Surgery

PEDIATRIC UROLOGY

OBJECTIVES:

After studying the summary of BPH the student should be able to:

1. List the advantages, disadvantages, and contraindications of neonatal circumcision. Discuss problems involving the external genitalia including hypospadias, balanitis, phimosis, and paraphimosis.
2. Discuss the normal achievement of continence, causes of primary nocturnal enuresis and secondary enuresis, and describe the most effective treatment for nocturnal enuresis.
3. Define cryptorchidism and state two complications of this condition. Discuss the treatment of a boy with an undescended testicle, including the optimal age and reasons for orchidoplexy.
4. State the common organisms that cause UTIs in newborns and children. Discuss the symptoms, work-up, and management of a child with a suspected UTI.
5. State four causes of antenatal hydronephrosis.

For questions regarding the above please email: Not Available

To report site difficulties please email: jsmyth@interchange.ubc.ca

Last reviewed 22-Sep-2003

Univeristy of British Columbia

Faculty of Medicine
317-2194 Health Sciences Mall
Instructional Resource Centre
Vancouver, B.C. Canada
V6T 1Z3
tel (604) 822-2421 | fax (604) 822-6061 | e-mail admissions.md@ubc.ca

© Copyright The University of British Columbia, all rights reserved.

Surgery

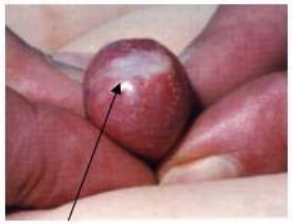
PEDIATRIC UROLOGY

CIRCUMCISION:

Circumcision is among the oldest practiced surgical procedures. Historically, many cultures have used circumcision as a rite of passage into manhood, while many other cultures use circumcision in religious ceremonies. The rates of circumcision vary throughout the world from rarely performed in many northern European countries to approximately 40% in Canada to as high as 90% in the USA. Circumcision has become a controversial subject in newborn males. The Canadian Pediatric Society and American Academy of Pediatrics state that no medical evidence exists to recommend routine neonatal circumcision. Consequently, the decision should be made through informed choice of the parents, whether circumcision is in the best interest of the child, after the risks and benefits have been explained.

Prepuce

1. The prepuce, or foreskin, completely covers the glans at birth, except for a small opening at the urethral meatus. The undersurface of the foreskin is fused with the glans at birth, and it is not until later in childhood that the foreskin is fully retractable. In uncircumcised boys, attempts at retraction should be avoided until at least 2 to 3 years of age.
2. **Pathological (acquired) phimosis** is the inability to pull back the foreskin because of fibrotic narrowing at the preputial orifice. This occurs as a result of poor hygiene, chronic balanitis, or repetitive forceful retraction of a congenital phimosis.
3. **Congenital/physiological phimosis** is the normal adhesions of the foreskin in to the glans in young boys and is not associated with urinary obstruction, hematuria, or preputial pain.



Pathological (acquired) phimosis

Neonatal Circumcision : Advantages, Disadvantages, Contraindications, and Recommendations

Advantages

1. Prevents pathological (acquired) phimosis
2. Prevents paraphimosis (inability to pull the foreskin back over the glans after it is retracted)
3. Decreases the incidence of urinary tract infections in infancy (relative risk is 4-10 times greater than a circumcised male, but absolute risk for an uncircumcised male of developing a UTI is still only approximately 1%).
4. Prevents balanitis and balanoposthitis (infection of the glans or glans and foreskin from retained secretions)

5. Prevents cancer of the penis (uncommon; may also be prevented by proper hygiene)

Disadvantages

1. Medically unnecessary in most boys
2. Painful
3. Risk of complications (low, but may include bleeding, infection, meatal ulcers, post-circumcision phimosis, penile necrosis, even death has been reported)

Contraindications

1. Congenital penile anomalies (hypospadias, epispadias, chordee, megalourethra, or webbed penis) because the foreskin may be needed for reconstruction.
2. Bleeding problems

