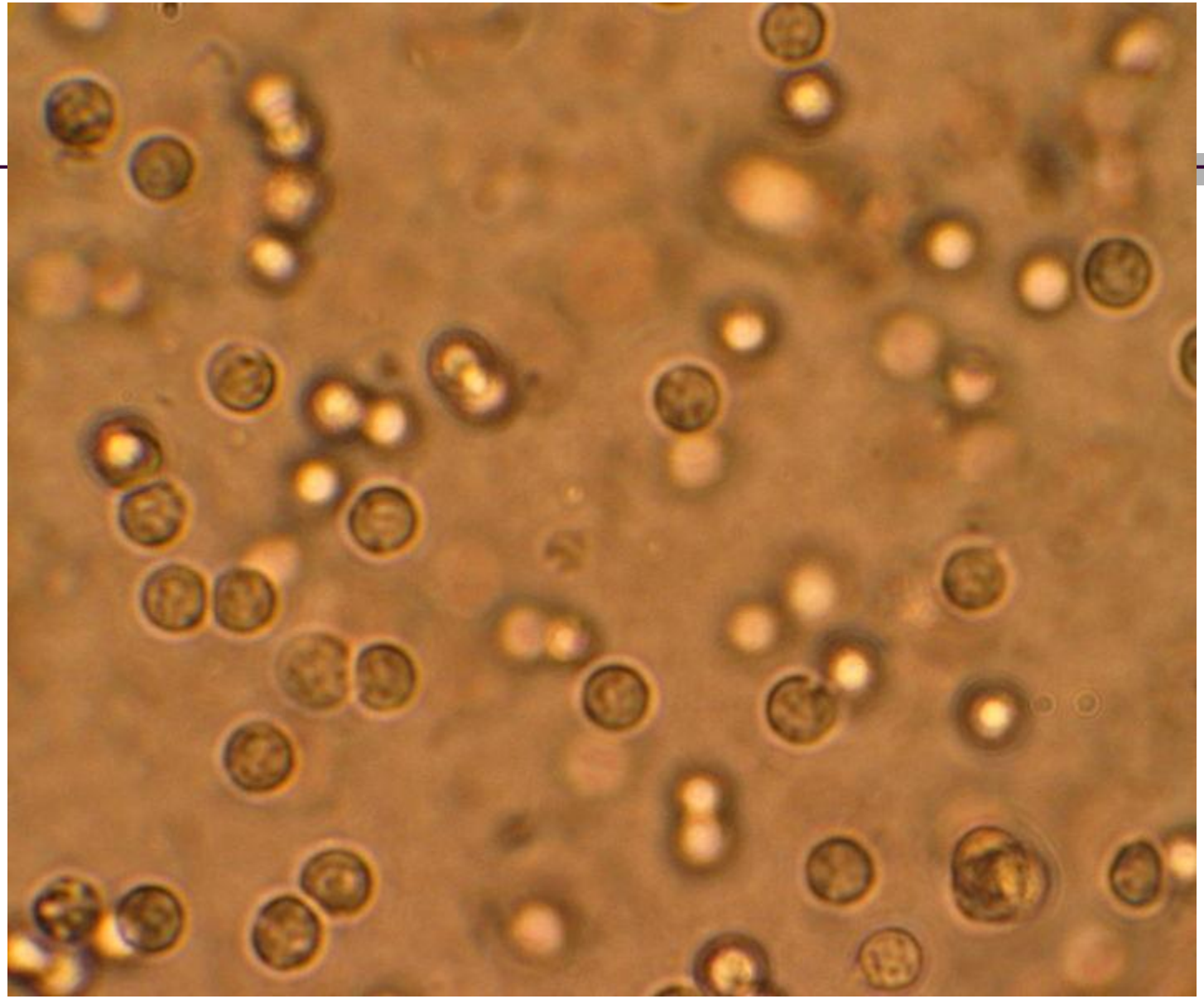
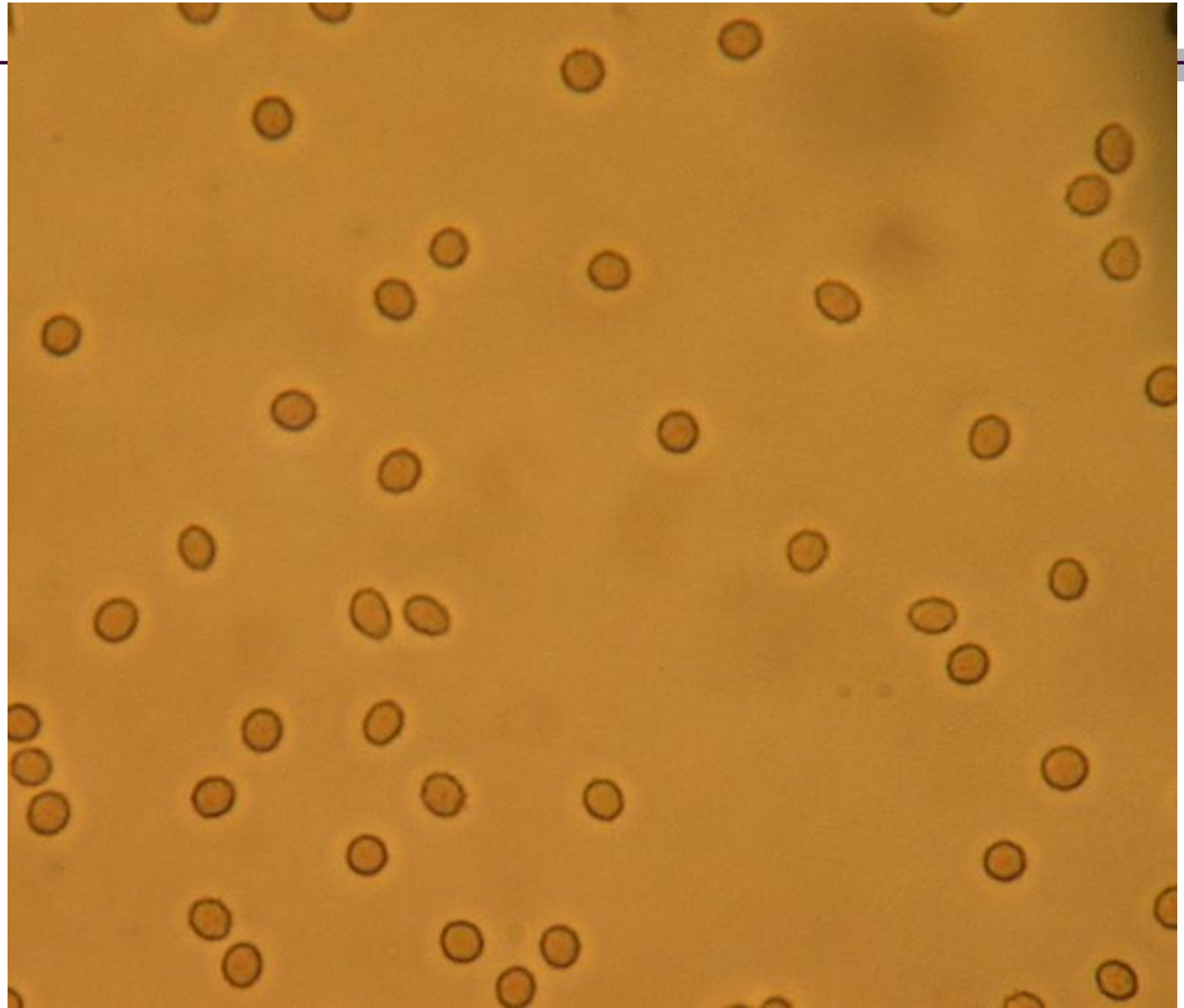
Nefrology

