Groin Pain in Pediatric Athletes: Perspectives From an Urologist

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Contents

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Groin pain is a common complaint among pediatric athletes. It is frequently a multifactorial condition that presents a considerable challenge. The anatomy is complex, multiple pathologies often coexist, different pathologies may cause similar symptoms, and many systems can refer pain to the groin. Many athletes with groin pain have had symptoms that significantly limit their activity, have tried prolonged rest and various treatment regimens, and received differing opinions as to the cause of their pain. Often times the diagnosis given depends on the physician's specialty. Although majority of physicians mainly focus on musculoskeletal etiologies, one must keep in mind that many other medical conditions especially with urologic origin may also affect the groin. Because of these overlapping medical conditions and because the anatomy of the region is so complex, a team approach is optimal.

Groin injuries and trauma may also result from a variety of causes in pediatric athletes and can affect external genitalia and urinary tract.

Inguinal and scrotal pathologies that cause groin pain compose a large percentage of a pediatric urologist's practice. This chapter reviews these conditions and their associated pathology, diagnosis, and treatment.

Groin pain may signal either intrascrotal or extrascrotal pathology. Intrascrotal pathology arises from one of the structures within the scrotum, including testes, spermatic cords, epididymis, or one of the testicular or epididymal appendages. Groin pain from extrascrotal pathology arises from conditions of the scrotal skin, such as cellulitis, abscess, insect bites, and Fournier's gangrene, or from pathology distant from the scrotum. The conditions arising from pathology distant from scrotum produce scrotal pain by stimulating genitofemoral, iliofemoral, or posterior scrotal nerves. Conditions such as ureteric stones, peritonitis, abdominal aortic aneurysm, and polyarteritis nodosa are such conditions that may be indicated by scrotal pain.

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Pediatric urologic pathologies such as varicocele, inguinal hernias may cause chronic groin pain in children. Patients with hydrocele, undescended or retractile testes, epididiymal cysts, testicular and paratesticular tumors generally do not present with pain as the main complaint. However, secondary conditions frequently generating from aforementioned pathologies may cause acute or chronic groin pain in pediatric population.

Acute pain in the groin area may also be the result of an emergency condition and requires prompt diagnosis and treatment. The long-standing chronic groin pain in some pediatric athletes may postpone early admission which is very essential. Although conditions like testicular torsion, epididymitis, orchitis, torsion of appendix testes or appendix epididymis, and incarcerated inguinal hernias are rarely fatal, they may produce testicular necrosis, infarction or atrophy, and may cause fertility problems if it is not diagnosed and treated in a timely fashion. Early and accurate diagnosis will not only prevent the catastrophe conditions but will also avoid unnecessary parental anxiety for conditions like a simple hydrocele. For synopsis and potential clues of groin pain see Table 1.

Table 1 Synopsis and potential clues of groin pain from urological perspective

Diagnosis	Pain	Unique characteristics
Torsion of testis	++++ (A)	Young age, pain beginning after physical exertion or trauma, lack of UTI symptoms, history of similar episodes
Torsion of appendix testis/epididymis	++ (A)	Young age, blue dot sign, cremasteric reflex intact
Epididymitis/orchitis	++++ (A)	Gradual pain/insidious onset, UTI symptoms, cremasteric reflex intact, relatively older age
Henoch–Schönlein Purpura	± (A)	Steroid responsive
Idiopathic scrotal edema	+ (A)	Acute onset edema
Lymphadenitis	+/± (A)	Related feet infection
Lower ureter stones	+/++ (A)	Lower UTI symptoms, colic, hematuria, history of stone disease
Trauma	++ (A)	Hematoma most common
Hernia	+ (C), ++/+++ (A)[a]	Reducible bulge in the groin or a thickened spermatic cord transversing inguinal canal (irreducible[a])
Varicocele	+/++ (C)	Palpation of the dilated veins, testicular atrophy

A: acute pain, C: chronic pain
[a]If incarcerated or strangulated

Urologic Conditions That Cause Chronic Groin-Scrotal Pain

Varicocele

Varicocele may be defined as diffuse dilation of the pampiniform plexus (the venous drainage of the scrotum). Generally, the venous drainage of the scrotum begins with multiple scrotal veins that coalesce with the plexus. This drainage ascends along the cord structures and ultimately forms a single testicular vein, draining on the right into the vena cava and on the left into the left renal vein. [14] Although the main symptom of admission is dilated veins observed in the scrotum, patients with especially high-grade varicocele suffer from chronic groin pain. This may limit the physical performance.

