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Зміст

Ключові терміни:
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**Case 1**

A term newborn male infant is noted to have unilateral hydronephrosis on prenatal ultrasound. At 3 days of age, a renal and bladder ultrasound shows a normal right kidney, and a moderately severe left renal hydronephrosis, with no dilation of the ureter. The bladder is normal. A voiding cystourethrogram is obtained at 6 weeks of age which shows no evidence of vesicoureteral reflux, and no posterior urethral valves. Urinalysis, complete blood count, electrolytes, BUN, and creatinine are normal. At 4 weeks of age, a Mag3 renal scan with furosemide (Lasix) washout shows equal split function (right kidney 50%, left kidney 50%). The t-1/2 (washout half time) shows normal washout on the right, and prolonged washout on the left.

The patient is placed on surveillance with serial renal ultrasounds and renal scans for the next 2 years. At 2 years of age, he develops left sided abdominal pain, nausea and vomiting, without fever or chills. A renal ultrasound shows worsening left hydronephrosis and a renal scan shows diminished left renal split function to 35% (the right split function is now 65%), and markedly prolonged left renal half-time. The right renal half-time is normal.

He undergoes a left pyeloplasty at 2 years of age, and does well post operatively. A Mag3 renal scan is done 3 months postoperatively, which shows the left renal split function to have returned to 45% (right 55%), with the washout half time to have normalized. A renal ultrasound postoperatively shows only minimal residual hydronephrosis.

**Case 2**

A 3 year old female infant presents with fever (T 39.6), nausea, vomiting, and left flank and abdominal pain, as well as dysuria. A CBC shows a WBC of 20,000, with a left shift. Urinalysis shows 50 to 100 WBCs per high power field. Intravenous fluids and IV antibiotics are administered with clinical improvement. Urine culture later grows out greater than 100,000 colonies of E. coli. A renal ultrasound shows normal kidneys (no hydronephrosis). She is discharged home on a full course of oral antibiotics for 2 weeks, which is then changed to once daily trimethoprim/sulfamethoxazole (TMP/SMX) prophylaxis thereafter.

A VCUG (voiding cystourethrogram) shows left Grade II vesicoureteral reflux. She is continued on suppressive TMP/SMX daily with no further UTIs. A nuclear cystogram 1 year later shows persistence of the reflux, and the suppressive antibiotics are continued. A subsequent nuclear cystogram one year later shows resolution of the reflux. The antibiotic prophylaxis is stopped, and the patient has no further problems with febrile UTIs/pyelonephritis.

For the pediatrician, hydronephrosis has become a finding to be encountered even before the child enters their care, with many children being diagnosed antenatally with prenatal ultrasonography. Hydronephrosis is the most common congenital condition that is detected by prenatal ultrasound and represents 50% of all abnormalities. The incidence of detectable urinary dilation in utero can be as high as 1 per 100 pregnancies but only 20% of these may be clinically significant postnatally. 50% of antenatal cases detected after 28 weeks gestation have postnatal imaging that is normal. The majority of cases detected prenatally will resolve either before the end of pregnancy or within year 1 of life.

Hydronephrosis in the older child is often found incidentally during the work-up for nonspecific abdominal complaints. Historically, prior to the extensive use of ultrasound, neonates with hydronephrosis presented with a palpable abdominal mass, urinary tract infections, urinary retention, hematuria, feeding difficulties, or failure to thrive.

With regards to ureteral development, in week 5 of gestation, the ureteral bud develops as a posterior
**Key Terms:**

(from urethral obstruction or posterior urethral valves).

Chronic severe urinary frequency, and complicated enuresis may suggest bladder outlet obstruction. Other specific abdominal complaints, especially if intermittent in nature, during periods of high urine flow, may suggest orthopedic anomalies are common in these patients.

Agenesis, vesicoureteral reflux, and a large capacity poorly contractile bladder. Failure of the ureteral bud to stimulate development of the metanephric blastema may result in multicystic, dysplastic kidneys, which may be confused with a hydronephrotic kidney. Unilateral multicystic, dysplastic kidney is the most common cystic disease of the newborn and the second most common infant abdominal mass after hydronephrosis. The left kidney is more commonly involved. There is no sex predilection or familial tendency.

