Pediatric Nursing

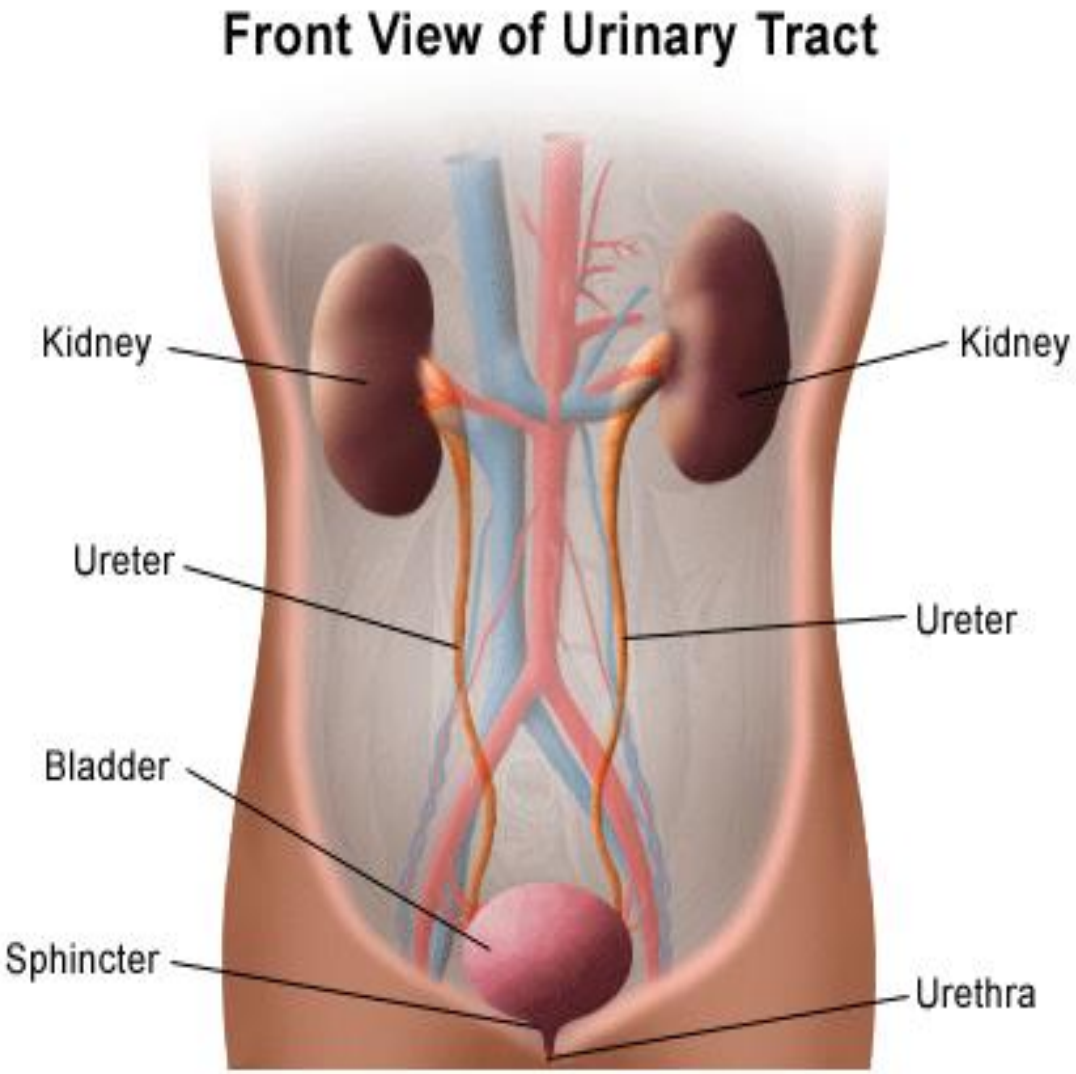
Genitourinary system

Lecture 14

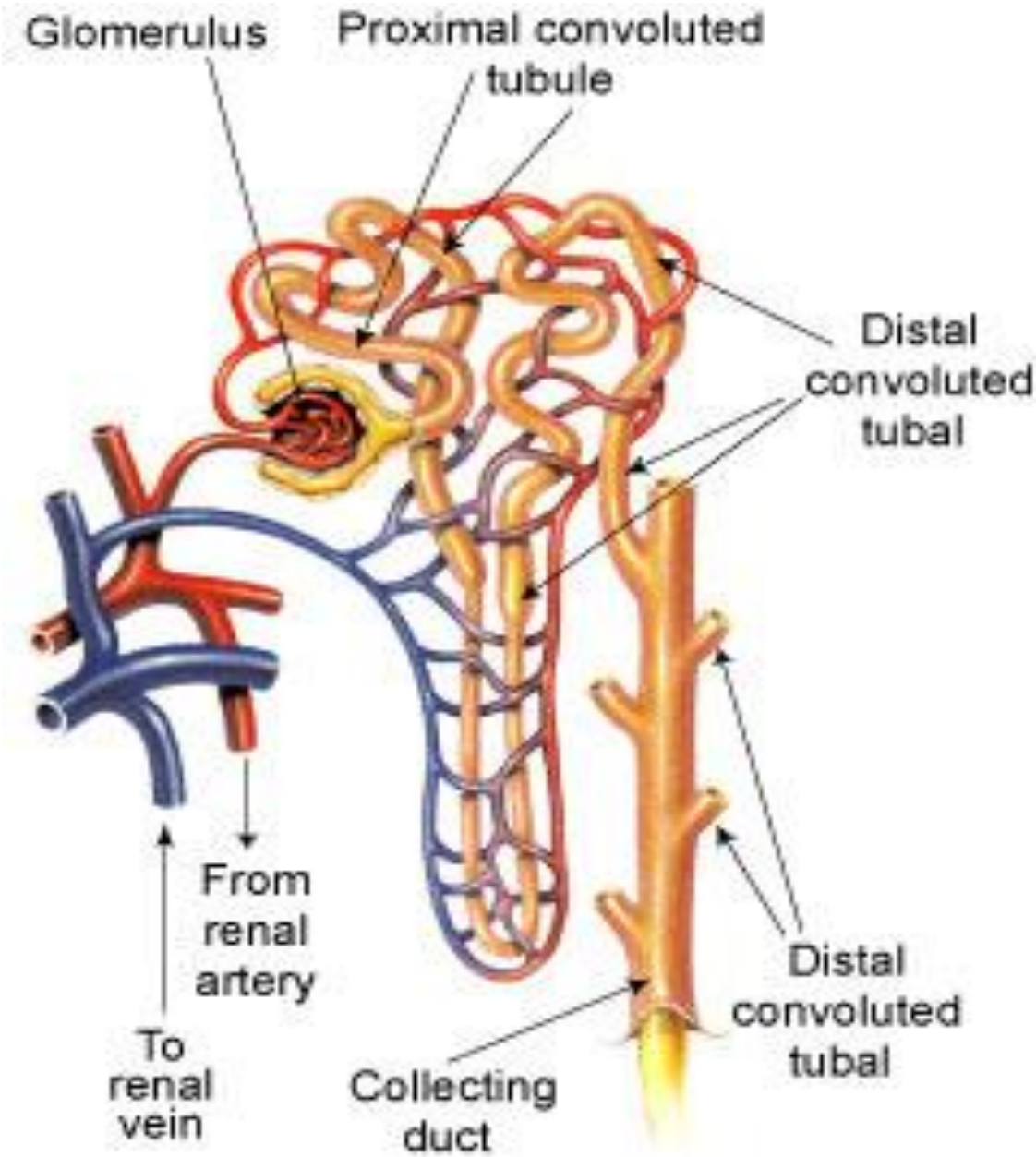
Anatomy & physiology

- The genitourinary system is composed from the urinary & genital system.

- The urinary system is composed from the kidneys, ureters , bladder, & urethra.

