Keys to the Diagnosis of Occult Urologic Disease in Children

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All physicians who care for children should be aware of the many indications for further urologic examination. A straightforward algorithmic approach to urologic diagnosis is not possible. The physician must individualize and carefully weigh the indications for the oftentimes expensive and uncomfortable tests that are required for urologic diagnosis. The reward is ample when a significant correctable lesion is recognized early enough for salvage on the basis of seemingly unrelated signs or symptoms.

Although the dissemination of knowledge of the genitourinary problems of children has become widespread over the past 20 years, it continues to be disturbing to see children with these problems remain undiagnosed despite repeated visits to physicians.[1] The purpose of this paper is to review the indicators which suggest genitourinary disease in children.

The majority of the indicators of childhood genitourinary disease may be classified as part of the time-honored "good history and physical." Many of the indicators appear at first unrelated to the genitourinary system and may be discovered under symptoms, physical findings, or laboratory findings (Table 1).

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Suggestive Symptoms

Urgency, frequency, and/or dysuria may suggest, among other entities, a urinary tract infection or neurovesical dysfunction. These symptoms should initially be evaluated by urinalysis, and the urethral meatus of both boys and girls should be inspected for abnormalities.[2] If an infection is not identified, consideration should be given to ruling out neurovesical dysfunction. If an infection is confirmed by the identification of bacteriuria in either a girl or a boy, a cystogram and an excretory urogram (IVP) are indicated. In girls it is important to be sure that the dysuria is not secondary to vulvovaginitis.

Nocturnal enuresis is a common presenting complaint. From the literature it is not always clear when to ascribe significance to this complaint. Generally, the child of six who still has nocturnal enuresis may need closer scrutiny. Findings which should alert the examiner are a history of a previous urinary tract infection, symptoms of hesitancy or a diminished urinary stream, dysuria, diurnal enuresis, and a history of recent onset of enuresis following a relatively long period of dryness. A cystogram and IVP should be considered. Enuresis below age three is difficult to assess. Children between ages three and six should be suspected of underlying urinary pathology if they exhibit a diminished urinary stream, daytime wetting, and reinitiation of wetting following a period of nocturnal dryness. A child of six who has always wet the bed, has no daytime wetting, no history of obstructive symptoms or infection, and a family history of prolonged enuresis can probably be watched expectantly. Less than four percent of children older than eight continue to be enuretic. Evaluation by cystography, regardless of the relative benignity of the symptoms, should be performed to search for possible obstructive or neurological causations.[3,4]

The rather non-specific complaints of nausea, vomiting, and diarrhea may herald urinary tract infections, particularly when these symptoms occur in children under two years of age. Children presenting with vomiting and persistent diarrhea should have a urinalysis.[5,6] Even if the urinalysis is normal, persistence of vomiting calls for an excretory urogram to rule out the presence of a ureteropelvic junction obstruction or other cause of obstruction.[7]

Failure to thrive is a commonly-used term in pediatrics, and certainly there are many causes for this condition. If the reasons for failure to thrive are not apparent after consideration of the more common causes, a cystogram and IVP may be obtained. Pyelonephritis may present in this manner, particularly in children under five years of age,[5] rather than in the classic

manner seen in adults.

Fever of unknown origin, as well as sepsis, should alert the physician to consider a urologic etiology. A urinalysis should be done whenever a child presents with fever. The question of whether to further evaluate urologically a child with fever of unknown etiology is difficult to answer and is largely a matter of judgment, particularly in view of the numbers of childhood diseases with prodromes of fever. The evaluation should consist of both an IVP and cystogram. A negative urinalysis does not rule out a urinary etiology. Ureteropelvic junction obstruction will occasionally present with fever as the only complaint.[7]

Undiagnosed abdominal pain in a child should make the physician suspicious of underlying urinary pathology, such as pyelonephritis and ureteropelvic junction obstruction.[7,9] Any abdominal pain is suspect. If a valid reason cannot be found to explain the pain, an IVP should be done.[8]

A history of hesitancy of urination or straining to void should be evaluated by a urinalysis. If these complaints persist in the presence of a negative urinalysis, a voiding cystourethrogram should be obtained to rule out neurovesical dysfunction or obstructive uropathy.

