These conditions should be considered in females and treated when present.

Urine Microscopy

The belief that more than five white blood cells (pus cells) per high-power field of a microscope constitutes a urinary tract infection is no longer accepted. Too many factors influence their numbers, inter alia diuresis. Early morning specimens, however, are more meaningful. It is reported that between 20 and 25% of patients with a significant bacteriuria (UTI) do not have pyuria.

Pyuria in itself does not constitute the diagnosis of a urinary tract infection. Faulty collection (contamination) as well as a number of more serious conditions could lead to sterile pyuria. Renal tuberculosis, analgesic nephropathy, nephrolithiasis, carcinoma in situ and interstitial cystitis are examples of such conditions.

Bacterial detection in the sediment of a spun urine sediment is not by any means an accurate method in the diagnosis of a urinary tract infection. Lactobacillus and diphtheroids may lead to erroneous diagnosis.

Urine Culture

Significant bacterial growth in a properly cultured urine specimen represents the most accurate method of establishing a urinary tract infection.

Interpretation of results has already been dealt with under the headings of definition and methods of urine specimen collection. It cannot, however, be emphasized enough that meticulous collection and transport of urinary specimens are of the utmost importance.

Urinary Tract Infections of Note

Acute Pyelonephritis

Classically these patients have fever, chills and costo-vertebral angle tenderness. These upper tract signs are mostly accompanied by dysuria, frequency and urgency.

Urine culture invariably grows bacteria while polymorphonuclear leukocytosis is present. The organisms are those already mentioned under organisms in the urinary tract although note should be taken of special characteristics of these organisms in upper tract infections. Vesico-ureteral reflux should always be excluded three to four weeks post-pyelonephritis in these cases.

If response to intravenous broadspectrum antibiotics is not noted within 72 hours, intravenous urography is mandatory to exclude underlying pathology, ie, urinary obstruction. Pyonephrosis (infected obstructive hydronephrosis) may follow. Renal ultrasound is most useful in this setting diagnosis.

We feel that the topic of chronic pyelonephritis is beyond the scope of this book and would suggest further reading by the interested student.

Xantho-Granulomatous Pyelonephritis

This term represents an atypical form of a severe, chronic, renal parenchymal infection which leads to perirenal fibrosis.

Microscopically massive tissue necrosis with phagocytosis of the liberated lipids (cholesterol) is found.

Flank pain, fever, chills and persistent urosepsis are the most commonly encountered symptoms. It is notable that urolithiasis, obstructive uropathy, diabetes mellitus or primary hyperparathyroidism is found in a significant percentage of these cases. *E. coli* is the most common pathogen.

Hepatic dysfunction may also accompany this pathological entity.

IVP reflects a poor or non-functioning kidney with renal calculi in 38% of cases. CAT scan reveals the kidney mass with definite areas of typical fat translucency.

Treatment is usually surgical.

Gram-Negative Bacteremia

The urologist is not infrequently called upon to deal with gram-negative bacteremia post-genito-urinary manipulation.

In 30% of cases these patients present one to two hours after invasive genito-urinary procedures (ie, cystoscopy) with fever, followed by hypotension. Others present with vague non-specific signs, ie, hypothermia, mental status change, hypercapnea, tachypnea, etc.

E. coli (33%), *Klebsiella-Enterobacter-Serratia* family (20%), *Pseudomonas, Proteus* and anaerobic species (10%) are the most commonly cultured organisms in gram-negative bacteremia.

Early recognition, diagnosis and appropriate treatment are essential. Mulitple blood cultures (aerobic and anaerobic) should be obtained: *proper examination is mandatory* to define the source of infection, ie, septic wounds, infected urinary tract, sputum, etc.

Institution of an appropriate antimicrobial agent should be an early and high priority while hypotension and renal failure warrant intensive surveillance and therapy.

Perinephritic Infections/Abscess

The early and accurate diagnosis of this condition continues to elude even the most experienced doctor.

The potential space between the renal capsule and Gerota's fascia is known as the perinephric space and it is here that the pus is inclined to accumulate.

Pyelonephritis, renal carbuncle, renal cortical abscess or pyonephrosis are some of the renal causes for perinephric abcess formation.

Hematogenous or lymphogenous seeding from distant pyogenic foci are responsible for the formation of perinephric abscess of extrarenal origin. Renal causes constitute the majority of cases, and the organism most commonly cultured is either *Proteus* or *E. coli*. *Staphylococcus aureus* is isolated most often in the abscesses of extrarenal origin.

In the majority of cases symptoms are usually present for more than two weeks before a diagnosis is made. Pain, fever, chills and voiding symptoms such as dysuria, frequency and urgency are the most commonly encountered complaints.

Leukocytosis is an almost constant finding. Chest and abdominal X-rays, IVP, sonar and nuclear imaging are of some value in the diagnosis, while CT scanning is the diagnostic technique of choice.

Percutaneous abscess drainage in conjunction with parenteral antibiotics has proved to be successful in a certain percentage of cases. However, a number of patients will need open drainage with disruption of abscess locules. Underlying renal abnormalities necessitate definitive treatment. Urinary tract infections, calculi, urinary tract obstruction and diabetes mellitus are the most common predisposing conditions in cases with perinephric abscess.

Urinary Tract Infections in Pregnancy

Due to hormonal and mechanical factors, marked dilatation of the urinary tract takes place which renders it more susceptible to infections. From four to 6% of females of child-bearing age are bacteriuric. Ninety-nine per cent of females who are bacteriuric in the last trimester of pregnancy were already so in the first.

Several complications of bacteriuria in pregnancy have been listed. Twenty to 40% of these mothers develop pyelonephritis while foetal leuco-encephalopathy, prematurity, perinatal morbidity, hypertension, eclampsia, anaemia and congenital anomalies have also been mentioned.

Urine culture during the first pre-natal visit is thus mandatory. Significant bacteriuria should be treated. Nitrofurantoin, penicillin, ampicillin or cephalosporins are safe in pregnancy. Follow-up culture two days after completion of the anti-microbial course is necessary. If positive, long-term low-dose prophylactic therapy until after confinement should be instituted (abovementioned antimicrobials are suitable, ie, nitrofurantoin macro-crystals 50 mg daily). Pyelonephritis (upper tract infections) with pyrexia and pain calls for intravenous therapy with broadspectrum antibiotics, ie, aminoglycoside and ampicillin.