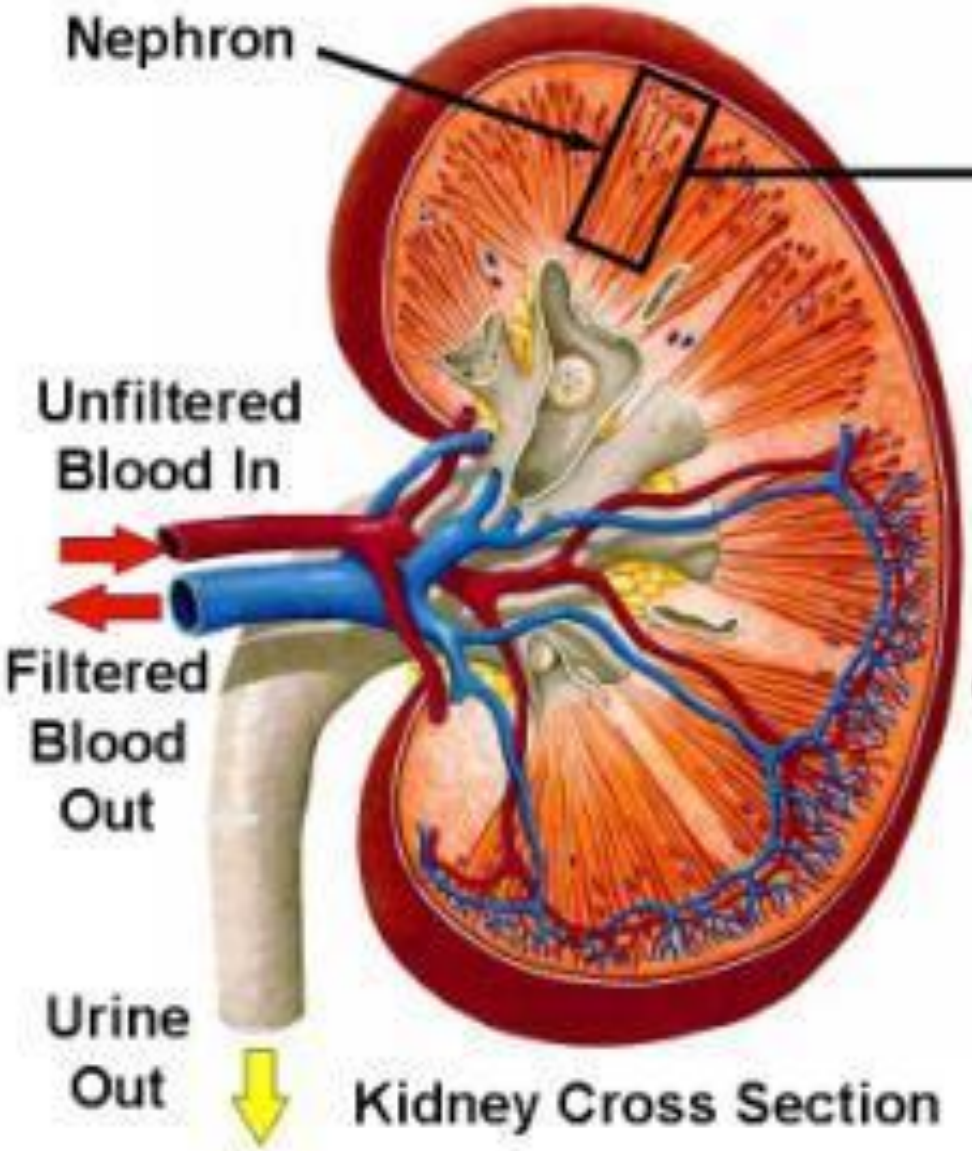


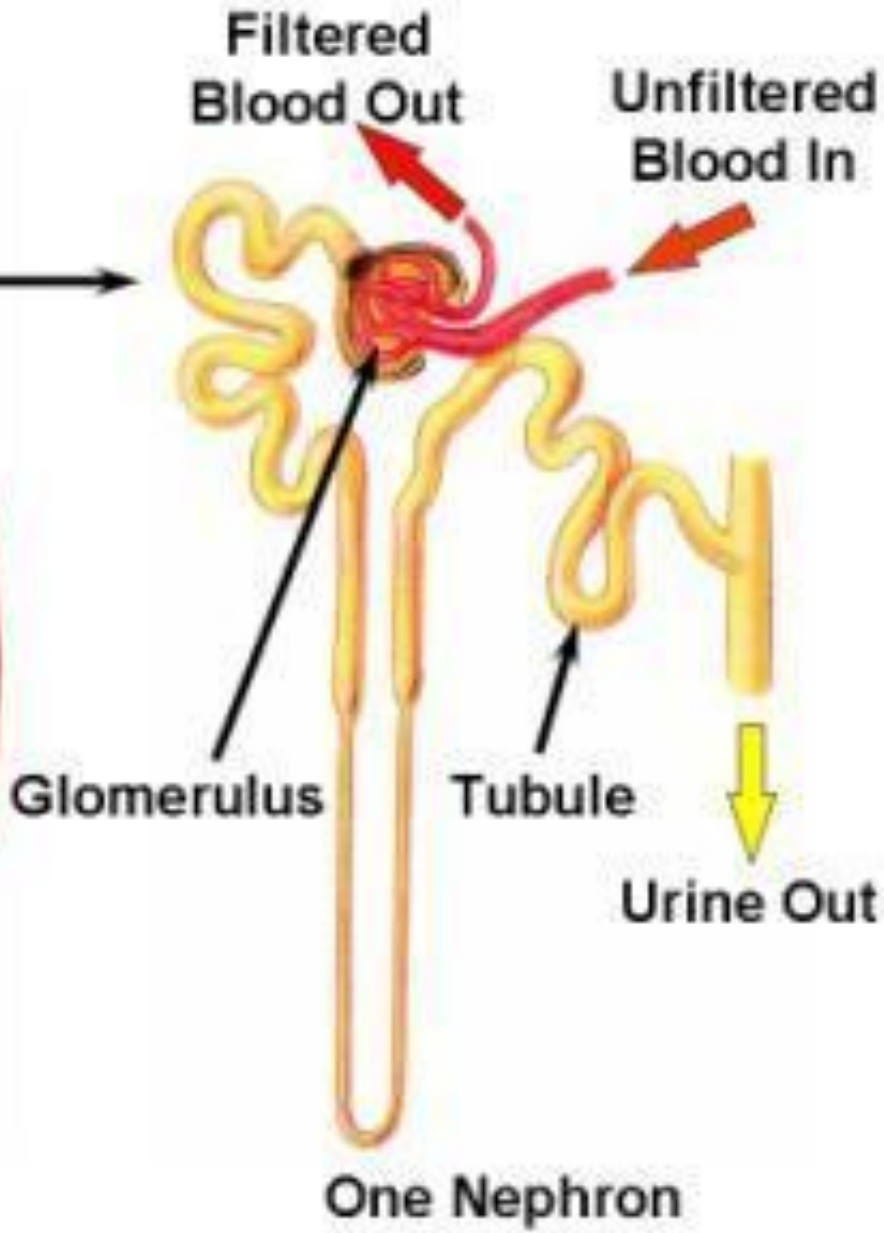
- The **functional unit of** the kidney is the nephron, which is a tubular structure containing the renal corpuscle, proximal convoluted tubule, loop of Henle, distal convoluted tubule, & the collecting ducts.



Nephron

Parts of the Nephron





- The corpuscle is composed of the glomerulus (a small group of capillaries)

- Water, electrolytes & other substances are reabsorbed or secreted in the tubules, including the following:

1- proximal tubules: sodium chloride, glucose, potassium., amino acid, bicarbonate, urea, & water are reabsorbed.

2- loop of Henle: water & sodium are reabsorbed. Leading to urine concentration & secretion of urea.

3- distal tubules: sodium chloride, bicarbonate & water are reabsorbed; potassium, urea, hydrogen ions & ammonia are secreted.

4- collecting tubules: water is reabsorbed.

- The presence of antidiuritic hormone (ADH) secreted by the posterior pituitary gland causes more water reabsorption, leading to urine concentration.
- Absence of ADH will cause diluted urine.
- As the urine collected in the collecting duct it moves into the renal pelvis and funneled into the ureters.
