

Urinary Tract Infection

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Urinary Tract Infection

Definition:

The presence of a “significant number” of bacteria in urine.

+

Symptoms

Urinary Tract Infection

Incidence

Boys: 1%

Girls: 3%

Onset

30 % < 1 year

70 % < 6 years

Primary Renal Diseases in 202 Jordanian Children with Chronic Renal Failure (CKD)

*The spectrum of chronic renal failure among Jordanian children
Radi M. A. Hamed - Department of Pediatrics, Jordan University Hospital,
Amman – Jordan. J NEPHROL. 2002; 15: 130-135*

Etiology	No.	%
Urinary tract abnormalities (anomalies)	85	42.1
Hereditary renal disorders	60	29.7
Glomerulonephritis	29	14.4
Renal hypoplasia / dysplasia	10	5
Vascular abnormalities	9	4.5
Unclassified (idiopathic)	9	4.5

Urinary Tract Infection

Classification (Localization):

- **Lower U.T.I**

 - Urethritis

 - Cystitis

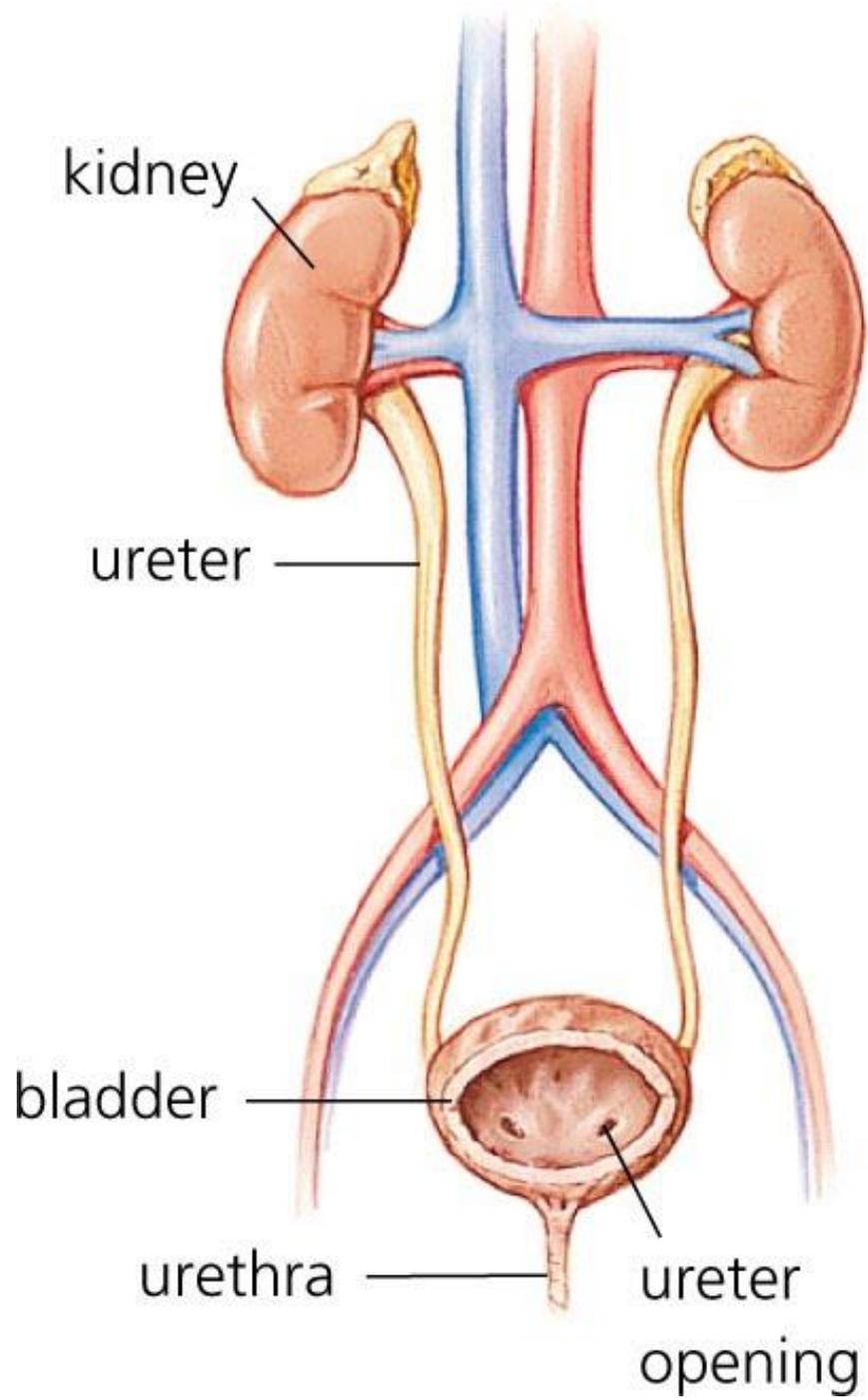
- **Upper U.T.I**

 - Pyelonephritis

Urinary Tract Infection

Classification:

- **Obstructive**
 1. Structural:
 - Congenital
 - Acquired
 2. Functional:
 - Neurogenic bladder (dys-synergia).
 - Constipation.
- **Non-obstructive**
 - e.g - Primary vesico-ureteral reflux.
 - Cystitis.



Urinary Tract Infection

Symptoms

Neonates / Nonspecific

	<u>%</u>
Weight loss/failure to thrive	76
Fever/sepsis	50
Cyanosis (Dusky)	40
Abdominal distention	16
Prolonged Jaundice	07
Vomiting	

Urinary Tract Infection

Symptoms

In infants

- Fever
- Irritability
- Abdominal pain
- Gastrointestinal symptoms
- Crying upon micturition
- Turbid urine/strong-smelling urine
- Failure to thrive (25%)

Urinary Tract Infection

Symptoms

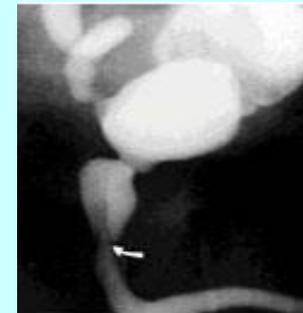
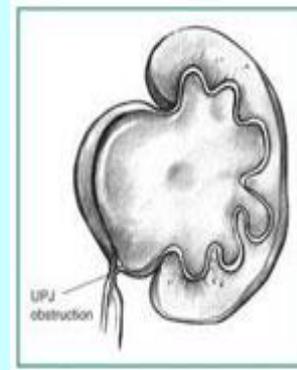
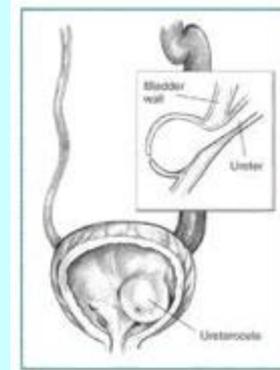
In older children

- Bladder irritation signs:
dysuria, frequency, urgency
- Incontinence: ? new onset
(nocturnal enuresis, day-time incontinence)
- Loin/flank pain.
- Fever, Chills-Rigors.
- Hematuria.

Urinary Tract Infection

Pertinent physical findings

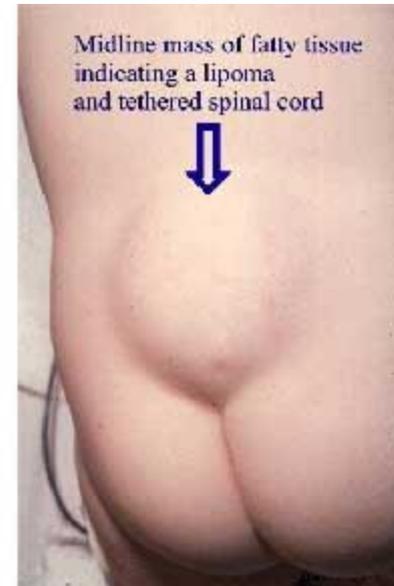
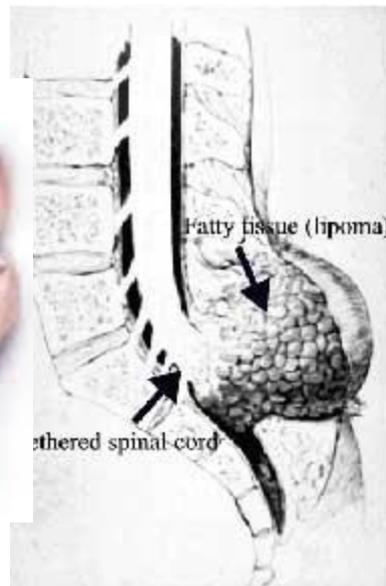
- palpable abdominal mass.
- Palpable urinary bladder post voiding.
 - Bladder outlet obstruction
 - Neurogenic bladder
- wrinkled, prune-like abdominal wall skin.
- Meatal stenosis / hypospadias.
- Diminished anal sphincter tone.
- Fecal accumulation.
- ? Uncircumcised.
- Supra-pubic tenderness.
- Loin tenderness.