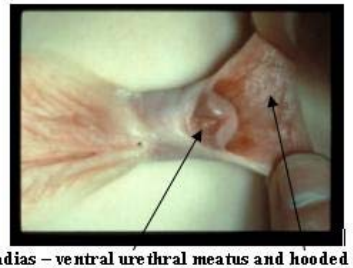
Recommended by Urologists

1. Boys who have anomalies of the foreskin, such as acquired phimosis, paraphimosis, and recurrent balanitis.
2. Boys with recurrent urinary tract infections (UTIs) or boys at risk for UTIs because of other GU anomilies.

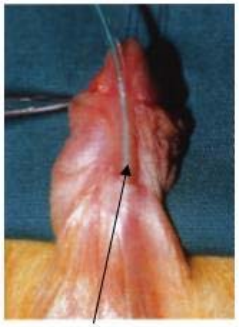
Hypospadias

1. Hypospadias can be defined as an association of three anatomical anomalies:

- An abnormal ventral opening of the urethral meatus
- Ventral curvature (chordee) of the penis
- A hooded foreskin, which is deficient ventrally



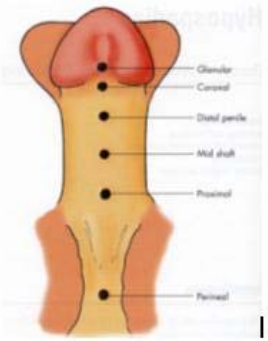
Hypospadias – ventral urethral meatus and hooded foreskin



Hypospadias – Mid shaft urethral meatus

Hypospadias – Coronal urethral meatus

2. The incidence of hypospadias is approximately 1 in 300 live male births and appears to be increasing in frequency. The etiology is not fully understood and is therefore considered multifactorial.
3. Severe forms of hypospadia can present as ambiguous genitalia, especially if associated with undescended testes. It is important to rule out congenital adrenal hyperplasia, mixed gonadal agenesis, and both pseudo and true hermaphrodism in an apparently male baby with severe hypospadias and cryptorchidism.
4. With the exception of an increased overall incidence of undescended testis, other anomalies of the GU tract are rare in patients with isolated hypospadias. Consequently, further investigation is not needed in these patients.
5. The standard classification of hypospadias is based on the preoperative site of the abnormal meatus.



Hypospadias Standard classification

Treatment

1. There are three specific principles to surgical correction of hypospadias:

- Correction of the penile chordee
- Reconstruction of the urethra (urethroplasty)
- Covering the penis (glanuloplasty)

Hypospadias reconstruction

2. **Neonates with hypospadias should not undergo circumcision as the foreskin is sometimes necessary for reconstruction of the urethra.**

Epispadias: urethral meatus opens on the dorsum of the penis, at a point along the glans or shaft.

Epispadias in a male and a female

Epispadias

For questions regarding the above please email: Not Available

To report site difficulties please email: jsmyth@interchange.ubc.ca

Last reviewed 22-Sep-2003

Surgery

PEDIATRIC UROLOGY

NOCTURNAL ENURESIS:

Nocturnal enuresis is nighttime bed wetting with continence during the day. This is a common condition that often has a psychological impact on the child and their family. Children with this condition often have low self-esteem and their interpersonal relationships, quality of life, and school performance are affected.

Epidemiology

1. Nocturnal enuresis can be classified as primary (PNE) or secondary (SNE) depending on the timing; PNE includes children 5 - 6 years old who have never achieved continence for a six month period, SNE are children who achieved continence and have again become incontinent.
2. Children achieve continence at different ages and usually achieve daytime continence before nighttime continence. **Most children achieve nighttime dryness by age 5.** Nocturnal enuresis is common and is not usually addressed in children under the age of 5 who have achieved daytime continence. Nocturnal enuresis is more common in males and prevalence of the condition gradually decreases with age.