- The muscle of the ureters move the urine to the bladder and stay in it until the internal sphincter relax losing the urine into the urethra.
- The external sphincter is become voluntary controlled by the child when the nervous system become matured.
- The contraction of the bladder during urination compress the lower portion if the ureters to prevent urine reflux back into the ureters.

Other function of the kidneys:

1. Activation of the vitamin D:

which is needed for the absorption of calcium & phosphorus from the small intestine.

2. Secretion of the erythropoietin hormone:

to stimulate production of the RBCs from the bone marrow.

3. Secretion of renin-angiotensin system:

to control systolic blood pressure.

Pediatric differences:

- All nephron that will make up the mature kidney is present at birth, the ureters are short & tubules have smaller surface area resulting in diminished water reabsorbion.
- The kidney size grow gradually reaching it full size by adolescence.
- During the first 2 years of life, the kidneys are less efficient in regulating electrolytes & acid base balance.
- The urinary output per Kg of body weight is decreased as the child grows as following:

1- infants: 2 ml/Kg/hr.

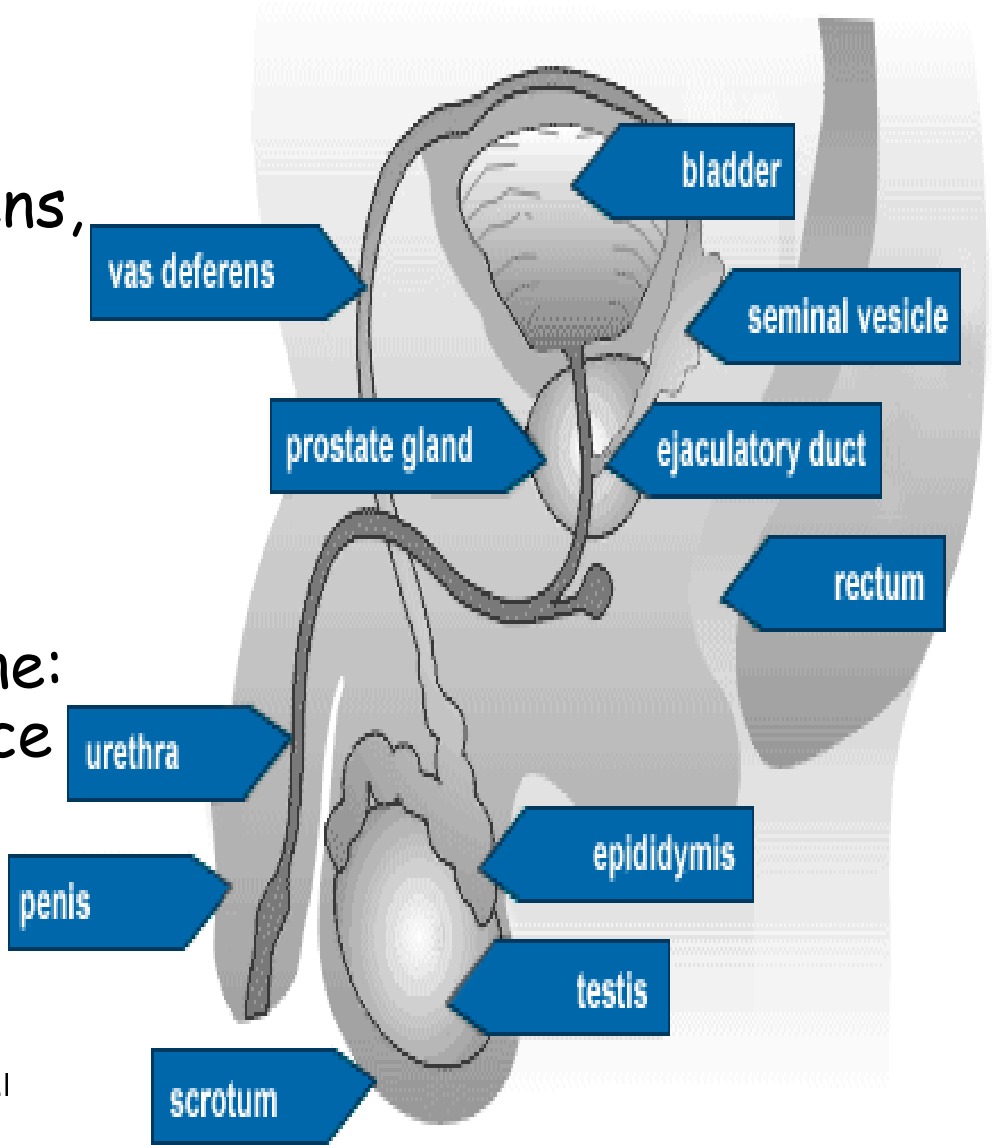
2- children: 0.5-1 ml/Kg/ hr.