Urinary Tract Infection

Pertinent physical findings

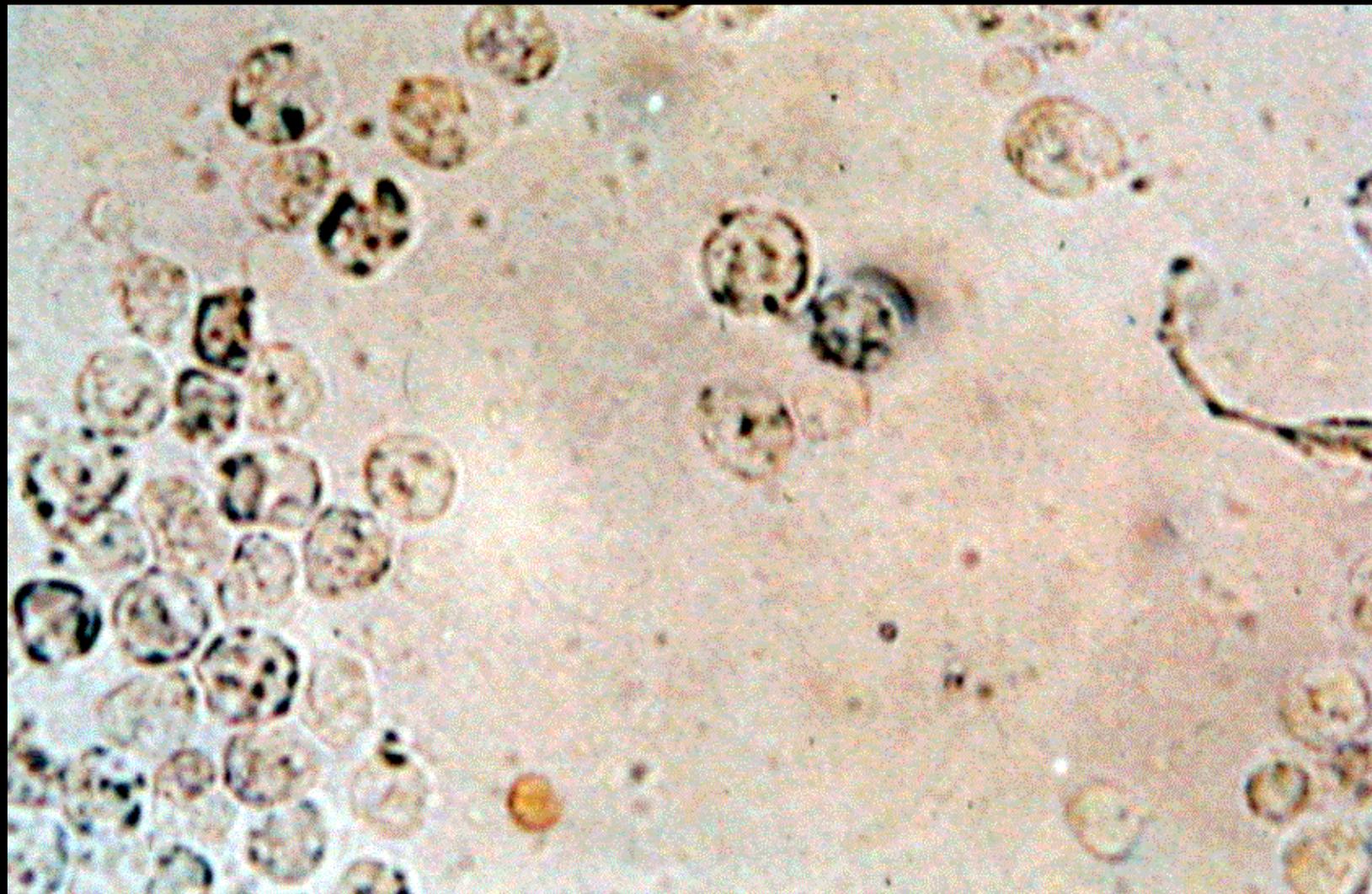
- Examination of the lower spine.
 - - Sacral agenesis.
 - - Evidence of occult spinal dysraphism: hairy patch, sacral dimple, sinus, dermoid
- Meningomyelocele



Urinary Tract Infection Diagnosis

- Pyuria: >5 WBCs/HPF
- Leukocyte esterase.
(the most sensitive single test in children with a suspected UTI).
- nitrite test.
(more specific but less sensitive).
- **Positive urine culture (main criterion).**





Rapid predictors of U.T.I

Tests

1. Bacteria seen under high power field on a non-centrifuged urine.
2. Nitrite test:
(reduction of urinary nitrate by bacteria).
Sensitivity in infants 50%, 98 % specificity.
3. Diptest for WBCs (Leukocyte esterase).

Urine culture

(Immediate C/S, or store at 4°C)

- Supra-pubic tap (<6 months).
- Urine-bag collection (infants).
- Catheter sample (any age).
- Mid-stream urine / clean catch.
(older children)

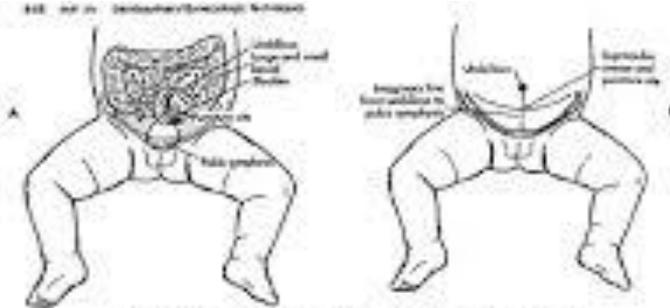


FIG. 71-2-4. Urethra and external os. (From: Nelson's Textbook of Pediatrics, 18th ed., W.B. Saunders, Philadelphia, 2007, p. 1418.)

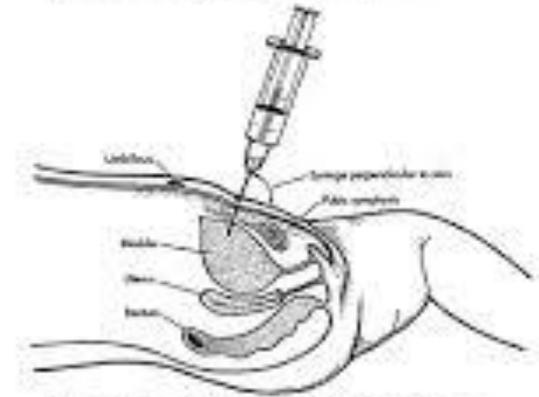


FIG. 71-2-3. Supra-pubic tap. (From: Nelson's Textbook of Pediatrics, 18th ed., W.B. Saunders, Philadelphia, 2007, p. 1418.)

From Davidson's Illustrated Textbook of Pediatric Emergency and Critical Care Procedures, 1/E, 1997 Mosby, Inc, Figure T1-2 and T1-3, Page 418; Royal Children's Hospital Melbourne website.

Urine culture

Significant growth

(Number of organisms of one species per ml of fresh uncentrifuged urine)

- Suprapubic: any growth.
- Catheter sample: $> 10^3$ /ml
- Midstream urine: $\geq 10^5$ /ml
- Bag specimen: $\geq 10^5$ /ml

Plastic bag collections (unreliable)

Principles

- Meticulous washing of the genital region.
(renew every 3 hours)
- Use soap and water for cleaning.
(avoid alcohol & iodine)
- Detach the bag within 15 minutes of voiding.

Urine C/S

Bag collections

Reliability

>10⁵/ml organisms (single species).