Vesicoureteral reflux refers to the retrograde flow of urine from the bladder into the upper urinary tract. It occurs at a rate of 1 per 1000 in the general population, but is 8 to 40 times more frequent in families with a history of reflux in a sibling. It will be found in 50% of infants and 30% of children with a UTI. Of those diagnosed with neonatal reflux, there is a male predominance, whereas females predominate when diagnosed after the newborn period. The average age for diagnosis of reflux is 2 to 3 years.

Vesicoureteral reflux may occur because the ureteral bud arises ectopically, leading to a laterally placed ureteral orifice and short submucosal bladder tunnel, which allows reflux. Reflux may also occur if there is incomplete or delayed development of the intrinsic smooth muscle of the distal ureteral segment. Vesicoureteral reflux predisposes an individual to pyelonephritis by facilitating the transport of bacteria from the bladder to the upper urinary tract. The immunologic and inflammatory reaction caused by a pyelonephritic infection may result in renal injury or scarring. Extensive renal scarring causes reduced renal function and may result in permanent renal damage or renal failure.

Vesicoureteral reflux is graded as follows: Grade I results in urine reflux into the distal ureter only. Grade II results in urine reflux into the ureter and the renal pelvis, without ureteral dilation and no distension of the renal pelvis (i.e., normal calices). Grade III results in urine reflux into the ureter and the renal pelvis, causing mild hydronephrosis (defined as mild dilation of the renal pelvis and blunting/dilation of the calices) and mild hydroureter (dilation of the ureter). Grade IV results in moderate hydronephrosis and hydroureter. Grade V results in severe hydronephrosis and severe hydroureter.

An ectopic ureter is defined as a ureter that drains into any location other than the bladder trigone. Embryologically, the delayed entry of the ureteral bud into the bladder results in a more distal and medially positioned ureteral orifice. In some instances, the ureter may not even incorporate itself into the bladder but may enter other structures. In females, this may include the urethra, introitus, vagina, uterus, and fallopian tube. In males, the ectopic ureter may enter the bladder neck, prostatic urethra, epididymis, seminal vesicles, or vas deferens. 70% of ectopic ureters are associated with duplicated collecting systems, with 30% found in non-duplicated systems. Ureteral ectopia in a duplicated system is 6 times more common in females than males. Ureteral ectopia in a non-duplicated collecting system is more common in boys.

Ureteroceles are a cystic dilation of the distal ureter at the level of the ureteral orifice (intravesical ureter). It results from a failure of normal distal ureteral development. Ureteroceles are more common in females than males by a ratio of 4:1. 80% of ureteroceles are associated with a duplex system and arise from the upper pole moiety. These upper pole segments usually demonstrate varying degrees of renal dysplasia.

Posterior urethral valves (a congenital membrane that obstructs or partially obstructs the posterior urethra) occur in boys (1 per 5000 to 8000), with greater than 50% diagnosed in the first year of life. It is felt that the etiology is failure of regression of the terminal segment of the mesonephric duct, which is normally represented by the plicae colliculi, which results in a congenital membrane that obstructs or partially obstructs the posterior urethra.

The Eagle-Barrett Syndrome (Prune Belly Syndrome, Triad Syndrome) is characterized by a dilated, non-obstructed urinary tract, deficiency of abdominal wall musculature (a visibly obvious deficiency of abdominal wall musculature with a distinct flabby abdomen), and bilateral cryptorchidism (undescended testes). The incidence is 1 per 35,000 to 50,000 live births with 95% of the cases occurring in boys. The syndrome is a result of in utero urinary tract obstruction and a specific mesodermal injury between the 4th and 10th week of gestation. GU anomalies that most commonly occur are renal dysplasia or agenesis, vesicoureteral reflux, and a large capacity poorly contractile bladder. Cardiac, pulmonary, and orthopedic anomalies are common in these patients.