- 23% of 5-year olds
- 20% of 7-year olds
- 4% of 10-year olds
- 1-2% of adolescents
- Secondary nocturnal enuresis (SNE) accounts for 15-25% of cases.

The etiology of nocturnal enuresis appears to be multifactorial:

1. Genetic predisposition has been quoted as:

    - 77% if both parents were enuretic as children
    - 43% when one parent was enuretic as a child
    - 15% when neither parent had a history of nocturnal enuresis

2. Nocturnal urine overproduction secondary to the failure to develop the normal circadian rhythm of increased ADH at night to concentrate and lower urine production.
3. Reduced bladder capacity during sleep
4. Failure of arousal from sleep ("heavy sleepers")
5. Psychological factors are rarely the cause of PNE but the result of it. They are commonly involved in the development of SNE.
6. Reduced bladder capacity during sleep has not been proven.
7. Other specific causes on the differential include: cystitis, constipation, obstructive sleep apnea, neurogenic bladder, urethral obstruction, seizure disorder, ectopic ureter, diabetes mellitus, diabetes insipitus, and heart block.

Work-up
The evaluation of nocturnal enuresis requires a thorough history, complete physical examination, and urinalysis.
1. The most important part of the work-up of a child with nocturnal enuresis is a detailed history including some of the following questions:

- Were there any complications to your child's birth?

- Does your child have a history of problems with his/her nervous system?
- Has your child ever had any surgery to his/her nervous system or genital area?
- Did you or your child's other parent wet the bed as a child?
- Has your child ever been consistently dry at night, at what age, and for how long?
- Does your child wet his/her pants during the day?
- Does your child appear to have pain with urination?
- How often does your child have bowel movements?
- Does your child ever soil his/her pants?
- How many times in a day does your child urinate?
- How many nights a week does your child wet the bed?
- Does your child ever wet the bed more than once in the night?
- How have you handled the nighttime wetting? (elicits information on interventions that have been tried; be alert for responses suggesting that the child has been punished or shamed).

2. A voiding log is important for providing additional information to the history.
3. Physical examination findings are usually normal. A complete physical should be performed including: vitals, overall appearance, back for cutaneous lesions or a gluteal cleft suggesting spina bifida, vagina, rectum, neurologic exam including gait looking for subtle neurologic deficits, and an abdominal exam to rule out enlarged bladder or abdominal masses.
4. Urinalysis is performed to assess specific gravity and glucose to rule out diabetes, and determine the presence of a UTI or hematuria.
5. If the findings of the physical exam and urinalysis are negative and the history does not suggest a secondary cause of enuresis, no further investigations are indicated.

- Further investigations should be carried out as indicated by findings in the history, physical or urinalysis.

Treatment
The most important reason to treat nocturnal enuresis is to minimizes the embarasment for the child and the frustration of the parents. Management should focus on behavioral therapy and can include pharmacologic treatment when needed. Specific abnormalities found in the work-up should be treated.

1. Behavioural:

- Children benefit from a caring and patient attitude by the parents; punishment has no role.
- Positive reinforcement techniques are often beneficial.
- Parent taking the child to void prior to the parent going to bed.
- Minimize fluid intake in the evening.

2. Bed-wetting alarm is the most effective treatment of nocturnal enuresis.

- It has a higher success rate (75%) and a lower relapse rate (41%) than other therapies.
- It works by negative reinforcement by sounding an alarm to awaken the child when they start voiding, the child awakens and finishes voiding in the toilet.
- May take up to 15 weeks.

3. Pharmacologic treatment consists of DDAVP (decreases nocturnal urine output) imipramine, and anti-cholinergics.

- DDAVP is useful for sleepovers and summer camps to avoid embarrassment. It is well tolerated. Long-term effectiveness is low and relapse rates are high. It should therefore be used for short-term situations.
- Imipramine and anti-cholinergics are not effective for long-term elimination of enuresis, have high relapse rates, and have bad side effects.