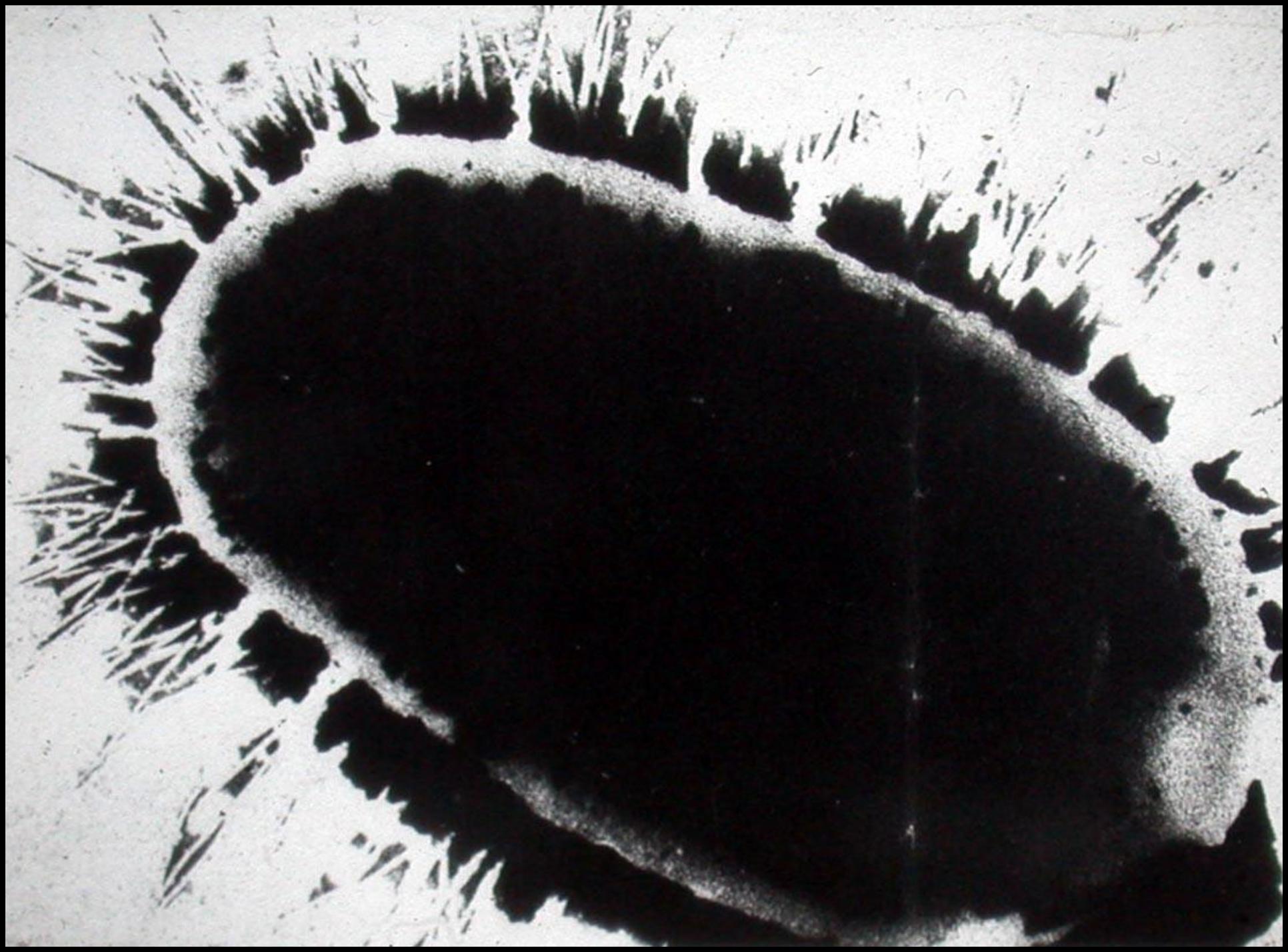
50-80%

Unreliable.

(10% of samples from healthy infants grew 50,000 CFU/ml)

Urinary Pathogens

- Gram negative rods (**Escherichia coli**)
- Proteus spp.
- Klebsiella spp.
- Citrobacter spp "coliforms"
- Enterobacter spp (Pseudomonas spp.)
- Enterococci (Strept. fecalis)
- Gram positive cocci, Staph. aureus,
Staph. saprophyticus,
Staph. albus)
- Candida.