3- adolescents: 40-80 ml/hr.

The male reproductive system

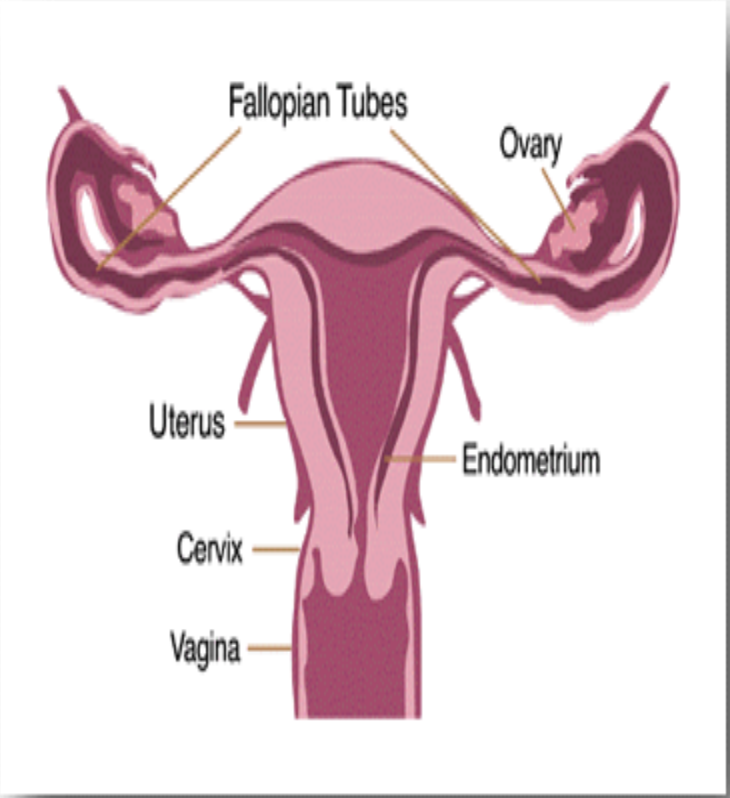
- Is composed from the testes, scrotum, penis, prostate, the vas deferens, which drain into the urethra.

- The tests produce the primary male sex hormone: testosterone, and produce sperm after puberty.



The female reproductive system

- Is composed of the ovaries, fallopian tubes, uterus & vagina.
- The ovaries produces the primary sex hormone: estrogen. Beginning at 8-12 years of age
- The ovaries produce ovum to be fertilized after puberty.



Diagnostic procedures

- CT scan.
- Cystoscopy.
- MRI.
- Renal biopsy.
- Renal or bladder ultrasound.
- **Blood tests:**

-BUN.

-urine analysis.

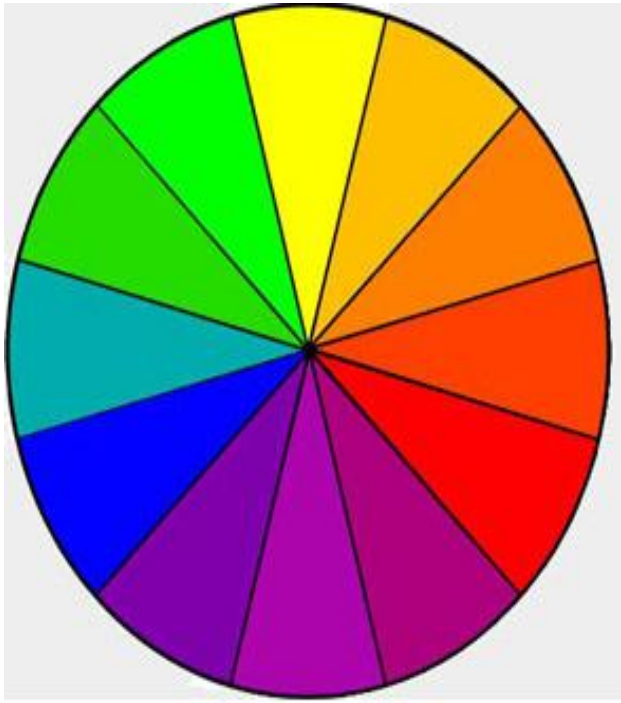
-urine culture.