Bense Tamás M.D.
SE, Bp.,Tűzoltó utcai Gyermekgyógyászati Klinika

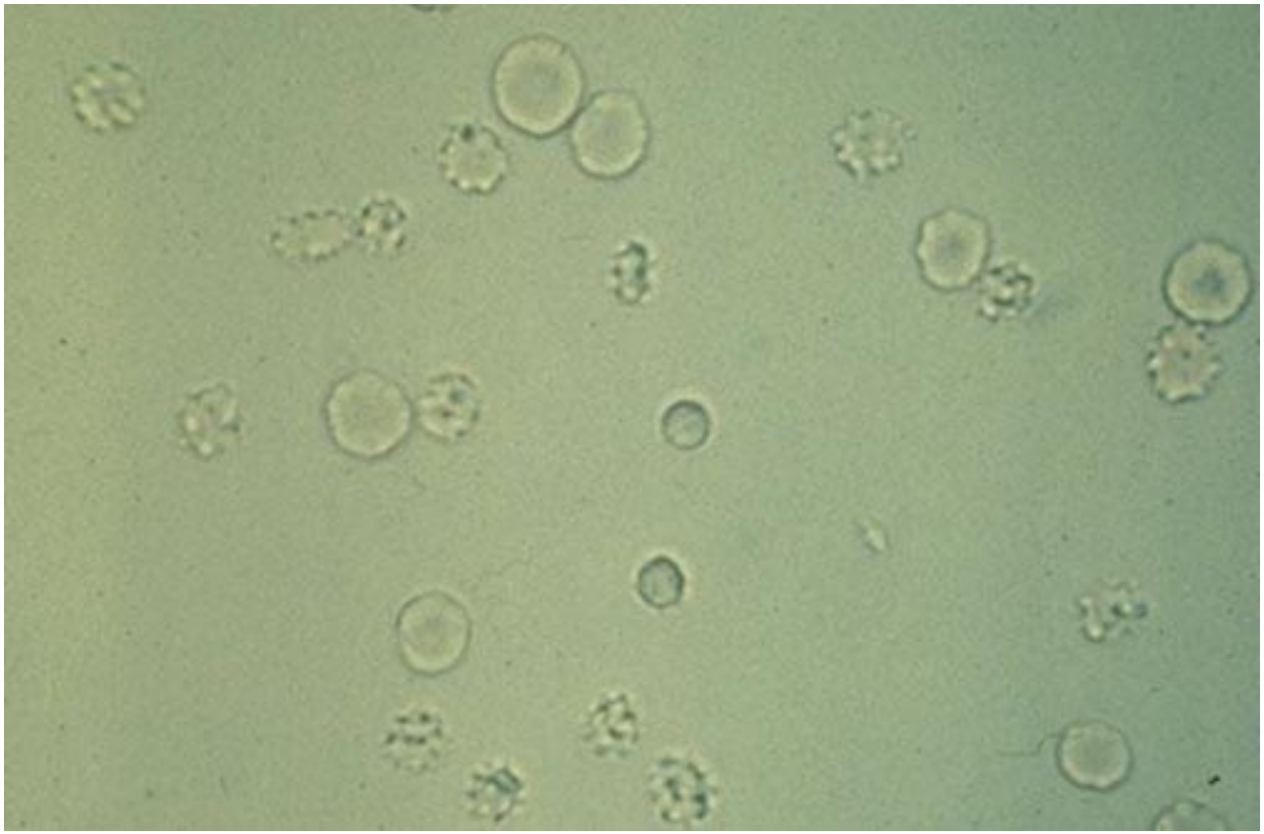
Urin sediment



Pyuria

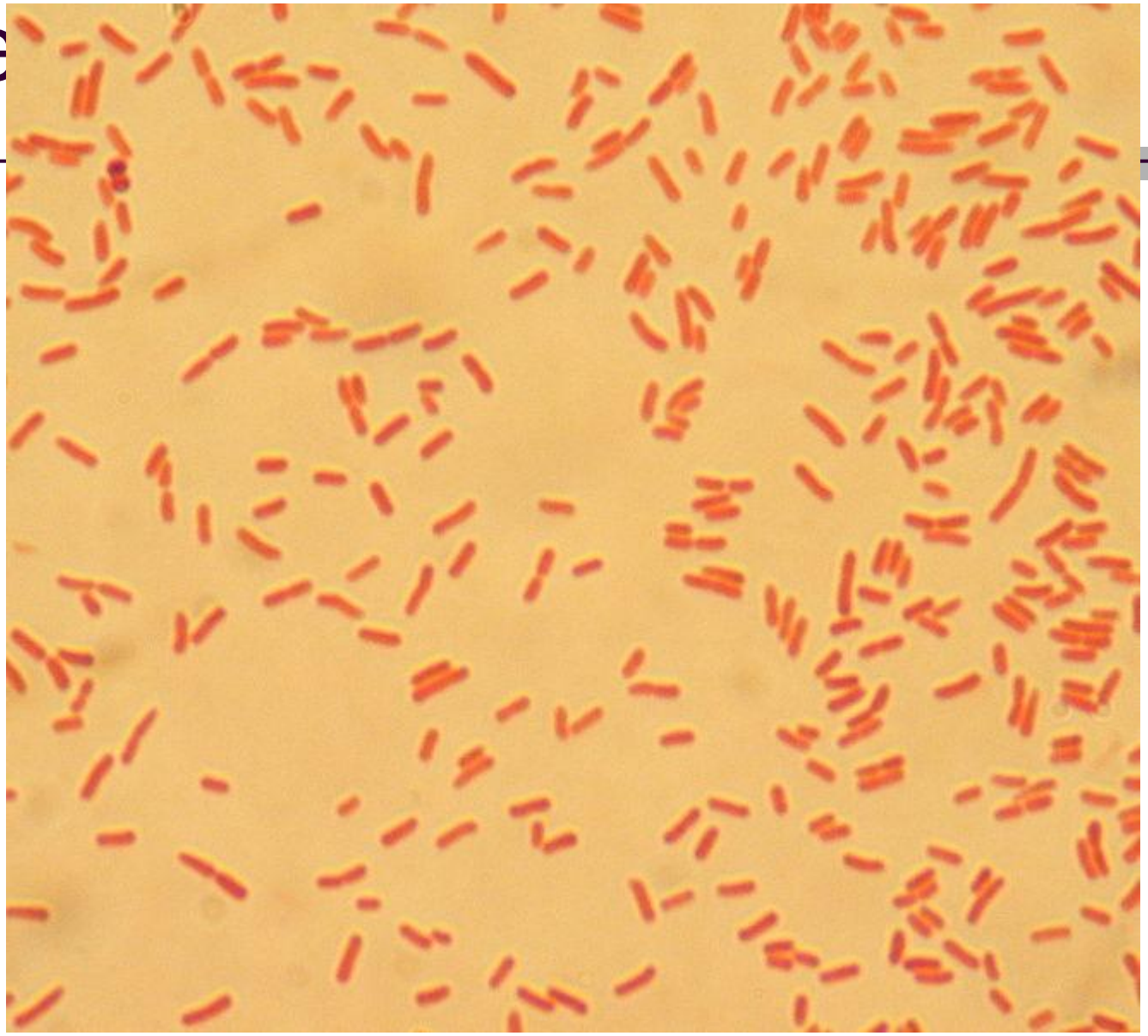


Haematuria

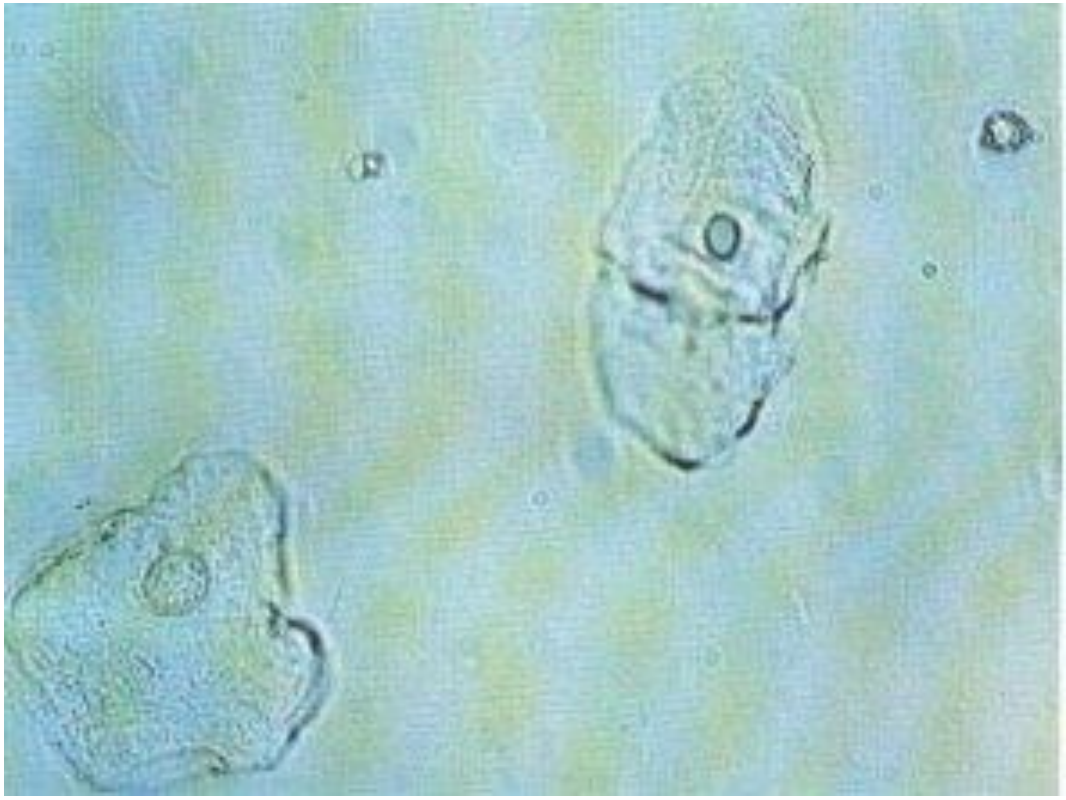


Dysmorph

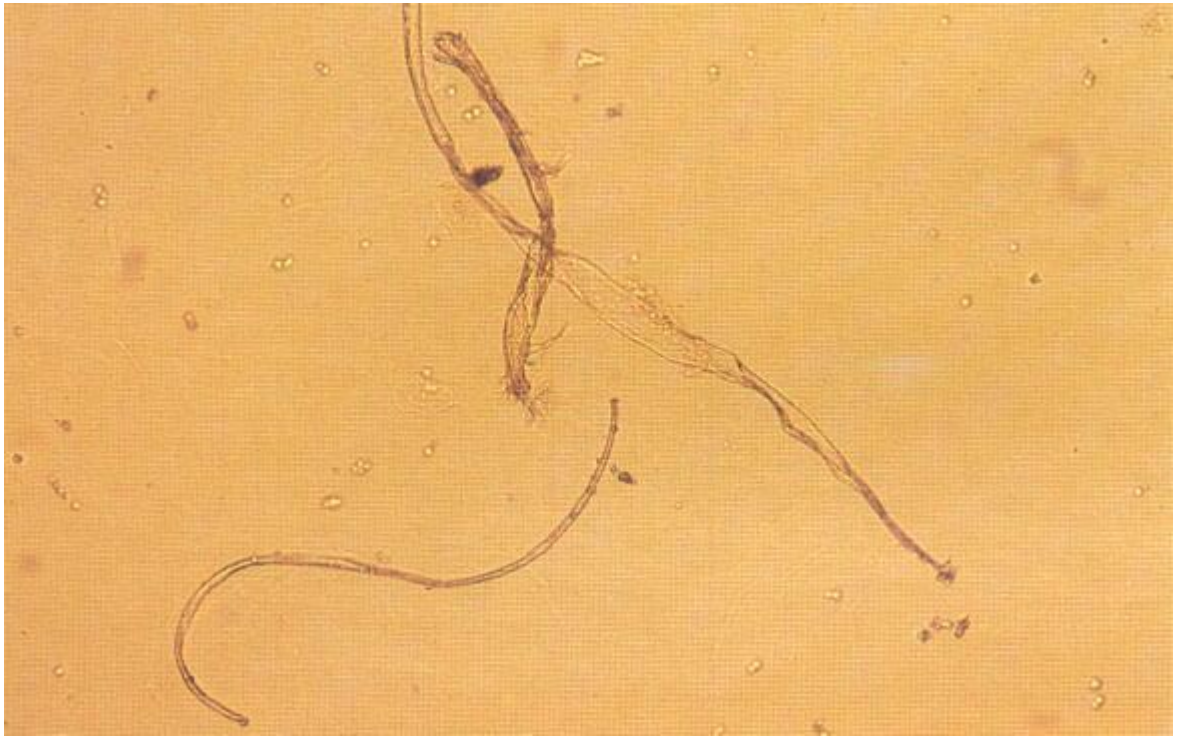
Hae



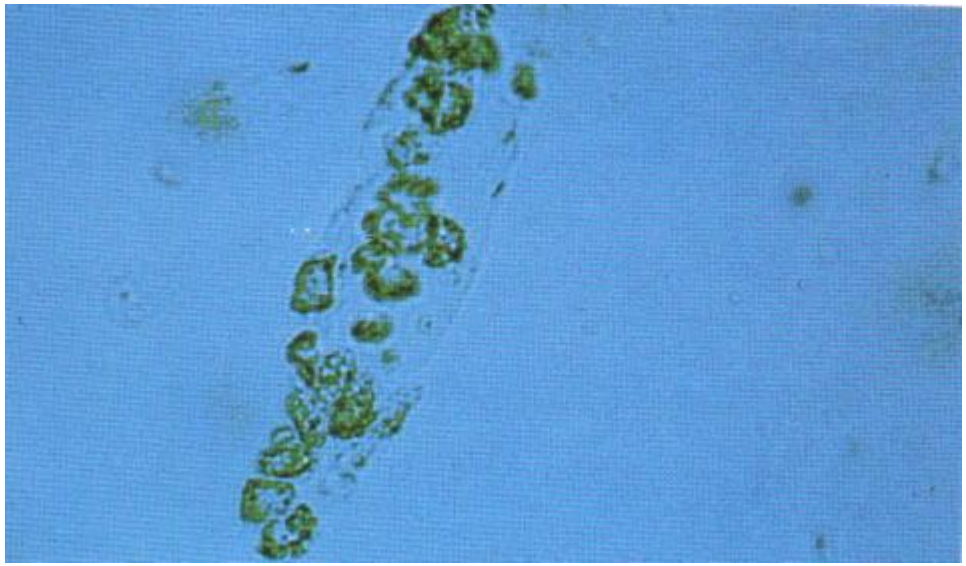
Bacteriuria



Squamous cell



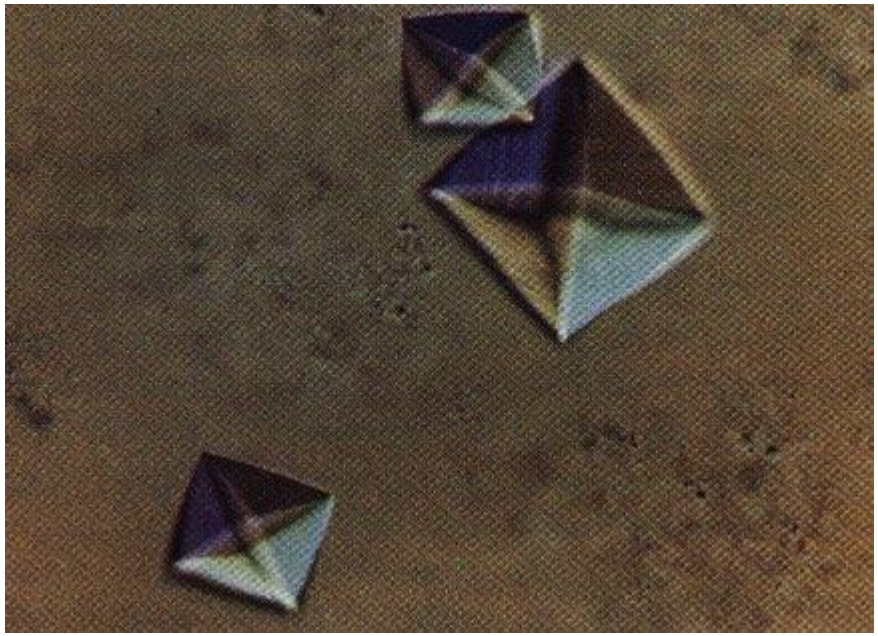
Foreign body

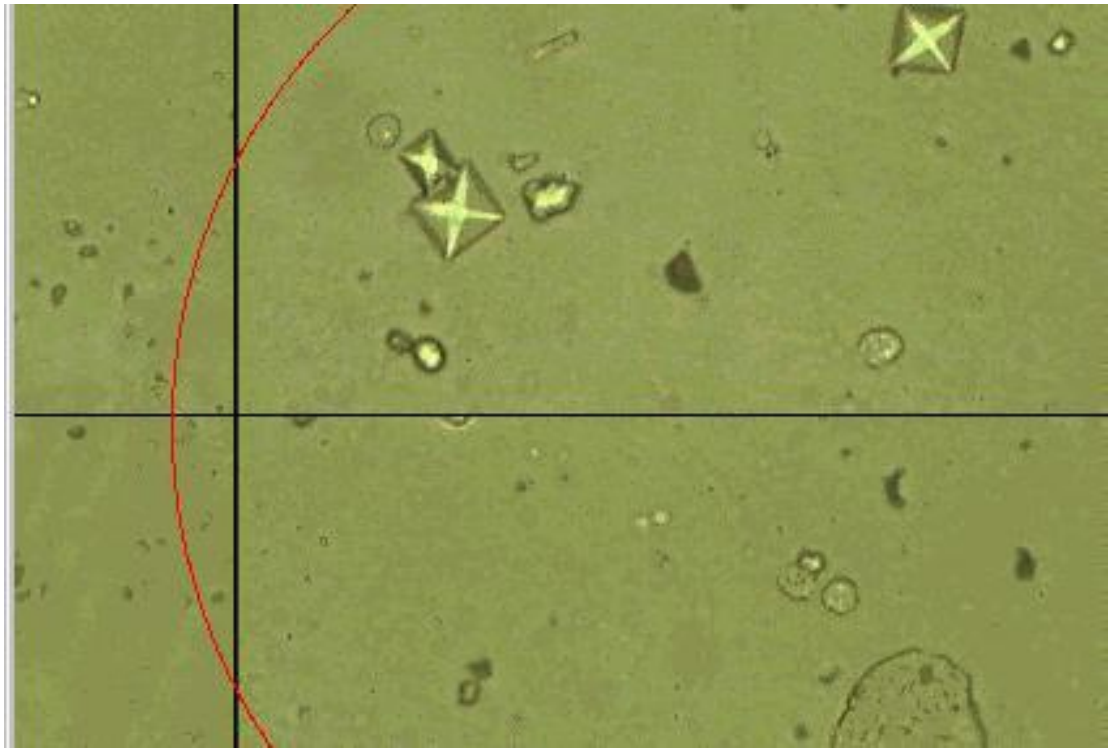


WBC cylinder

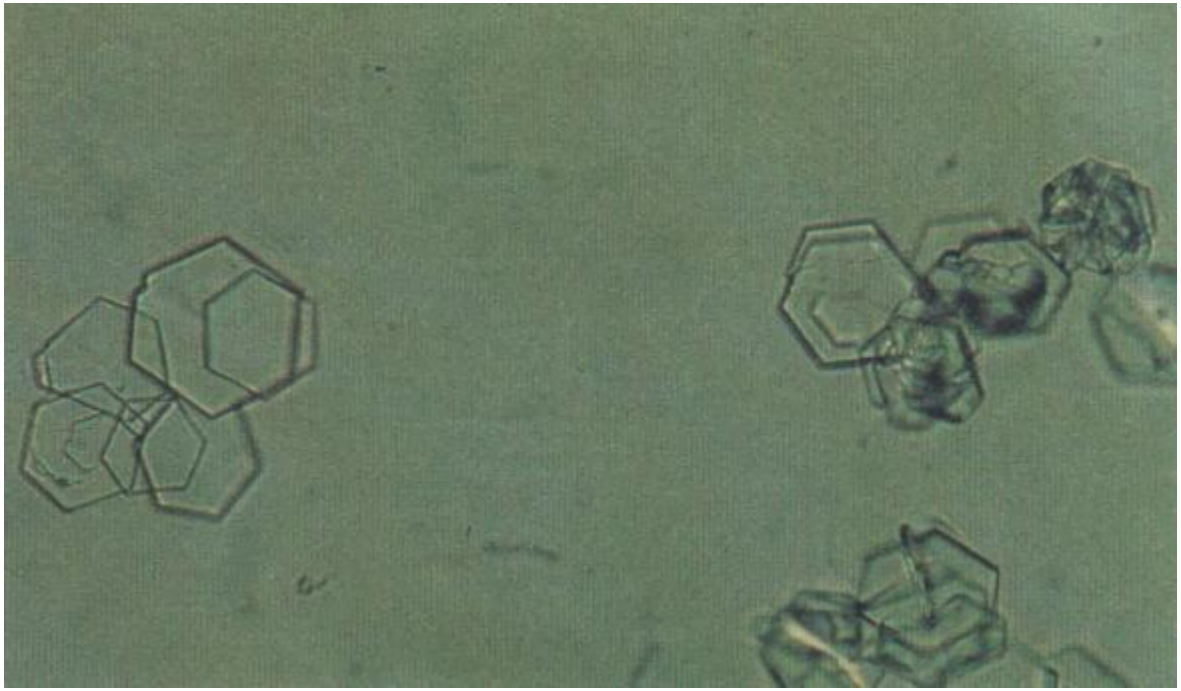
RBC cylinder

Hyalin cylinder

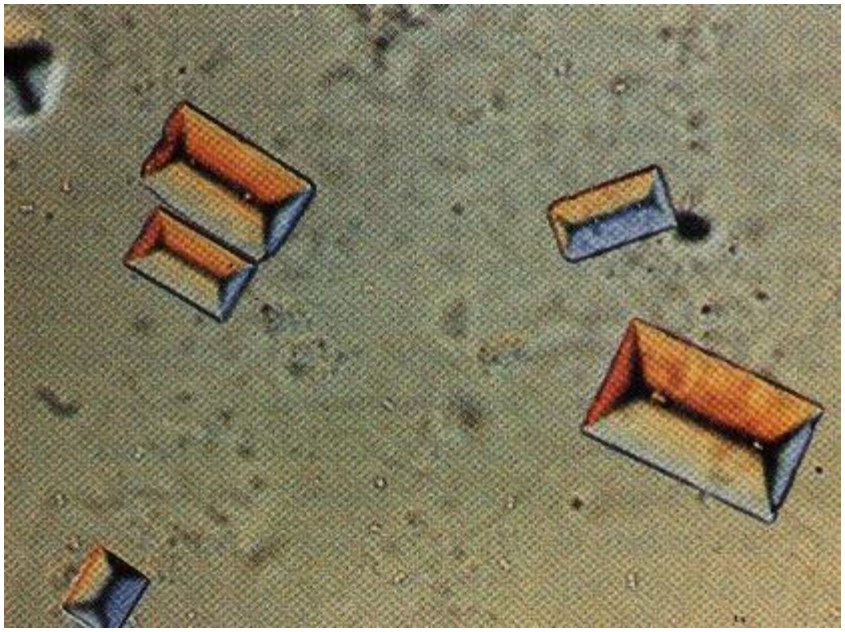




Ca-oxalate



Cystinuria



struvit

UTI

-Pyelonephritis

-Cystitis

Individual Risk Factors: Girls
White race Age < 12 mo Temperature ≥ 39°C Fever ≥ 2 d Absence of another source of infection

Probability of UTI	No. of Factors Present
≤1%	No more than 1
≤2%	No more than 2

Individual Risk Factors: Boys
Nonblack race Temperature ≥ 39°C Fever > 24 h Absence of another source of infection

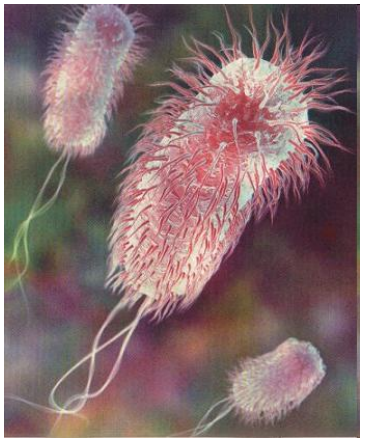
Probability of UTI	No. of Factors Present	
	Uncircumcised	Circumcised
≤1%	a	No more than 2
≤2%	None	No more than 3

Uncircumcised boys have 4-20x higher rate of UTI

UTI

Pyelonephritis

- enterobacteriacae (E.coli, Proteus, Klebsiella, Enterobacter)



- Gram+ coccus (Enterococcus, St. saprophyticus)
- other: Haemophylus inf, Pseudomonas, stb

Culture

- In children „significant” bacteriuria: 50000< CFU/ml of a single urinary pathogen

Sensitvitiy and specificity of urinanalysis aone and combination

	sensitivity	specificity%
Leu esterase test	83	78