The etiology remains unclear. Most theories have as a common thread an increased venous backpressure with subsequent venous varicosity. These theories are based on insufficient venous valves [2], anatomic angle of venous drainage [28], external compression of the drainage system [32], and backflow of metabolites from left adrenal vein onto the subjacent testis [3]. Although varicocele can appear at any pediatric age, the incidence peaks near mid-puberty and catches the incidence of adult population. Overall, varicoceles are estimated to occur in 15% of the adolescent population [34]. They are almost all left-sided and rarely bilateral. Right-sided varicocele has been reported with situs inversus, adding to the emphasis on anatomic etiology [33]. Most adolescents who have varicocele are asymptomatic and discovered on routine examination. There may be some mild discomfort. Although the mechanism is unclear, there is general agreement that larger varicoceles are more likely to result in testicular injury than smaller ones, and that this injury appears to be a function of increasing time [12].

Most cases of childhood varicocele require no treatment, but because of the gross appearance of varicocele, parents need to be well counseled. Generally a larger scrotum than normal is observed during physical examination when the boy stands upright. Palpation of the scrotum is like feeling “a bag of worms”. The mass of veins often disappear when the child lies down. Adolescents who have pain, large varicoceles, or loss of ipsilateral testicular volume over time should undergo surgical therapy. Prior surgical therapies focusing on mass ligation of the internal spermatic vessels have had good results, but a significant incidence of postoperative hydrocele is reported [1].

Subinguinal microsurgical varicocelectomy, with preservation of the testicular and cremasteric arteries and lymphatics, offers excellent results with little morbidity [19, 29]. Some centers treat varicocele with retrograde embolization through the renal vein, which is generally associated with

lower success. The subinguinal microsurgical varicocelectomy has a very low morbidity and recurrence is uncommon, therefore it should be the choice of technique when surgery in a child is indicated.

Hernia

Inguinal hernias may occasionally cause mild to moderate groin pain in pediatric population. Sometimes acute onset of groin pain may indicate an acute surgical problem like incarceration. Congenital inguinal hernia and hydrocele in children are a result of the failure of the processus vaginalis to obliterate. The end result is the same, with the provision for the extra-abdominal passage of peritoneal fluid (resulting in a hydrocele) or a viscus (resulting in a hernia). The processus vaginalis may obliterate at any point between the internal inguinal ring and the scrotum, or it may do so incompletely. These variations account for the diverse classification of hernias and hydroceles, including complete or scrotal hernias, communicating or noncommunicating hydroceles, and the canal of Nuck in girls. Although the exact process is unclear, it is generally agreed that obliteration of the processus vaginalis occurs only after the 7th month of gestation. Retardation or absence may cause one of the aforementioned conditions [30].

Indirect inguinal hernia is the protrusion of an abdominal viscus into a peritoneal sac, the processus vaginalis, which then trasversus the inguinal canal [5]. The contents of the sac are generally intestines but may be omentum or ovaries and fallopian tubes in little girls. Repair of inguinal herniation is the most common operation performed on children, and boys with hernias outnumber girls by a ratio of approximately 5:1 [24].

Femoral and direct hernias are uncommon in children relative to adults and usually diagnosed correctly in the operating room. Femoral hernias are more common in girls and, similar to direct hernias, are often found in children who have had a previous indirect herniorrhaphy.