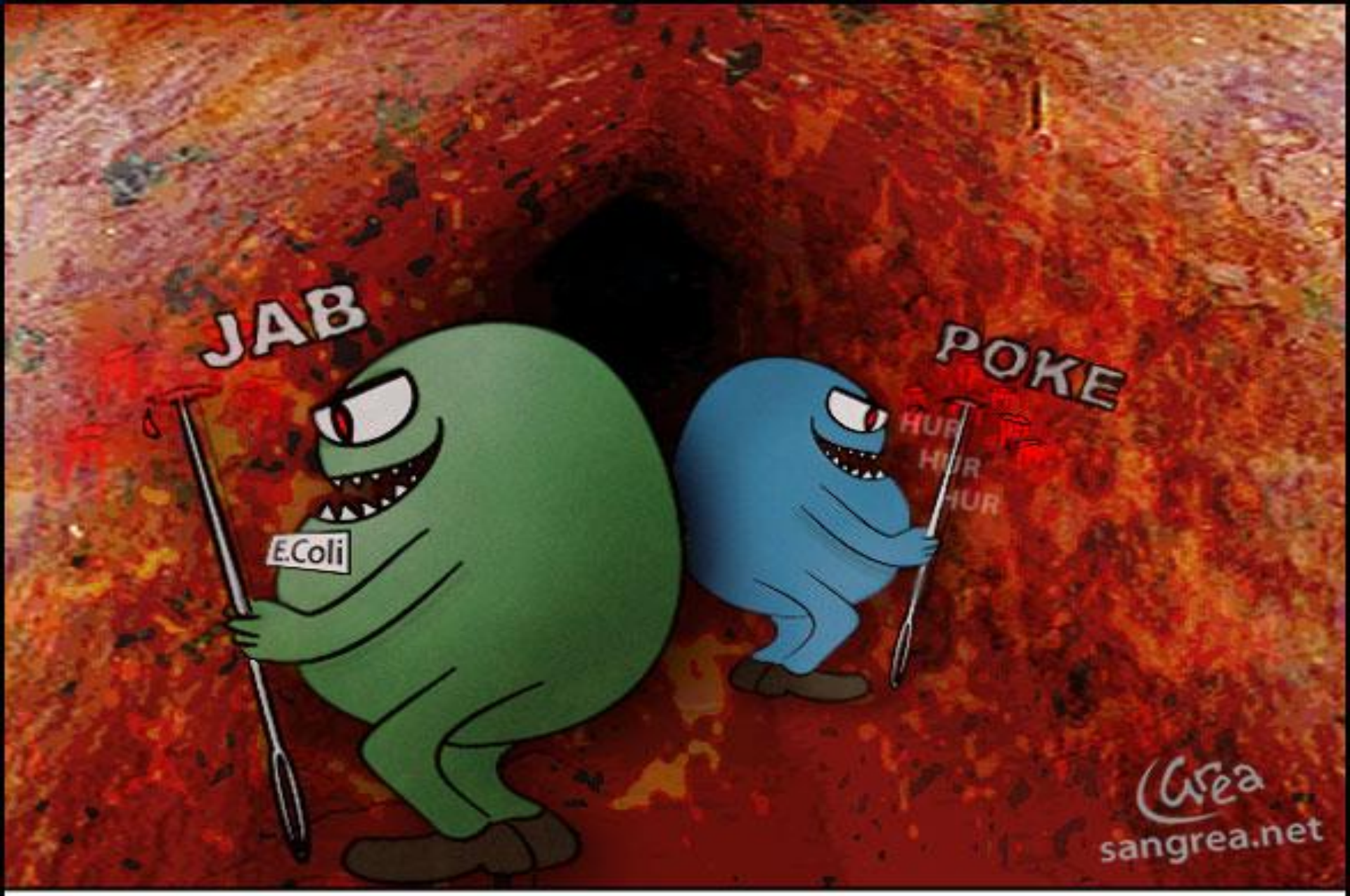
-KFT

-creatinine clearance.

The color wheel

- Is used as a guide for standardization description of urine color.
- **Normal urine** color is pale yellow.
- Yellow concentrated urine: bile in urine.
- Orange: alkaline or concentrated urine.
- Red-orange: acid pH, medication.
- Red: blood; menses.
- Pink: diluted blood
- Tea: melanin, hematurea.
- Dark gray: medication, dyes.
- Blue: medication, dyes





The dreadful truth behind urinary tract infections

URINARY TRACT INFECTION

DEFINITION:

TISSUE RESPONSE TO THE PRESENCE OF SIGNIFICANT AMOUNT OF BACTERIA IN THE URINE

Urinary Tract Infection

- UTI can be bacterial, viral or fungal.
- It can be in the lower urinary tract including bladder or urethra & called **cystitis** or affect the upper urinary tract including ureters, renal pelvis & renal parenchyma & called **pyelonephritis**.

- UTI can be acute or chronic (recurrent or persistent).

- Is the second most common infections in the children.
- It higher in female (3%) than in males (1%).

- However; in newborns UTI occur in male more than female due to obstructive structural defects predisposing infant to infection.

- As the child grows the female child become more suitable to infection than males, due to their short urethra (2cm), and it is closer proximity to the anus & vagina, increasing the risk of contamination by fecal bacteria.

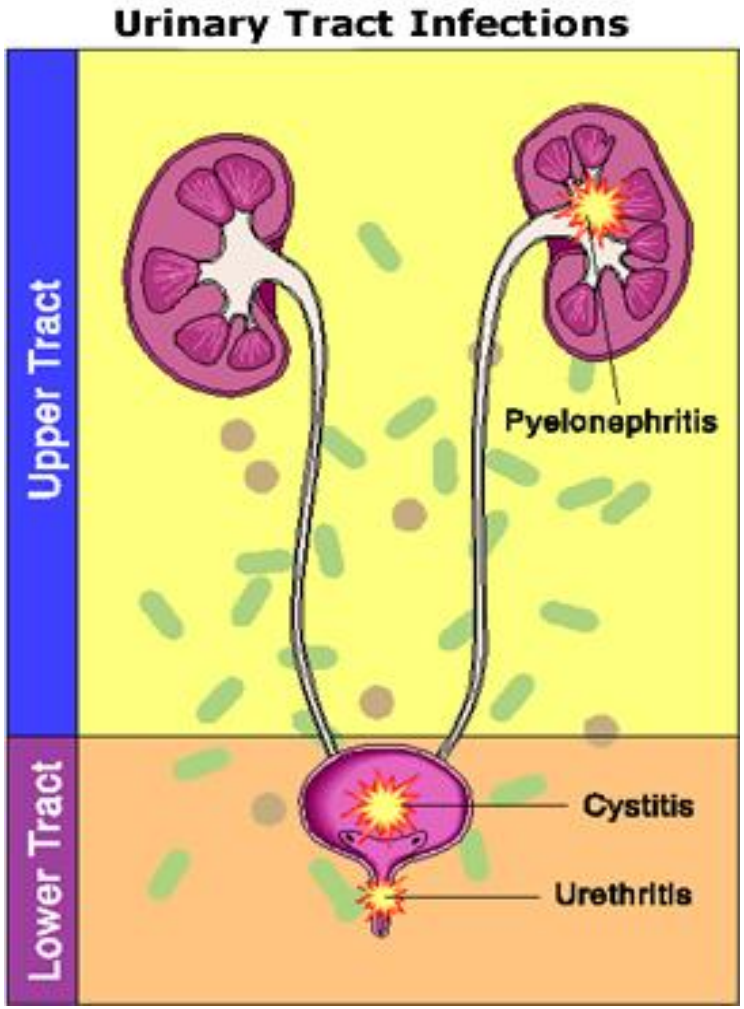
PATHOGENESIS

Upper urinary tract infection:

- Pyelonephritis

Lower urinary tract infection:

- Cystitis



Etiology

- The urinary tract is normally sterile, the presence of microorganism will lead to infection.
- The most common organisms is *Escherichia coli*. (gram negative bacteria).
- Other causative microorganisms are: Staphylococcus, Klebsilla, Pseudomonas, Enterobacter & Enterococcus.
- There are multiple cases leads to UTI including:

1- **urinary stasis** that make bladder good environment for bacterial growth.