Management of Urinary Tract Infections

Localization of infection to the upper or lower tract can be achieved by way of various methods. With the exception of haemorrhagic cystitis a single large dose of an anti-microbial agent will eradicate more than 90% of lower urinary tract infection while in patients with upper tract infection, single dose therapy carries a 71% rate of recurrence (same organism).

Upper tract infection, we believe, should be hospitalized and treated by way of the intravenous route until the fever subsides. Poor response to IV antimicrobials necessitates upper tract evaluation by way of IVP, sonar or computerized tomography.

Neonates (0-3 months) with UTI have a 30% incidence of septicaemia while this figure falls to 5% in infants above age thre months. Aggressive management is thus mandatory in the 0-3 months group. It is desirable to exclude congenital anomalies in children with properly documented urinary tract infections. IVP and urinating cystogram are the special investigations of choice but should not be carried out during a period of bacteriuria as infections may precipitate vesico-ureteral reflux. These investigations should preferably be delayed for two to three weeks after cessation of the bacteriuria. Ultrasound has proved to be invaluable in evaluation of the urinary tract, especially in neonates.

Ampicillin and gentamicin by way of the IV route is preferred in the 0-3 months group while sulfonamides, ampicillin alone or cephalosporins would be satisfactory after three months.

Chronic bacterial prostatitis rates high as a cause for recurrent UTI in men. Prostatitis and prostatitis-like conditions are beyond the scope of this book.

It is out opinion that asymptomatic bacteriuria warrants no treatment, with the exception of pregnancy.

The first infection in females with symptomatic bacteriuria responds well to either single dose oral therapy (ampicillin, amoxicillin, two double-strength trimethoprim-sulfamethoxazole (TMP/SMX), 100 mg of macrodanting or one single intra-muscular dose of gentamicin (80 mg).

It is important that single-dose therapy should be initiated within the first two days.

Recurrent urinary tract infections in the healthy ambulatory female can be suppressed by various drug regimes, ie, Nitrofurantoin macrocrystals 50 mg nocte or even alternate days for 3-6 months. In cases where UTI follows intercourse a single dose of either Nitrofurantoin macrocrystals (100 mg) or TMP/SMX following intercourse may suffice. In females voiding after intercourse may be beneficial. "Antibiotic on the shelf" also proves effective in some cases of recurrent UTI. Patient takes 100 mg of Nitrofurantoin macrocrystals or one double-strength TMP/SMX at the onset of symptoms.

A separate chapter is devoted to urinary tract infections associated with urethral catheterization and this will be dealt with there.

In summary it could be stated that single-dose therapy could be used for infections limited to the lower tract in females. Upper tract infections need aggressive initial therapy followed by 4-6 weeks of prophylaxis. Further investigation (IVP and urinating cystography) is also warranted in renal infections. In women with recurrent UTI, prophylactic regimes have proved successful. Men and children require longer therapy periods than do females and should always be screened radiologically for possible underlying structural anomalies.

Comment

Urinary Tract Infections

D P De Klerk

Although 100000 of the same organism per millilitre urine in a midstream clean-catch speciment is regarded as diagnostic of urinary tract infection (UTI), one should not be blinded by this magic figure. Certain organisms, ie, *M. tuberculosis* and mycoplasma are notoriously difficult to culture. The demonstration of the causative organism in chronic bacterial prostatitis depends on the culture of a post-prostatic message urine specimen: any known pathogen must be regarded as significant.

Any pathogen cultured in urine obtained by catheter or suprapubic puncture may be significant, although obviously contamination may occur during collection.

Not all patients with dysuria and frequency have a UTI. Young girls are frequently referred for urological evaluation with a vague history of repeated bouts of lower urinary tract symptomatology and/or abdominal pains, but no bacteirological confirmation. Expense is the usual excuse, but this is false economy. In many cases these symptoms may be due to vaginitis, chemical irritation (ie, bubble-bath or deodorans) or anal irritation.

The differentiation between cystitis and pyelonephritis is important, both for managemenet and prognosis. Symptomatology is a poor differentiator of upper fromlower UTI. Certainly the absence of flank pain or costovertebral tenderness does not exclude pyelonephritis. As a rule of thumb, cystitis can be regarded as a "urinary" infection and treated with a short course of urinary antiseptics, which give high urinary concentrations, while pyelonephritis and prostatitis should be regarded as "tissue" infections and a longer course of an antibiotic, with high tissue concentrations, should be used.

Which patient should be evaluated for a urologically correctable cause of UTI? It should be emphasized that approximately half of children with a bacteriologically documented UTI will have a correctable underlying anatomical abnormality, of which half will have vesico-ureteric reflux. On the other hand, evaluation of young, sexually-active women will rarely reveal an abnormality. In the latter group, screening by ultrasound for upper tract abnormalities and a post-void residual urine seems a reasonable alternative to invasive and expensive procedures, ie, cystoscopy and intravenous pyelogram. In all patients with relapsed infections and proven upper UTIs a more aggressive approach is merited.

In adult males, investigation is always indicated once acute or chronic bacterial prostatitis and urethritis have been excluded. For this reason, localization of the infections by differential urinary examination and culture is invaluable. For this study the first 10 mL of voided urine (representing the urethra), and midstream urine (representing the bladder and kidney) and a postprostatic massage urine specimen (representing the prostate) are collected and the severity of pyuria and bacterial count compared. With the pyuria or bacteria concentrated in the first or last portion, urethritis or prostatitis can be diagnosed respectively, thus avoiding further investigation.

Chapter 9.3: The Acute Scrotum

C F Steinmann

The differential diagnosis of acute scrotum in an emergency is difficult and the diagnosis is rarely certain.

In dealing with this condition certain clinical signs and some special investigations may help in the diagnosis to determine the type of therapy.