For inguinal hernias the diagnosis is generally made by the history and may be confirmed by finding a reducible bulge in the groin or a thickened spermatic cord transversing inguinal canal. This is generally associated with a chronic groin pain localized to inguinal canal or scrotum. It may be helpful to ask parents to take a snapshot of the bulge when the history is in doubt and physical findings are not supportive. There are three noteworthy things to remember when evaluating children with hernias. (1) Needle aspiration is contraindicated; (2) Little else feels like hernia to the experienced examiner; (3) One must have a clear concept of differential diagnosis which includes inguinal lymphadenopathy, undescended testes, and hydroceles [10].

The "gold standard" for repair of the pediatric indirect inguinal hernia remains high ligation of the processus vaginalis at the internal ring [11].This ligation has been performed laparoscopically, but with short-term follow-up, no clear advantage over open repair is demonstrated [4]. The treatment of the unusual direct pediatric hernia is dictated by local findings at operation, with the end result being the reinforcement of the inguinal floor.

Femoral hernias are probably best treated using a Cooper's ligament repair. In the adolescent with a larger direct hernia, consideration may be given to a laparoscopic preperitoneal tension-free mesh herniorraphy as opposed to direct groin exploration and repair [27].

Hernias become an acute surgical problem when they incarcerate. By definition, incarceration occurs when intra-abdominal or pelvic contents become stuck in the hernia sac beyond the inguinal ring. If the hernia is not promptly reduced, intestinal swelling and ultimately impairment of the blood supply, leading to strangulation may occur. The characteristics of incarcerated hernia are severe sudden onset of pain and a hard, tender fixed mass in the groin. If the hernia has been present for some time symptoms of intestinal obstruction with vomiting may be noted. Frequently, there is no history of a hernia in these children. Generally, most incarcerated hernias can be reduced if one is familiar with techniques. Firm, steady pressure with the fingertips of both hands must be applied at the level of internal inguinal ring. Once the hernia is reduced, the patient should be scheduled for operation within 24–48 h. The frequency of testicular compromise in this setting has been noted to range from 3% to 5%. One should always counsel the family that the blood supply to the testes may have been impaired by the incarceration [10].

Urologic Conditions That Cause Acute Groin-Scrotal Pain

The Acute Scrotum

The emergent evaluation of a painful swollen and red scrotum remains a diagnostic challenge because there are very few absolutes. Like most acute surgical problems, the best approach is a careful history and physical examination in conjunction with sound surgical judgment. Diagnostic tests are often helpful in this process, but despite recent refinements in technique, they remain diagnostic adjuncts only. The time taken to acquire these tests and the availability of those experienced to interpret them must also be cautiously taken into account [14].

Testicular Torsion

Probably testicular torsion is the only urologic pathology that can cause groin pain and require prompt operation. Torsion of the testes is generally heralded by pain, which is always the first symptom. The pain may begin either suddenly or gradually, but with time it increases and is usually severe regardless of subjective pain threshold of a given patient.

The diagnosis to be ruled out is testicular torsion because testicular loss increases with ongoing ischemic time, and the cornerstone of therapy remains emergent surgical exploration. Testicular more commonly affects adolescents despite the fact that neonatal testicular torsion can be observed [8]. In adolescents, there is the presumed bell-clapper deformity that predisposes the testes to torsion. This is the abnormally high investment of the tunica on the spermatic cord within the scrotum. Generally, in these young boys intravaginal torsion of testes within the tunica vaginalis occur.

The history is usually that of acute onset of scrotal pain that may radiate to the groin and may be accompanied by nausea and vomiting. Prior similar episodes that spontaneously resolved may represent a partial torsion and remain a strong historical clue [16]. Gradual onset of pain is often more consistent with epididymitis or testicular appendiceal torsion. Pain of longer duration, usually greater than 24 h, may also point to a nonsurgical cause or to testicular torsion that has progressed to necrosis.

The physical examination may be difficult at best due to pain and distress. No pathognomonic physical findings of testicular torsion have been reported. Those signs that have been reported as being useful include a high riding gonad due to foreshortening of the spermatic cord by the torsion, a transverse testicular lie, absence of the cremate reflex, and anterior presentation of the epididymis [6]. Unless the examination provides focal findings such as localized epididymal tenderness, testicular torsion should remain the diagnosis to be excluded.

