Urologic Emergencies

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KEYWORDS

• Urologic emergencies • Acute urinary retention • Infected nephrolithiasis
• Paraphimosis • Penile fracture • Priapism • Fournier gangrene • Testicular torsion

KEY POINTS

- When evaluating a potential urologic emergency, the internist should have a high level of suspicion for a serious underlying illness or injury.
- Diagnosis often relies heavily on clinical history and physical examination, with imaging playing an increasingly vital role.
- Urologic consultation should be requested early if surgical intervention is thought to be necessary.

ACUTE URINARY RETENTION

Acute urinary retention (AUR) will be encountered by most health care professionals, and it should be distinguished from chronic urinary retention, which is usually due to the same cause but is less emergent because it develops over time.

Clinical Presentation

AUR can be secondary to obstructive causes or a dysfunctional (atonic) bladder. When obstructive, it presents an overwhelming majority of the time in men rather than in women. Most commonly, this is due to the presence of a large, obstructing prostate secondary to benign prostatic hyperplasia (BPH). Less common obstructive causes include narrowing of the urethra due to urethral strictures or bladder neck contractures, which are usually consequences of prior urologic surgery, prior Foley catheterization, straddle injuries or other trauma, sexually transmitted infections, or congenital causes such as hypospadias.

When AUR is due to a dysfunctional bladder, an inciting factor is usually present. This factor tends to be a side effect of a medication, especially an anticholinergic or opioid, or a side effect of general/locoregional anesthesia.[1] Although this cause is most common in women presenting with AUR, such medications in men can

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exacerbate an already existing obstructive condition such as BPH. A typical example would be postoperative urinary retention after surgery.

Therefore, typical presenting symptoms of AUR include a history of difficulty with urination or prior urinary retention episodes, a lack of urination for several hours or longer, frequent urination of small amounts, overflow incontinence, abdominal or suprapubic pain, and a suprapubic mass on palpation caused by the distended bladder.

It is important to separate this from patients experiencing gross hematuria who can develop clots, which may be passed painfully in the urine. Clots accumulating in the bladder can obstruct the outlet and prevent passage of any urine leading to retention as well.

Last, neurologic illnesses can be responsible for retention via inability of the bladder to sufficiently contract. A thorough history and physical examination should always be performed to rule out spinal cord injury, compression, multiple sclerosis, Parkinson disease, or cauda equina syndrome as the cause of AUR.

Diagnosis

The diagnosis of AUR relies heavily on history-taking and the physical examination. Additional diagnostic tools, such as ultrasonic bladder scan, to determine urine volume can be used. It should be noted that the presence of ascites would lead to a false-positive reading by the bladder scanner because it will simply detect this intra-abdominal fluid. A bedside bladder ultrasound can also be performed to visualize the distended bladder and, if present, blood clots.

Treatment

Primary management of AUR involves emergent bladder drainage with insertion of a Foley catheter. The type of Foley used should be based on the clinical situation as detailed in later discussion (**Fig. 1**). In all cases, an α1-blocker such as tamsulosin should be started and continued for a minimum of 3 days before Foley removal because this has been demonstrated to increase the chances of a successful voiding trial.[2–4] In practice, however, a period of 1 to 2 weeks appears to be associated with a higher rate of successful decatheterizations.

In an uncomplicated case of AUR, a standard 16-French Foley catheter should be inserted under sterile technique. If resistance is met and the patient is an older man with BPH, increasing the Foley size to 18 or 20 French may be more successful because increased rigidity allows better passage of the enlarged prostate. A Coudé catheter with its curved tip also facilitates placement because the tip is designed to align itself with the curve in the bulbar urethra, making it more likely to pass between obstructing prostatic lobes. If resistance is consistently encountered, further attempts should be abandoned because a false urethral passage may form. Urology consultation should follow, because a flexible bedside cystoscopy may be necessary to place a guidewire into the bladder over which a Foley catheter can be advanced.

In a younger patient in whom BPH is unlikely and a urethral stricture is suspected (typically a history of congenital hypospadias, pelvic trauma, or radiation), decreasing the Foley size to 12- or 14 French often allows placement. Again, if resistance is consistently encountered, flexible cystoscopy by urology should be performed at the bedside to allow for immediate dilation of the stricture.