Older children and adults who present with calculi, flank pain, nausea and vomiting, hematuria, non-specific abdominal complaints, especially if intermittent in nature, during periods of high urine flow, may have ureteropelvic junction obstruction. Daytime incontinence, infrequent voiding, poor urinary stream, chronic severe urinary frequency, and complicated enuresis may suggest bladder outlet obstruction (from urethral obstruction or posterior urethral valves).
Many patients with vesicoureteral reflux (VUR) have been discovered prenatally by detection of fetal hydronephrosis, although the diagnosis of VUR is not made until postnatal studies are performed. 80% of these neonates are boys, and most have more severe reflux than do females with VUR discovered after UTI. 80% of reflux diagnosed after UTI occurs in females. Children may present with clinical pyelonephritis, fever, abdominal/flank pain, malaise, nausea, vomiting, cystitis with dysuria, frequency, urgency, and urge incontinence.

Patients with ureteral ectopy and/or ureteroceles may be picked up initially with prenatal ultrasound. They may also present at an older age with febrile UTIs, incontinence, hematuria, failure to thrive, abdominal pain, or pelvic pain. Ureteroceles may also present with a palpable abdominal mass or cystic intralabial mass (the result of a large ureterocele that has prolapsed through the urethral lumen).

For the infant noted to have hydronephrosis on prenatal ultrasound, an ultrasound on day 2 of life should be performed. Ultrasound is the mainstay of screening and can provide excellent morphological evaluation in experienced hands. The degree of hydronephrosis and caliectasis can be seen, together with the renal size, parenchymal thickness, and some subjective assessment of the renal cortical texture. Cortical cysts, calcifications, and corticomedullary junction can be noted. The presence and morphology of the contralateral kidney, and the distal ureter should be evaluated. A careful evaluation can rule out distal ureteral dilation, eliminating the necessity of an IVP or retrograde contrast study of the ureter. Renal and ureteral duplication may be noted on ultrasound, as well as the presence of a ureterocele in the bladder. If there is no dilution, then a repeat ultrasound is done at one month. If no hydronephrosis is present at one month of age, the evaluation can then stop.

A voiding cystourethrogram (VCUG) is done if hydronephrosis persists after birth. If the patient is a male, has hydrourerteronephrosis, a thick walled bladder, and/or posterior urethral valves are suspected, then a VCUG should be obtained immediately. The presence of a bladder outlet obstruction is readily established on VCUG. Posterior urethral valves show a characteristic appearance of a prominent bladder neck, dilated posterior urethra, and a bulging membrane at the distal aspect of the verumontanum. The bladder is usually thickened, with trabeculation and diverticula. Vesicoureteral reflux may also be present. Ureteroceles may be evident. If valves are present, cystoscopy should be done and the valves resected.

If posterior urethral valves are not suspected, then antibiotic prophylaxis is begun, and a VCUG, and diuretic renography obtained at 4 to 6 weeks.

The VCUG may show vesicoureteral reflux. Reflux grade is important because more severe reflux is associated with higher rates of renal injury, and treatment success varies with reflux grade. Follow-up cystography is done using radionuclide cystography because radiation exposure is less than with standard contrast cystography.

Diuretic renography (Mag3 or DTPA radioisotopes) provides information on renal function, with the early uptake of tracer by a kidney indicative of separate renal function ("the split function"). It can also show obstruction by demonstrating the washout from the kidney, augmented by the administration of a diuretic 20 minutes after administration of the initial tracer. The initial transit of the tracer through the kidney reflects renal perfusion and the amount of tracer accumulated in each kidney 1 to 3 minutes after injection is proportion to its GFR. The differential function (i.e., split function) of each kidney can be calculated. A diuretic is administered IV once the collecting systems are full with the radioisotope. Sequential images, computer generated time-activity curves, and calculated half-times will determine the degree of washout of the tracer in the area of interest. Prolonged washout times (called washout half-times) are often associated with true urinary tract obstruction.

Diminished renal function is definitely present when the split function is less than 35% to 40% (10), while good renal function is demonstrated by split function values of 45% to 50%. A poor washout half-time is greater than 20 minutes, and a good washout half-time is less than 10 to 12 minutes.