Testicular torsion is a surgical emergency. Early recognition and prompt intervention are imperative if the testis is to survive. Once venous obstruction has occurred, swelling may lead to arterial occlusion and infarction. The duration of symptoms in the period before infarction varies and depends on the magnitude of torsion. Testicular loss may occur as early as 2 h after the onset of symptoms, though a few testes appear to survive torsion of longer than 12 h [26].

Approximately 30% of children who present with testicular torsion have had brief episodes of testicular pain. Pubertal boys are the most susceptible group. One out of 160 males is affected with this problem. Torsion of undescended testes occurs more frequently than it does for a descended testes, due to the lack of fixation [20]. The presentation of torsion in undescended testes is different: a tender mass is noted high in the groin in association with an empty scrotum. This may be confused with inguinal hernia or lymphadenitis.

Epididymo-orchitis is the entity most commonly confused with testicular torsion. There are several differentiating features. The age of patient is usually the best clue. Epididymitis and ochitis are rarely seen before puberty, except in children with congenital anomalies. Fever and urinary symptoms are more common in epididymitis.

Color Doppler ultrasonography, although operator dependent, is very sensitive in detecting spermatic cord blood flow. It must be remembered, however, that the detection of such flow does not rule out torsion and should not preclude emergent exploration [17]. More recent studies have attempted to further refine ultrasonic predictive value using Doppler waveform spectral analysis and high resolution ultrasound [9]. Specificity has not approached 100%. It may be that ultrasound is more useful in supporting a nonsurgical cause of the acute scrotum [6]. Consideration of a nonsurgical cause coupled with a supportive ultrasonographic finding such as an enlarged testicular appendage may lead to expectant observation.

Many surgeons advocate radionuclide scanning for diagnosis of testicular torsion. Technetium 99 m scintigraphy offers detailed images of testicular anatomy and blood flow and has been reported to have 90% accuracy in diagnosis of torsion [25]. The test will document absent testicular blood flow if there is torsion, but testicular infarction induces an inflammatory reaction of adjacent tissues and may confound interpretation of the study. The significant downside is the time required to prepare the radioisotope, assemble technical staff, perform the scan, and obtain experienced interpretation. For these reasons, many physicians do not employ this test unless their strong suspicion is a nonsurgical etiology of the scrotal pain.

Manual detorsion is an early option for management of torsion. Some surgeons believe that manual detorsion can buy time, allowing for potential testicular salvage. The clinician stands at the feet of the supine patient and attempts to untwist the testicle outward from a medial to lateral orientation. This maneuver may result in immediate symptomatic relief but should not lull the clinician into equivocation about surgery. Exploration is still mandatory [10]. To reiterate, a clinical impression of testicular torsion should result in emergent operative exploration. Unless clinical findings dictate otherwise, such as a paratesticular mass, the approach should be trans-scrotal. The median raphe is incised and the testicle assessed after detorsion is completed [14]. Normal testes with clearly restored blood flow and those of questionable viability after intraoperative observation should undergo fixation within the tunica. Clearly, necrotic testes in most cases should be removed. The data supporting contralateral gonadal injury induced by a retained necrotic testis are not conclusive [15]. When a necrotic testis is left behind, however, the postoperative swelling, erythema, and pain are not inconsequential as the gonad atrophies and are resorbed.

In addition, leaving behind an unknowingly necrotic testis in the hope of in situ recovery risks scrotal abscess formation. At the end of the scrotal exploration, the contralateral gonad should undergo tunical fixation because the consequences of future gonadal loss are life changing and there is a higher potential of contralateral torsion secondary to an increased incidence of bilateral bell-clapper deformity.

Torsion of Appendix Testes and Appendix Epididymis

Another cause of groin pain in pediatric population is the torsion of a testicular or epididymal appendage. The onset of pain is more gradual, and examination may reveal more focal findings.