For questions regarding the above please email: Not Available

To report site difficulties please email: jsmyth@interchange.ubc.ca

Surgery

PEDIATRIC UROLOGY

CRYPTORCHIDISM:

Cryptorchidism is defined as failure of the testis to descend from its intra-abdominal location into the scrotum. A normal testis develops in the celomic cavity and descends into the scrotum at 36 weeks gestation, guided by contractile cordlike structures termed the gubernaculum testis. An undescended testicle can be located in the inguinal canal (72%), ectopic location including suprapubic, perineum, and upper thigh (20%), and intra-abdominal (8%). The incidence of cryptorchidism at time of birth is 3% in term infants and up to 30% in preterm infants. Most initially cryptorchid testis spontaneously descend within the first three months. The right testicle is 2X more common to be undescended and cryptorchidism occurs bilaterally 30% of the time.

Clinical Presentation
Undescended testis are most frequently diagnosed at birth during the routine neonatal examination after birth or prior to hospital discharge.

Cryptorchid right -testis. Empty right hemiscrotum and a visible swelling in the perineum lateral to the scrotum

Complications

Cryptorchidism is associated with increased risk of testicular malignancy, infertility, testicular torsion ,and inguinal hernia.
1. The incidence of testicular cancer is estimated to be 10 to 40 times that of the general population, beginning in young adulthood. The higher the cryptorchid testis, the greater the overall lifetime risk of malignant degeneration. Orchidopexy does not reduce the risk of cancer, but facilitates self-examination and the early detection of testicular tumours on physical examination.
2. Undescended testis is associated with reduced sperm quality and quantity. Although fertility potential of an undescended testis is never 100%, fertility can be preserved with early orchidopexy. Unilateral cryptordism probably does not affect overall fertility status.

Differential diagnosis includes:

1. Retractile testis – commonly present in prepubertal boys as the cremasteric reflex is hyperactive. If the testicle can be manipulated into the scrotum without tension (even if it doesn't stay there), the parent can be reassured that there is no abnormality and

only observation is required.
2. Congenital absence – rare condition
3. Atrophic testis – usually secondary to torsion
4. Inguinal lymph node

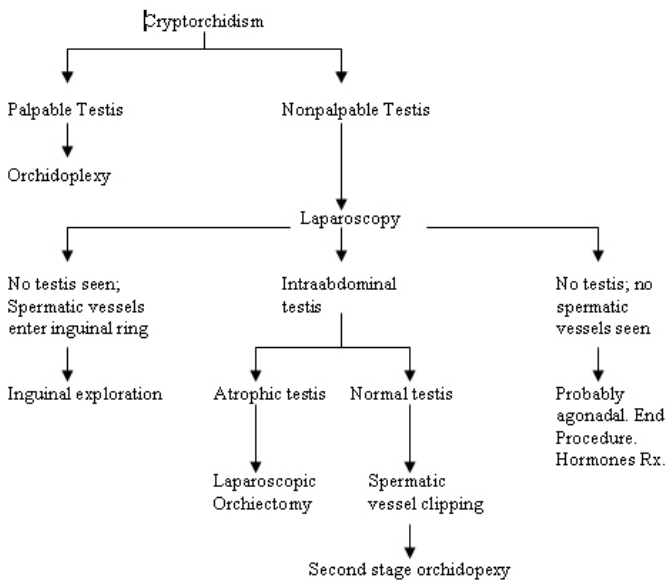
Investigations

Laproscopy has become the procedure of choice for a non-palpable testis as failure to visualize the testis with other imaging modalities doesn't prove anorchia, and must be followed up with laproscopy.

Treatment

1. Orchidopexy is recommended for all boys whose testicles remain undescended by the age of one year.
2. Hormonal therapy using HCG or luteinizing-release hormone are alternatives to orchidopexy for initial treatment in equivocal cases, however, these therapies have been shown to be ineffective in double-blind placebo controlled trials. They may be rationally tried in boys with bilateral undescended testis in whom a hormone deficiency may be the underlying cause.

Algorithm for the management of a cryptorchid testis.