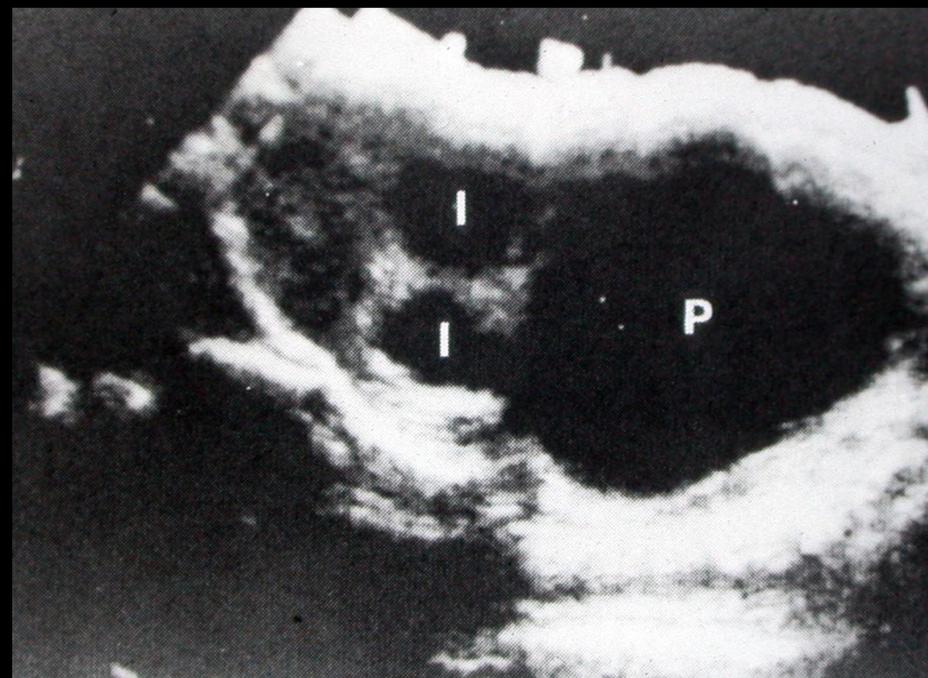
UTI

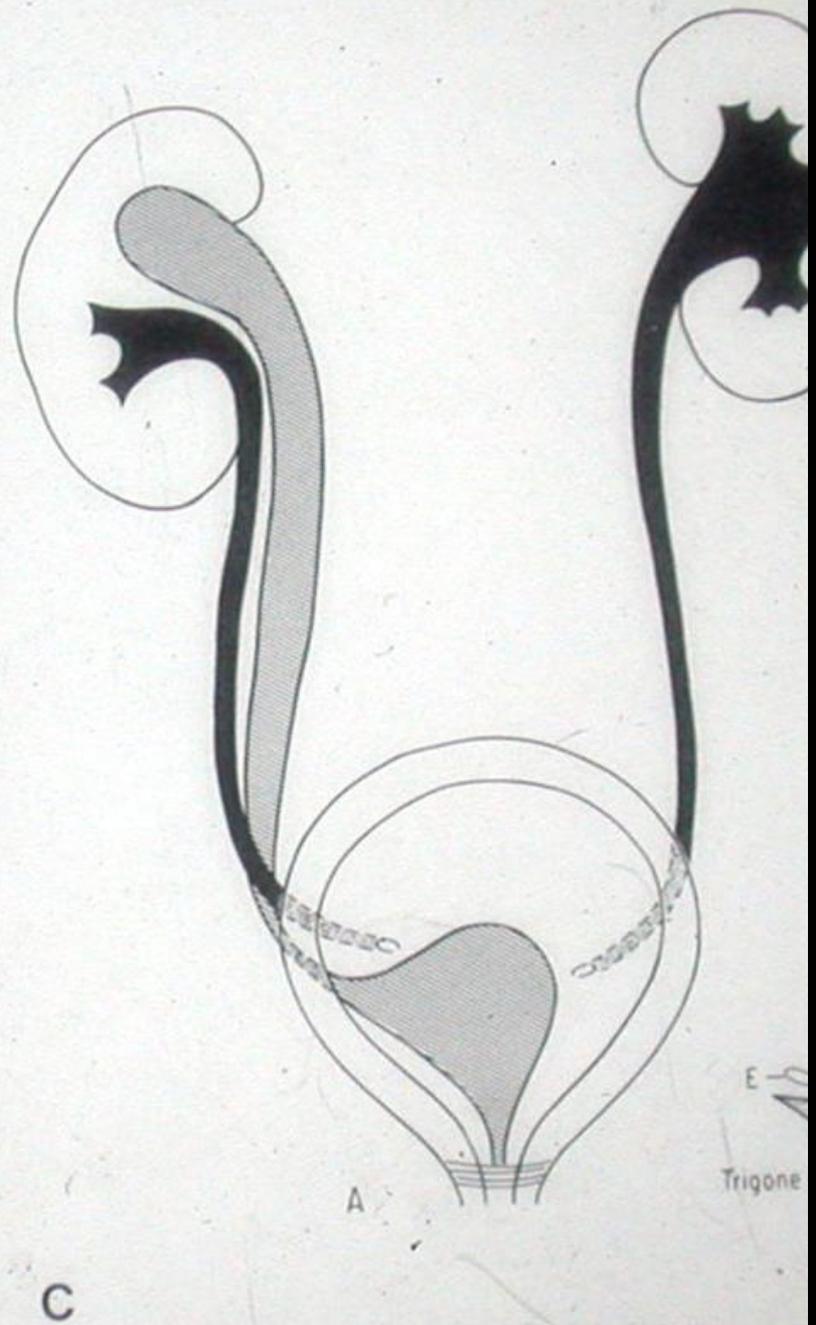
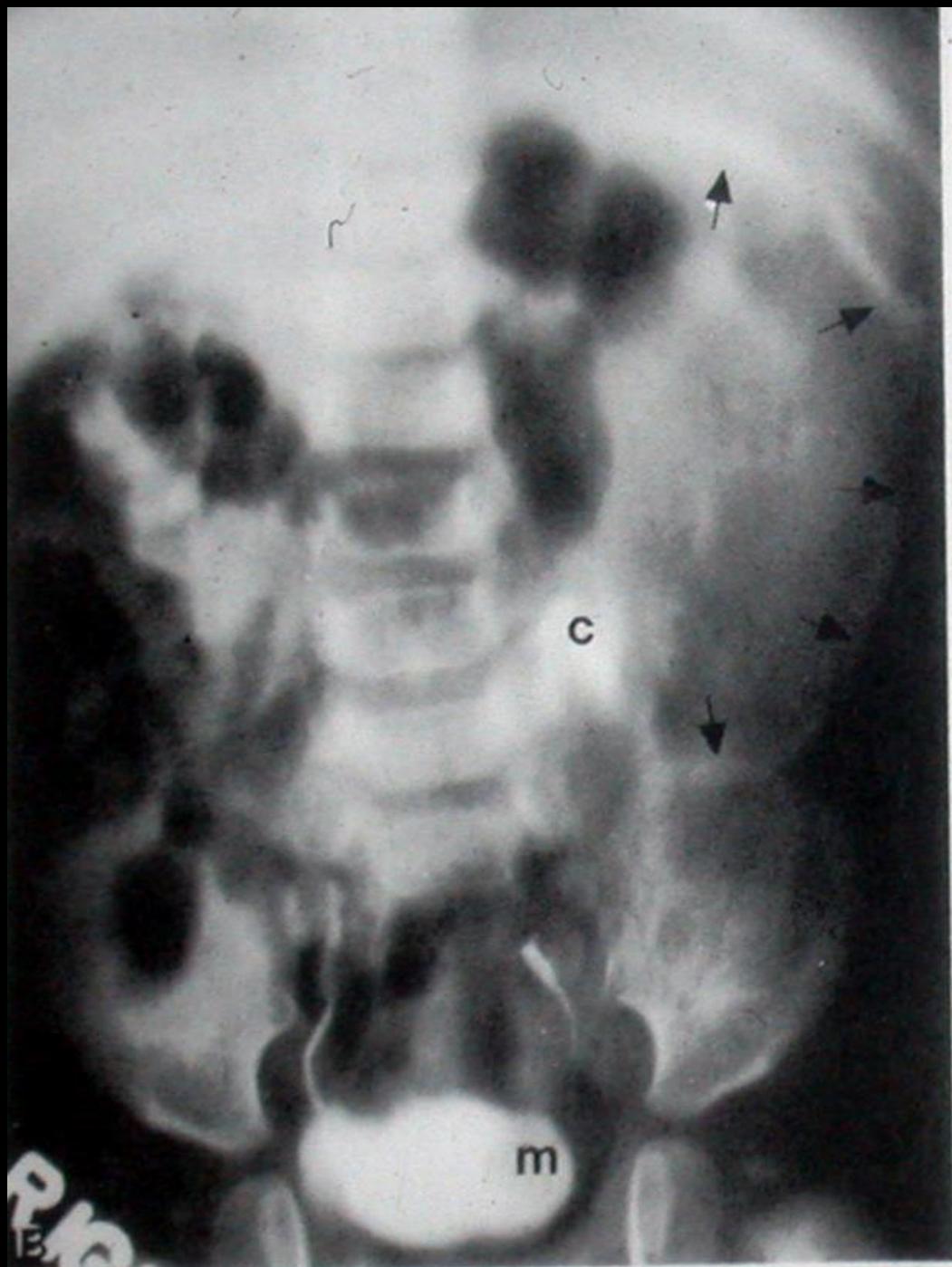
Investigation

Young child
Less than 5-7 years
Boy or Girl

First UTI

Ultrasound



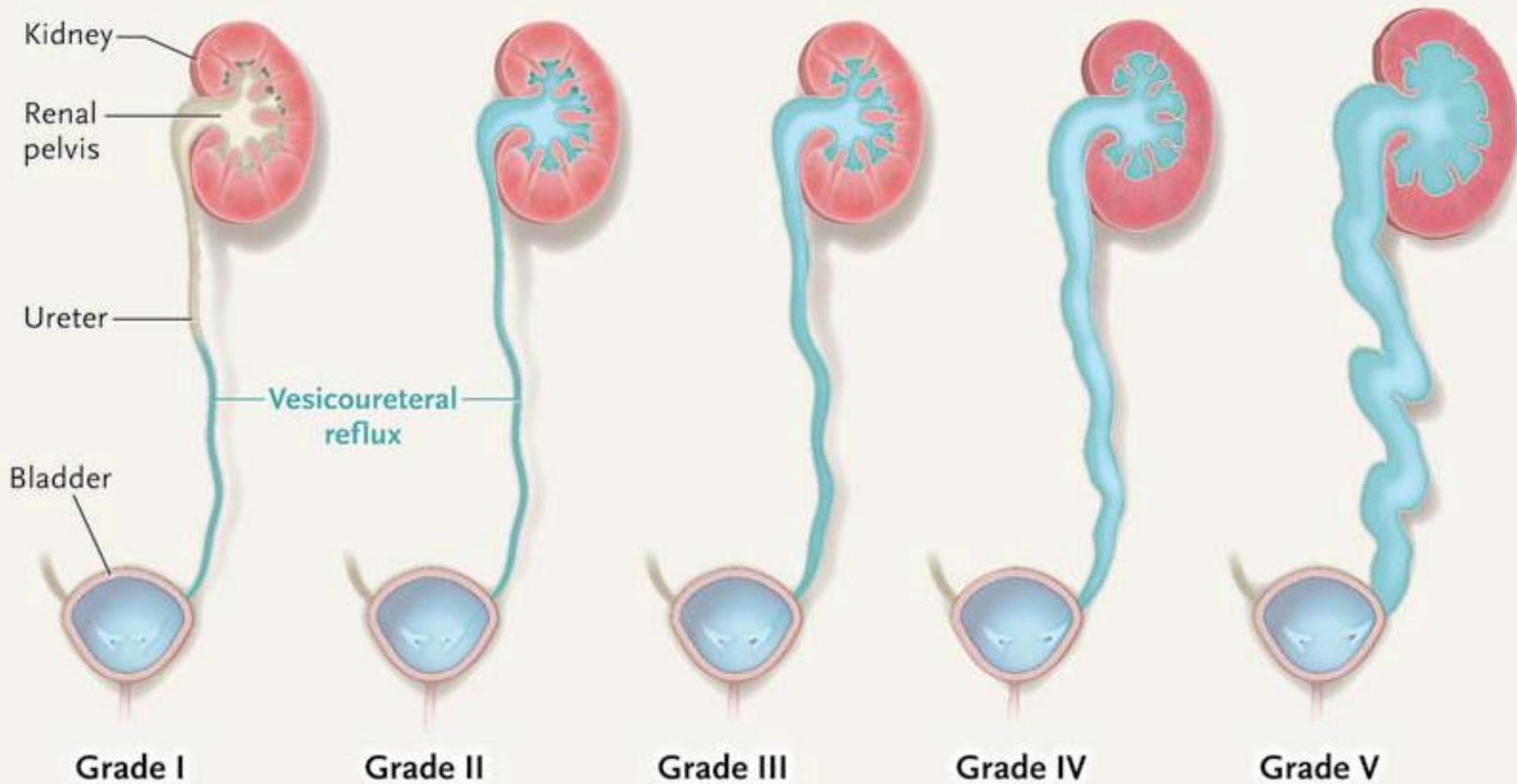


If ultrasound is abnormal; consider

Voiding Cysto-Urethro-Gram
(**VCUG = MCUG**)

- Contrast material instilled in the UB (catheter).
- Problems: Invasive / high radiation exposure – gonads.
- **Bladder:**
 - shape
 - size
 - trabeculations
 - haustrations
 - diverticulae
- **Urethra.**
- **Ureters** (reflux).