Nitrit test	53	98
Microscopy WBC	73	81
Microscopy bact	81	83
Esterase + and Microscopy +	99.8	70

Therapy

- Treatment orally or parenterally is equally efficacious
- Duration 7-14 days
- „toxic” or unable to retain oral intake: parenteral treatment

staphylococci, and *Corynebacterium* specimens. ceive an antimicrobial agent pare

TABLE 2 Some Empiric Antimicrobial Agents for Parenteral Treatment of UTI

Antimicrobial Agent	Dosage
Ceftriaxone	75 mg/kg, every 24 h
Cefotaxime	150 mg/kg per d, divided every 6–8 h
Ceftazidime	100–150 mg/kg per d, divided every 8 h
Gentamicin	7.5 mg/kg per d, divided every 8 h
Tobramycin	5 mg/kg per d, divided every 8 h
Piperacillin	300 mg/kg per d, divided every 6–8 h

TABLE 3 Some Empiric Antimicrobial Agents for Oral Treatment of UTI

Antimicrobial Agent	Dosage
Amoxicillin-clavulanate	20–40 mg/kg per d in 3 doses
Sulfonamide	
Trimethoprim-sulfamethoxazole	6–12 mg/kg trimethoprim and 30-60 mg/kg sulfamethoxazol per d in 2 doses
Sulfisoxazole	120–150 mg/kg per d in 4 doses
Cephalosporin	
Cefixime	8 mg/kg per d in 1 dose
Cefpodoxime	10 mg/kg per d in 2 doses
Cefprozil	30 mg/kg per d in 2 doses
Cefuroxime axetil	20–30 mg/kg per d in 2 doses
Cephalexin	50–100 mg/kg per d in 4 doses

ally (Table 2) until they exhibit clinical improvement, generally within 24 to 48 hours, and are able to retain orally ad-

the total course of therapy should be 7 to 14 days. The committee attempted to identify a single, preferred, evidence-

distinguishes the benefit of treatin 7 vs 10 vs 14 days, and the range i allowable.