-Stasis is caused by abnormal anatomical structures or abnormal function (e.g. neurological bladder: an interrupted nerve supply to the bladder leads to incomplete bladder empting & stasis).

-Also stasis occur due to infrequent voiding (common in school age children) leading to urine stasis and UTI.

2- vesicouretheral reflux:

The back flow of urine from bladder into uterus during voiding leading to incomplete voiding & swept bacteria up to kidneys.

3- renal scaring that results from hydronephrosis or pyelonephritis (accumulation of urine in the renal pelvis).

Scars are associated with hypertension, proteinurea & renal failure.

4- other factors:

Irritated perineum, uncircumcised male in the first 6 months of life, masturbation, sexual abuse.

5-Sexual activity:-

CLINICAL PRESENTATION

S & S most helpful in identifying young children with UTI:

1-History of previous UTI

2-Temperature >40°C

3-Suprapubic tenderness

4-Lack of circumcision

Clinical manifestations

- The symptoms in newborns are nonspecific:

- Unexplained fever.
- Failure to thrive.
- Poor feeding.
- Vomiting & diarrhea.
- Strong smelling urine.
- Irritability.

- Symptoms in children more than 1 month of age.

Types of UTI	Clinical manifestations
Lower UTI-cystitis	Frequency, dysuria, urgency, hematurea, strong smelling urine, cloudy urine, abdominal or suprapubic pain
Upper UTI-pyelonephritis	High fever, chills, abdominal & flank pain, costovertebral angle tenderness, persistent vomiting, moderate to sever dehydration

CLINICAL PRESENTATION

Older children:

Fever

Urinary symptoms

Abdominal pain

Back pain

New onset urinary incontinence

fever, chills, vomiting and flank pain are suggestive of pyelonephritis in older children

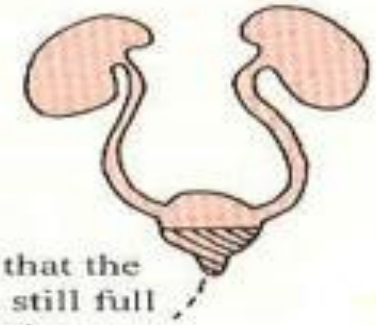
short stature, poor weight gain, or hypertension secondary to renal scarring

Suprapubic and costovertebral angle tenderness

◄ Interruptions in the urinary stream

► Frequent urination, especially at night

◄ Hesitation before beginning to urinate



► A feeling that the bladder is still full after urinating

▲ Terminal dribbling

▲ An urgent need to urinate

▲ Weak urinary stream

LABORATORY EVALUATION

Urine

Dipstick
microscopy
Culture & sensitivity

Diagnostic tests:

- **Urine analysis**: is used by a clean container or urine collector.
- It need no sterile maneuver. Urine is taken from midstream clean catch. If cultured, Results will be more than 100,000 Colony-forming units (cfu/ml).

- **Urine culture**: is taken in sterile Container, & by catheterization. Results show more than 50,000 cfu/ml.

MANAGEMENT

Illustration: Don Smith

MANAGEMENT

GOALS:

Elimination of infection and prevention of urosepsis

Relief of acute symptoms

Prevention of recurrence and long-term complications

MANAGEMENT

Decision to hospitalize:

Age <2 months

Clinical urosepsis or potential bacteremia

Immunocompromised patient

Vomiting or inability to tolerate oral medication

Lack of adequate outpatient follow-up

Failure to respond to outpatient therapy

Clinical therapy

- Antibiotic is given as soon the urine sample is taken for 5-14 days.
- Type of antibiotic is selected upon the child's age, sign & symptoms, & sensitivity of cultured organisms.
- Follow –up culture is needed after 48-72 hours of drug administration if the child still febrile.
- Children with pyelonephritis may have repeat the culture monthly after full recovery for 3 months & every 3 months for one year & then yearly.
- Correct defect if present (surgical)

Nursing interventions

- Increase fluid intake.
- Hygiene (way of cleaning), female must wipe from front to back.
- Use cotton under wearing rather than nylon.
- Caution against tight underwares.
- Avoid long periods of urine holding.
- teach parent how to prevent future UTI.

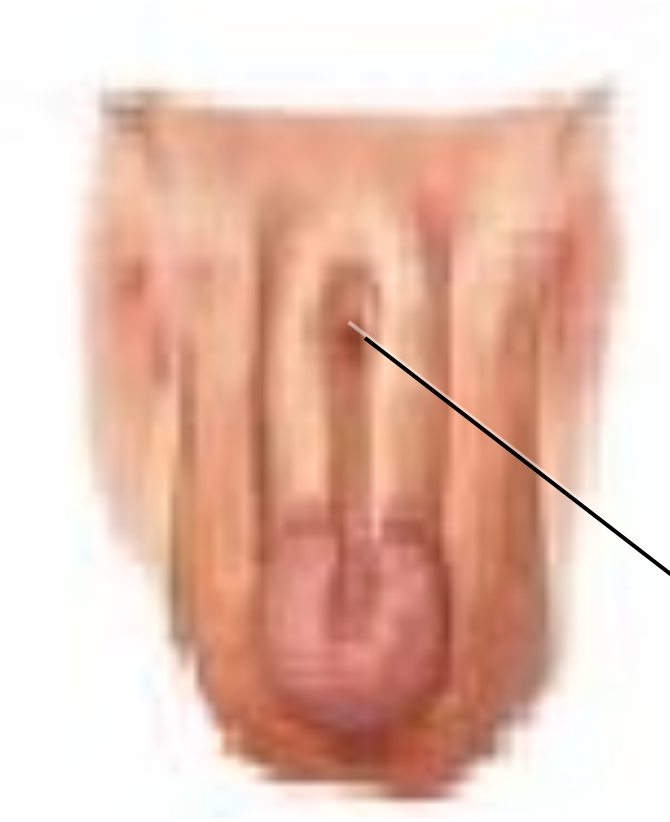
Hypospadias & Epispadias

- Are congenital anomalies involving abnormal location of the urethral meatus in males.
- In both cases, the urethral folds fail to fuse completely over the urethral groove.

