

## Mini Review

# Urological Causes of Abdominal Pain in Children: A Mini-Review

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## Abstract

Abdominal pain is a common presentation to a various abdominal and extra-abdominal diseases in children. Most of urologic disorders may present in children with abdominal pain yet, their presentation may be atypical and confusing. Pediatrician and primary care giver must have high index of suspicion for these disorders. Good interpretation of the clinical manifestation and appropriate acquisition of suitable laboratory and radiologic investigations are the keys to accurate diagnosis of an abnormality in the child's urogenital tract. Urological disorders that may cause abdominal pain in children may include some common disorders such as: -urinary tract obstruction and hydronephrosis -urinary tract infections -tumors and trauma of the urinary tract -other conditions.

## INTRODUCTION

Abdominal pain in children is in one of the most important symptom in clinical practice as it represents a wide plethora of causes and predisposing factors that may be attributed to either a local cause or even a systematic cause. It is important to mention that abdominal pain a common presentation of various urologic diseases in children (which in turn are common in children). An important issue to state is that abdominal pain in children due to urologic cause may differ in clinical presentation and course than in adults, that's to say that urologic abdominal pain may have a non-classical presentation. Another critical issue to consider is that pain in the genitalia (due to torsion or orchitis) may be referred to the abdominal and vice versa hence workup of a case of abdominal pain should include genital thorough genital examination. Primary care physician or care provider must have a high index of suspicion to identify a urologic cause for abdominal pain.

## Types and classification of urologic abdominal pain

**Renal Pain:** It is located in the ipsilateral costovertebral angle the pain may radiate across the flank anteriorly toward the upper abdomen and umbilicus and may be referred to the testis or labium. Association with gastrointestinal symptoms is common

**Bladder Pain:** Produced either by bladder distension or bladder inflammation.

**Testicular Pain:** Scrotal pain is either primary or referred. Primary scrotal pain is usually due to acute epididymitis or

torsion of the testis. Referred scrotal pain may arise in the kidneys or retroperitoneum.

## Etiology and Management of urologic abdominal pain in children

## An overview:

- Hydronephrosis and Urinary Tract Obstruction
- Urinary tract infections [UTIs]
- Urinary tract trauma
- Tumours of the urinary tract
- Genital tract abnormalities
- Other Causes

### A. Hydronephrosis and Urinary Tract Obstruction Urinary stone disease in children

Urinary stone disease is the most common cause of urologic abdominal pain. Abdominal pain due to Upper urinary tract stone in children may differ than the classic flank pain in adults. In many cases the condition may present with vague abdominal pain, recurrent UTI, lower urinary tract symptom and hematuria. Renal colic, which occurs in approximately 40–75% of children with urolithiasis [1,2] presents with a sudden onset of severe cramp-like flank, abdominal, or pelvic pain associated with gastrointestinal symptoms (nausea and vomiting). Irritative voiding symptoms (i.e. urgency, and frequency) occur when the calculus is in the distal third of the ureter. In some

patients the pain can present as diffuse abdominal pain and can obscure the clinical picture, delaying the correct diagnosis [3]. Sternberg et al found that frequent symptoms were loin pain (76%). Other symptoms included gross hematuria (15%) of patients and concurrent urinary tract infection (UTI) in (8%) of patients [4].

Initial investigation includes pelvi-abdominal ultrasound, urinalysis and KUB. The most sensitive test for identifying stones in the urinary system is non-contrast helical computerized tomography scanning. It is safe and rapid, with 97% sensitivity and 96% specificity [5-7]. Intravenous pyelography is rarely used in children, but may be needed to delineate the calyceal anatomy. Non-contrast computerized tomography [NCCT] can determine stone density and skin-to-stone distance; all of which have an impact on extracorporeal shock wave lithotripsy (ESWL) outcome [8-11]. The disadvantage of non-contrast CT is the absent quantification of renal functions, as well as high radiation. Metabolic workup is mandatory in children with urinary stone disease. Treatment options include conservative management [fluids and medical expulsive therapy], [ESWL], percutaneous nephrolithotomy [PCNL], ureteroscopy [URS], and open or laparoscopic surgery.

### Pelvi-ureteric junction obstruction [PUJO]

PUJO is the most common cause of congenital urinary tract obstruction in children. The obstructing factors may include fibrous band, a dynamic segment or crossing vessel at the pelvi-ureteric junction. Secondary causes of PUJO such as stone, polyp, or stricture may be present. Most of children with congenital hydronephrosis are diagnosed during the prenatal ultrasonographic imaging during pregnancy [12]. The usual clinical presentation is abdominal pain and recurrent UTI.

PUJO is one of the common causes of recurrent abdominal pain in children. Dietl's crisis was described by Josef Dietl in 1864, and includes episodic, upper abdominal crampy pain, nausea, and vomiting associated with intermittent renal pelvic obstruction [13]. Recurrent abdominal pain ceases after surgical correction of the PUJO [14].