Incontinence of urine should usually be investigated. Particularly after age three, it is unusual to have daytime wetting. An evaluation should include a cystogram and an IVP. As stated by Malek and co-workers, "Urinary incontinence in a toilet trained girl with a normal voiding pattern is pathognomonic of ureteral ectopy."[10,11]

Hematuria in children must be investigated. Although it is true that certain ingested materials may color the urine and simulate blood, this can be ruled out by a urinalysis. The most common cause of hematuria in a child is glomerulonephritis, and this may be suggested by the presence of red cell casts. All children with hematuria should be evaluated with an excretory urogram. Endoscopy of the urethra and bladder may be indicated if the etiology is not apparent or to localize the site of bleeding.[12,13] Traumatic hematuria should also be evaluated by excretory urography. Smith and coworkers have stated that 20 percent of children with post-traumatic hematuria will subsequently be found to have pre-existing renal disease.[14]

Table 1. Keys to Urologic Disease in Children

Symptoms or Signs

- Urgency, frequency, dysuria
- Enuresis
- Nausea, vomiting, diarrhea
- Failure to thrive
- Fever of unknown origin and sepsis
- Undiagnosed abdominal pain
- Hesitancy or straining to void
- Urinary incontinence
- Hematuria

Laboratory Findings

- Urinalysis
  - Bacteria
  - Pyuria
  - Hematuria
- Radiographic Findings
  - Mass lesion displacing bowel
  - Lumbar hemivertebrae
  - Absence of the sacrum and coccyx
  - Scoliosis and kyphosis
  - Significant vertebral rachischisis

Physical Findings

- Myelodysplasia
- Caudal Regression Syndrome
- Lumbar hemivertebra, agenesis of sacrum or coccyx
- Congenital scoliosis or kyphosis
- Hemihypertrophy
- Non-familial aniridia
- Hypospadias
- Imperforate anus
- Palpable abdominal mass
- Intersexual states
- Neonatal ascites
- Hypertension
- Gross external ear abnormalities
- Single umbilical artery
- Congenital heart disease
- Cystic fibrosis

Syndromes or Symptom Complex

- Prune Belly Syndrome
- Noonan's Syndrome
- Turner's Syndrome

Family or Genetic History

- Sickle cell disease or trait
- Von-Hippel-Lindau Syndrome
- Tuberous sclerosis
- Medullary sponge kidney
- Polycystic disease of liver and kidney
- Vesicoureteral reflux
- Ureteropelvic junction obstruction

Suggestive Physical Findings

One of the most obvious physical findings which suggests urologic disease in a child is myelodysplasia. An IVP and cystogram should initially be obtained shortly after birth and then at regular intervals thereafter. There is a high incidence of abnormalities noted on even the initial examination, including not only obstructive changes but also major anomalies.[15,16] Children with the caudal regression syndrome have a high incidence of both upper and lower tract anomalies.[17] This condition may be suggested by foot deformities, decreased lower extremity muscle tone, and rumplessness.

Children with lumbar hemivertebrae, agenesis, or hypoplasia of the sacrum or coccyx, which are most frequently noted on a radiographic examination of these areas, often exhibit both upper and lower urinary tract changes secondary to concomitant neurovesical dysfunction.[18] These anomalies are appropriate indications for a cystogram and IVP. Congenital scoliosis and kyphosis, which may be diagnosed on physical examination or radiographically, should alert the physician to the possibility of urinary anomalies. These children should be evaluated with an IVP. Vitko and co-workers found an incidence of 30 percent of patients with associated urinary tract abnormalities.[19]

Hemihypertrophy may be associated on occasion with nephroblastomas (Wilms' tumors) and probably indicates the need for further evaluation with an IVP.[20] Nonfamilial aniridia is a rare condition which should prompt the ordering of an excretory urogram to rule out the presence of nephroblastoma (Wilms' tumor). These examinations should be repeated at intervals until adulthood.[21]

Hypospadias of any degree requires an IVP. Five to 25 percent of patients with hypospadias will have an abnormal IVP. However, almost all authorities agree that boys with hypospadias should be studied further.[22-24] The presence of concomitant hypospadias and bilateral cryptorchidism is suggestive of an intersex state and should be pursued shortly after birth with a buccal smear and/or karyotyping, a retrograde urethrogram or a genitogram, 24-hour urinary 17-ketosteroid determinations, and serum sodium concentrations.

Boys with undescended testes may be candidates for an IVP.[23] In most cases where positive findings are present, the urologic abnormality could have been predicted by other criteria.[25]

Meatal stenosis as a physical finding probably does not require a radiographic evaluation of the urinary tract unless the patient is symptomatic or the urinary stream is quite small.[26]

A child born with an imperforate anus should have an IVP and a voiding cystourethrogram as soon after birth as feasible.[27] The incidence of associated genitourinary anomalies is quite high (47 percent).[28]

A palpable abdominal mass in a child is a prime indication for an IVP.[1,2,8,29] The yield is high, with obstructed collecting structures being the most common cause of abdominal masses. Every child who presents to a physician, regardless of the complaint, should have a thorough abdominal examination. A palpable or visible bladder should be investigated initially by inquiries regarding the child's voiding habits and size of the urinary stream. If the bladder appears to be distended or if there are concomitant urinary symptoms, a cystogram should be done.