A DMSA (another renal isotope) renal scan is useful for the evaluation of cortical renal scarring and patients with VUR. Following an episode of pyelonephritis, renal scarring is usually apparent in DMSA scans within 3 months, but may not be apparent in IVP or ultrasound until 1 to 2 years later.

Excretory urography (IVP-intravenous pyelography) is especially performed in the older infant and child. It defines the collecting systems anatomy well, and can be very useful with ectopic kidneys, duplicated kidneys, and ureters, as well as with megaureter. A CT scan is also useful for imaging the renal and ureteral anatomy, and CT angiography can be used to image crossing vessels at the ureteropelvic junction (UPJ). Urodynamics (bladder function studies) are indicated when a functional obstruction is suspected (neurogenic, or non-neurogenic). Patients with spinal dysraphism should be evaluated with urodynamics.

Serum blood chemistries, especially creatinine, are also useful in these patients, and should at least be obtained early on to help establish baseline renal function.

It is important to emphasize that imaging studies cannot be taken and evaluated in isolation, but must be evaluated in conjunction with the other imaging, laboratory, and clinical findings over time, especially with a period of observation (with serial studies), before definitive surgery is considered.
Ureteropelvic junction obstruction is the most common cause of congenital hydronephrosis. US or IVP will show a dilated renal pelvis, and calyces without ureteral dilation. Diuretic renography/renal scan will show an obstructive pattern (prolonged washout half time). Vesicoureteral reflux may be present in some children with UPJ obstruction. In the older child presenting with vague abdominal complaints, renal ultrasound, IVP, and/or CT scan will show a dilated renal pelvis and calyces, without ureteral dilation.

Ureterovesical junction obstruction is the second most common cause of congenital hydronephrosis. Hydronephrosis is noted, along with associated ureteral dilation on renal US and/or IVP. Renal scan may show an obstructive pattern. Dilated ureters (megaureters) are divided into three primary categories: refluxing megaureters, obstructed megaureters, and non-obstructed, non-refluxing megaureters. An uncommon fourth primary variety is the refluxing, obstructed megaureter. Secondary megaureter may occur because of extrinsic processes such as tumors, retroperitoneal fibrosis, and vascular malformation. Another cause is functional ureteral obstruction such as with neuropathic bladder disease in those with spinal dysraphism. VCUG is helpful in the differentiation of the above categories.

Posterior urethral valves are the most common cause of lower urinary tract obstruction and occurs in males. The prenatal US may show hydrourouterourephrosis, bladder thickening, and oligohydramnios. The newborn physical exam may reveal a palpable distended bladder, a palpable prostate on rectal exam, poor urinary stream, and signs and symptoms of renal and pulmonary insufficiency. Renal US shows hydronephrosis and a thickened bladder. VCUG is diagnostic for posterior urethral valves. There is associated reflux in 30% of patients.

In females, the most common cause of anatomic bladder outlet obstruction is a ureterocele that has prolapsed into the urethra (urethral prolapse may resemble a large doughnut shaped mass in the perineum). 90% of cases are associated with the upper pole of a complete duplicated collecting system. This condition has also been observed in males. Renal ultrasound may show findings similar to those found with posterior urethral valves, as will VUCG and renal scan. The renal US and/or VCUG will also clearly show the ureterocele.

Primary vesicoureteral reflux may present initially as hydronephrosis in the newborn. VCUG is diagnostic, and renal scan shows a non obstructive pattern. It tends to be of higher grade and with a male predominance when presenting in the newborn period.

Other causes of hydronephrosis or apparent hydronephrosis, are the multicystic, dysplastic kidney, ectopic ureter, megacalyxcsis, simple renal cyst, urachal cyst, ovarian cyst, hydrocolpos, sacrococcygeal teratoma, bowel duplication, duodenal atresia, anterior meningocele, and the prune belly syndrome.

Ureteropelvic junction obstruction repair (open pyeloplasty) is recommended when there is the morphological appearance of UPJ obstruction on US or IVP, no evidence of distal ureteral distension, and renal function depressed to less than 35% of total renal function. Neonates with better than 35% renal function are followed with repeat scans at 3 to 6 months, then at 12 months of age, and surgery is indicated only when there is clear deterioration in renal function. 75 to 85% of infants followed in this manner with observation did not require surgery. Most patients being followed with observation received antibiotic prophylaxis.