Differential Diagnosis

Scrotal Conditions

- Idiopathic scrotal oedema
- Cellulitis/scrotal abscess
- Gangrene of the scrotum

Testicular Conditions

Torsion

- Intravaginal
- Extravagingal
- Torsion of the appendages

Trauma

- Hematocoele
- Rupture of the testis

Infective Conditions

- Infective epididimo-orchitis
- Bilateral
- Non-specific
- Specific
- Mumps-orchitis

Tumour

Inguino-Scrotal Conditions

- Strangulated inguinal hernia

Scrotal Conditions

The fascial layers of the abdominal wall descend into the scrotum and are continuous with the layers of the scrotum.

A thorough knowledge of these fascial planes is mandatory for the management of scrotal infections.

Idiopathic Scrotal Oedema

This is an interesting and not uncommon occurrence in boys usually betweent the age of 3 and 9 years, affecting the scrotum and adjacent structures.

The condition has a rapid onset and there is little or no pain but local tenderness is present. It is usually unilateral but can affect both sides. The affected side becomes swollen, firm and pink. The swelling extends into the perineum and often the groin. It may also affect the penis.

The testis may be palpable and is normal.

The pathogenesis is unknown but it may be a low-grade cellulitis.

The patient is usually apyrexial and the total white-cell count is normal. The urine is sterile.

The condition has been attributed to an allergic reaction although the localized nature and its constant characteristic distribution are against hypersensitivity as the entire explanation. Clinically acute scrotal oedema may resemble torsion of the testicle or epididimitis. The absence of pain, the fact that the swelling is behind the scrotum in many cases and the fact that a normal testis may be palpable usually allows the distinction to be made.

Ultrasound and radioisotope scanning will exclude testicular involvement. When these investigations are not available and the diagnosis remains in doubt, operative exploration is required.

The acute swelling subsides almost as rapidly as it appeared and has usually disappeared after 24-48 hours. In some cases skin discoloration persists for a longer period.

The condition may be treated with an antihistamine such as prometazine hydrochloride (Phenergan) 5-10 mg according to the child's mass.

Cellulitis/Scrotal Abscess

Primary abscesses of the scrotal wall are not uncommon.

The causes may vary from infections of the hair follicles or sweat glands, instrumentation of an infected urethra or through abrasion of the skin.

They behave as localized furuncles elsewhere and are treated as such with incision and drainage with antibiotic coverage if necessary. Although this condition is painful and disabling it is usually not serious.

Scrotal cellulitis or erysipelas, on the other hand, is a more serious condition due to a streptococcal infection. It usually develops from a single area with a definite margin occurring as a result of surgical incisions, wounds, scrotal abscesses and fistulae. It gradually spreads to involve the entire scrotum. The scrotum is swollen, tense, smooth, warm and red. Blebs may form on the surface. As it is usually due to a streptococcus, penicillin is the antibiotic of choice.

The scrotum should also be elevated to reduce oedema and it is seldom necessary to make pressure-relieving incisions.

Gangrene of the Scrotum

Commonly known as Fournier's gangrene, this condition was previously thought to be idiopathic. It is now certain that if it presents early it is possible to diagnose a predisposing condition in most cases.

It is known to occur after mechanical, chemical or thermal injuries to the scrotum. Often underlying undiagnosed aggravating conditions like diabetes mellitus, alcoholism and general debility are present.

It may occur at any age from the neonatal period onwards. The typical onset is sudden. The scrotum becomes swollen, red and glossy and subcutaneous emphysema precedes the onset of gangrene. The infections may be limited to the scrotum or may extend to involve the skin of the penis or the abdominal wall. There are severe general effects with chills, fever and marked toxemia and prostration.

The syndrome can arise through two mechanisms. An infection of the lower urinary tract can spread and involve the periurethral glands. Once it penetrates the *tunica albuginea* it spreads to involve Buck's fascia and from there to involve the dartos fascia. The dartos of the penis is a direct extension of the Colles fascia of the scrotum which is continuous with Scarpa's fascia of the abdominal wall.

If the source of the infection is perirectal or peri-anal in origin it can penetrate Colles' fascia and involve the penis and scrotum by direct extension.

The infection causes an obliterative endarteritis which leads to necrosis of the overlying skin. Several organisms have been implicated such as *Streptococcus, Staphylococcus,* haemolytic *Streptococcus, Proteus vulgaris* and *Clostridium welchii* and related anaerobes. It is, however, usually a mixed infection.

Treatment consists of broadspectrum antibiotics. An aminoglycoside to provide coverage of gram-negative rods should be used in conjunction with either clindamycin or Chloramphenicol which provides coverage of bacteroides. If clostridia is suspected, intravenous penicillin also should be used.

Surgical management includes the wide incision and drainage of all involved areas and excision of all necrotic and devitalized skin and subcutaneous tissue. Since involvement of the deep fascial layers and muscle does not occur with this syndrome it is not necessary to continue debridement into normal appearing tissue.

Daily dressings should be made at first in the operating room under general anaesthesia where additional debridement can be performed if necessary. Urinary diversion is indicated usually by suprapubic catheter because of the possible causative urethral stricture or urinary extravasation. A diverting colostomy may be required if a colonis source is suspected.

Since the blood supply of the testes is different from that of the penis and scrotum they are rarely involved in the gangrenous process. If significant loss of scrotal skin has occurred, the testes can be preserved by subcutaneous placement into the medial aspects of the thigh. The scotal skin has remarkable regenerative capacity and new scrotum can form from remaining scrotal skin. However, split-thickness skin grafts can help expedite the healing process.

Despite aggressive surgical and medical management, Fournier's syndrome gas a significant mortality rate of up to 50%.

Testicular Conditions

Testicular Torsion

Torsion of the spermatic cord has two peak periods of occurrence: one during the first year of life and the other around puberty.

The right and left testes are equally affected.

With a scrotal testis the torsion can be:

- Supra- or extravaginal torsion

The cord undergoes torsion outside the *tunica vaginalis testis* so that strangulation affects the serous membrane and its contents. This is seen mainly in infancy at which age the *tunica vaginalis* and *gubernaculum* have only a loose attachment to the scrotal wall. However, it was described in a boy aged 12 years by Barker.

- Intravaginal torsion

This is possible only if the intravaginal anatomy is abnormal. There either is abnormal coverage of the tunica where it covers the entire epididimis and often extends unusually high up the spermatic cord, or where there is a wide mesorchium which separates the testis from the epididimis so that only the testis undergoes torsion.