Ultrasonography

- Febrile infants with UTIs should undergo renal and bladder ultrasonography

(evidence quality C; recommendation)

Cystographia

- VCUG should NOT be performed routinely after the first febrile UTI
- VCUG is indicated if US reveals hydronephrosis, scarring

(evidence quality B)

- Further evaluation should be conducted if there is a recurrance of febrile UTI

Rates of VUR after UTI %

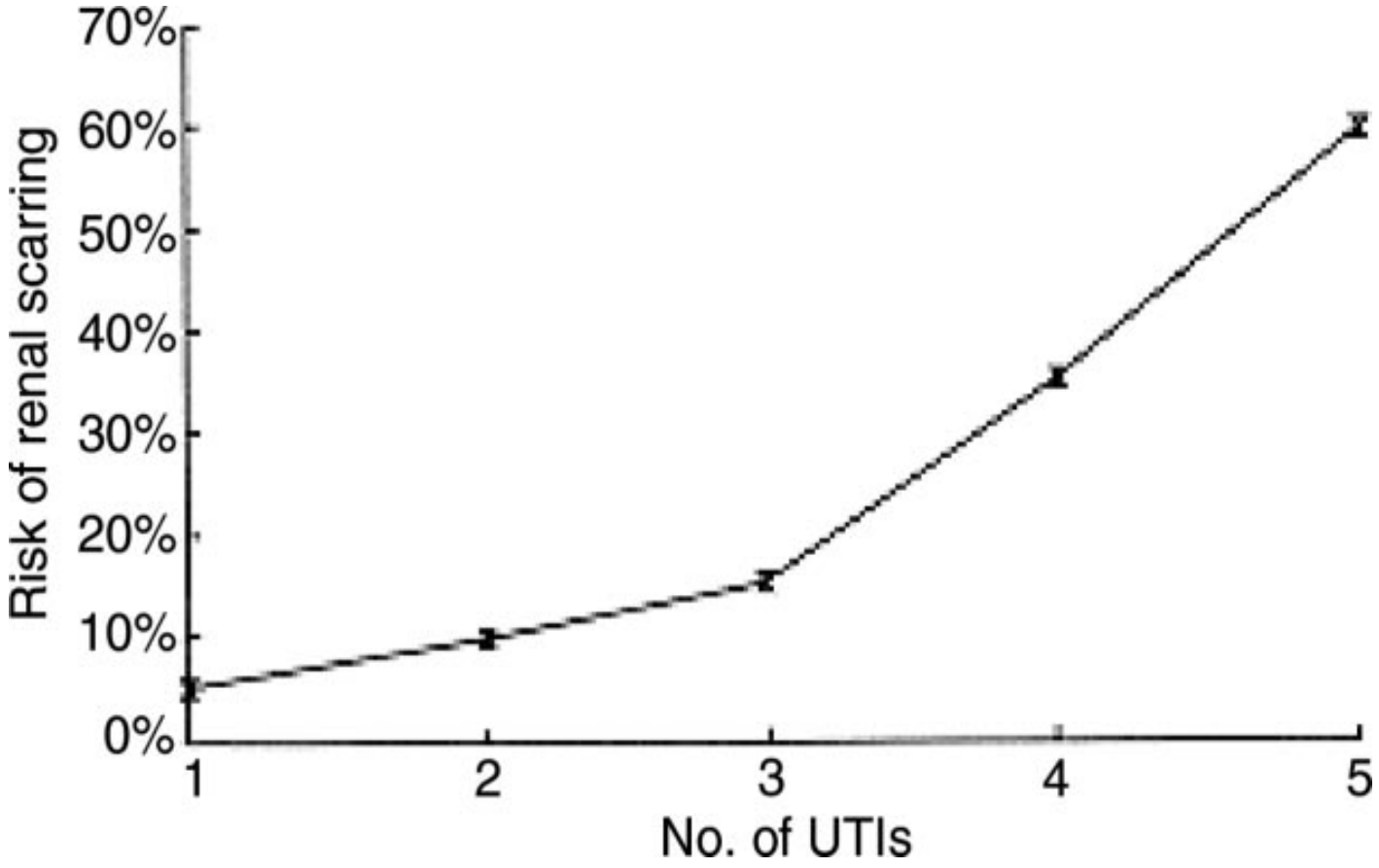
	1st UTI	Recurrence
NO VUR	65	26
VUR gr.I-III	29	56
VUR gr.IV	5	12
VUR gr.V	1	6

Prophylaxis

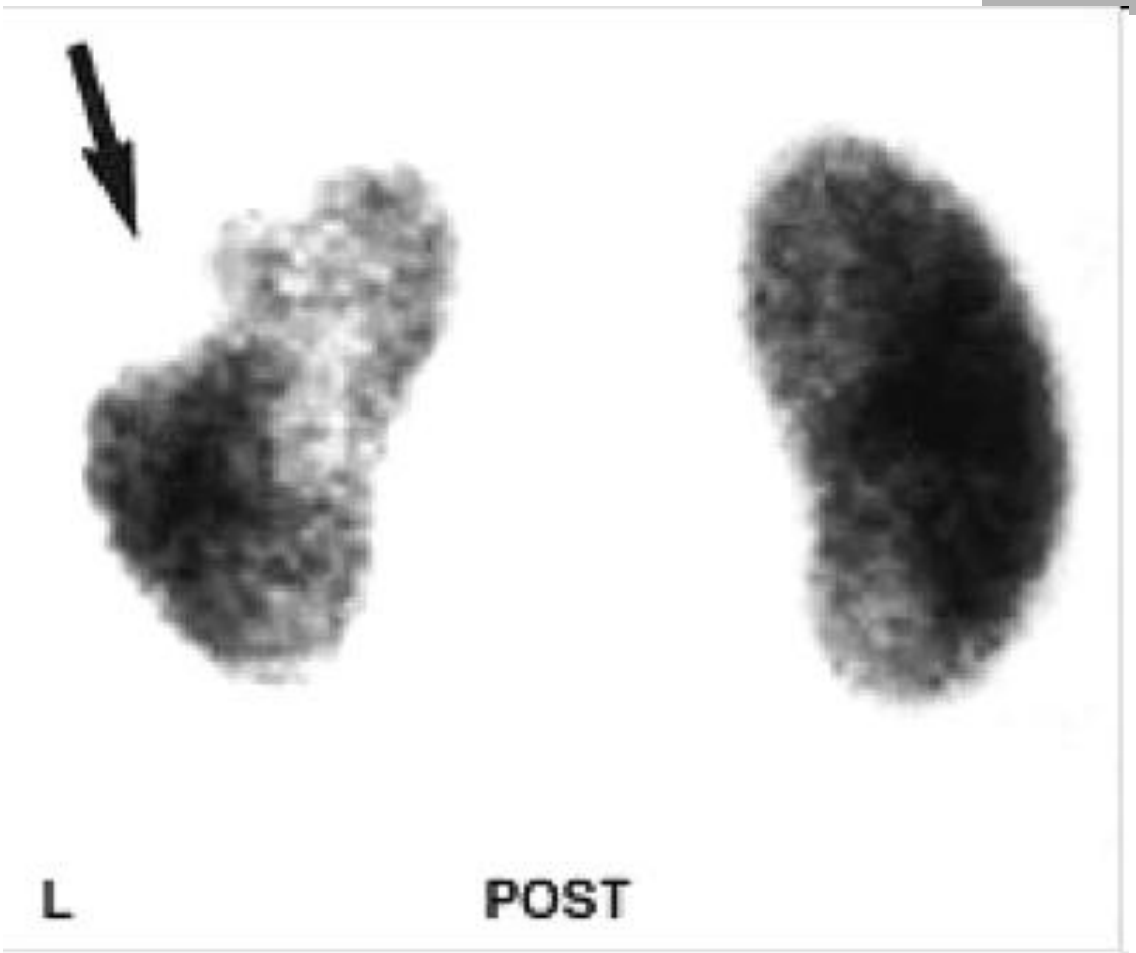
?

Prophylaxis

- Evidence from published randomized controlled trials suggest when cystograaphy shows VUR gr I-IV, antimicrobal prophylaxis is not recommended to prevent febrile UTI


70%
60%
50%
40%
30%
20%
10%
0%
Risk of renal scarring
1
2
3
4
5
No. of UTIs

DMSA

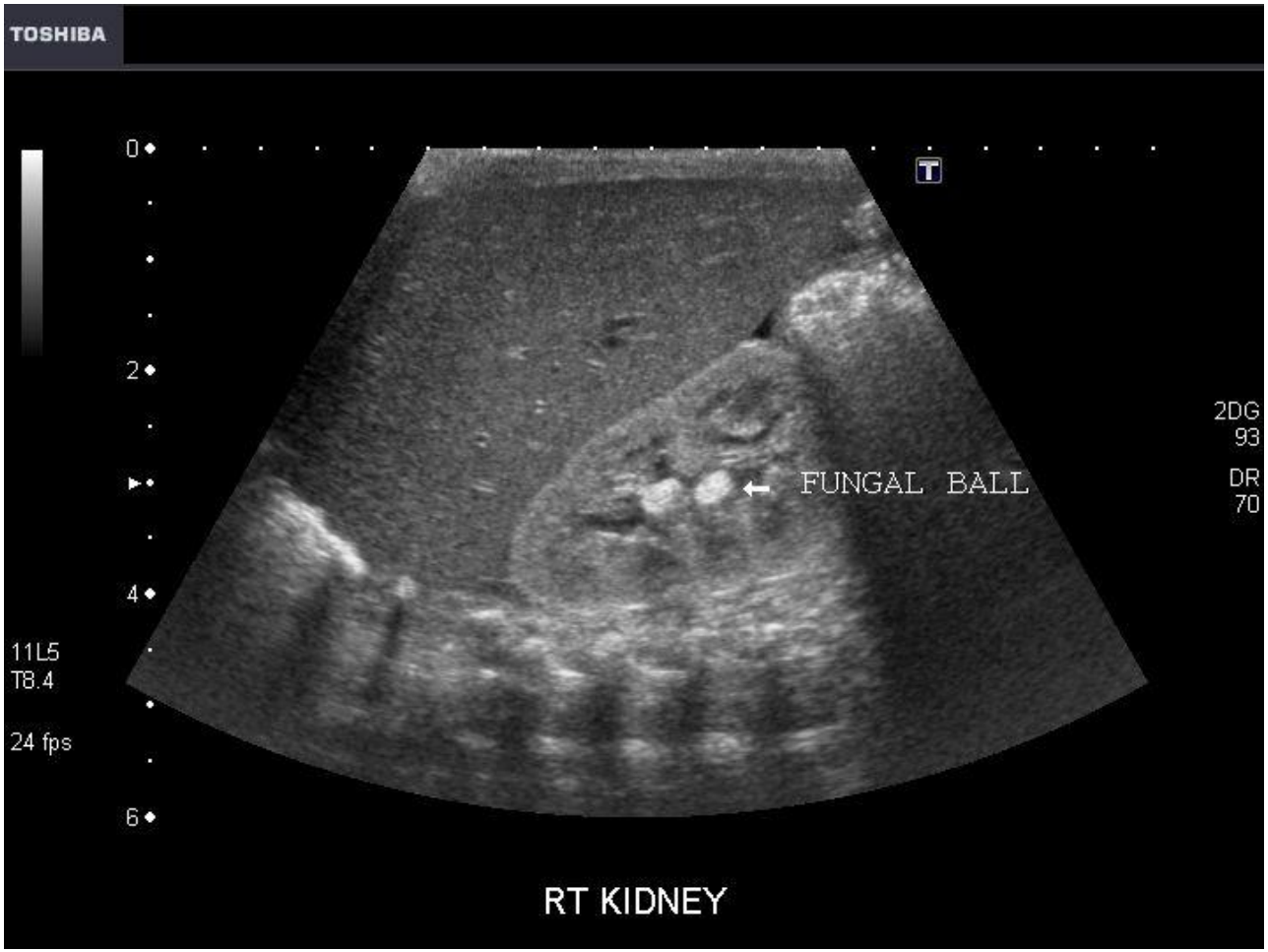


ГC-99m DMSA with SPECT

Results

- Dg: pyuria and 50.000 colonies< single uropathogenic organism
- Th: 7-14 day
- US
- Antimicrobal prophylaxis VUR gr I-IV: NO!
- NO VCUG after 1st UTI
- Recurrence of febrile UTI: VCUG


Jámbor,Vivien Beatrix
128164217
06 Sep 10
09:45:43
TIs 0.2
Fr #118
SE:1
6.6 cm
SE, II. GYERMEKKLINIKA
C7-4 Ped/PedAbd
ACCES#7006977AHASUH
128164217
2008.12.15.
2D Opt:HSCT
Fr Rate:Targ
SonoCT™
09:45:43
2D Echo
Hasi UH vizsgálat
Hasi UH vizsgálat
SE, II. GYERMEKKLINIKA
2010.09.06.