Older children, and adults, who present with a symptomatic UPJ obstruction will need repair, and can be considered for laparoscopic and endoscopic treatment of their UPJ obstruction, in lieu of an open pyeloplasty. The success rates of open pyeloplasties are greater than 95%.

Ureterovesical junction obstruction/megaureters in the newborn can be managed with observation (with serial US and renal scans) and antibiotic prophylaxis, in those whose renal function is greater than 35%. Indications for surgical repair (open ureteral reimplant, sometimes with tapering), include deterioration of renal function, breakthrough pyelonephritis, pain, or calculus formation. When a ureterocele is present, the best initial management is endoscopic incision of the ureterocele.

Posterior urethral valves should be treated in the neonatal period. Treatment is centered on securing adequate drainage of the urinary tract, initially by placement of a urinary catheter and later, by primary cystoscopic ablation of the valves, vesicostomy, or upper urinary tract diversion. The long-term outcome is dependent upon the degree of renal dysplasia present. Associated vesicoureteral reflux should be treated with antibiotic prophylaxis. Persistent bladder dysfunction should be treated with anticholinergics, alpha blockers, and clean intermittent catheterization, as indicated.

Primary vesicoureteral reflux is managed with antibiotic prophylaxis. Penicillin in the neonate, and TMP/SMX or nitrofurantoin in the older infant and child, is generally administered once daily at a dose calculated to be 1/4th to 1/3rd of the dose necessary to treat an acute infection. Reflux tends to resolve over time as the intravesical segment of the ureter elongates, with the greatest rate of spontaneous resolution occurring in the lowest grades of reflux (approximately 15% per year). Follow-up cystography is generally performed every 12 to 18 months. The radionuclide cystogram is performed by many because the radiation done to the gonads is lower than with a standard cystogram. In addition, periodic upper tract imaging studies (US, IVP, renal scan) are often performed to detect renal scarring and growth. Many clinicians treating children with reflux obtain urine specimens, periodically for UA and/or culture.

Medical management with antibiotic prophylaxis is considered successful if the child remains free of infection, develops no new renal scarring, and the reflux resolves spontaneously. Failure of medical...
management is indicated by breakthrough UTIs, the development of new renal scars, or the failure of the reflux to resolve. Noncompliance and allergic reactions to the prescribed medications may also lead to failure of medical management.

Failure of medical management/antibiotic prophylaxis is an indication for surgical repair of the refluxing ureter. Open surgical management (ureteral reimplant) involves modifying the abnormal ureterovesical attachment to create a 4:1 to 5:1 ratio of length of the intravesical ureter to ureteral diameter. This corrects the reflux in 98% of patients who undergo ureteral reimplantation for Grades I to IV reflux, and in 80% of those who undergo reimplantation for Grade V reflux.

Ectopic ureters are treated surgically based upon whether the patient presents with single or duplex systems, how well each moiety functions, and whether there is ipsilateral lower pole reflux. Partial nephrectomy and ureterectomy are indicated for upper pole moieties that are nonfunctioning or very poorly functioning (less than 10% of total function).
lower pole reflux, ureteropyelostomy or high ureteroureterostomy are reasonable approaches. Ureteral reimplant (ureteroneocystostomy) is a good option for patients with upper pole function and lower pole reflux.

The management of ureteroceles is similar to ectopic ureteral management in that the approach taken is dependent upon many variables (single or duplex systems, ipsilateral or contralateral reflux, obstruction, and degree of function present). The goals of surgery are to preserve renal function, correct obstruction and reflux, eliminate urinary stasis and infections, and preserve urinary continence with minimal morbidity and mortality. Management options include observation, transurethral incision of the ureterocele, upper pole nephrectomy with partial ureterectomy, ureteroneocystostomy with ureterocele excision, high ureteroureterostomy, and transvesical ureterocele repair.

Prune Belly Syndrome (Eagle-Barrett Syndrome) treatment involves optimization of urinary tract drainage, management of renal insufficiency, and antibiotic prophylaxis. Surgical repair of reflux, orchiopexy, and abdominal wall reconstruction is performed later in childhood.