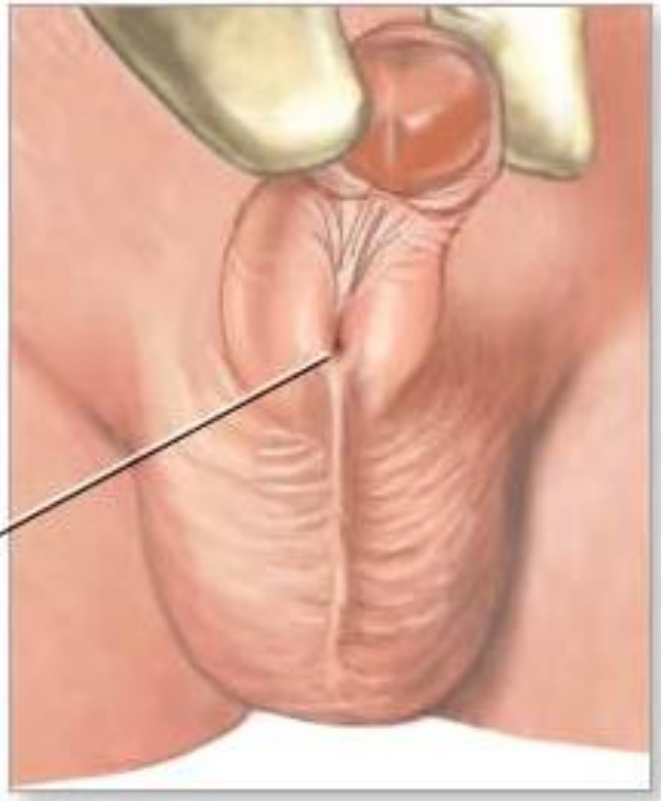
- **In hypospadias**, the urethral opining is located in any area on the ventral or undersurface of the penile shaft, and in sever cases in the scrotum.
- **In epispadias**, the opining is located on the dorsal surface of the penile shaft; it can be an opining or a fissure extended over the entire length of the penis.

Epispadias

Hypospadias

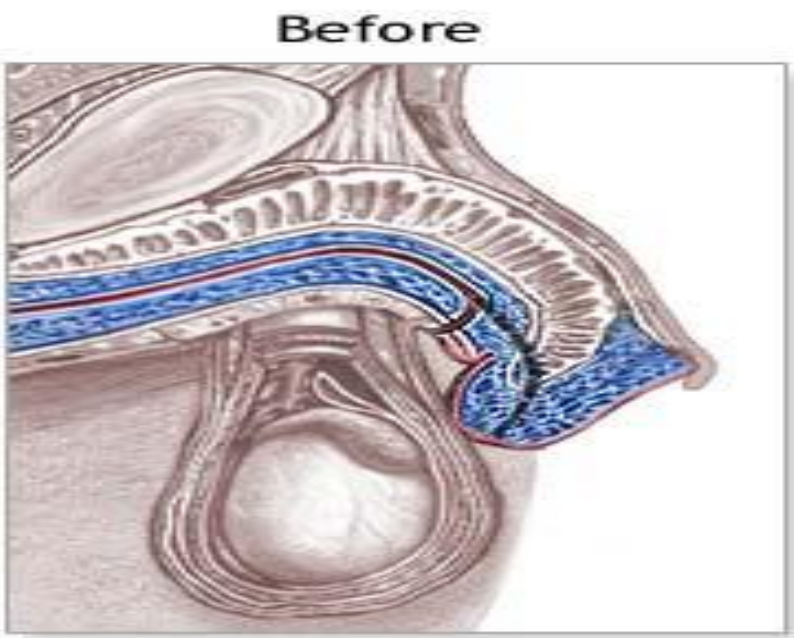


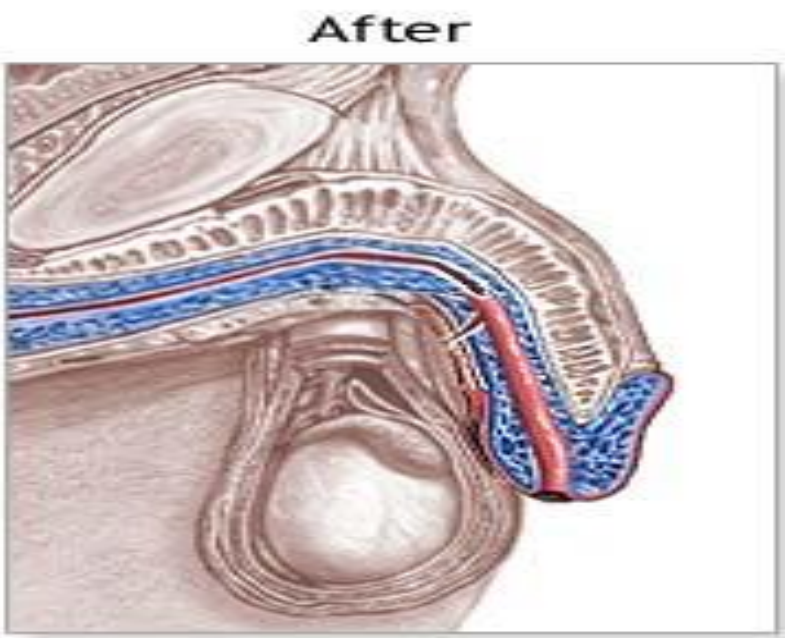
Urethral opening



Managements

- The defects are corrected through surgical repair, during the first year of life.
- Give antibiotic until the stent fall out.
- not to *circumcision* the child





ADAM.