TOSHIBA
0
2
4
6
T
FUNGAL BALL
2DG
93
DR
70
11L5
T8.4
24 fps
RT KIDNEY

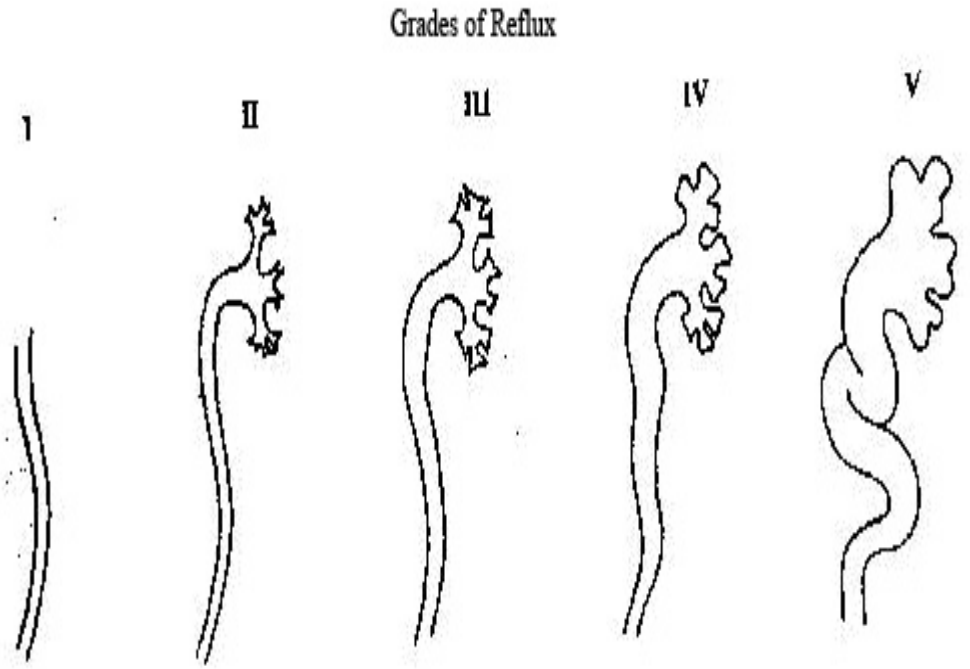
	Therapy		
	Primery	Alternative	Comment
Treatment group UTI			
Asymptomatic cystitis	Th: - (unless hig risk group: neonate, neutropenic urologiic procedure)		
Symptomic cystitis	Fluconasole 3 mg/kg 2 weeks	AmB 0,3-0,6 mg/kg	
Pyelonephritis	Fluconasole 3-6 mg/kg	AmB 0,5-0,7 mg/kg	

Therapy			
	Primery	Alternative	Comment
Treatment group			
UTI			
Urinary fungus ball	Fluconasole 3-6 mg/kg AmB 0,5-0,7 mg/kg Surgical removal if possible		Local irrigation with AmB
Candidaemia	Fluconasole or echinocandin		Echinocandin Remove intravascular catheter

Fungus ball

- Immunodeficiency
  (premature, dystrophia, neutropaenia)
- antibiotikum th
- Diabetes
- malformation
- Urology

Vesicoureteralis reflux (VUR)

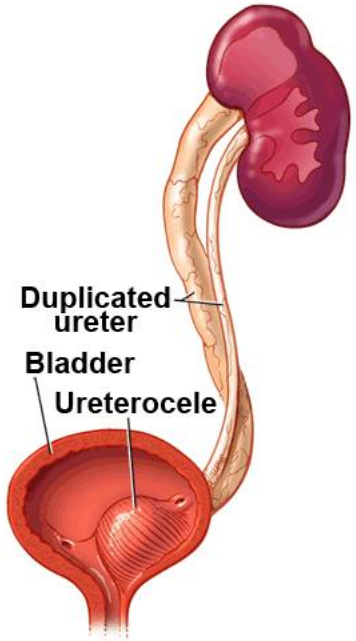


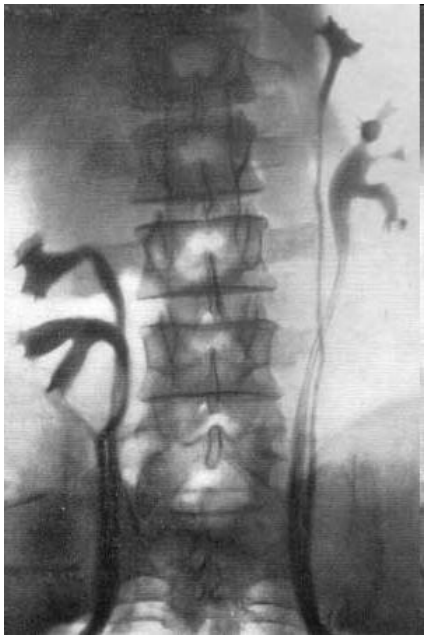
Vesicoureteralis reflux (VUR)