Multicystic, dysplastic kidneys are followed by serial ultrasounds. They do not benefit from antibiotic prophylaxis. They involute over time. Most urologists observe the multicystic, dysplastic kidney. There are proponents of excision of these kidneys due to a risk (albeit a very small risk) of malignant transformation.

Fetuses with mild to moderate hydronephrosis are generally observed prenatally. Although there are some centers that treat severe hydronephrosis prenatally related to obstructive uropathy, this is very controversial. The consensus is that intrauterine intervention should be considered only if persistent or progressive oligohydramnios develops in a fetus with a normal karyotype, there are no other life threatening anomalies, and fetal immaturity that precludes delivery. These procedures should only be performed at tertiary referral centers with extensive experience with fetal surgery.

The widespread use of obstetrical ultrasound has resulted in the detection of antenatal hydronephrosis as a common presentation of congenital renal, ureteral, bladder, and urethral anomalies. Neonatal evaluation and treatment of these congenital urinary anomalies allows the preservation of renal function, the relief of obstruction and reflux, the elimination of infection, and the preservation of urinary continence, to a much greater degree than was possible prior to the advent of prenatal US. Patients with hydronephrosis and/or reflux have an excellent prognosis today.

Questions

1. What is the most common congenital condition detected by prenatal US?
2. What is the initial imaging study that should be done to evaluate a newborn with a history of antenatal hydronephrosis?
3. What further studies should be obtained in a 2 day old male with US findings of hydroureteronephrosis, and a thick walled bladder? What diagnosis is suspected and what is the appropriate treatment?
4. What are the two most common causes of newborn hydronephrosis and how are they distinguished one from another?
5. What further tests should be ordered for the infant, with a history of prenatal hydronephrosis which persists on US on day 2 of life?
6. What are the options for treatment of UPJ and/or UVJ obstructions?
7. What is a ureterocele?
8. What is the cause of primary vesicoureteral reflux?
9. How does antibiotic prophylaxis for the management of vesicoureteral reflux prevent renal scarring?
10. What are the indications for surgical treatment of primary vesicoureteral reflux?
The ectopic insertion of the ureter into the bladder wall laterally results in a short intravesical tunnel, which acts as an incompetent valve during urination, allowing urine to reflux back up into the ureter. A ureterocele is a cystic dilation of the distal ureter at the level of the ureteral orifice. In infants noted to have good (35 to 40% or greater) split function on the renal scan, then serial VCUG will show a prominent bladder neck, a dilated posterior urethra, with a bulging membrane at the distal aspect of the verumontanum. Poor function usually represents a posterior urethral valve (PUV). Normal function usually excludes valve disease. Bladder function is evaluated by Micturating cystourethrogram (VCUG) and diuretic renal scans (at 3 to 6 months of age, then at 12 month of age) may be used to follow the patient nonsurgically, on antibiotic prophylaxis.

A VCUG should be obtained to evaluate for posterior urethral valves. If PUV are present, the VCUG will show a prominent bladder neck, a dilated posterior urethra, with a bulging membrane at the distal aspect of the verumontanum. The bladder may be thickened. Reflux may be present. The treatment is centered on securing adequate drainage of the urinary tract; initially by placement of a urinary catheter, and later by transurethral ablation of the valves. A vescicostomy (surgical formation of a cutaneous bladder stoma) may be done as a temporizing measure if the infant cannot undergo transurethral ablation of the valves.

Ureteropelvic junction (UPJ) obstruction is the most common cause, with ureterovesical junction (UVJ) obstruction being the second most common cause of congenital hydronephrosis. They are distinguished by the fact that with UPJ obstruction, the ureter is not dilated, whereas the ureter is dilated with UVJ obstruction. In infants noted to have good (35 to 40% or greater) split function on the renal scan, then serial ultrasound and diuretic renal scans (at 3 to 6 months of age, then at 12 month of age) may be used to follow the patient nonsurgically, on antibiotic prophylaxis. If there is renal function deterioration, breakthrough UTIs, or symptoms of renal colic, then surgery (pyeloplasty in UPJ obstruction, and ureteral reimplant in UVJ obstructions) is indicated. Only 25% of children with UPJ obstructions will require conversion to surgical management.