For questions regarding the above please email: Not Available

To report site difficulties please email: jsmyth@interchange.ubc.ca

Last reviewed 22-Sep-2003

Univeristy of British Columbia

Surgery

PEDIATRIC UROLOGY

URINARY TRACT INFECTIONS:

Urinary tract infections (UTIs) are common in children occurring more commonly in males (especially if uncircumcised) under the age of 2 and more commonly among females over the age of 2 (due to short and straight urethra). Clinicians should have a high index of suspicion in any child with a fever of unknown cause. A single UTI can cause damage to the growing kidneys of children as they are immature and susceptible to permanent renal injury. Children 2 months to 2 years are at the greatest risk of renal damage from a UTI. The most common cause is E. coli, accounting for up to 80% of UTIs. Other pathogens include: a variety of enterics (Klebsiella, Proteus, enterococci), Staphylococcus, and Staph saprophyticus. Risk factors include: female (2+ years old), neurogenic bladder (urine stasis), reflux, genitourinary tract abnormalities, immunocompromised, uncircumcised male.

Presentation

1. The clinical presentation of a UTI is highly variable, and with occasional exceptions the clinical features are wholly non-specific.
2. UTIs can present as failure to thrive, feeding difficulties, vomiting, or jaundice with or without fever in neonates.
3. The presentation in older children is as variable and can include any of the following signs and symptoms:

A. Urinary tract signs and symptoms

- Dysuria
- Frequency
- Dribbling/hesitancy
- Enuresis after successful toilet training
- Malodorous urine
- Hematuria
- Squatting
- Abdomonal/suprapubic pain

B. Systemic signs and symptoms

- Fever
- Vomiting/diarrhea
- Flank/back pain

Physical Exam

1. As with the history, few findings on physical exam suggest UTI or VUR.
2. The physical exam should exclude hypertension, an abdominal or flank mass, or a palpable bladder, neurologic deficits, and abnormal genitalia.

Investigations

1. Maintaining a high level of suspicion for UTI in febrile children, particularly when an unexplained fever last 2 – 3 days, will lessen the number of missed UTIs. It is recommended that UTI be considered in all children less than 2 years of age with an unexplained fever. **A single pyelonephritic episode in a child risks permanent renal injury and sequelae** (renal

insufficiency, renal ischemia, hypertension, subsequent dialysis or transplant).
2. **Urinalysis with culture is the first investigation in a suspected UTI:**

- Suprapubic aspiration is the most reliable method for obtaining urine for urine culture. This however, causes a great deal of anxiety for the child and parents. The most practical and reliable method of sample collection is via a sterile in/out urethral catheterization. Alternatives include mid-stream collection in older children and placing a collection bag over the perineum of infants. These collection methods are often contaminated and the results must be interpreted with the urinalysis and clinical picture in mind (ie. multiple bacteria cultured in the absence of pyuria is probably a contaminated sample).

3. I**n general, imaging with the first UTI is indicated in all children less than 5 years old, children of any age with febrile UTI and boys of any age.**

- **Minimal work-up includes renal and bladder ultrasound, and voiding cystourethrogram (VCUG).**
- The timing, completeness, and age of GU investigations remain controversial amongst different specialty groups, and in different countries.

Treatment

1. Treatment consists of antibiotic therapy.
2. Initial antibiotic therapy should be based on age, clinical severity, location of infection, presence of structural anomaly, and allergy to certain antibiotics.
3. Treatment generally begins with a broad-spectrum antibiotic, but it may need to be modified pending urine culture and sensitivities.

For questions regarding the above please email: Not Available

To report site difficulties please email: jsmyth@interchange.ubc.ca

Last reviewed 22-Sep-2003

Univerisity of British Columbia

Faculty of Medicine
317-2194 Health Sciences Mall
Instructional Resource Centre
Vancouver, B.C. Canada
V6T 1Z3
tel (604) 822-2421 | fax (604) 822-6061 | e-mail admissions.md@ubc.ca

© Copyright The University of British Columbia, all rights reserved.