- congenital

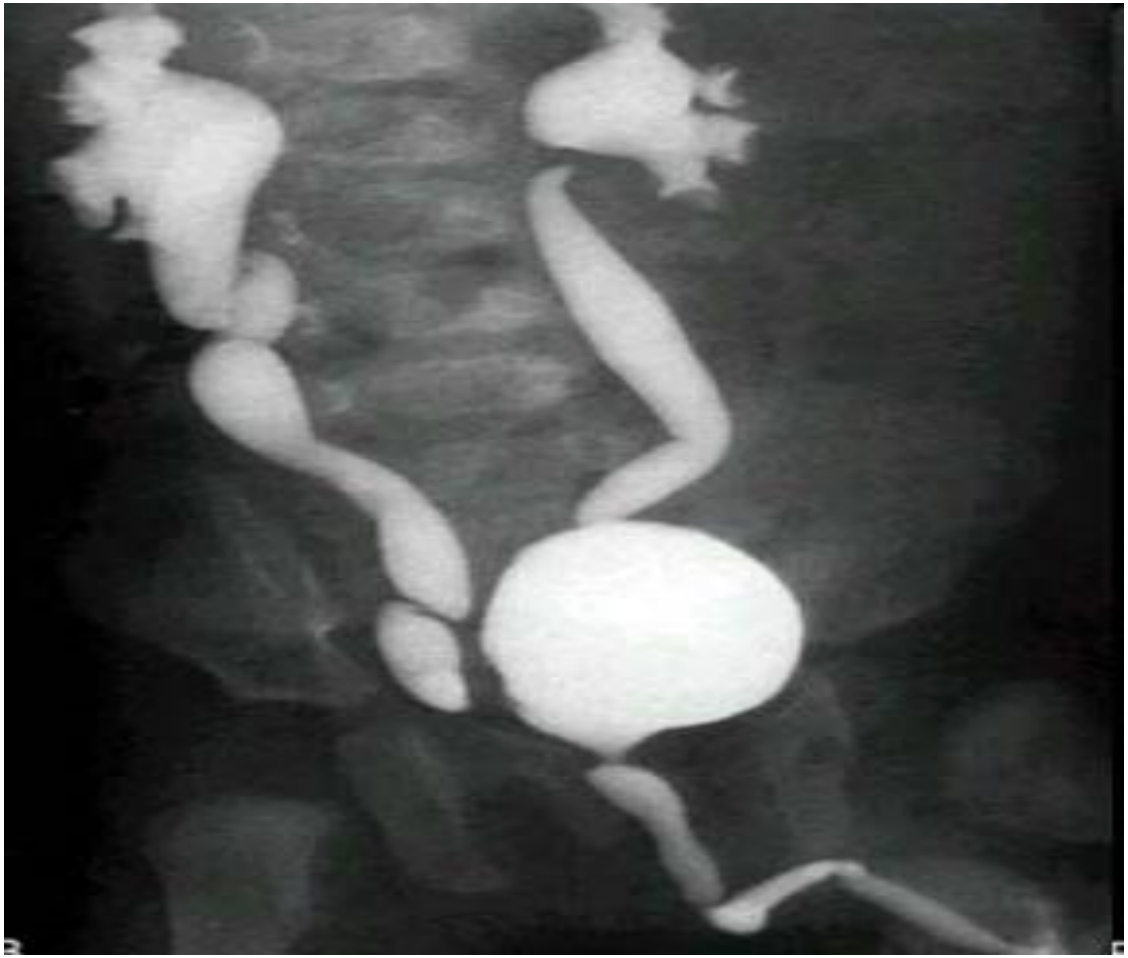
-ureter duplex, ectopia

-diverticulum

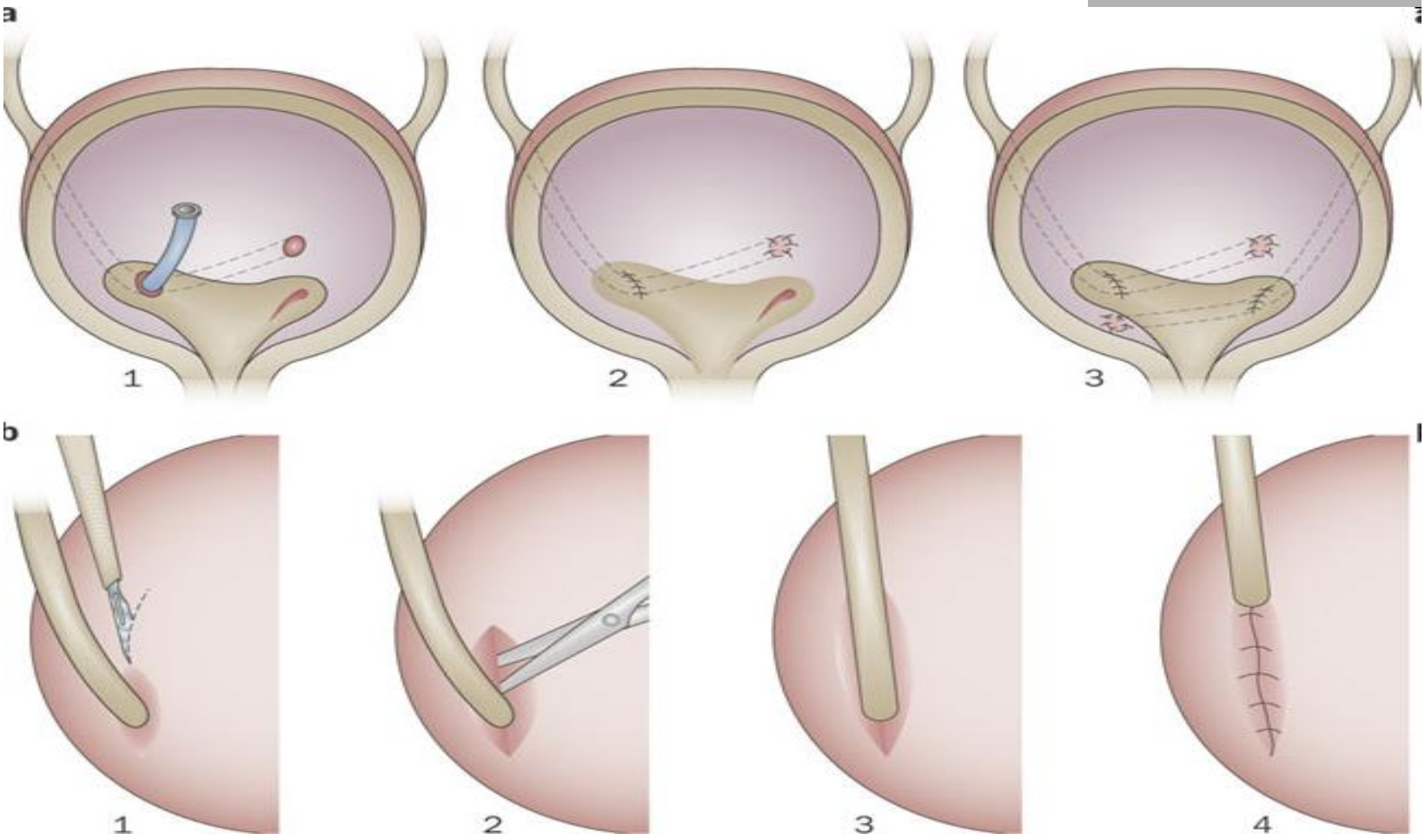




– subvesical obstr.



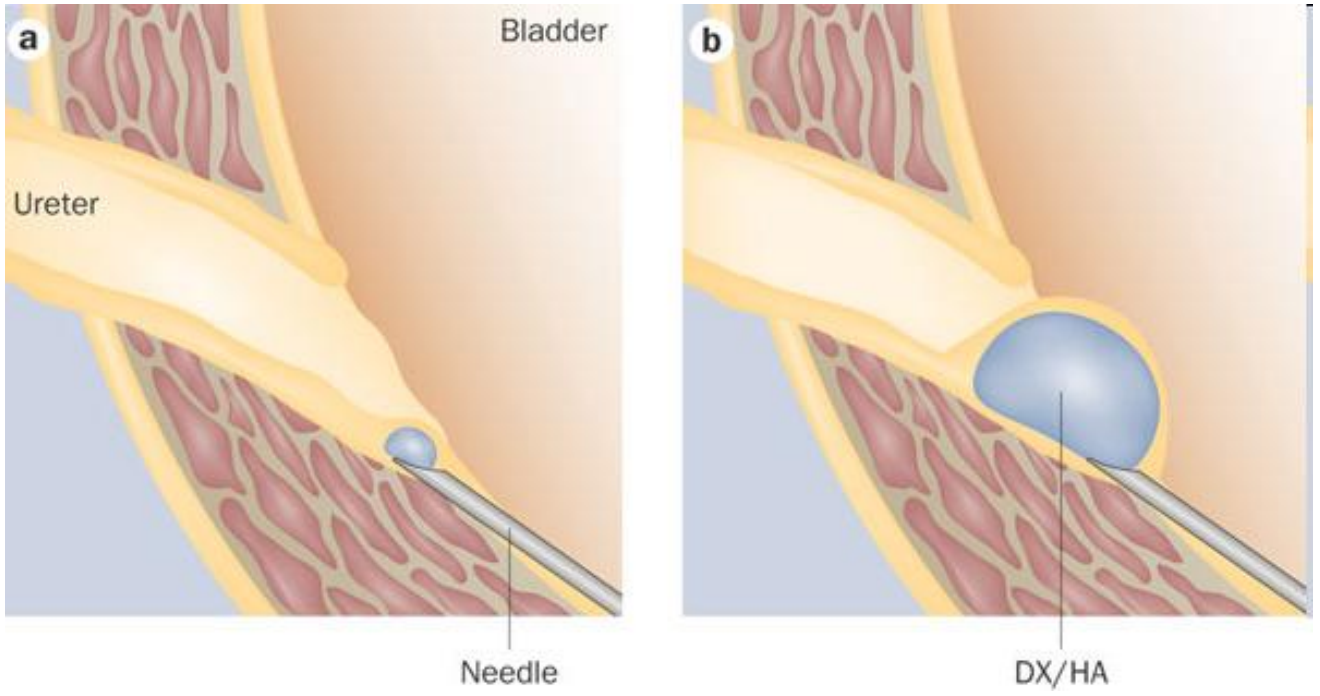
Ureter neoimplantatio



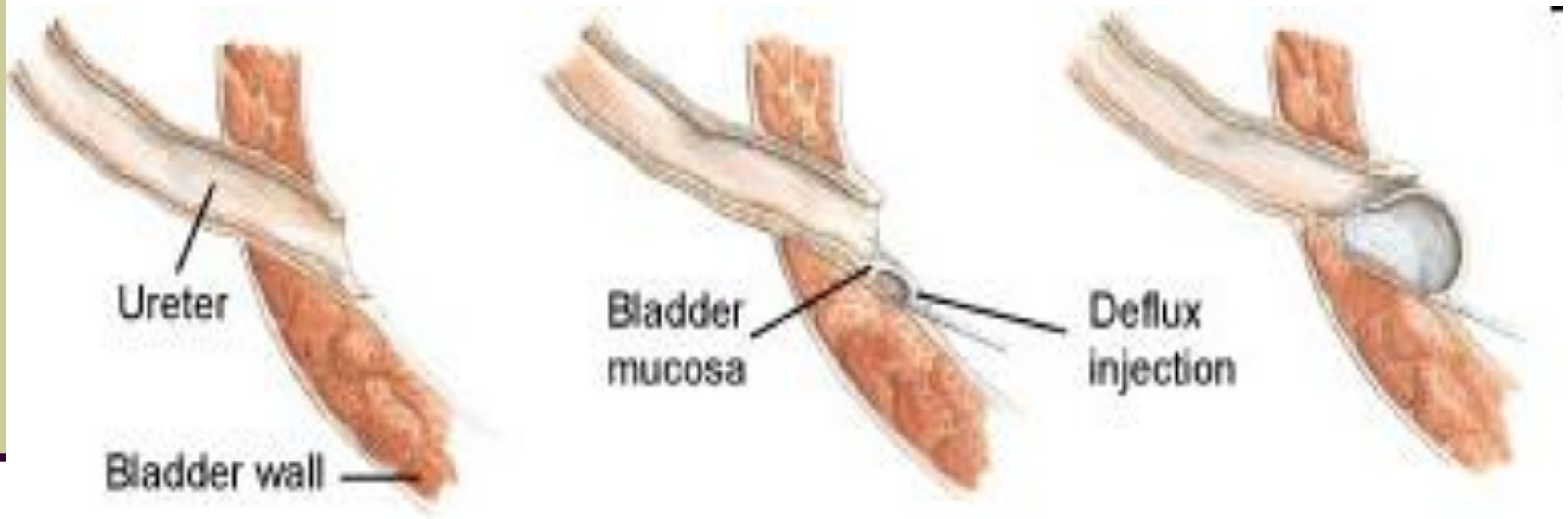
UTI, VUR

VUR th

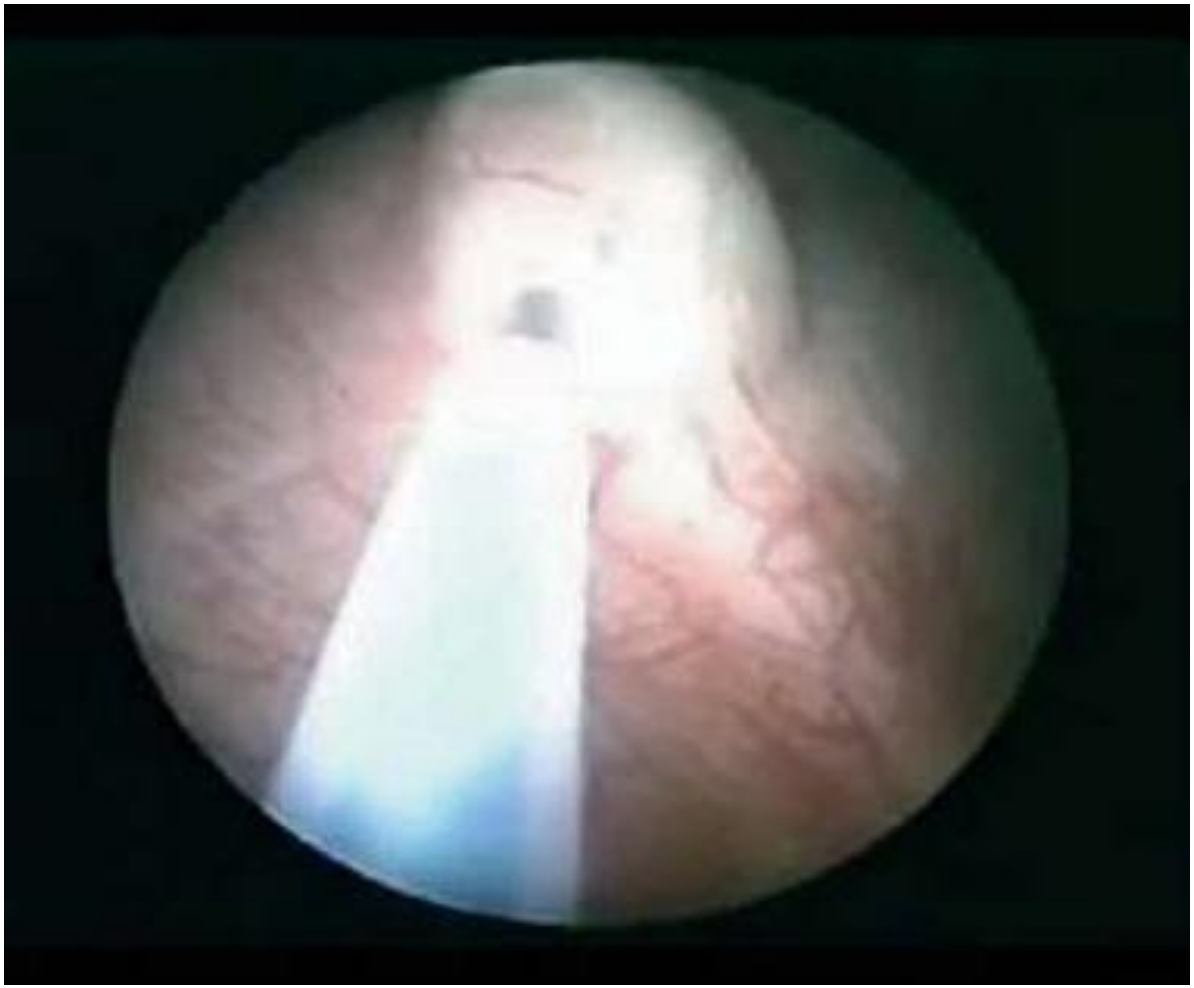
- endoscopy (SMING, SDING, STING)