Hydronephrosis represents 50% of all abnormalities detected with prenatal US. If PUV are present, the VCUG will show a prominent bladder neck, a dilated posterior urethra, with a bulging membrane at the distal aspect of the verumontanum. The bladder may be thickened. Reflux may be present. The treatment is centered on securing adequate drainage of the urinary tract; initially by placement of a urinary catheter, and later by transurethral ablation of the valves. A vescicostomy (surgical formation of a cutaneous bladder stoma) may be done as a temporizing measure if the infant cannot undergo transurethral ablation of the valves.

If there is renal function deterioration, breakthrough UTIs, or symptoms of renal colic, then surgery (pyeloplasty in UPJ obstruction, and ureteral reimplant in UVJ obstructions) is indicated. Only 25% of children with UPJ obstructions will require conversion to surgical management.


Answers to questions

1. Hydronephrosis represents 50% of all abnormalities detected with prenatal US.
2. A renal and bladder US should be obtained on day 2 of life. US done earlier may yield a false negative (no hydronephrosis) due to low urine output not distending the collecting systems. If it is normal, then the US should be repeated at 1 month of age, and be normal before considering the hydronephrosis to have resolved.
3. A VCUG should be obtained to evaluate for posterior urethral valves. If PUV are present, the VCUG will show a prominent bladder neck, a dilated posterior urethra, with a bulging membrane at the distal aspect of the verumontanum. The bladder may be thickened. Reflux may be present. The treatment is centered on securing adequate drainage of the urinary tract; initially by placement of a urinary catheter, and later by transurethral ablation of the valves. A vescicostomy (surgical formation of a cutaneous bladder stoma) may be done as a temporizing measure if the infant cannot undergo transurethral ablation of the valves.
4. Ureteropelvic junction (UPJ) obstruction is the most common cause, with ureterovesical junction (UVJ) obstruction being the second most common cause of congenital hydronephrosis. They are distinguished by the fact that with UPJ obstruction, the ureter is not dilated, whereas the ureter is dilated with UVJ obstruction.
5. The infant should be placed on antibiotic prophylaxis (with penicillin) and a VCUG and diuretic renal scan done at 4 to 6 weeks of age.
6. In infants noted to have good (35 to 40% or greater) split function on the renal scan, then serial ultrasound and diuretic renal scans (at 3 to 6 months of age, then at 12 month of age) may be used to follow the patient nonsurgically, on antibiotic prophylaxis. If there is renal function deterioration, breakthrough UTIs, or symptoms of renal colic, then surgery (pyeloplasty in UPJ obstruction, and ureteral reimplant in UVJ obstructions) is indicated. Only 25% of children with UPJ obstructions will require conversion to surgical management.
7. A ureterocele is a cystic dilation of the distal ureter at the level of the ureteral orifice. A ureterocele which has prolapsed into the urethra is the most common cause of congenital bladder outlet obstruction in females. Transurethral incision of the ureterocele is a minimally invasive treatment for symptomatic ureteroceles.
8. The ectopic insertion of the ureter into the bladder wall laterally results in a short intravesical ureter (a short submucosal bladder tunnel), which acts as an incompetent valve during urination, allowing urine to reflux back up into the ureter.
9. The antibiotic prophylaxis sterilizes the urine, and thus prevents bacteria ascending up the refluxing ureters, from causing pyelonephritis and renal scarring/damage. This allows time for normal growth and development of the ureter and bladder to occur. With growth, lengthening of the submucosal bladder tunnel/intravesical ureter results in the resolution of reflux over time, particularly in those with lower grades of reflux. Observation includes serial cystograms (usually nuclear scintography) every 12 to 18 months.

10. The failure of medical management (and thus the need for ureteroneocystostomy) is indicated by breakthrough UTIs, the development of new renal scars, or the failure of reflux to resolve over time. Non compliance or allergic reactions to the prescribed antibiotics may also lead to the failure of medical management.