If gross hematuria or clots are present, placement of a larger 22- or 24-French 3-way Foley catheter for continuous bladder irrigation is recommended. Initially, irrigation by hand should be attempted with a 60-mL syringe to remove clots. If the irrigation fluid

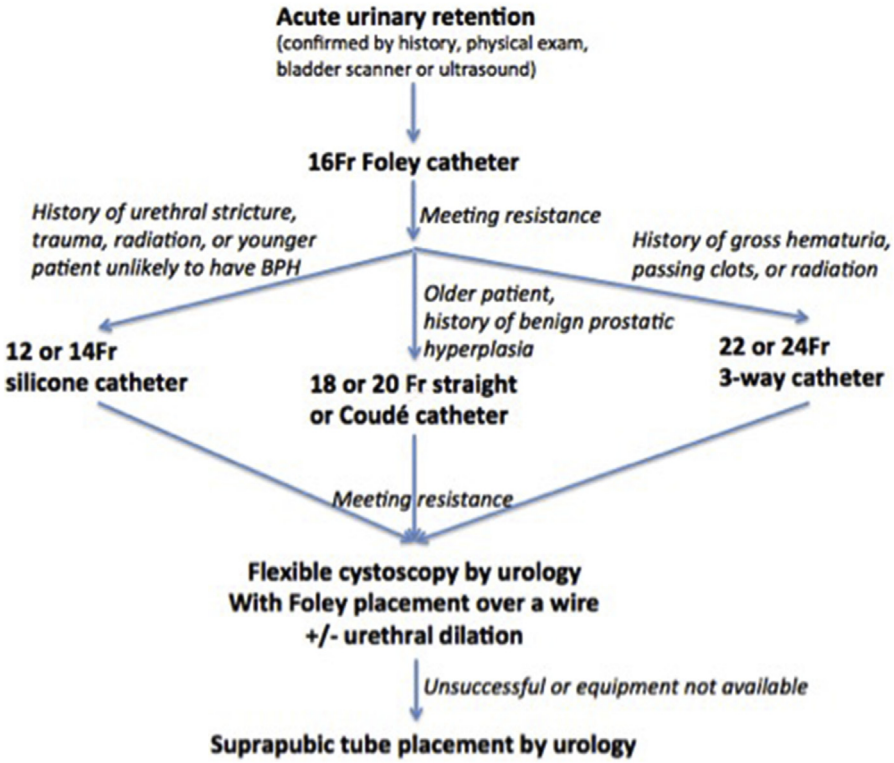

Fig. 1. Flowchart for management of acute urinary retention.

remains bloody and fails to clear up, continuous bladder irrigation through the third port of the catheter should be initiated.

NEPHROLITHIASIS

Kidney stone disease has been increasing in prevalence in US adults over the last several decades,[5] and evidence from the National Health and Nutrition Examination Survey suggests that the prevalence has doubled between 1994 and 2010.[6] Although asymptomatic kidney stones can be found in nearly 10% of patients,[7] it is those with refractory pain or a high stone burden that are treated surgically. Furthermore, concerns of concomitant urinary tract infections should trigger emergent urologic intervention to prevent bacteremia or sepsis. Bilateral obstructing stones or an obstructing stone in a solitary kidney is also an indication for intervention to avoid acute renal failure caused by total obstruction.

Clinical Presentation

Most patients presenting to the emergency room or outpatient office with kidney stones will complain of colicky flank or abdominal pain on the side of the stone, pain that radiates to the groin and specifically the scrotum in men or labia in women, nausea, and vomiting. In terms of urinary symptoms, patients may have frequency, dysuria, and gross hematuria. A history of hyperparathyroidism, type 1 renal tubular acidosis, inflammatory bowel disease, sarcoidosis, cystinuria, gout, metabolic

syndrome, diabetes, and recurrent urinary tract infections is associated with stone formation.[7]

In a patient with an infected kidney stone, presentation with systemic symptoms such as fever and chills in addition to the aforementioned ones is common. Beware of immunocompromised patients who may not mount a sufficient immune reaction for these symptoms to be present. In these cases, most commonly in diabetic patients or those on chemotherapy, emergent stent placement may be indicated in the absence of systemic symptoms.