Grades of VUR



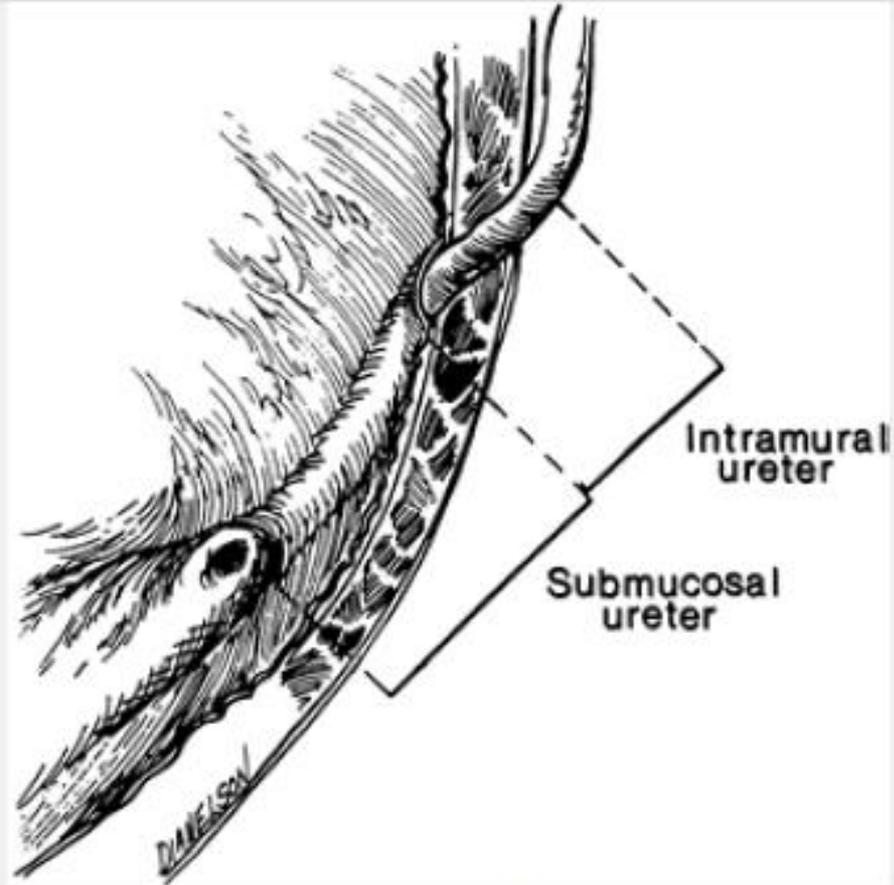


Figure 43-15 Normal ureterovesical junction. From Harrison JH, et al, eds. *Campbell's urology*, 4th ed. Philadelphia: WB Saunders, 1979:1597, with permission.

Normal urinary bladder & urethra



Spining top deformity





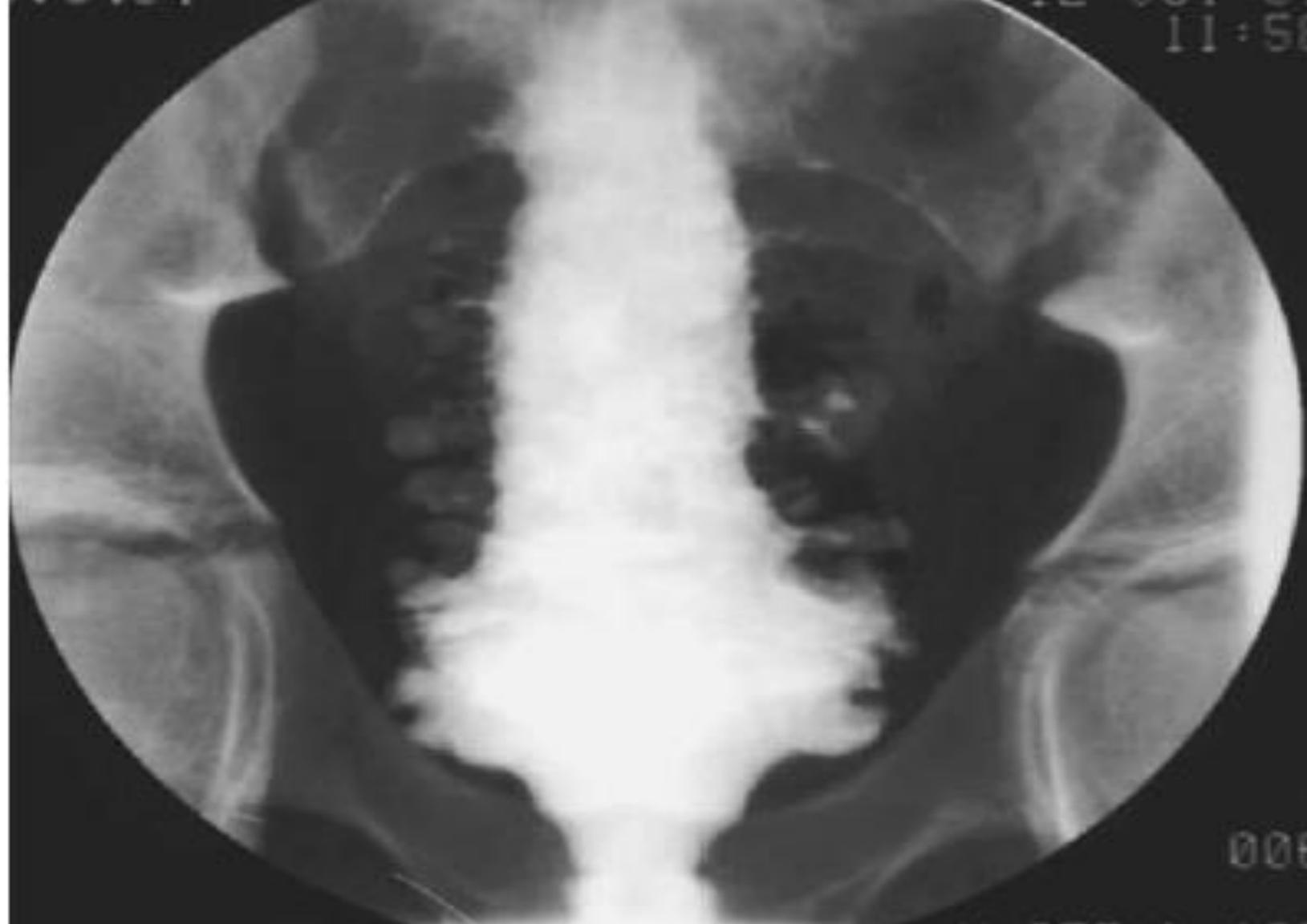


Figure 6.3 Contrast VCUG in a patient with long-standing bladder outlet obstruction. Severely trabeculated bladder with a narrow lumen, the so-called 'Christmas tree' appearance is evident.



UTI

Investigations in children

Additional tests:

- Radionuclide renal scans (isotopes-99Tc):
 - **Dynamic** (Function test) DTPA, MAG-3
 - **Static** ("anatomy") DMSA
- **CT-urogram.**
- **MRI** - with/without contrast.
- "Intravenous urogram (IVU)"; rarely indicated (Duplex)
- Cystoscopy.