SDING



SDING



Cystic KD

- PKD

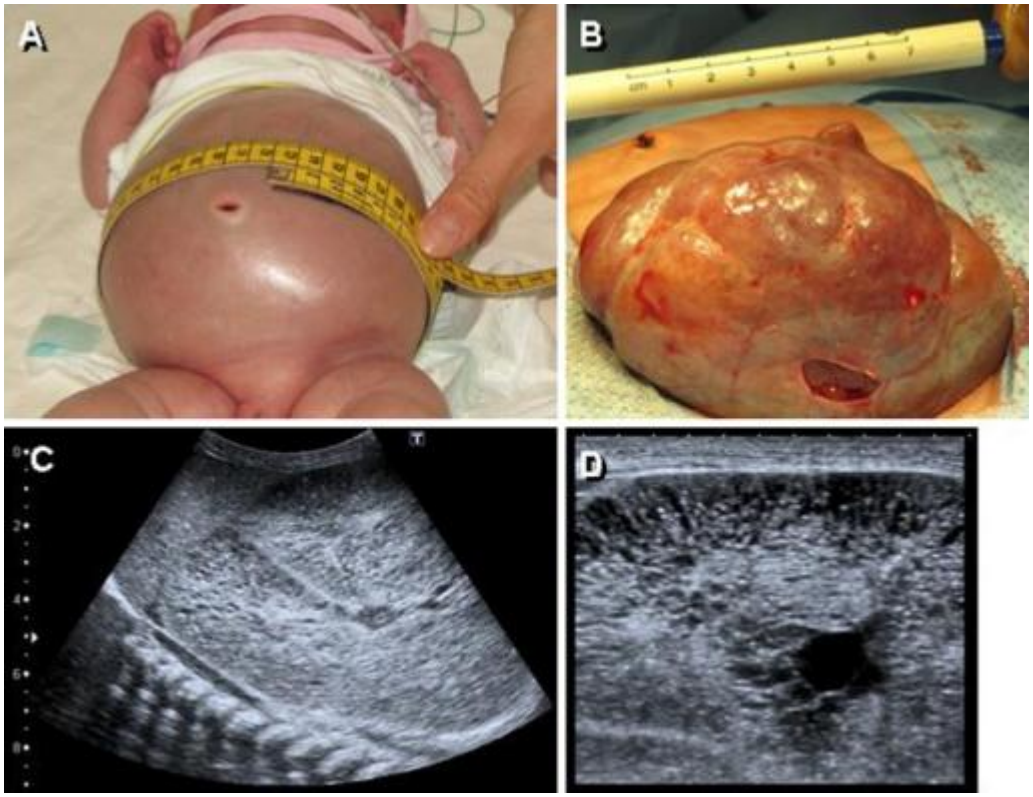
ARPKD

(enlarged kidney, olygohydramnion, abdominal mass, pulmonary hypoplasia,CRF

Hepatic fibrosis, portal HT)

1-2 mm-es cysts

ARPKD



Cystic KD

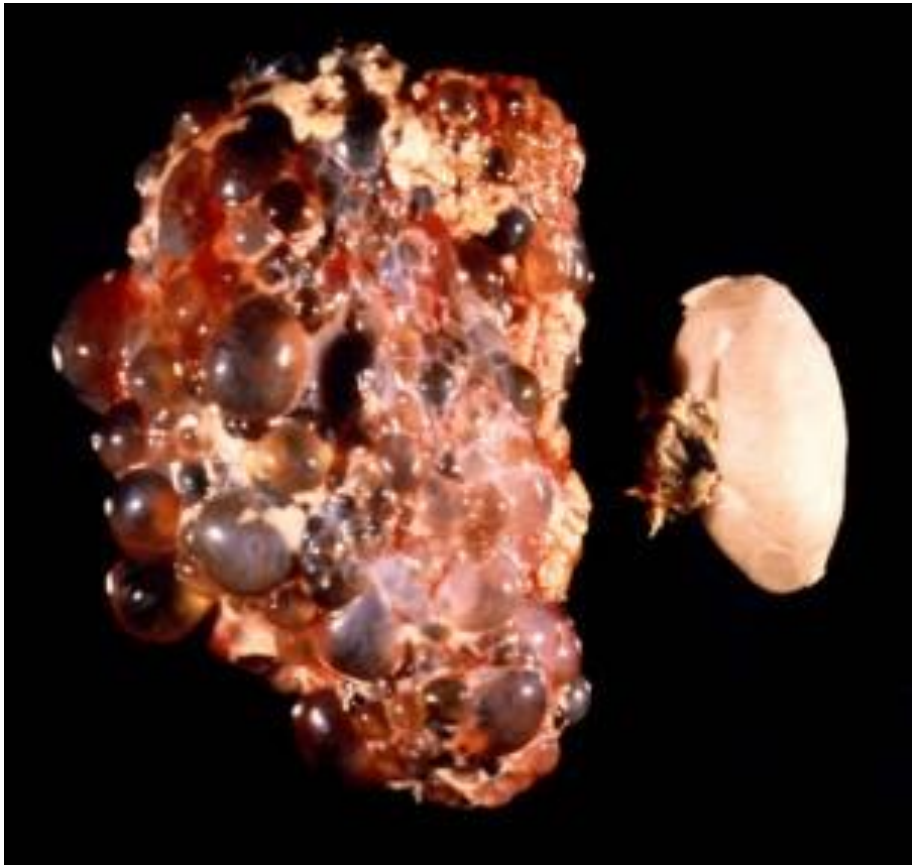
- PKD

ADPKD (+ family history, or new mutation, HT, abd. pain, UTI, CRF: 30-40 y

Enlarged kidney with macrocyts

Live- or pancreas cysts

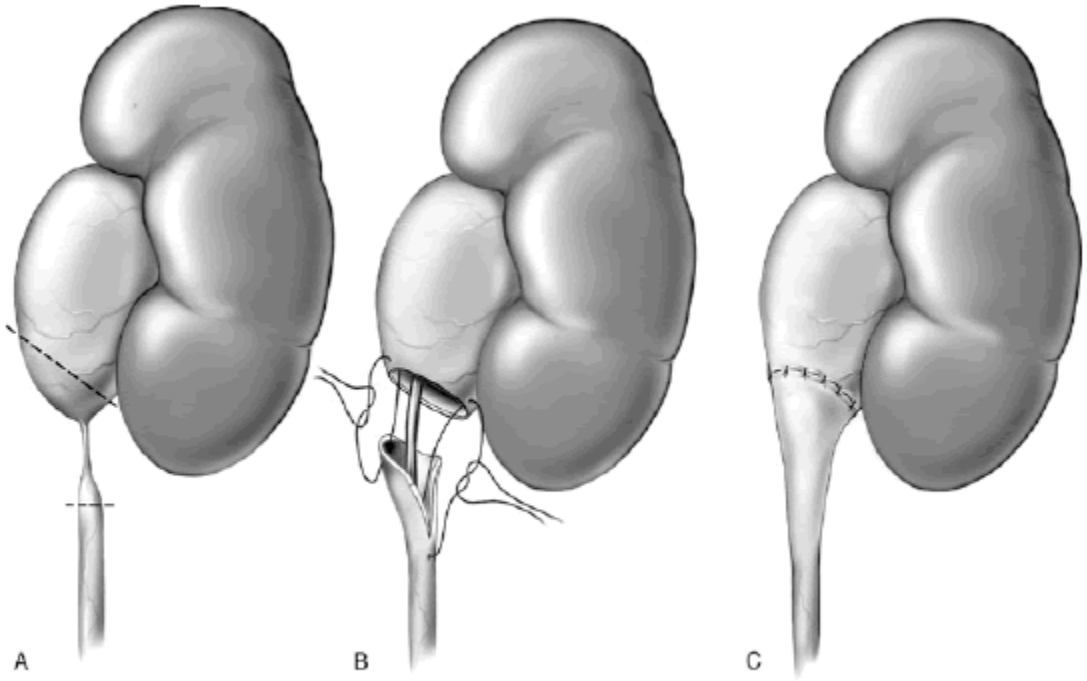
ADPKD



ADPKD

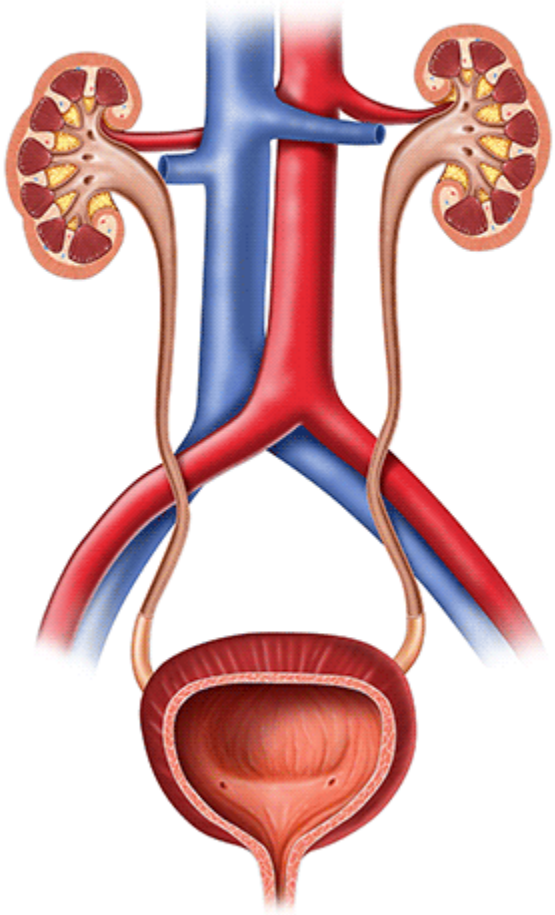
Obstructive uropathy

- PU stenosis
- UV stenosis
- VUR
- Ureterokele
- Subvesical obsrt.