Diagnosis

The most useful diagnostic test when a stone is suspected is a computed tomographic (CT) scan, which allows determination of the location, size, and quantity of stones as well as the degree of hydronephrosis. Although ultrasound has become a more widely used modality in the initial evaluation of stones,[8,9] CT imaging remains the gold standard because it visualizes almost all stone types and has sensitivities and specificities of greater than 95%.[10,11]

Typically, a patient with an infected kidney stone will have leukocytosis, a positive urinalysis with nitrites, leukocyte esterase, bacteria, or white blood cells, and ultimately a positive urine culture. Bilateral obstructing stones or an obstructing stone in a solitary kidney will be visualized anywhere between the ureteropelvic junction and the ureterovesical junction. Hydronephrosis will be present proximal to the stone or stones, and the obstruction may lead to an acute kidney injury (AKI). It should be noted that these patients may have a mild AKI because of renal colic causing nausea, vomiting, and decreased fluid intake or appetite. Infected stones, bilateral obstructing kidney stones, or an obstructing stone in a solitary kidney warrants emergent treatment and urology consultation. In the case of an infected stone, broad-spectrum antibiotics should be started immediately as well.

Treatment

Emergent urologic treatment of these conditions consists of placement of a ureteral stent, which diverts the urine around the stone obstructing the kidney. Definitive stone treatment can occur via ureteroscopy with laser lithotripsy and stone extraction once the patient has stabilized and recovered. For intractable pain that is not manageable with oral medications, stent placement is also indicated because it will mitigate the pain.

PENILE EMERGENCIES: PARAPHIMOSIS

Paraphimosis refers to the entrapment of the foreskin behind the glans penis for a prolonged amount of time (**Fig. 2**). Because venous and lymphatic return from the glans and foreskin is reduced, painful edema of the trapped foreskin occurs and further impedes reduction of the foreskin. If not reduced in a timely fashion, paraphimosis can eventually result in tissue ischemia and necrosis.

Clinical Presentation

In the clinical presentation, patients present with severe pain for several hours. In an adult, the typical presentation is in the hospital setting in which a Foley catheter is placed in an uncircumcised male patient, and the foreskin is retracted during the procedure but not reduced thereafter. In a young child, it can be seen after a physical examination in which the foreskin was traumatically reduced or by aggressive parental attempts at hygiene.[12]

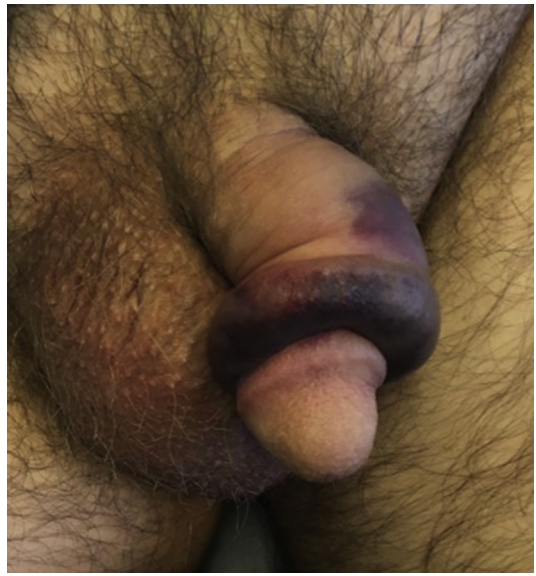

Fig. 2. Swollen and edematous foreskin trapped behind the glans penis, resulting in paraphimosis. Note the dystrophy of the foreskin, which may lead to ulceration or gangrene if untreated.

Diagnosis

Diagnosis relies on physical examination, and there is no role for imaging studies.

Treatment

Treatment involves pain control and reduction of the edematous foreskin, which is successful in the vast majority of cases. In addition to pain medication, an icepack on the area can minimize swelling and also be helpful as a local analgesic. To perform the reduction, gentle steady pressure should be applied to the foreskin for 5 to 10 minutes to compress the edema and decrease swelling.[13] Then, 2 thumbs should be placed on the glans and pushed against it while the fingers pull outwards on the foreskin. If this maneuver fails, it can be repeated with longer compression time. However, if this also remains unsuccessful, then urology should be consulted because an emergent dorsal slit procedure at the bedside may be necessary. This procedure consists of incising the foreskin at the dorsal aspect to facilitate foreskin reduction, and the dorsal slit can be extended to a full circumcision later.

PENILE EMERGENCIES: PENILE FRACTURE

Fracture of an erect penis should be promptly explored and surgically repaired to prevent long-term complications, specifically erectile dysfunction and Peyronie disease.