The testicular appendix is a mesothelial remnant located on the superior pole [13], and the epididymal appendix is an embryological remnant located on the head of epididymis; these two locations account for 99% of appendage torsions [22]. The anatomy of both structures may lead to torsion and they become twisted on the pedicle and infarct. The symptoms are similar to those of torsion of the testes proper. Some authors report, however, that torsion of the appendix testes is not as painful as torsion of the testicle. Different from testicular torsion there is typically an absence of anorexia, vomiting, fever, and abdominal pain. The testical will be in its normal position and of normal size. Palpation of the testes or epididymis may reveal a small tender, firm, and mobile nodule ranging in size from 3 mm to 5 mm. Unlike with testicular torsion cremasteric reflex is present. In particular, the "blue dot" sign is a well-known and pathognomonic indicator of torsion of the appendix testis or the appendix epididymis. This is the appearance of a localized spot of discoloration (usually blue) usually associated with point tenderness rather than diffuse testicular tenderness. By taking a careful history one may learn similar episodes of swelling or mild to moderate pain, which may have represented a slight twisting of this pedunculated structure [10].

Treatment is symptomatic with analgesics, and rapid resolution is the rule. When diagnosis is certain, bed rest, scrotal elevation, scrotal support, and control of pain are sufficient. Occasionally, scrotal exploration is warranted to resect the necrotic appendage that can significantly diminish the discomfort. One often explores the scrotum anticipating a torsed testicle, only to find infarcted appendix testes.

Epididymitis and Orchitis

Epididymitis and orchitis are two common causes of acute scrotal pain. Ductus epididymis forms a crescent-like structure that sits on the posterior surface of each testicle and transports maturing sperm through the vas deferens to the collection site in the seminal vesicles, which reside on the underside of the prostate gland. This route serves as a descending pathway for pathogens resulting in epididymitis. The epididymis connects distally into each testicle and can act as a conduit for an infection descending into the testicle. When both structures are involved, the result is epididymo-orchitis [7].

Usually, patients report an insidious onset of pain rather than more abrupt and intense onset of pain that occurs with a testicular torsion. The pain typically develops over period of hours to a day. In one study, patients with epididymitis had a longer duration of symptoms before seeking treatment than did patients with testicular torsion, who usually sought treatment in less than 12 h. The patient may describe the pain as ranging from dull to intense. The pain may be referred to the ipsilateral lower abdomen and flank. A small number of patients may have intractable pain. A few patients may appear to be systemically ill, with an elevated body temperature. An elevated temperature and dysuria are common complaints; dysuria was noted in all patients with epididymitis but only in 14% of those with torsion [16].

The acute scrotal swelling which is produced by epididymitis may closely stimulate testicular torsion. Prehn's sign or pain relief when the testicles are elevated may occur with epididymitis and may help differentiate between epididymitis and torsion. The inguinal canal should be digitally examined to rule out a hernia. The cremasteric reflex needs to be assessed and is typically intact with epididymitis [16].

A urine dipstick analysis may be positive for leukocytes and nitrites, and a microscopic urinanalysis may identify white blood cells and organisms. Urine should be cultured and sensitivity obtained to determine the causative organism and the appropriate antibiotic therapy [7].

Generally, acute bacterial epididymitis is uncommon in boys. If it is seen in the young child, it is usually as a complication of urinary tract infection secondary to local anatomic abnormality [31]. The organisms involved in epididymitis and orchitis vary depending on the age group. *Escherichia coli* is most frequently identified in males before puberty [7]. In addition to infectious etiologies epididymitis may result from trauma as well as secondary inflammation caused by torsion of appendix testes. An important consideration to keep in mind is that when older boys develop epididymitis there is often an absence of demonstrable bacterial infection. In such cases it is felt that viruses or atypical bacteria may be the cause. In such a setting, an unusual organism such as Salmonella or Haemophilus may well be the etiologic agent. Direct hematogenous seeding may be the cause in these situations [7].