The first condition leads to strangulation of the testis and epididimis.

The exact cause of testicular torsion is uncertain. Forceful contraction of the spirally arranged cremaster muscle may be the initiating influence. A history of preceding trauma or physical exertion may be elicited but the significance of these factors is questionable. Torsion of the vascular pedicle may be in either direction and the number of turns variable.

Spontaneous correction is possible but in most cases the torsion persists and if not relieved, haemorrhagic infarction develops. Bilateral simultaneous torsion has been described.

Clinical Features

Clasically, in acute onset excruciating pain develops, often associated with vomiting. Gradual onset of the symptoms does not exclude the condition. Often there is lower abdominal or left iliac fossa pain simulating intra-abdominal pathology.

On examination lowgrade pyrexia is common. The testis is swollen, firm and tender and is drawn up to the scrotal neck. The affected side of the scrotum becomes reddened and oedematous. If torsion is unrelieved, the testis undergoes atrophy.

Diagnosis

The diagnosis is often made late. This is due to patients often waiting to see if the pain does not disappear spontaneously or to the prevalent misconception that testicular torsion is invariably a hyperacute episode. This together with the mild pyrexia often leads to the misdiagnosis of epididimitis.

Epididimitis is rare in children and is then usually associated with a urinary infection or urethral pathology. Mumps orchitis is rare in a prepubertal child. Torsion of the testicular appendix or infarction may clinically be indistinguishable from testicular torsion.

Since the abnormal anatomy that predisposes to torsion is commonly bilateral, Angell recommended that the patient be examined standing up, as a horizontal position of the unaffected side supports the diagnosis.

With the aid of special investigations the diagnosis which otherwise would have been made with scrotal exploration can not in the majority of cases be done without surgery. Doppler flow studies may show absence of testicular bllodflow which is usually enhanced in the epididimo-orchitis. Ultrasound shows epididimal enlargement in infectious conditions and may show an appendix testis or appendix epididimis if torted.

The most valuable examination, however, if available is testicular isotope scintigraphy with Technetium 99m. The angiographic phase shows normal or decreased perfusion - never increased. In the tissue phase a round cold area replaces the testicle and there is little activity in the dartos - the so-called "Bullseye" sign. An exception to the rule of obtaining a scan might be made for the newborn in whom the information yield of the study is low.

As the patient matures, the likelihood that acute scrotum is caused by torsion declines, while that of infection increases. Thus in patients thirteen to eighteen years old, torsion accounts for 75% of cases of acute scrotum, torsion of an appendage in 16% and epididimitis only for 8%. In the 19-24 year age group epididimitis accounts for 90% and in those older than 24, 96%.

Treatment

Reduction of torsion by external manipulation may be successful but it does not take the place of surgery not does it indicate any delay in surgical exploration. The testis is explored through a scrotal incision, the torsion untwisted and the effects are observed. Thew *tunica albuginea* should be incised to allow the parenchyma to be inspected. If there is no red bleeding and the testis remains black it should be removed, otherwise it should be retained.

The Leydig cells have greater resistance to ischaemia than the seminiferous tubules and preserving the testis may preserve hormone function. However, there is evidence that auto-immune antibodies develop in a post-torsion preserved testis. This may result in infertility even though the other testis is normal and therefore some authors advocate orchidectomy of any torted testis. Whether the affected side is retained or removed it is mandatory that prophylactic orchidopexy is performed on the opposite side since the predisposing anatomical abnormalities are present bilaterally in at least 50% of cases. The contralateral side is exposed through an incision in the overlying scrotum and the *tunica albuginea* is attached to the dartos by two or three absorbable sutures.

The testicular salvage rate depends mainly on the rapidity with which the vascular obstruction is released. (Table 9.3.1)

Table 9.3.1. Differential Diagnosis of Testicular Trauma, Torsion, Tumor and Epididymitis

Torsion: Normal urine. Palpation: 1. Pain. 2. Indefinable structures. 3. Horizontal lie. Onset: 1. Sudden. 2. Previous episodes. 3. During sleep or vehicle ride. Scan: Decreased activity. Doppler:

Trauma: Normal urine. Palpation: 1. Pain and swelling. 2. Related to nature of injury. Onset: Sudden. Scan: Depends on injury. Doppler: Depends on injury.

Tumor: Normal urine. Palpation: 1. Painless unless haemorrhage. 2. Diffuse or local testicular swelling. Onset: Gradual unless haemorrhagic. Scan: Normal. Doppler: Normal.

Epididymitis: Urine: Pyuria bacteriuria. Palpation: 1. Discreet epididymis. 2. Soft testis (early). Onset: 1. Gradual. 2. Groin pain. 3. Previous funiculitis. Scan: Increased activity. Doppler: Normal.

Torsion of Testicular and Epididimal Appendages

Torsion of these vestiges of Müllerian and Wolffian ducts most commonly affects the appendis of the testis (the sesile hydatid of Morgagni). The strangulated hydatid swells to about the size of a pea and haemorrhagic infarction usually follows rapidly. The aetiology is obscure. An unusually large appendix is probably more susceptible to complications.

The highest incidence is in boys of pubertal and immediately prepubertal years.

Clinical Findings

Pain, usually of sudden onset, is referred to the scrotum, inguinal area and lower abdomen. The symptoms are usually undistinguishable from that of testicular torsion.

The enlarged appendix may be palpable above the testis and trans-illumination in whites may show the so-called "blud-dot" sign due to infarctions of the appendage. Technetium 99m scan may also be helpful to establish the diagnosis. If the diagnosis can be made without doubt and if symptoms are not too excrutiating, conservative treatment may be indicated with analgesics. If there is doubt, surgical exploration is indicated with excision of the infarcted hydatia.

Trauma

History of trauma to the perineal area is usually prevalent. There is swelling of the scrotum with redness and tenderness of the area. Usually the normal intrascrotal anatomy cannot be distinguished by palpation.

Ultrasound is very helpful in determining the extent of the trauma, indicating if only haematocele or testicular rupture is present.