Nursing managements

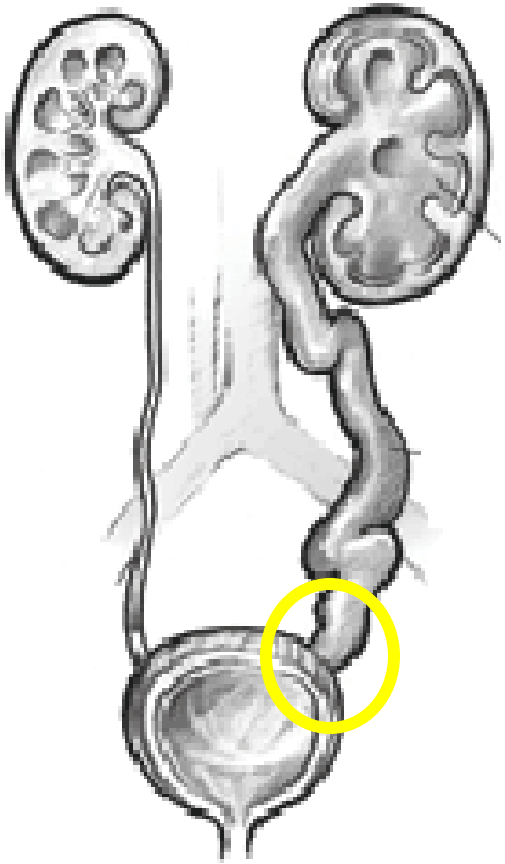
- Teaching the parents preoperatively to relive their anxiety.
- Postoperatively: child is received with simple dressing and stent in the new urethral opining to keep it open, few blood is seen soon after surgery. But the urine will be more clear after that.
- Encourage fluid intake to maintain adequate urinary output & patency of the stent.

- Notify the doctor if no urine drainer for one hour.
- Give analgesia as ordered (ibuprofen) to control the pain.
- Use double diaper: one to collect stool and another to collect urine by catheter.
- Restrain the child activity, so stent or catheter stay in place.
- In some cases a suprapubic catheter is inserted to provide an alternative route for urination. ensure parent education about all catheters inserted.

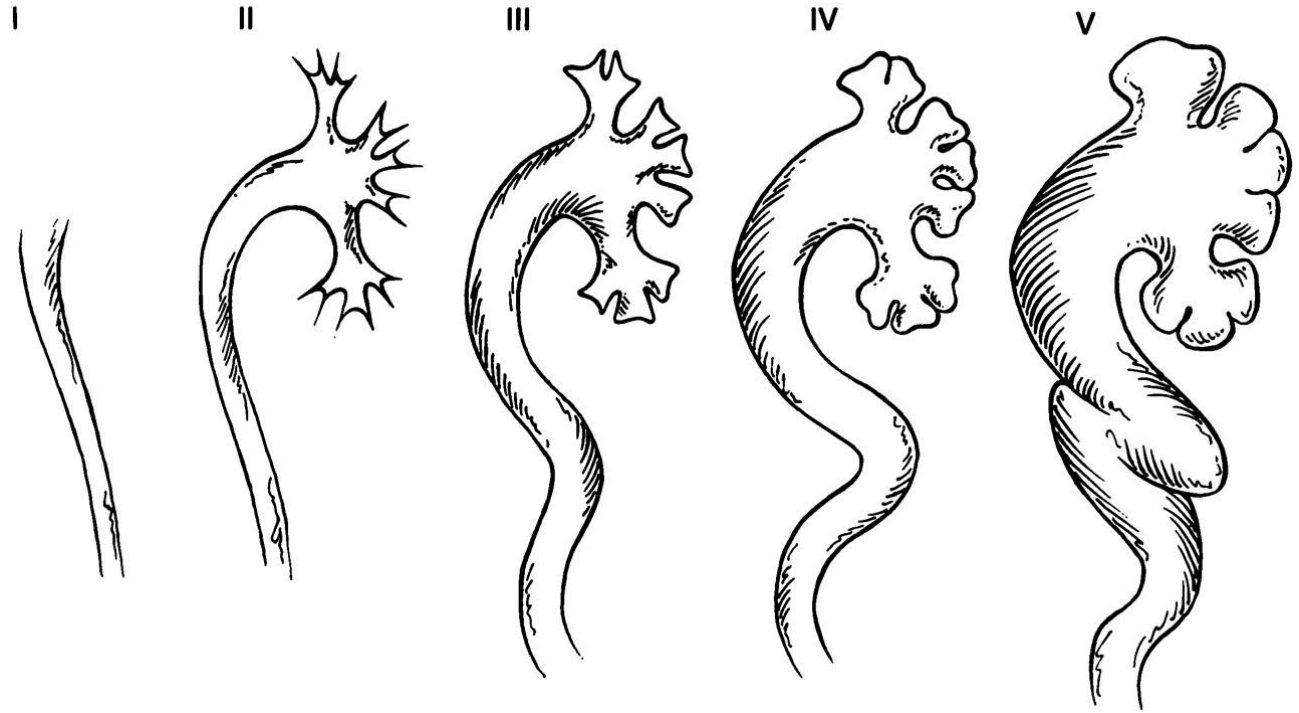
Vesicoureteral Reflux

- Is the stenosis or obstruction at the uretrovescular junction.
- Leading to dilation of the entire ureter, renal pelvis and kidney.

- The child show recurrent signs of UTI due to stasis, hematurea, pain, abdominal mass (from enlarged kidney)



It has stages according to the degree of dilation of the ureter



Management

- Include surgical correction of the obstruction of stenosis.
- Valve repair if sever.
- preoperative nursing interventions include decreasing level of anxiety of parents, increase their knowledge about the surgery.
- Postoperative nursing interventions include: monitoring vital signs, intake output and signs of urinary retention (as decreased output & bladder distention).

- double diaper.

Difficult Question

- When developing the teaching plan of a parents of 12 month old, with hypospadias repair.

Which of the following would the nurse expect to include as most important?

A. Assisting the child to become familiar with his dressing so the child will leave them alone.
B. Encourage the child to ambulate as soon as possible by using a favorite push toy.
C. Forcing fluid to at least 2,500 ml/day by offering him a favorite juices.
D. Preventing the child from disrupting the catheter by using soft restrain.

Easy Question

- After teaching the parents about the urethral catheter placed after surgical repair to their son's hypospadias, the nurse determines that the teaching was successful when the mother states that the catheter in her child's penis accomplishes which of the following?

A. Decrease pain at surgical site.
B. Keeps the new urethra from closing.
C. Measures his urine correctly.
D. Prevents bladder spasms.

Very Easy Question

- After a surgical repair of a hypospadias, a 12 month old child retain to nursing unit with an intravenous line, a urethral catheter, and a suprapubic catheter. Which of the following would the nurse explain to the parents is the primary purpose for the suprapubic catheter?

A. To ensure an accurate measure of the urine.
B. To provide an alternative urinary elimination route.
C. To provide entry port for bladder irrigation.
D. To allow assessment for blood clots in urine.