The preliminary diagnostic method is pelvi-abdominal ultrasonography. Ultrasonography can detect degree of hydronephrosis, antero-posterior diameter of the renal pelvis, parenchymal thickness and echogenicity. Doppler US can be used to calculate renal artery resistive index and can be used to demonstrate crossing vessel at the pelvi-ureteric junction. Diuretic Radio-isotope renography [with  $^{99m}\text{Tc}$ -MAG3] is important tool of diagnosis. Split kidney function, GFR, Renal isotope uptake curve and time, all are information obtained by this technique. Surgical treatment of PUJO [when indicated] includes open pyeloplasty or laparoscopic pyeloplasty. Other options of treatment include watchful waiting and endoscopic incision [Endopyelotomy].

### Megaureter and Ureterovesical junction (UVJ) obstruction

Ureterovesical junction (UVJ) obstruction is an obstructive condition at the distal ureter as it enters the bladder [obstructive Megaureter]. Megaureters are the second most common

cause of neonatal hydronephrosis. They usually affect male boys and occur on the left side [15,16]. Clinical presentation includes recurrent UTI, hematuria, and abdominal mass or cyclic abdominal pain. Diagnostic Work up includes ultrasound, voiding cystourethrography, dynamic nuclear renography and urethroscopy in some cases. Treatment is by surgical ureteral tailoring and anti-reflux re-implantation

### Vesicoureteral reflux [VUR]

Vesicoureteral reflux is an anatomical and/or functional disorder that leads to retrograde flow of urine from the urinary bladder to the ureter with or without the kidney. In children this condition may lead to serious consequences, such as renal scarring [due to repeated pyelonephritis], hypertension, and renal failure. Fortunately, a good proportion of reflux patients does not develop renal scars and probably do not need any intervention [17]. VUR in children has an incidence of nearly 1%. The classic age of presentation occurs in school children. They present with abdominal pain as a prime symptom [18]. The standard imaging tests include renal and bladder ultrasonography, voiding cystourethrography [VCUG] and nuclear renal scans. A baseline renal isotope scan using dimercaptosuccinic acid [DMSA] scan at the time of diagnosis can be used for detection of renal scarring and later during follow-up [19,20]. The treatment lines for VUR include non-surgical treatment [follow up or continuous antibiotic prophylaxis] or surgical correction [endoscopic injection of bulking agent or surgical ureterovesical reimplantation].

### Urinary tract obstructions at other levels

Urinary tract obstructions at other levels, such as bladder outlet or the urethra [posterior urethral valve, congenital meatal stenosis] may cause abdominal pain.

#### B. Urinary tract infections [UTIs]

Urinary tract infections (UTIs) are the most common bacterial infection in children [21-23]. Clinical presentation is variable (Table 1), especially considering age, gender, pathogen and anatomical malformations [24-27]. The diagnosis of UTI in children depends on adequate clinical evaluation [through history and examination], urinalysis and urine culture and sensitivity.

**Table 1:** Clinical presentation of UTI according to site.

Upper urinary tract (pyelonephritis)	Lower urinary tract (Cystitis)
Diffuse pyogenic infection of the renal pelvis and parenchyma	Inflammatory condition of the urinary bladder mucosa
<ul style="list-style-type: none"> <li>• Abrupt onset Fever (&gt;38°C), chills, costovertebral angle or flank pain, and tenderness.</li> <li>• Cystitis symptoms in older children along with fever/flank pain.</li> <li>• Infants and children may have non-specific signs such as poor appetite, failure to thrive, lethargy, irritability, vomiting or diarrhea</li> </ul>	<ul style="list-style-type: none"> <li>• Dysuria, frequency, urgency, malodorous urine, enuresis, hematuria, and suprapubic pain</li> </ul>
Data obtained from references [28-30]	

Rosen and coworker demonstrated that UTI in children was associated with development of chronic abdominal pain in children and those children with a history of UTI had nearly 6 times odds of developing chronic abdominal pain compared with their siblings [31]. Diagnostic tools include urinalysis, urine culture and sensitivity, abdominal pelvic ultrasonography. Radioisotope renography and voiding cystourethrography are indicated in some circumstances. Treatment is with appropriate antimicrobial therapy.

### C. Urinary tract trauma

Kidney injury in blunt abdominal trauma accounts for 10% of all blunt abdominal injuries [32]. Children have higher risk of renal damage due to blunt abdominal trauma than adults because their kidney is larger in relation to the rest of the body and often retains fetal lobulations. It has also less protection due to less perirenal fat, weaker abdominal muscles, and a less ossified or elastic thoracic cage [33]. The mechanism of blunt renal trauma is sudden deceleration of the child's body [sport accidents, falls, and contact with blunt objects]. Diagnosis of renal injury with blunt abdominal trauma can be suspected with abdominal flank tenderness, lower rib fractures, fractures or vertebral pedicles, trunk contusions and abrasions, and hematuria. Contrast pelvi-abdominal CT is the gold standard method for diagnosis and staging of renal trauma. Treatment includes either conservative management or surgical exploration.

### D. Tumors of the urinary tract

Wilm's tumor accounts for 6% to 7% of all childhood cancers. It is the most common renal tumor of childhood, accounting for 95% of all kidney cancers in children under the age of 15 in the United States [34,35]. The usual presentation of Wilm's tumor is painless abdominal mass. However severe pain may be encountered in cases of hemorrhage inside the tumor or tumor rupture due to trauma.