Clinical Presentation

Nearly all penile fractures occur during sexual intercourse,[14] because the penis must be erect for this to happen. The otherwise relatively thick tunica albuginea that encases the corpora cavernosa is thinned out due to the stretch during an erection. Patients often provide a history of having vigorous sexual intercourse when the erect penis slipped out and struck the perineum or pubic bone of their partner. This buckling

injury causes the erect penis to bend abnormally and results in a laceration of the tunica albuginea[15] and is typically associated with a "popping" or "cracking" sound and rapid detumescence.

Diagnosis

Diagnosis relies on the history provided by the patient in conjunction with the physical examination. It is important to note that patients often provide incomplete details likely because of embarrassment or fear. On examination, the penis may be discolored and swollen. A penile hematoma will result in a typical "eggplant deformity" as the fascial organization of the penis typically limits the hematoma formation to this organ (**Fig. 3**). The hematoma can, in some cases, also extend to the scrotum, perineum, and suprapubic regions. Because the urethra may often be injured simultaneously, gross hematuria, blood at the meatus, or inability to void may be present.

In men in whom the clinical suspicious of penile fracture is high, imaging studies are unnecessary. When the suspicion is low, ultrasound is rapid, noninvasive, inexpensive, and accurate at determining whether a tear in the tunica albuginea layer is present and warrants surgical repair.[16,17] Although MRI has been described as a diagnostic tool in equivocal cases,[18] it is not recommended because of the time required, limited availability, and expense.[19]

Treatment

Treatment of penile fracture involves prompt surgical exploration and repair. Flexible cystoscopy is done in the operating room to visualize urethral injury. Through a vertical penoscrotal incision[20] or a distal circumcising incision, the penis is explored for lacerations of the tunica albuginea layer as demonstrated in **Fig. 4**. The lacerations are sutured closed, and urethral injuries are repaired primarily as well. The Foley catheter may be maintained postoperatively depending on the degree of urethral injury, and

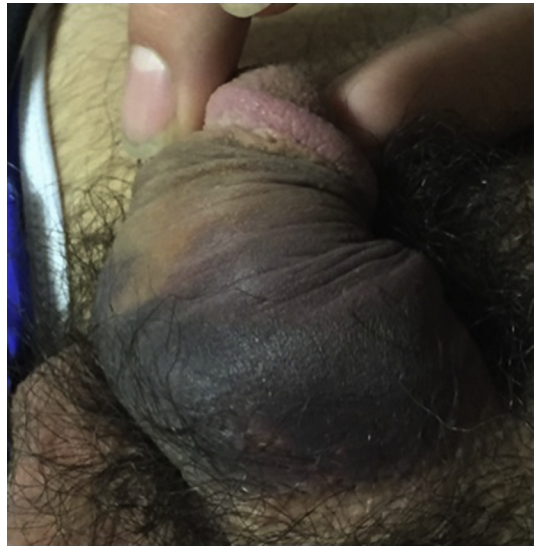

Fig. 3. Patient who presented with a history consistent with penile fracture and the physical examination findings above. Note the discolored and swollen penis resulting in a typical "eggplant deformity."

Fig. 4. Exploration of a penile fracture in the operating room. A tear in the midline in the corpora cavernosa is visualized that requires repair.

sexual abstinence is recommended for several weeks to give the tunica albuginea sufficient time to heal.

PENILE EMERGENCIES: PRIAPISM

Priapism is defined as having an erection without sexual stimulation lasting for more than 4 hours. It can be subdivided into ischemic, stuttering, and nonischemic types. This section focuses on ischemic priapism because it requires emergent treatment, as minimal or no arterial inflow into the corpora cavernosa is present, and if untreated, often results in permanent erectile dysfunction (ED). In fact, erectile function was preserved in 92% of patients in one study if ischemic priapism was reversed in less than 24 hours compared with 22% preservation with priapism lasting longer than 7 days.[21]

Clinical Presentation

A thorough history is essential to determine predisposing factors and the time course of the persistent erection. Patients at risk include those with hematologic dyscrasias, such as sickle cell disease (SCD), those with elevated white blood cell counts as in leukemia, and patients with neurologic conditions affecting the spinal cord. Although the overall incidence of priapism is low, the lifetime probability of developing ischemic priapism in a man with SCD is 29% to 42%.[22] Medications associated with priapism are trazodone and intracavernous injections for men with ED. Prolonged erection and

priapism have been reported to be as high as 35% in this population.[12] Notably, priapism is rare with PDE5 inhibitor therapy, and case reports describe other concomitant risk factors, such as SCD, recreational use of the medication, and use in combination with intracavernous injections.[23–25] In addition to a history of these predisposing conditions or medication use, patients will have progressive penile pain associated with the duration of the erection.