Prompt surgical exploration with corrective surgery of the testis, orchidectomy or drainage of the haematocele is usually indicated.

Infective Conditions

Acute Epididimo-Orchitis

Epididimo-orchitis is the most common of all the intrascrotal inflammations. It usually affects adults and only rarely affects the prepubertal child.

Organisms reach the epididimis commonly through the lumen of the vas from previously established urinary infection. The haematogenous route is a more rare mode of infection.

Non-Specific Epididimo-Orchitis

It is caused by the usual organisms that cause urinary infections, ie, the colon bacilli and occasionally streptococci. It appears as a complication of acute or chronic prostatitis, urethral stricture and cystitis.

Straining which may force infected urine down the *vas deferens* is a precipitating factor.

Clinical Symptoms

The onset is usually more gradual than that of torsion. The temperature is usually 38 °C or higher with other symptoms of urinary infection such as dysuria and frequency. The scrotum is red and swollen. Secondary hydrocele is common, as is leucocytosis. On

examination the enlarged epididimis can sometimes be palpated and the cord is thickened and tender elevation of the testis may relieve the pain (Prehn's sign). Ultrasound may aid in the diagnosis and so may isotope scanning which shows increased vascularity.

Treatment

Local treatment includes bed rest, scrotal support and observation for abscess formation.

Systemic treatment consists of broadspectrum antibiotics intravenously which is changed to the antibiotic of choice according to culture and sensitivity of the urine. Treatment should be intravenous for at least five days and then orally for another fourteen days. Analgesics, anti-inflammatories and antipyrexial medication should be administered as indicated.

The degree of clinical response depends on the severity of the lesion. Contitutional reactions sich as fever, leucocytosis and pyuria often respond well, but the resolution of the local process may be disappointingly slow. After the acute stage has subsided, a thorough search should be made for the initiating focus especially investigating the urinary tract. In recurrent epididimo-orchitis a vasectomy is indicated to prevent recurrence, but performed only after the infection is cleared up.

If the teperature stays high in spite of the treatment an underlying abscess should be suspected which can be verified with ultrasound. Surgical drainage and sometimes an orchidectomy is indicated.

Specific Epididimo-Orchitis

This is due to:

--> tuberculosis
--> syphilis
--> gonorrhea.

Tuberculosis usually is a more chronic condition with a cold abscess in the tail of the epididimis. Frequently, beading of the *vas deferens* is palpable.

Gonococcal epididimo-orchitis differs only from the acute non-specific type in that there usually is a urethral discharge.

Syphilis produces epididimitis due to vascular spread and therefore affects the head of the epididimis. Other evidence of syphilis is usually present and the urine is sterile.

Testicular Tumour

Tumour of the testis seldom presents as an acute scrotal condition. The enlargement together with signs simulating acute recurrent epididimo-orchitis may fool the clinician.

Ultrasound usually establishes the diagnosis and treatment should be according to that of testicular tumours.

Mumps Orchitis

This is mainly a disease of the mature testis. This complication may be expected in about 18% of adults with mumps parotitis. Orchitis usually develops a few days after the onset of the parotitis but sometimes it precedes the parotis swelling.

The majority of cases is unilateral. The main complication is testicular atrophy of varying severity.

Treatment

The administration of cortisone in high doses is the treatment of choice with good results. The practice of capsular incision to relieve intratesticular pressure is outdated and rarely indicated.

The atrophic testis is in a small percentage of cases liable to later develop a seminoma. Prophylactic removal of the atrophic testis is therefore sometimes indicated. Bilateral involvement with atrophy requires hormonal replacement therapy if indicated.

Inguino-Scrotal Conditions

Strangulated hernia sometimes presents as an acute scrotum. The scrotal involvement with inguinal extension should alert one that it may be a hernia.

In children there is frequently an undescended testis which complicates the diagnosis and treatment.

The clinical signs and symptoms of this condition as well as the treatment are discussed under the surgical condition.

Comment

The Acute Scrotum

J H Naudé

Regarding "Fournier's gangrene" it is recommended that this term be reserved for idiopathic cases and that peri-urethral abscess with resultant extravasation of urine and cellulitis or necrotising fascitis be identified as such. The same would apply to ischio-rectal or peri-anal abscesses with extention to the genital skin. It is regarded as important that a specific diagnosis be made as it will profoundly influence the management of the case.

If these conditions are lumped together under the ill-defined and semantically incorrect diagnosis of "Fournier's gangrene", accurate diagnosis and specific therapy will not be encouraged.

The high mortality rate of 50% quoted, might have occurred in a previous era, but is certainly no longer seen.

Treatment of Epididimo-Orchitis

It is stated that antibiotic treatment should be intravenous for at least five days. This makes little sense as the culture and specific antibiotic sensitivity should be available from the third day. It might well be that the antibiotic of choice could be one that would be administered orally with excellent effect.

Surgical drainage of an abscess resulting from acute epididimo-orchitis with testicular involvement is an exercise in futility, as drainage will persist until all seminiferous tubules have been extruded. Orchidectomy allows for a rapid resolution of the condition and the final result in terms of functioning testicular tissue is the same.

Chapter 9.4: Haematuria

S Reif

Haematuria, whether it be macroscopic or microscopic, is often the first symptom of significant urinary tract disease. It is estimated that 20% of patients suffering gross (macroscopic) haematuria and ± 10% of patients with microscopic haematuria have a neoplasm somewhere along the urinary tract (table 9.4.1).

Haematuria is defined as the excretion of abnormal quantities of erythrocytes in the urine, or as the passage of blood in the urine. Pseudohaematuria indicates a reddish discoloration of the urine as a result of medications such pyridium foods, ie, beets, vegetable dyes, urate crystals or porphyria. Haemoglobinuria leads to erroneous diagnosis in the sense that by way of the "dipstick" method blood is present in the urine but without evidence of erythrocytes microscopically.

Patient Evaluation

History

Initial haematuria (haematuria occurring at the onset of urination) suggests a possible pathological process in the urethra while terminal haematuria (haematuria occurring at the end of micturition) usually indicates a source in the bladder or prostate/bladderneck. Total haematuria (haematuria throughout voiding) represents kidney disease.