Surgery

PEDIATRIC UROLOGY

VESICOURETERAL REFLUX (VUR):

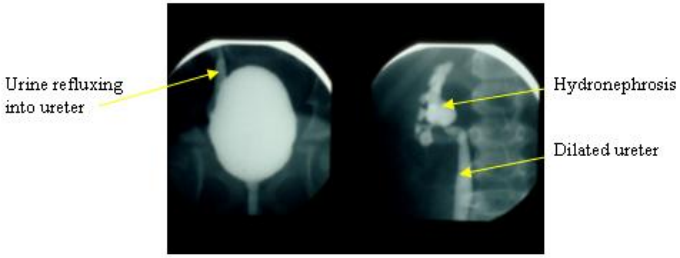
1. VUR is the abnormal back backwash of urine into the kidney secondary to an abnormal lateral insertion of the ureter into the bladder.
2. **VUR is the most common finding in children evaluated for UTIs** (occurs in 30 – 50 %)

- 10 times more common in girls than boys and commonly bilateral.

3. Diagnosis and staging of VUR is by VCUG:

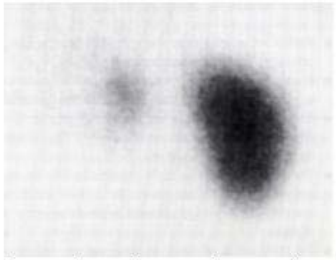
- Grade I – ureters only fill
- Grade II –uereters and pelvis fill
- Grade III ureters and pelvis fill, some dilatation
- Grade IV – ureters, pelvis and calices fill, significant dilatation
- Grade V – ureters, pelvis, and calices fill, major dilatation and tortuosity

VCUG with dilated ureter pelvis and renal calyx



VCUG with dilated ureter and hydronephrosis

4. DMSA imaging reveals evidence of scarring in 25-40% of VUR patients at the time presentation. Scarring manifests as a photopenic area on DMSA scanning due to the absence of functioning tubular tissue to which the radionucleotide tracer normally binds.



DMSA showing renal scarring secondary to unilateral VUR

5. Reflux of infected urine damages the kidney in young children, so either the urine must be kept sterile or the reflux must be corrected.

A. Stage I – III tends to correct with growth of the bladder (80% of patients). Children are treated with prophylactic antibiotics until the condition corrects is outgrown or corrected surgically.

- Amoxicillin in neonates.
- Trimethoprim/Sulphamethoxale (Bactrim, Septra) or nitrofurantoin beyond the neonatal period.
- Observation is required with repeat VCUG, ultrasound, and urine cultures if infection is suspected.

B. Severe reflux (stage IV and V) or reflux that fails to correct with age is treated with surgery. Reflux that results in breakthrough UTIs despite adequate antibiotic prophylaxis is also an indication for surgical correction.

- Surgical repair is designed to reconstruct the ureterovesical junction to create a lengthened submucosal tunnel for the ureter, which functions as a one-way valve as the bladder fills.

C. There is a more recent trend amongst practitioners to a more conservative approach of stopping antibiotics in older patients with low to moderate grades of VUR. In this way low risk patients can be spared long term follow-up and unnecessary interventions. This approach is as yet unproven in a prospective randomized fashion however.

Surgery

PEDIATRIC UROLOGY

ANTENATAL HYDRONEPHROSIS:

Antenatal hydronephrosis refers to dilation of the renal collecting system diagnosed on prenatal ultrasound. Hydronephrosis is a common finding occurring in 1% of prenatal ultrasounds. Ultrasound can visualize a dilation of the renal collecting system, but obstruction of the urogenital tract cannot be confirmed until after birth.