Children with intersexual states should be evaluated with an IVP, a cystogram, and a retrograde urethrogram or genitogram. A cystogram may delineate obstructing Mullerian duct remnants.[30]

Neonatal ascites should stimulate an investigation for obstructive uropathy using voiding cystourethrography and IVP.[31] Posterior urethral valves are a common cause of infantile urinary obstruction producing ascites.

Hypertension in a child should prompt the performance of an IVP to look for suggestions of vascular disease and to identify gross renal abnormalities and anomalies.[1]

Severe gross external ear anomalies are an indication for an IVP.[32] Generally, helical anomalies, if not severe, are not an indication for a urological evaluation unless accompanied by other anomalies or symptoms referable to the genitourinary system.[33] Taylor states that there is a particularly high yield of upper tract anomalies if, concomitant with the external ear anomaly, there is also an ipsilateral underdevelopment of the facial bones.[34]

The presence of a single umbilical artery noted at the time of delivery is an indication for IVP. Feingold and co-workers found that 33 percent of infants with a single umbilical artery had a urinary tract anomaly.[35]

Children with congenital heart disease should have an IVP to identify possible urinary tract abnormalities.[36] The contrast material used in cardiac arteriography is excreted by the kidneys, and adequate evaluation of the urinary tract can be accomplished without a separate injection. Approximately eight to ten percent of children with congenital heart disease will have a urinary tract abnormality demonstrable on IVP. In children with ventricular septal defects the incidence of urologic anomalies has been reported as high as 27 percent.[36]

Boys with cystic fibrosis should be examined carefully because of the frequency of genital abnormalities. The most frequent anomalies are hernia, hydrocele, undescended testes, and absence of the vas deferens.[37]

Suggestive Laboratory Findings

Bacteriuria, pyuria, or hematuria noted on even a routine screening urinalysis should be regarded as significant. Bacteriuria is significant if the urine specimen is obtained by careful catheterization or suprapubic aspiration. Bacteria noted in a clean catch specimen should be confirmed. All children with confirmed bacteriuria, pyuria, or hematuria should be evaluated with an IVP and a cystogram. Significant pyuria is generally defined as greater than 5 to 8 white blood cells per high power field (WBC/HPF) noted after centrifuging 5 to 8 cc of urine. Hematuria may be difficult to

evaluate when noted microscopically, particularly when the urine has been obtained by suprapubic needle aspiration of the bladder or by catheterization. In a clean catch specimen, 5 to 8 red blood cells per high power field (RBC/HPF) following the centrifugation of a 5 to 8 cc aliquot of urine is significant. Hematuria, either gross or microscopic, should be evaluated with IVP.[12]

Radiographic findings which should be further evaluated for urinary abnormalities are mass lesions displacing bowel, lumbar hemivertebrae, hypoplasia of the sacrum and coccyx, absence of the sacrum and coccyx, congenital scoliosis and kyphosis, and significant vertebral rachischisis.[18,19]

Suggestive Syndromes and Symptom Complexes

Although there are numerous syndromes and symptom complexes with concomitant urologic abnormalities, several should be remembered because of their relative frequency. The Eagle-Barrett Syndrome or Prune Belly Syndrome is characterized by children with absence or gross deficiencies of the abdominal musculature, undescended testes, and abnormalities of the urinary collecting structures.[38,39] Any child with suggested deficiencies of the abdominal musculature should have an IVP and cystogram.

Children with Noonan's Syndrome should have an excretory urogram. This syndrome is one of multiple stigmata which includes pulmonic stenosis, ptosis, undescended testes, high arched palate, skeletal anomalies, and hypertelorism. Riggs has reported that up to 50 percent of the children studied have renal anomalies.[40]

Children with Turner's syndrome (gonadal dysgenesis) may have significant urinary tract abnormalities and should be evaluated with an excretory urogram.[41] Persky had found that up to two thirds of these children will have upper tract anomalies.[42]

Suggestive Family Or Genetic History

Burger has stated that: "We must be knowledgeable enough and responsible enough to identity those in the general population who are genetically at risk before they come to us with full blown clinical symptoms."[43] Some conditions which may have urologic manifestations and which are inherited are sickle cell disease and trait, Von-Hippel-Lindau Syndrome, tuberous sclerosis, medullary sponge kidney, and polycystic disease of liver and kidney. There is some evidence that vesicoureteral reflux and ureteropelvic junction obstruction may be genetically transmitted.[43]

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