Dysuria accompanied by haematuria would suggest urethral or lower tract infection while total haematuria with ureteric colic represents upper-tract bleeding with possible clots passing down the ureter.

A family history of renal disease could include such conditions as polycystic disease, angiomyolypoma (associated with tuberous sclerosis) and hereditary nephritis (hearing disorder and haematuria). Personal or family history of bleeding disorders (coagulopathy), drug/analgesic abuse (analgesic nephropathy), previous cancer (metastasis),

cyclical haematuria (endometriosis) and a history of a recent pharyngitis (post-streptococcal glomerulo-nephritis) lend invaluable information in the evaluation of a patient with haematuria.

General Examination

Findings on physical examination such as high blood pressure (hypertensive nephropathy), oedema (glomerulo-nephritis), petechiae (coagulopathy), adenoma sebaceum (tuberous sclerosis), heart murmur (subacute bacterial endocarditis), atrial fibrillation (renal emboli), abdominal mass (polycystic disease or tumour) and abdominal bruit (A-V fistulae) stress the obvious reasons for an examination of this order. Prostatic enlargement (benign or malignant) sometimes leads to haematuria and thus necessitates rectal examination.

Special Investigations

Urinalysis

Urinalysis ("dipstick" and microscopy) is an essential and often neglected step in the work-up of a case with haematuria.

The "dipstick" strip indicates the presence of blood, proteins, glucose and pH. Glucosuria as a result of diabetes mellitus may be a lead to the cause of the haematuria, ie, diabetic nephropathy or papillary necrosis. A constant low pH is found in some cases of hyperuricosuria with uric acid crystallization and haematuria. Proteinuria in the range of 100-300 mg/dL (2+ to 3+) on "dipstick" is indicative of renal pathology as not even gross haematuria leads to this amount of proteinuria. Haematuria associated with 2+ or 3+ proteinuria would suggest glomerular or interstitial renal pathology.

Urine microscopy is performed after a freshly voided urine specimen is centrifuged for 3-5 minutes at between 2000 and 3000 rpm. The sediment should be examined by low-power (x10) and high-power (x40) light microscopy. Two or more erythroces per hpf is regarded as abnormal as only 3% of normal individuals exceed this number. Red blood cells casts, whether accompanied by proteinuria or not, are diagnostic of glomerular bleeding, and certainly calls for nephrological investigations.

Abnormality in red blood cell morphology provides some evidence as to their origin. Glomerular disease commonly leads to dysmorphic red cells which are best recognized by phase contrast microscopy (see table 9.4.2). Glomerular haematuria includes conditions such as IgA nephropathy, various forms of glomerulo-nephritis and familial nephritis (Alport syndrome). Bear in mind that 21% of cases suffering from glomerulo-nephritis present with haematuria that is not accompanied by red cell casts or proteinuria. While glomerular renal haematuria is suspected by the excretion of dysmorphic red blood cells and in 80% of cases proteinuria, urinalysis in non-glomerular renal haematuria reveals no dysmorphic cells or casts while proteinuria is sometimes present. Non-glomerular renal haematuria includes such conditions as prolonged exercise, bleeding, dyscrasias, medullary sponge kidney, polycystic kidney, papillary necrosis, pyelonephritis, analgesic nephropathy, renal vein thrombosis and arterio-venous anomalies.

White blood cell casts may be indicative of pyelonephritis while sterile pyuria may include conditions such as tuberculosis, papillary necrosis and carcinoma in situ. The presence of *Schistosoma haematobium ova* offer enough evidence for a diagnosis.

Although urine culture is essential as part of the work-up, it should be clearly stated that infections might be present as a complication of carcinoma of the bladder.

Urine cytology has become a recognized and routinely used diagnostic tool in the armamentarium of the urologist. Diagnosis of carcinoma in situ is sometimes made before the urologist cystoscopically visualizes any lesion.

Excretory Urography

Excretory urography (IVP) is the examination of choice if, after a good history, thorough general examination and detailed urinalysis, a diagnosis cannot be made. Tumour, calculi and obstructive uropathy of the upper tracts are thus defined.

Cystoscopy

Cystoscopy should follow a normal excretory urogram (IVP). Cystoscopy makes the mid and lower urinary tract accessible to direct inspection and biopsy. In cases of elusive intermittent, gross haematuria, cystoscopy should be performed during an episode of active bleeding.

If after the abovementioned routine the etiology of the haematuria has not been established, further investigations are called for.

Further Investigation

The history and general examination should again be scrutinized. Bear in mind that analgesic abusers often deliberately lie about their intake of medicaments. Factitious haematuria, not too infrequently eludes the casual investigator. Special investigations should now be aimed at sickle-cell disease/trait, the coagulation profile, analgesic blood levels, ASO titer (post-streptococcal glomerulo-nephritis), C3 and C4 complement (glomerulo-nephritis), PPD and early morning urine for tuberculosis culture. Should these investigations not afford a diagnosis, tests such as sonography or CT scanning (undetected tumours and calculi), arteriography (AV anomalies), venacavagraphy (renal vein thrombosis) and renal biopsies can be considered.

The reader should appreciate that even after such a rigorous program there will be a group of patients in whom a diagnosis cannot be made. It is these cases that careful follow-up by way of urine cytology should be considered to pick up the early malignancy undetected at initial evaluation.

Haematuria in the Newborn

As stated above it is mandatory that haematuria, whether it be gross or microscopic, be fully evaluated. In the overwhelming majority of cases in children and

adults, haematuria is not a life-threatening emergency. In the newborn, however, the opposite is true. Fortunately gross haematuria in the neonate is rare.

Three conditions, renal artery thrombosis, renal vein thrombosis and renal cortical necrosis, deserve mention while some others, ie, obstructive uropathy, polycystic kidneys, nephroblastoma, bleeding dyscrasias and medullary sponge kidney, warrant consideration.

Summary

In older patients the aphorism that haematuria (gross or microscopic) is carcinoma until otherwise proven, remains unchallenged. It is still the most common presenting symptom in bladder carcinoma occurring in 85% of cases. As it is rarely accompanied by other symptoms, it is often termed "painless haematuria". Carcinoma in situ, on the other hand, often presents with vesical irritability and microscopic haematuria.