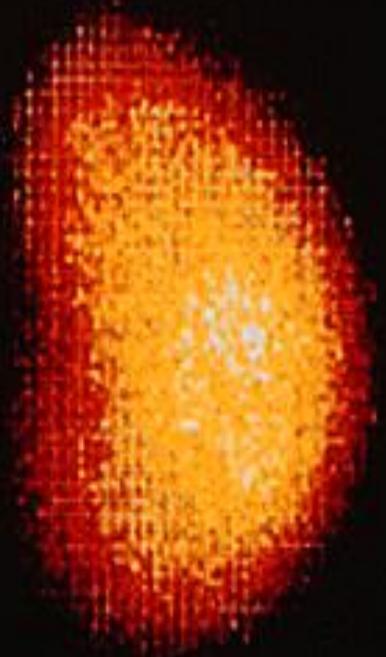
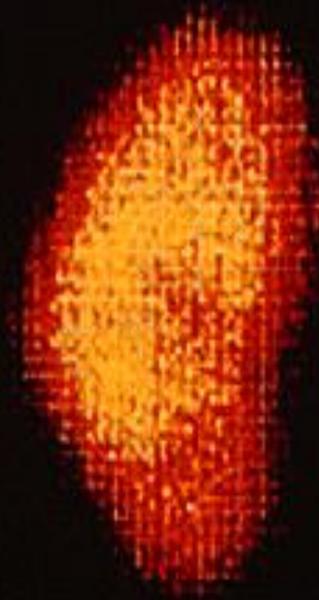
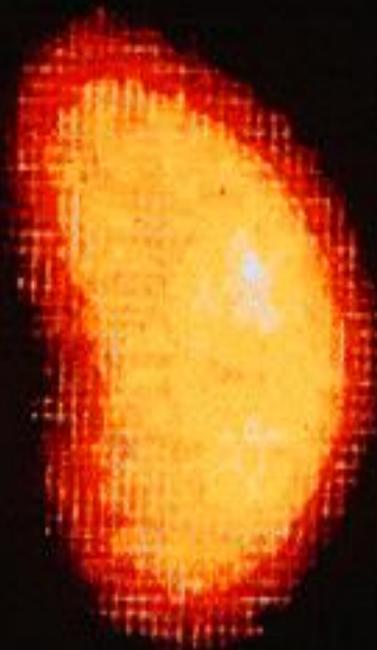
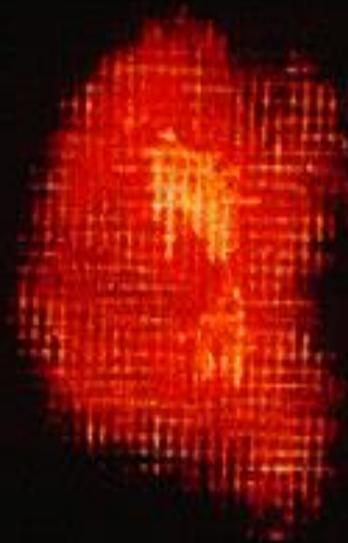
T99-DMSA scintigraphy (static isotope)