Outpatient treatment includes antibiotic therapy, bad rest, scrotal elevation, and oral anti-inflammatory drugs. Treatment should be based on urine cultures and sensitivities. The usual

expectation is that the patient should become afebrile and have less discomfort within 24–48 h and should recover within 10–14 days. If epididymitis is seen in sexually active adolescents, they should be treated for gonorrhea or a chlamydial infection. The criteria for inpatient treatment include intractable pain, nausea and vomiting, dehydration, and systemic illness where the patient is toxic or septic [7].

Henoch–Schönlein Purpura

Although Henoch–Schönlein Purpura (HSP) is sometimes considered in the differential diagnosis of acute groin swelling, it may be associated with mild to moderate pain. Two percent to thirty-eight percent of patients with this vasculitis are at risk for scrotal involvement, and reports describe HSP first presenting as scrotal swelling similar to testicular torsion [18, 21].

HSP is a vasculitis of unknown etiology and is characterized by a non-thrombocytopenic purpura, which usually shows skin, joint, intestinal, and renal involvement. It occurs most commonly between 2 and 20 years of age. Although the condition is generally a self-limiting problem and is responsive to steroid therapy, many patients will undergo exploratory surgery because of the clinical similarity to testicular torsion [7].

Idiopathic Scrotal Edema

This condition presents with a low grade cellulitis involving one or both sides of the scrotum and can be the cause acute groin pain in prepubertal boys. The edema is rapid in its onset and commonly involves the groin and perineum. Penis can occasionally be involved. Generally, the pain is very little but local tenderness is present. The peripheral white blood cell count in this condition is normal; however, occasionally there is associated eosinophilia, leading some authors to believe that this condition is an allergic phenomenon similar to angioneurotic edema [7].

During an evaluation of swollen scrotum, idiopathic scrotal edema may resemble an introscrotal torsion or epididymitis, but the lack of severe pain should make the distinction quite clear. Idiopathic scrotal edema subsides almost as rapidly as it appears and is generally gone within 2 days. No treatment is necessary, but occasionally some skin discoloration persists.

Lymphadenitis

Inguinal or femoral lymphadenitis can be seen as a tender, sometimes inflamed mass that can cause pain in the groin. Examination of the lower extremities with particular attention to the feet is mandatory to help diagnosis. One should not forget that feet can be often infected in athletes by bacteria or fungi. The nodes are often tender. Examination will demonstrate a normal inguinal canal and spermatic chord. No treatment is necessary in the setting unless the lymph nodes become suppurative. Incision and drainage should be performed [7].

Lower Ureter Stones

One-third of the distal part of the ureter is the most common part of the ureter where stones exist. Different from the upper urinary tract stones, stones stuck on one-third of the distal part may cause inguinal or scrotal pain. The typical presentation of the pain is by intermittent episodes that are typical for colic of ureteric origin. Associated macroscopic or microscopic hematuria, pyuria, and crystaluria can be observed in urine analysis. Positive patient or family history of stone disease might help diagnosis. Since more than 90% of urinary tract stones are radiopaque, a plain abdomen-pelvic x-ray is suggested. Ultrasonographic evaluation might provide useful information about the dilatation of the associated kidney. For non-opaque stones which could not be identified by ultrasound scan, computerized tomography might be used.

Children are generally more capable of passing larger stones than adults. Besides treatment for pain, use of alpha blockers might improve stone expulsion rates.

Trauma

Trauma to the groin may be the result of child abuse, trauma suffered in a motor vehicle accident, or sports accident in pediatric athletes. Trauma to the scrotum is the most frequent type of trauma and most often results in a scrotal hematoma. Testicular rupture may occur and in these patients physical examination is nearly impossible. Ultrasonography in this setting is very helpful. Testicular rupture should be repaired immediately [7]. A transverse laceration is usually found in the dense, fibrous tunica albuginea, which surrounds the parenchyma of the testicle. Follow-up studies show that testicles maintain adequate size and function after the repair and functional [23]. Scrotal hematomas, while often painful, should be treated symptomatically with analgesics and scrotal support.

Occasionally, a blue scrotum is seen after abdominal trauma because intraperitonial blood has filled a hernia sack. The hernia in this case should be repaired electively after the injuries are healed [7].

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