Dysmorphic erythrocytes, proteins and casts in the urine help us to categorize our patients into nephrological and urological groups. The former with emphasis upon immunological studies, often kidney biopsy to serve a final diagnosis. The latter group after routine ward and laboratory work up (FBC and SMA II) undergo excretory urography and cystoscopy.

Comment

Haematuria

D P de Klerk

Haematuria should never be ignored. Even in the young woman with acute haemorrhagic cystitis, follow-up is required to ensure that the haematuria has resolved once the infection has been adequately treated. However, "false haematuria", ie, contamination by vaginal bleeding or the foreskin, "pseudohaematuria" and haemoglobinuria must be excluded, the latter by microscopy.

Beware: Haemoglobinuria can clot!

Total macroscopic haematuria (ie, bladder or kidney bleeding) has a much more sinister prognosis than either terminal or initial haematuria. With total, particularly painless haematuria, bladder, ureteral or renal tumors must be excluded by diligent investigation. The duration of haematuria has no prognostic implication: the single episode of haematuria requires the same attention as repeated episodes.

In South Africa, genito-urinary tuberculosis and bilharzia should always be remembered. No patient is exempt: the author has treated clergymen, businessmen and pubertal children with genito-urinary tuberculosis. Bilharzia is not confined to the northern provinces: cases of vesical bilharzia have been recorded in patients that have spent their entire life in the south-eastern Cape.

The most common cause for macroscopic haematuria in the young, prepubertal child is glomerulonephritis. These children should not be subjected to cystoscopy

routinely, until glomerulonephritis has been excluded. In addition, calcium crystaluria has recently been recognized as a common cause of haematuria in children.

The importance of intravenous pyelogram and cystoscopy in the work-up of the adult with non-nephrological haematuria has been discussed. It should be emphasized that intravenous pyelography is necessary in all such patients, and that sonagraphy is an inadequate substitute: calyceal delineation is necessary to exclude small lesions, ie, stones, transitional cell carcinoma and papillary necrosis. Furthermore, in patients with upper urinary tract pathology and total painless haematuria, cystoscopy should be recommended to exclude additional vesical pathology.

Chapter 9.5: Acute Retention of Urine and the Management of Urinary Catheters

S Reif

Retention of Urine

Urinary retention is defined as an inability to pass urine (void). Acute urinary retention usually leads to severe pain and discomfort while retention in the chronic form often manifests with dribbling of urine (overflow incontinence). In the latter the patient more often than not is unaware of his distended bladder.

Prostatic enlargement, neurogenic bladder, posterior urethral valves (boys), urethral strictures and spasm of the external urethral sphincter are the most commonly encountered causes of urinary retention in males whereas atonic bladder, sphincter spasm and urethral carcinoma are included among the reasons for retention in females.

Undue stimulation of the S2,3 and 4 sensory receptor area could lead to sphincter spasm with urinary retention. Procedures or irritation to the anal region (ie, haemorrhoidectomy, fissure-in-ano), vagina (ie, Brtholin abscess) and perineum are not too infrequently associated with acute urinary retention. Although urinary retention is more common in patients with underlying prostatic hypertrophy it may also follow in patients with completely normal urinary tracts.

Treatment by way of catheterization should always be done under the strictes aseptic conditions adhering to all the principles in this regard.

Overdistension of the urinary bladder leads to lacerations of the urothelium with subsequent post-catheterization haematuria and sometimes clot formation. Catheter blockage may follow. It is sometimes wise to force diuresis by way of IV fluids in these patients in order to prevent clot formation.

Alleviation (catheterization) of a patient with chronic urinary retention frequently leads to a post-obstructive diuresis which may leave the patient dehydrated and in electrolyte disbalance. Careful monitoring of these patients is mandatory.

Management of Urinary Catheters

Introduction

Transurethral catheterization of the urinary bladder has become such an integral part of modern-day optimal patient care that the intrusiveness and sometimes life-threatening complications of this procedure are often overlooked.

It is estimated that the number of patients in teaching hospitals who require an indwelling catheter is approximately 10%. Only when bearing in mind that hospital-acquired urinary-tract infections account for 40% of all nosocomial infections and that almost 80% of these infections result from catheterization, can one appreciate the magnitude of the problem.

Pathogenesis of Catheter-Associated Urinary Tract Infections

Bacteria leading to catheter-associated urinary-tract infections originate from the periurethral and/or perineal organisms, organisms infecting the collecting devices or from bacterial infections caused by disruption of the closed catheter system at the catheter drainage-tube junction. Bacteria reach the bladder cavity either by way of the sheath of exudate that surrounds the catheter in the urethra or via the lumen of the catheter itself by way of air bubbles that travel upward in the drainage tube, or by bacterial mobility. Most authors are in agreement that the major pathway is by ascending infection through the lumen of the drainage tube.

Possible Complications in Catheterized Patients

The primary cause of morbidity associated with catheterization is bacterial infection of the bladder, usually by gram-negative bacilli or enterococci. In approximately 1% of these urinary tract infections, bacteremia will follow. A small percentage of patients with gram-negative rod bacteremia will develop life-threatening septicaemia. Knowledge of the clinical picture, pathophysiology and management of this syndrome is essential. Prostatitis, prostatic abscess, pyelonephritis, epididymo-orchitis, peri-urethral abscesses, urethral strictures, and bladder and renal calculi are also complications of note.

Indications for Catheterization of the Urinary Bladder

Having thus established the potential morbidity associated with catheterization, this procedure should therefore not be carried out without due consideration of the indications.

Indications would include the relief of urinary obstruction, optimal patient monitoring, to provide access to the bladder, ie, for collection of urine speciments, cystography, cystometry and to instil cytotoxics or antibiotics into the bladder, to maintain anatomic continuity, ie, after trauma or surgery and to ensure an empty bladder, ie, after repair to ruptured bladder or cystostomy.

Equipment and Technique

Most institutions have prepacked sterilized catheter packs available for the purpose of catheterization. A standardized hospital technique is usually a prerequisite. Should the reader, however, want further information in this regard, an excellent article (practical procedures) is mentioned among the references.