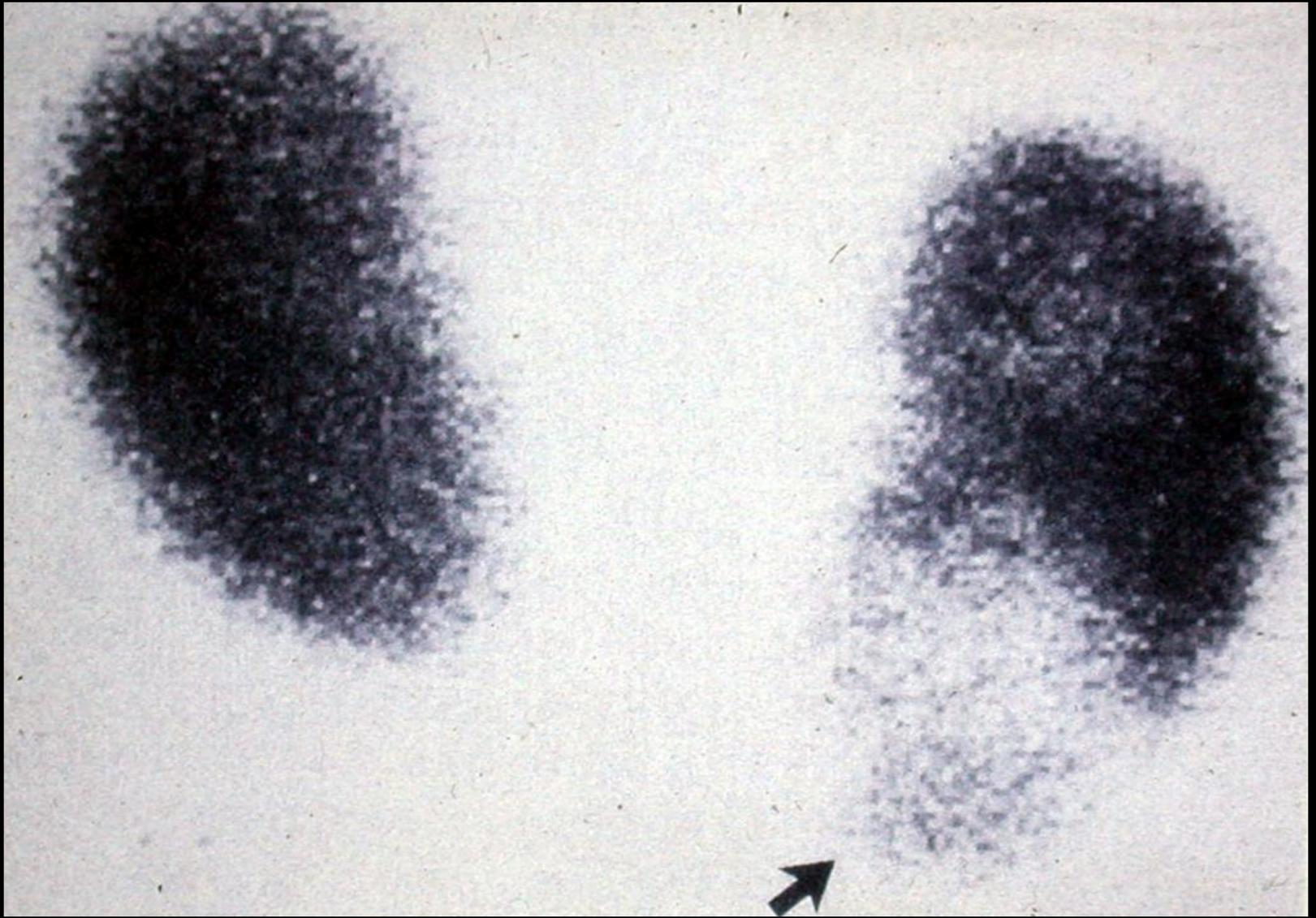
32%

68%

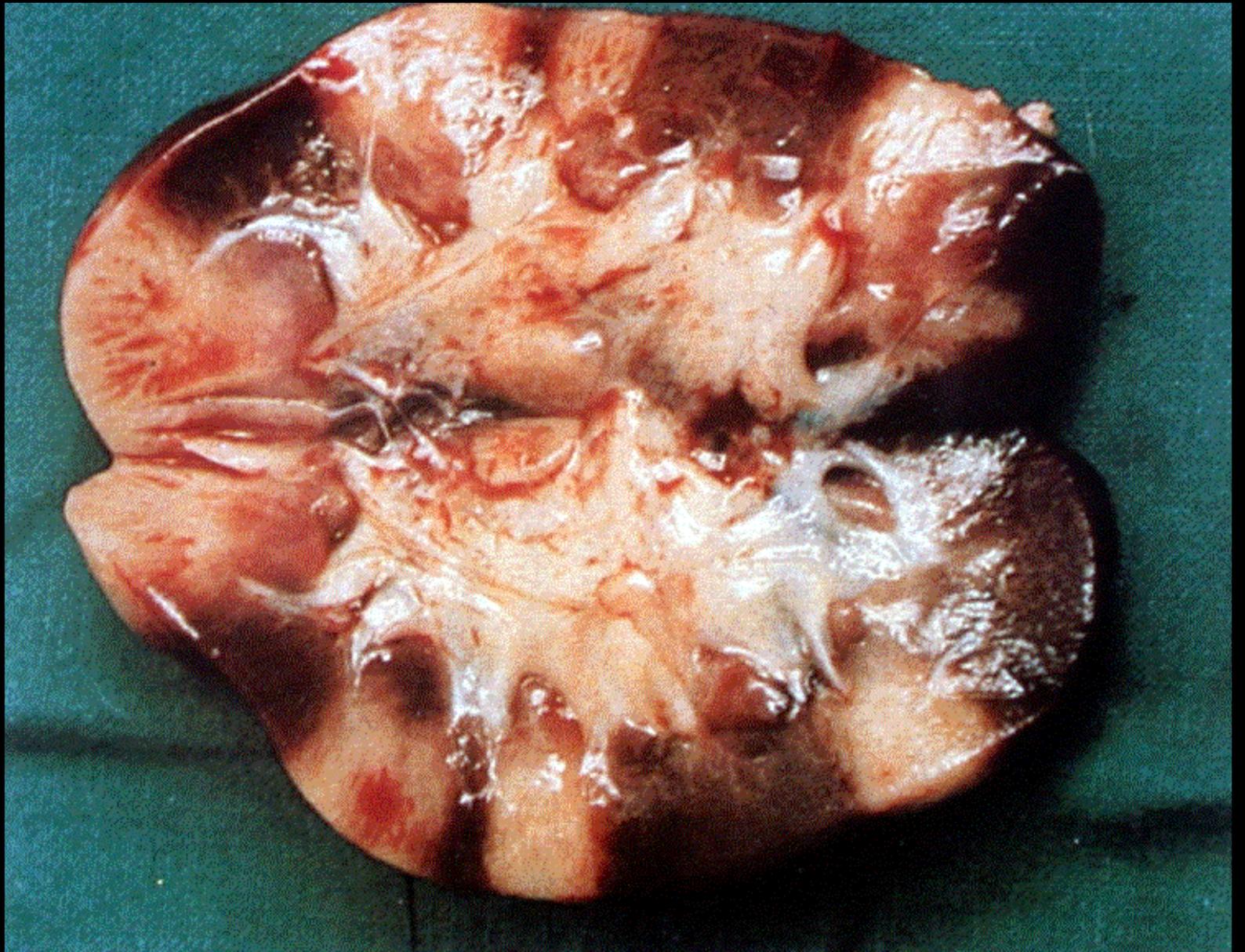
39%

61%



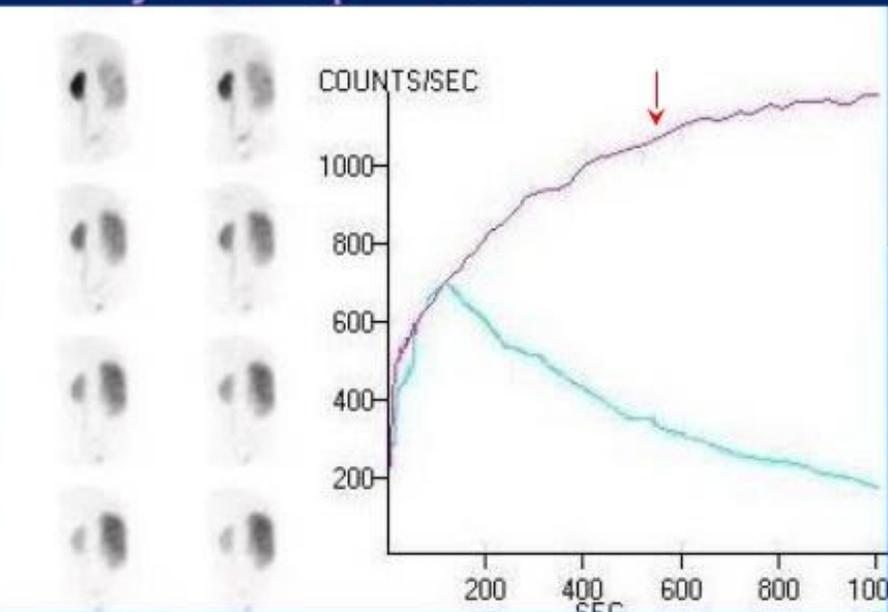






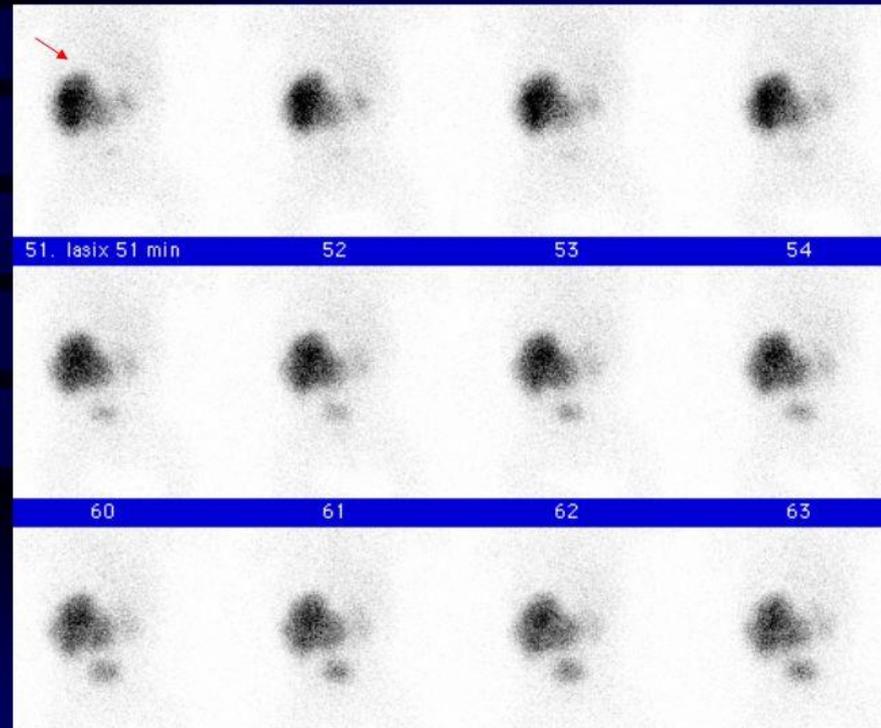
Dynamic isotope renal scan (T-99) MAG-III DTPA

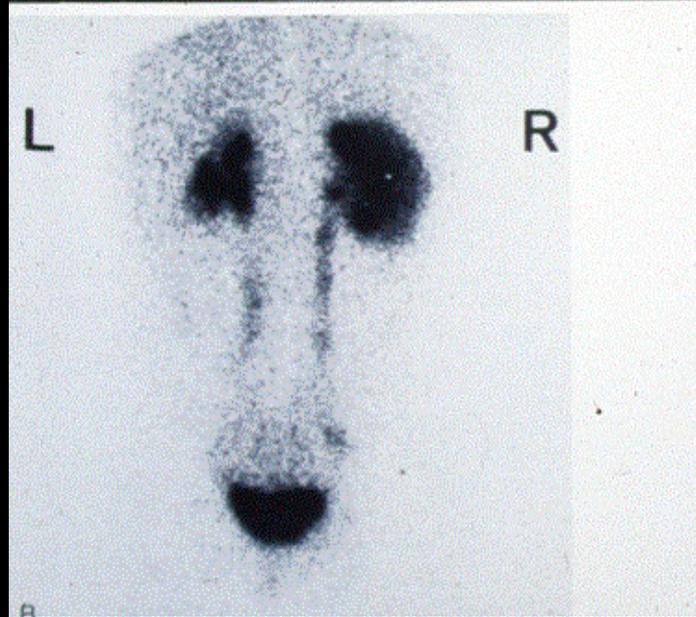
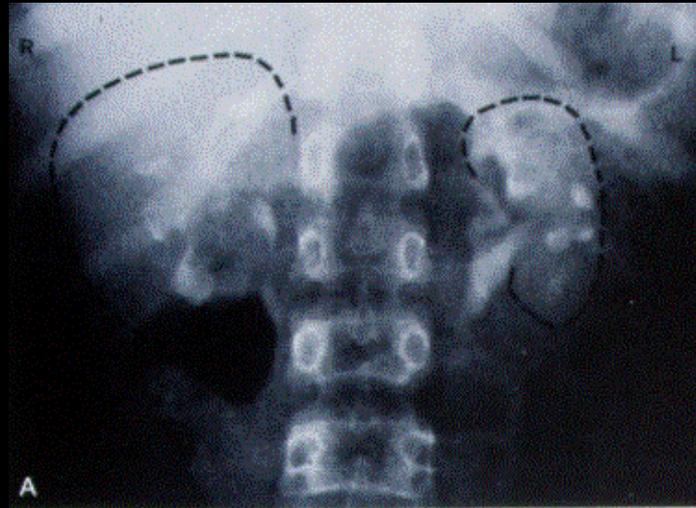
Scintigraphic evaluation of
Hydronephrosis