On physical examination, patients with ischemic priapism will have a rigid, erect penis. If signs of trauma or bruising are present in the perineum to suggest straddle injury, it is more likely to be nonischemic priapism, in which case the penis will be erect but not completely rigid.

Diagnosis

After a history, physical examination, and basic laboratory analysis, a corporal blood gas analysis should be obtained to differentiate between ischemic and nonischemic priapism. Although this distinction can often be made on the basis of history and physical examination alone, corporal aspiration serves both diagnostic and therapeutic purposes. To obtain this aspirate, 1% lidocaine without epinephrine should first be injected to provide anesthetic, either circumferentially around the penile base in a ring block fashion or dorsally at the penile base. A single, large-bore 14-gauge to 18-gauge butterfly needle should be inserted into the proximal penile shaft at the 3 or 9 o'clock position. The penile shaft should be compressed with one hand and blood be aspirated from the corpora. Initially, the blood will be dark and deoxygenated. Diagnostically, sending this off for venous blood gas analysis will reveal hypoxia ($P_{O_2}<30$), hypercarbia ($P_{CO_2}>60$), and acidosis (pH<7.25) to suggest ischemic priapism. This needle should be left in place for therapeutic purposes as detailed in the next section.

Treatment

Oral agents such as pseudoephedrine and terbutaline have been used for prolonged erection with variable success rates,[26] but are not recommended for acute ischemic priapism.

Treatment centers on continued corporal aspiration of blood, saline irrigation, and use of phenylephrine. The goal is to empty the cavernosal spaces sufficiently and free them of partially clotted blood so that new arterial blood can flow into the cavernosal spaces to preserve the smooth muscle fibers needed for erection. Using the already placed needle at the 3 or 9 o'clock position, aspiration with empty syringes should be continued until the blood coming out from the corpora becomes brighter in color, suggesting that the hypoxic, hypercarbic, and acidotic blood is being removed and fresh, oxygenated blood is now supplying the penis. Aspiration can be successful in softening the erection, relieving pain, and relieving priapism in 36% of cases.[27] Irrigation of the corpora with saline will facilitate the aspiration of blood clots.

If corporal aspiration and irrigation is unsuccessful, phenylephrine should be injected.[27,28] As an α-adrenergic agent, phenylephrine causes cavernous smooth muscle contraction. The pharmacy should be asked to prepare phenylephrine diluted in normal saline to a concentration of between 100 and 200 μg/mL in 1-mL syringes. These injections can be repeated every 3 to 5 minutes, up to a maximum dose of 1 mg. Corporal aspiration should continue between successive phenylephrine injections. As a sympathomimetic, phenylephrine can cause hypertension, reflex bradycardia, tachycardia, and arrhythmias, especially in the elderly and those with preexisting cardiac conditions. Close monitoring of vitals should be performed on a cardiac or electrocardiogram monitor during and after injections. If aspiration, irrigation, and

phenylephrine injections fail, then surgical therapy will be necessary with distal or proximal shunting procedures in the operating room.

SCROTAL EMERGENCIES: FOURNIER GANGRENE

A necrotizing fasciitis of the male genital skin, urethra, or rectum, Fournier gangrene is a severe complication of an initially localized bacterial infection that can rapidly progress to sepsis and death. It requires aggressive treatment and emergent surgical debridement because the mortality rate averages 20%.[29]

Clinical Presentation

Patients often have a history of diabetes mellitus, local trauma, instrumentation, and perirectal or perianal infections. They present initially with systemic symptoms, such as fever and chills, as well as local symptoms, such as cellulitis and a swollen, erythematous, and tender penis, scrotum, inguinal area, or perineum.[30] Genitourinary symptoms include dysuria and obstructed voiding. These symptoms rapidly progress to include crepitus and a dark purple or black discoloration of the skin (**Fig. 5**). When septic, patients commonly have altered mental status and abnormal vitals.

Diagnosis

The diagnosis of Fournier gangrene relies heavily on clinical history and physical examination. Differentiating cellulitis from Fournier gangrene is important and can be distinguished by the presence of marked systemic toxicity out of proportion to the local findings. The hallmark is palpable crepitus underneath the skin, which is sufficient to make the diagnosis.