Etiology of Antenatal Hydronephrosis

1. Up to 50% of neonates detected with hydronephrosis on prenatal ultrasound are normal on postnatal ultrasound.
2. The remaining 50% that continue to have hydronephrosis after birth have a range of diagnoses. Four causes of antenatal hydronephrosis remaining at birth include:

A. Ureteropelvic junction (UPJ) obstruction accounts for the majority (64%)

- Most common cause of obstructive uropathy in children
- 2 times more common in males and more common on left.
- 15% of cases are bilateral.
- It is caused by: segment of ureter lacking peristaltic activity; congenital narrowing, muscular bands, or external compression of the ureter.
- Usually presents on prenatal ultrasound, but can present as a child with flank pain following consumption of large volumes of fluid.
- Diagnosis is made by ultrasound and diuretic renogram.
- Treatment includes surgical repair with good prognosis. The gold standard of surgical management of UPJ obstruction is the dismembered pyeloplasty.

B. Vesicoureteral reflux (VUR)

- Refer to VUR in the UTI section of this seminar

C. Megaureter

- Megaureter can be secondary to an obstructive process or in isolation. A megaureter that is not associated with other problems occurs during fetal development. It occurs when a section of the ureters normal muscular layer, is replaced by stiff, fibrous tissue. In the absence of a muscular layer, normal peristalsis of the ureter cannot occur resulting in megaureter.
- Diagnosis and treatment follow the same protocols as VUR.

D. Posterior urethral valves

- Most common obstructive urethral lesion in male infants with an incidence of 1:50,000.
- It is caused by abnormal congenital mucosal folds in the distal prostatic urethra that looks like a thin membrane that impairs bladder drainage.
- Usually presents on prenatal ultrasound as antenatal hydronephrosis, but can present in a child with obstructive symptoms, UTI, flank masses, or urinary ascites if renal pelvis ruptures.
- Diagnosis is made by voiding cystourethrogram (VCUG), and less commonly, by ultrasound. Renogram should be obtained for renal function and prognostication.
- Initial management should consist of draining the bladder with a urethral catheter, start prophylactic antibiotics, measure serum creatinine and electrolytes, and image the kidneys and urinary tracts.
- Treatment is ablation of the valves
- Prognosis depends on renal function at time of diagnosis. Approximately 1/3 have impaired renal function at the time of diagnosis.

Management of Antenatal Hydronephrosis

The ideal management of antenatal hydronephrosis remains controversial over the aggressiveness of management as the majority of infants are born normal or with a good prognosis.

1. Amniotic fluid volume is the single most significant determinant of fetal well-being and survival. Amniotic fluid is maintained by fetal urine production from 16 weeks gestation. Oligohydramnios secondary to a urogenital obstruction is the main concern when antenatal hydronephrosis is seen on prenatal ultrasound. Oligohydramnios is associated with pulmonary hypoplasia and malformation due to compression.

2. Fetal intervention (generally vesicoamniotic shunting is reserved for the severe end of the pathologic spectrum where intrauterine or early postnatal death are likely.

3. In the majority of cases the pregnancy is allowed to progress normally and medical input consists of monitoring (serial ultrasounds) where appropriate.

4. All infants with a history of antenatal hydronephrosis should have a post-natal ultrasound performed with in the first 2 weeks of life. Ultrasounds performed within the first 72 hours of life may underestimate the degree of hydronephrosis because of the relative dehydration and decreased renal blood flow that occurs in the first few days of life.

- If the renal parenchyma is normal and there is no sign of dilation of the calyces or renal pelvis, the child may be followed with ultrasounds.
- If the postnatal ultrasound diagnosis hydronephrosis and hydroureter, the child should be treated with prophylactic antibiotic (amoxicillin) until the presence of reflux is excluded with a voiding cystourethrogram (VCUG).
- Diuretic renogram should be performed after 1 - 3 months of life if hydronephrosis is confirmed post-natally to assess kidney function and drainage. Prior to this, renal immaturity makes interpretation of the study difficult.
- The cause of the hydronephrosis should be treated according to cause, severity and prognosis.

For questions regarding the above please email: Not Available

To report site difficulties please email: jsmyth@interchange.ubc.ca