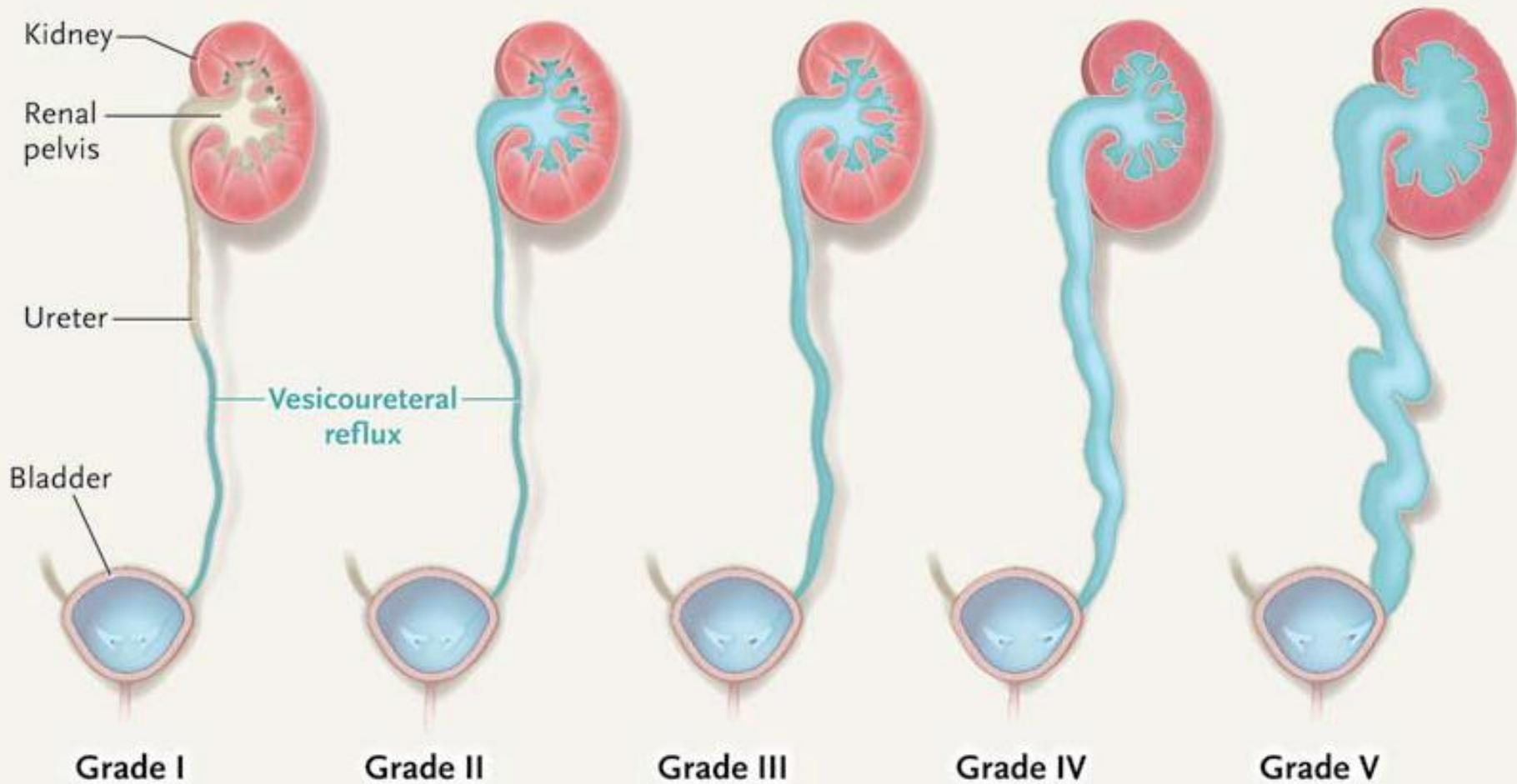
Obstructive hydronephrosis of the right kidney,
indicating a no response to intravenous diuretic.

Lt UPJ obstruction





Vesico-ureteral reflux



Vesico-ureteral reflux

- Common cause of UTI.
- **Primary, secondary** (bladder outlet obstruction/neurogenic bladder).
- Sterile reflux >> renal damage (significantly increased with infection) .
- Primary - may disappear with time.

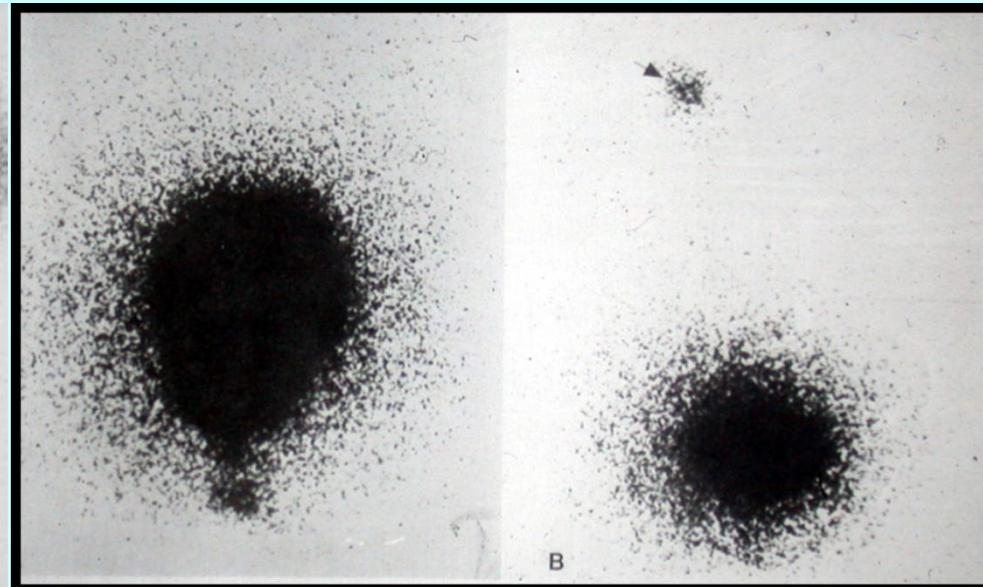
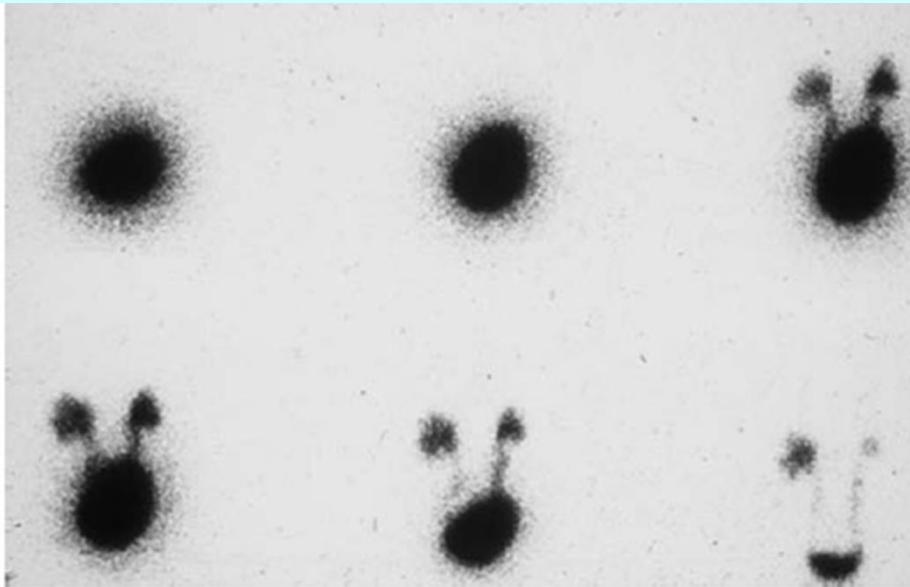
Mild (grade I, II)	85-90%
Moderate (grade III)	80%
Severe (grade IV, V)	40%

Primary VUR

- **Familial incidence:**

Up to 30% of siblings of children with VUR can have asymptomatic VUR.

- Need for **screening** of siblings:
Radionuclide cystogram



Urinary Tract Infection

Complications

- Renal scars (Higher risk in young children).
- Hypertension.
- Chronic kidney disease (CKD).
- Failure to thrive.
- Renal stones (mixed stones / struvite).



Urinary Tract Infection

Treatment

- **Antibiotic choice:** Sensitivity testing.
- **Outpatient:**
 - Co-trimoxazole
 - 2nd generation cephalosporins
 - Fluoroquinolones
 - Other antibiotics.
- **Inpatient:**
 - Aminoglycosides.
 - 3rd/4th generation cephalosporins.
 - Carbapenems.
 - Pipracillin/tazobactam.
 - Quinolones. / other antibiotics.
- **Duration:**
 - 5 days in lower UTI.
 - 10-14 days in upper UTI (pyelonephritis)
- **Repeat C/S:**
 - 3rd day,
 - Whenever symptomatic.
 - Regular follow-up in susceptible patients.

Urinary Tract Infection

Treatment

- Children with acute pyelonephritis can be treated effectively with oral antibiotics (e.g., Cefuroxime, Cefixime, Amoxicillin/clavulanate) for 10 to 14 days or with short courses (2-4 days) of IV therapy followed by oral therapy.
- In sick, febrile, young (infants & newborns), patients should be admitted to hospital and treated with **parenteral antibiotics** + other supportive measures.

UTI

Consideration for Prophylactic Antibiotics Controversial

- In vesico-ureteral reflux.
- Conditions associated with urinary stasis / obstructive uropathies.
- Increased the risk of resistant uropathogens.

Dose: One quarter the therapeutic dose.
Given at bed time.

Drugs: Nalidixic acid
Nitrofurantoin
Cephalosporins
Co-trimoxazole
Amoxicillin (newborns, infants)

END

Percent chance of reflux persistence for 1–5 years following presentation