Neuroblastoma is the most common extracranial solid tumor of childhood. The tumor may arise in the retroperitoneum, adrenal, paravertebral ganglia. The variety of locations where these tumors arise and the spectrum of their differentiation results in a wide range of clinical presentations. The hallmark presenting symptoms are abdominal pain and abdominal mass [36]. Other solid benign tumor includes mesoblastic nephroma and angiomyolipoma [Table 2]. These patients should be referred to the specialist as soon as possible.

### E. Genital tract abnormalities

Testicular Torsion should always be included in differential diagnosis when evaluating lower abdominal pain in young males. The external genital organs should be examined in every child or adolescent with acute abdominal pain. The most common presenting symptoms are abdominal pain and vomiting [38].

- **F. Other Causes** Horseshoe kidney generally present with vague abdominal pain. Patients can develop abdominal pain and nausea with hyperextension of the spine (Rovsing syndrome), presumably resulting from stretching of the isthmus [39].

- Renal ectopia present with symptoms attributed to the genitourinary or gastrointestinal system, such as vague

**Table 2:** Childhood renal tumors.

Benign renal tumors	Malignant renal tumours
<ul style="list-style-type: none"> <li>• Mesoblastic nephroma [&lt;1 year of age]</li> <li>• Cystic nephroma</li> <li>• Angiomyolipoma</li> <li>• Haemangioma/ lymphangioma</li> </ul>	<ul style="list-style-type: none"> <li>• Wilm's tumor</li> <li>• Neuroblastoma</li> <li>• Clear cell sarcoma (bone secondaries)</li> <li>• Rhabdoid tumor (bone/ brain secondaries)</li> </ul>
Data obtained from reference [37]	

abdominal pain or renal colic secondary to uretero-pelvic junction obstruction or urolithiasis.

- Urachal Cyst and sinus Urachal remnants can present as one of four primary recognized pathologies; patent urachus, urachal sinus, vesico-urachal diverticulum, and urachal cyst. An infected urachal cyst is an important diagnosis to make as complications include sepsis, fistula formation, and rupture leading to peritonitis [40,41]

- Painful bladder syndrome in children [interstitial cystitis in children]. Chenoweth and Clawater were the first to report interstitial cystitis in children. In their series of seven cases, they describe the presenting signs and symptoms as: day and night frequency of urination, abdominal pain, decreased bladder capacity, negative urinalysis and culture. In addition, these children were described as being extremely nervous and tense, resting poorly, crying frequently, and having poor appetites [42].

- Psychological non-neuropathic bladder (Hinman syndrome) and dysfunctional voiding in children: Hinman described an apparent 'syndrome' of voiding dysfunction that mimics neuropathic bladder disease but may be a learned disorder [43]. It results from active contraction of the sphincter during voiding, creating a degree of outflow obstruction. Abdominal pain develops secondary to chronic constipation [44]. Affected individuals exhibit extremely similar clinical features to those seen in individuals with Urofacial syndrome, except for abnormalities in facial expression, which does not occur.

### Crystalluria in children

Crystalluria means the presence of crystal in urinalysis. It represents supersaturation of urine with this substance. It can be found in normal and pathological conditions.

Normal Crystalluria include calcium oxalate, uric acid, triple phosphate, calcium phosphate and amorphous phosphates or urates is caused by transient supersaturation of the urine, ingestion of foods, or by changes of urine temperature and/or pH which occur upon standing after micturition. In a minority of cases. On the other hand pathological crystalluria urolithiasis, acute uric acid nephropathy, ethylene glycol poisoning, hypereosinophilic syndrome. In addition, crystalluria can be due to drugs such as sulphadiazine, acyclovir, triamterene, antiepileptic drugs and others [45].

Clinically Crystalluria may be asymptomatic [especially in normal children] or can be discovered accidentally during routine checkup. In contrast pathologic Crystalluria usually present with abdominal pain, dysuria, failure to thrive or macroscopic hematuria and recurrent UTI [46].

It should be noticed that the majority of renal calculi in children are comprised of either calcium oxalate or calcium phosphate and are often associated with a metabolic abnormality. Idiopathic hypercalciuria and hypocitraturia are the most frequently reported metabolic abnormalities. Given the high risk of recurrences in children with idiopathic hypercalciuria and hypocitraturia and the importance of excluding rare but treatable conditions such as primary hyperoxaluria and cystinuria a comprehensive metabolic evaluation is indicated in all children [47].

Crystalluria examination should preferably be performed on first morning urine or fresh fasting voiding samples by polarized microscopy. Urine samples must be stored at 37 degrees C or at room temperature and examined within two hours following voiding [48].

## CONCLUSION

Urologic causes of abdominal pain in children represent a wide spectrum of diseases and abnormalities. Clinician must have high index of suspicion with good interpretation of the physical signs. Radiologic assessment is mandatory in all cases and referral to pediatric urologist must be done complex cases.

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