Choice of Catheter

Basically two "material" types of catheters are currently in ure. It is recommended that the less expensive latex type be used for the patients who needs short-term catheterization, while the much more expensive silicone variety be reserved for long-term catheterization.

The latter catheter has the advantage that recatheterization is needed less often (once in 6-12 weeks), encrustations do not readily accumulate on this material and that the retention balloons do not deflate by osmosis as quickly as they do in the case of some latex catheters. Furthermore, silastic (silicone) catheters are less irritating to the urethral mucosa since body salts do not adhere to this catheter. Some investigators hold the view that urethritis is a much more common complication of latex catheters and that the latter kind of catheter therefore has a higher stricture formation rate.

As a rule it is fair to state that the bigger the calibre of the catheter, the higher the incidence of urethral strictures will be. A 16-18 French catheter is a good, responsible choice for adults.

Risk Factors

The incidence of nosocomial catheter-associated urinary infection is higher in the female patient, the patient above 50 years old, and the patient with a serious underlying disorder and is directly related to the duration of catheterization. The risk of infection ranges from 4-7.5% per day. Concerted efforts to limit the duration of catheterization would therefore result in decreasing the 10-20% incidence of urinary tract infections in catheterized patients.

Catheter Care

The most dramatic breakthrough in catheter care came almost 20 years ago with the introduction of closed-catheter urinary drainage which led to a reduction in catheter-associated bacteriuria from the astonishing figure of 90% at four days in open systems to ± 35%.

While the periodic installations of ie, hydrogen peroxide into collecting bags may delay the onset of bacteriuria, prophylactic antibiotic irrigations of closed-catheter systems have proved unsuccessful and in fact could lead to resistant organisms.

Controversy surrounds the possible advantage of routine cleansing and application of antimicrobial agents to the urethral meatus (catheter-meatal junction). We have already established that the majority of bacteria reach the bladder by way of the catheter lumen.

Furthermore, a miracle is required to keep these meatal dressings in position. Antibiotic installations along the urethra could lead to resistant strains and the author therefore holds the opinion that apart from normal personal hygiene, no other meatal or urethral care is indicated.

The incidence of catheter-associated urinary-tract infections among patients who do and do not receive antibiotics will eventually be the same. There is, however, good evidence that the period between catheterization and infection is longer among patients receiving antibiotics.

The routine use of antimicrobials to prevent catheter-associated infections carries the risk of infection by resistant organisms and the possible emergence of resistant flora in the hospital, although the administration of antimicrobial agents for the sole purpose of preventing nosocomial urinary-tract infections during short periods of catheterization appears to reduce the incidence of infection, it is advisable to use them prophylactically only in high-risk cases. A specific prophylactic regime is, therefore, called for in patients with ie, valvular cardiac disease.

Patients on catheter drainage prior to surgery should be regarded as having infected urine and treated as such.

With the above considerations taken into account it would seem fair to withold prophylactic antibiotics in patients where the catheter is to be removed within 48 hours. Routine urine culture is called for in all other cases. A positive culture should be treated with the appropriate antimicrobial and in these cases prophylaxis by way of ie, nitrofurantoin 100 mg twice daily for seven days is advisable beginning on the evening before catheter removal as patients who suffer from catheter-associated infections show persistance of bacteriuria even though the infection was treated appropriately. In all other cases urine culture five to seven days post-catheterization is also necessary.

One-time catheterizations for the purpose of ie, specimen collection, cystography or cystometry, carries an infection rate of 1-20%. If, however, one-time catheterizations are followed by a single dose of an antimicrobial, such as ie, nitrofurantoin 100 mg, the incidence of these infectionxs will be very low.

Antibiotics have a very limited place in the management of patients on long-term indwelling catheters (months/years) - limited in the sense that chemotherapy would eliminate the predominant strains but this could lead to replacement by resistant bacteria. Antibiotics in these patients should be reserved for patients who suffer pain, pyrexia, rigours or constitutional upset.

Comment

Acute Urinary Retention and the Management of Urinary Catheters

D P de Klerk

While the diagnosis of urinary retention is usually obvious, it is merely a symptom of underlying disease. In the middle-aged or elderly male, benign prostatic enlargement is by far the predominant cause. While urethral stricture, prostatic carcinoma and external sphincter dysynergia should be considered, these tend to present more insidiously. In the younger male acute prostatitis may cause acute retention, but as in the female with acute cystitis, urinary retention should be differentiated from severe urgency.

Acute urinary retention in the female is uncommon and rarely due to physically obstructive causes. Psychogenic retention may be responsible for as many as 50% of cases, but an acute peripheral neuropathy, ie, herpes zoster, should be considered.

In children, severe dysuria may lead to external sphincter spasm with retention.

Although transurethral catheterization is clearly indicated in certain circumstances, ie, acute urinary retention, the potential long-term consequences should always be considered and proper precautions taken to minimize complications. The urologist is all too frequently confronted by the patient with a urethral stricture subsequent to unnecessarily prolonged catheterization for questionable indications.

Certain aspects of catheter care merit emphasis:

--> Catheterization is a sterile procedure which should not be left to the inexperienced.

--> To minimize trauma the smallest size catheter that will fulfil the requirements should be used. Remember that the catheter should easily pass the external urethral meatus. However, a too small catheter may not have adequate stiffness to overcome the resistance of the external sphincter or a "high" bladderneck. The catheter should be well lubricated and anaesthetic jelly may be used to decrease patient discomfort and resulting sphincter spasm.

--> Except after prostatectomy, there is rarely reason to inflate the balloon of the Foley catheter to more than 5 cm^3. Large balloons simply increase bladder spasms with no other benefit.

--> Leakage around the catheter is either due to bladder spasms or catheter blockage. The problem will not be solved by the passage of a larger catheter.

--> The catheter should be firmly secured to the upper leg in a mobile patient or to the lower abdomen in the paralysed or unconscious. The tape should never be applied to the catheter itself, but to the tube of the catheter drainage bag.

--> Unless the catheter cannot otherwise be cleared of obstruction, never break the closed system. Never clamp or otherwise obstruct a catheter. "Bladder training" by intermittent clamping of the catheter is of no value and potentially dangerous in the patient with infected urine.