Laboratory analyses are only an adjunct and may reveal a leukocytosis, hyponatremia, hypocalcemia, elevated serum creatinine levels, and elevated lactate. Cultures

Fig. 5. Presentation of Fournier gangrene. Note the black discoloration of the scrotum. Crepitus will be present underneath.

should be obtained from the blood, urine, and any wound, which often show multiple organisms including *Klebsiella*, *Proteus*, *Staphylococcus*, and *Streptococcus*. Ultrasound can show scrotal wall thickening containing gas, and CT can often diagnose Fournier gangrene radiographically. However, it is not recommended to delay treatment to obtain imaging.

A severity index was created and validated to determine prognostic factors for a patient with Fournier gangrene. Elevated heart rate, respiratory rate, creatinine, bicarbonate, lactate, and calcium levels were found to be associated with increased mortality. Of patients with a severity index score of less than 9, there was a 96% survival rate. On the other hand, patients with a severity index score of 9 or more had mortality of 46%.[31]

Treatment

Sepsis management principles are essential, including adequate intravenous hydration and antimicrobial therapy with broad-spectrum antibiotics. Immediate surgical debridement is required to extensively resect all infected tissue. The wound is left open, and a second debridement in the operating room may be performed 24 to 48 hours later if additional necrotic tissue is detected or if the patient remains unstable. Vacuum-assisted closure devices are effective at helping these wounds heal. Once the patient has stabilized and the wound healed, it can be closed primarily or, if more extensive, with skin grafts or skin flaps.

SCROTAL EMERGENCIES: TESTICULAR TORSION

Testicular torsion refers to a twisting of the spermatic cord causing lack of blood flow through the testicular artery to the testicle. It is commonly attributed to excess mobility of the testis within a bell-clapper deformity, where the tunica vaginalis is abnormally fixed proximally on the cord.

Although the list of differential diagnoses is long, including torsion of an appendix testis, epididymitis, orchitis, strangulated hernia, hydrocele, varicocele, intrascrotal mass, and referred pain, suspicion of testicular torsion requires urgent evaluation and management. The viability of the testis is inversely related to the duration of the torsion. In more than 1100 patients, the risk of orchiectomy was 5% at 0 to 6 hours after onset of pain, 20% at 7 to 12 hours, and 80% at more than 24 hours.[32] Although the impact on fertility is poorly understood, subtle abnormalities of semen quality are common in patients after treatment of testicular torsion.[33]

Clinical Presentation

Torsion is most common after 10 years of age but can occur at any age.[34] Boys present with acute onset, one-sided testicular pain that lasts several hours in duration. On examination, the testicle can be exquisitely tender, can be high riding, and might even be oriented horizontally because of twisting of the spermatic cord. The testicle can be indurated, the cord thickened, and the scrotum edematous. The cremasteric reflex (elevation of the testis when scratching the inner thigh) can be reduced or absent.[35] Preservation of this reflex is associated with sufficient testicular blood flow but can still be seen in patients in whom torsion was subsequently confirmed.[36]

In contrast to testicular torsion, patients with epididymitis will present with gradual onset pain over days to weeks, and their cremasteric reflex will be intact. A history of urinary tract infections, sexual activity, intermittent catheterization, or recent Foley catheter use may be present.

Diagnosis

Diagnosis hinges on the clinical presentation as noted above. With the advent of rapid and reliable scrotal imaging, color Doppler ultrasound is often performed to confirm the diagnosis before taking a patient to the operating room. Lack of intratesticular flow on ultrasound is 86% sensitive and 100% specific in the diagnosis of torsion.[37] In practice, surgical exploration will often be performed if the ultrasound is equivocal and clinical signs and symptoms are suggestive of torsion.

Treatment

Once testicular torsion is suspected, manual detorsion should be attempted at the bedside in order to relieve symptoms after premedicating with narcotics. Manual detorsion is performed via the "open-the-book" maneuver. The testicle should be grasped and rotated away from the midline. Although the testicle may be partially or completely unwound in this manner, the patient should still be taken for surgical exploration or at least for a repeat ultrasound because manual detorsion can fail to completely relieve torsion in up to 32% of cases.[38]

In the operating room, the affected testicle is untwisted and examined for a healthy color and overall viability. The testis is then sutured to the inner lining of the scrotum (orchiopexy) to prevent retorsion. The contralateral testis should also be sutured to the scrotum as well. If the testis is deemed nonviable intraoperatively, it is removed.

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