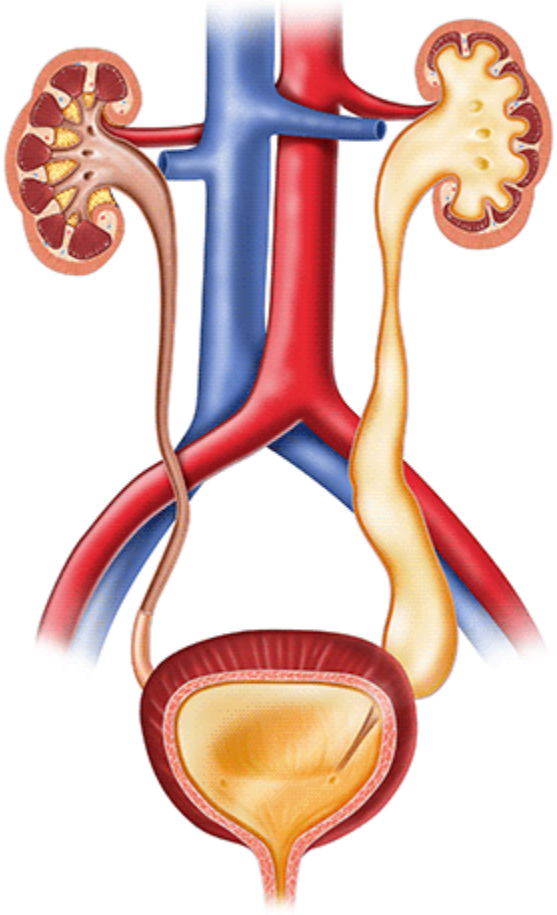


Streem et al. *Campbell's Urology*, 8th ed., 2002; 480

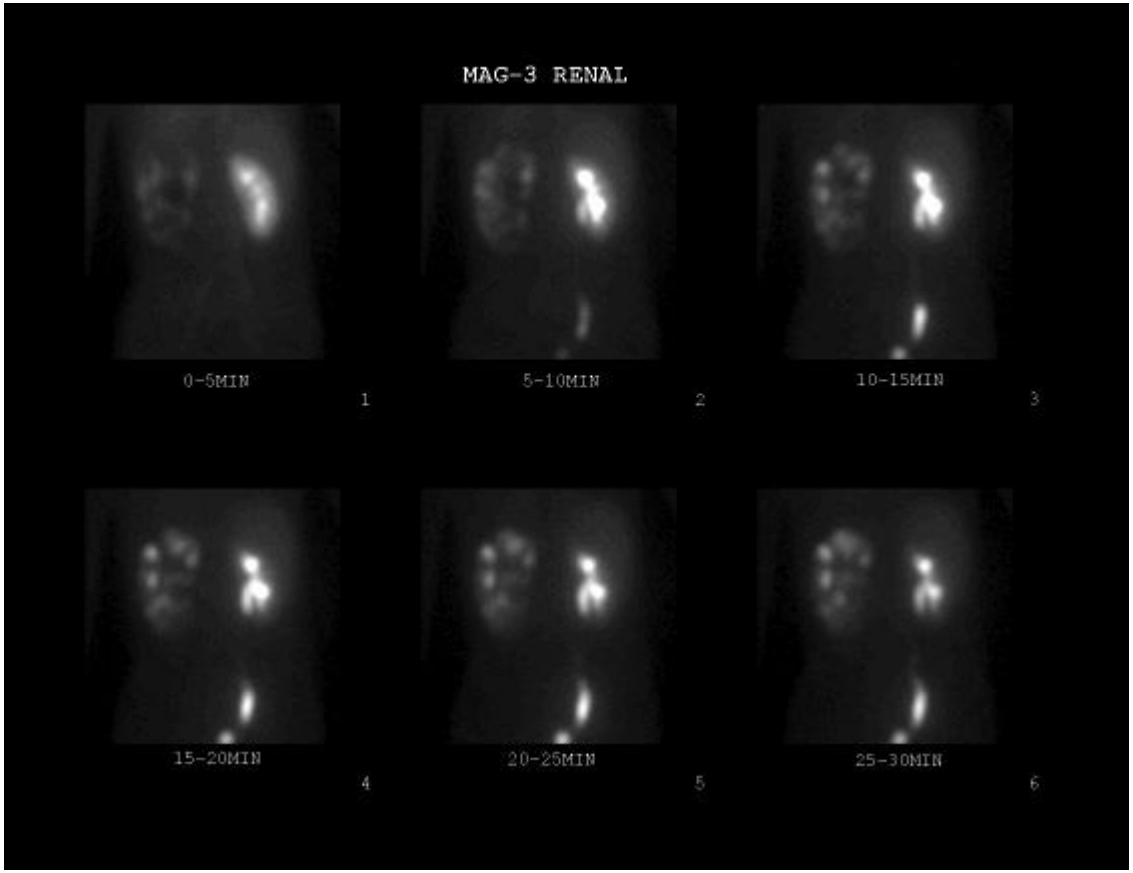
Normal System



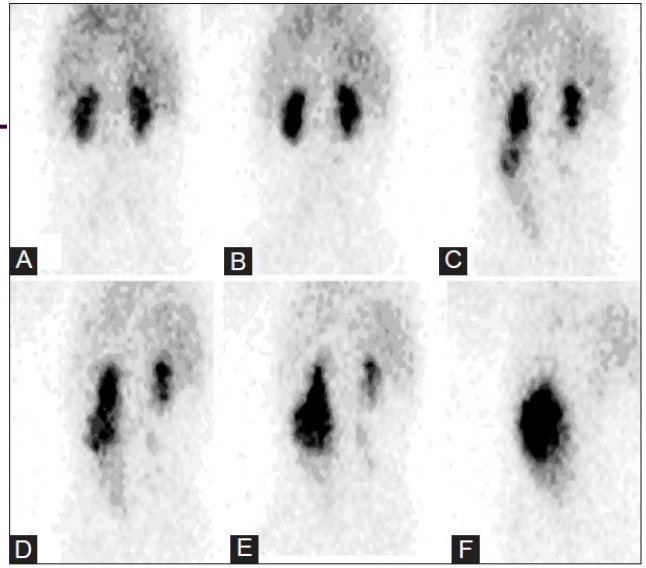
Ureterovesical Junction Obstruction

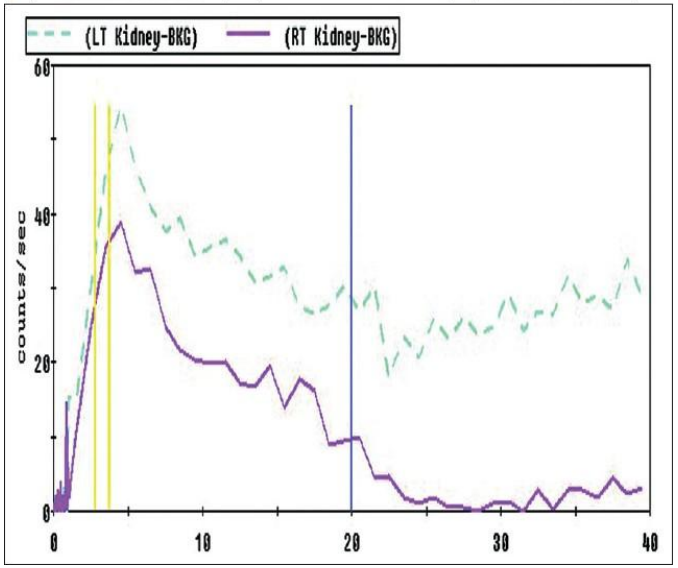


MAG3 scan


MAG-3 RENAL
0-5MIN
1
5-10MIN
2
10-15MIN
3
15-20MIN
4
20-25MIN
5
25-30MIN
6

MAG3 scan


A
B
C
D
E
F


(LT Kidney-BKG)
(RT Kidney-BKG)
counts/sec
60
40
20
0
0
10
20
30
40

POSTERIOR URETHRAL VALVES

- Only occurs in males
- 1/5,000 male births
- Accounts for 20% of all childhood end-stage renal failure

← Dysplastic kidneys

← Dilated urinary tract

← Malformed bladder

Glomerular diseases

Glomerular diseases

- **Nephrotic sy**

-proteinuria (3 g<), hypalbuminaemia, oedema, hyperlipidaemia)

INS

-minimal change

-minimal change diffúz mesangiai hypercell.

-FSGS

Th: steroid

Steroiddepend. or resist.: CP, Cya

Less common *membranosus* (HBV, HCV, HIV)

MCGN

congeitális and infantile type

Glomerular diseases

- **<u>Recurrant glomerular haematuria</u>**

-**IgA nephropathia, HSP nefritis**

(after infection 1-4 day: macr hematuria, nefritic sy

Th: RPGN (steroid and/or plasmepheresisi)

-**Alport sy** (haematuria, in boys GN, deafness, CRF).

-Thin basemenet membrane nephropathy

(hematuria, + family histroy, non prgressive)

Glomerular diseases

- **Acute postinfect. GN**

(after streptococcus or viral infection10-14 d)

AST ^, C3˘

Echo

Th: ab, fluid and electrolit balance

Diuretic, antihipertensiv th, renal replacement th

Glomerular diseases

- **Rapidly progr. GN**

-acute nefritic, progr. oligo-anury

-primer ill secunder (SLE, IgA NP, HSP, MCGN)

-etiology:

-immunkomplex dep. (IgA, postinfect, SLE)

-basal membr ab (Goodpasture)

-”pauci-immun” (ANCA + Wegener gr)

Hipertonsion

Hipertension

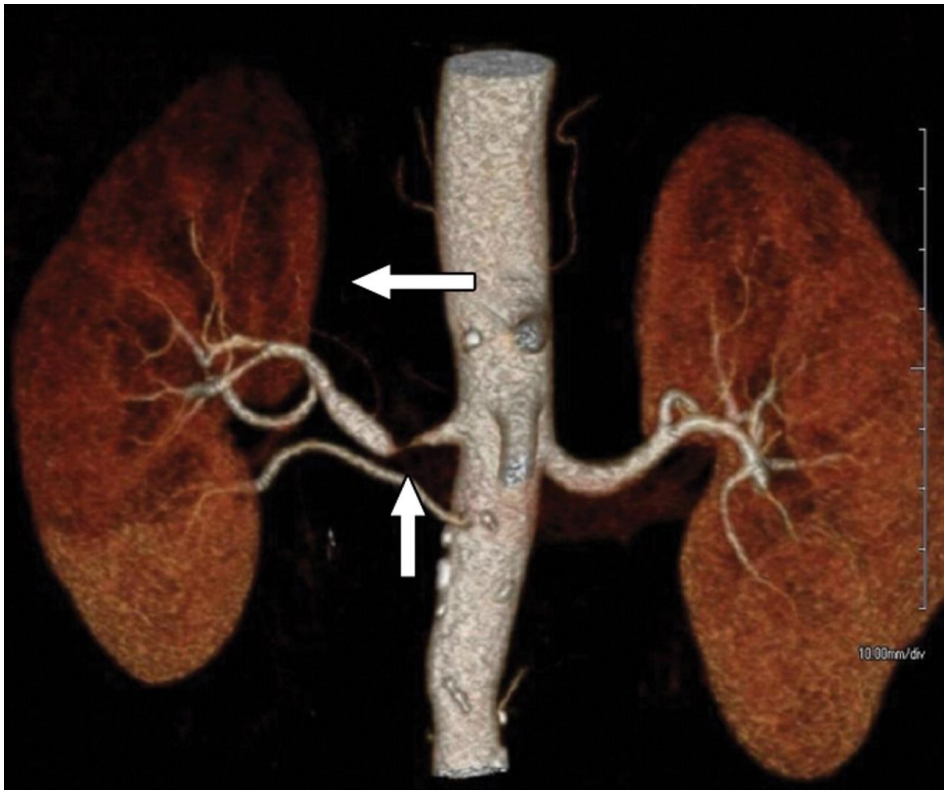
- Renoparenchymal diseases

(PKD, GN, renal hypoplasia)

Hipertension

- Renovascularis

(a renalis stenosis, thrombosis)



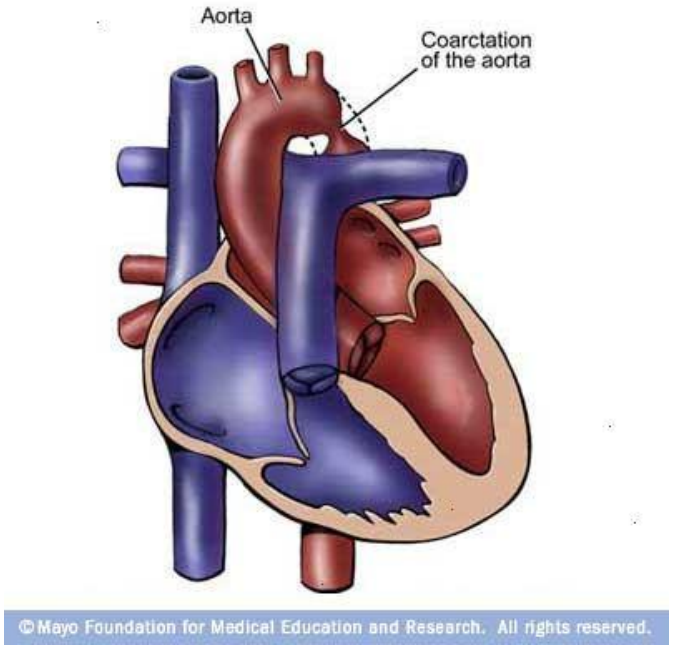
Hipertension

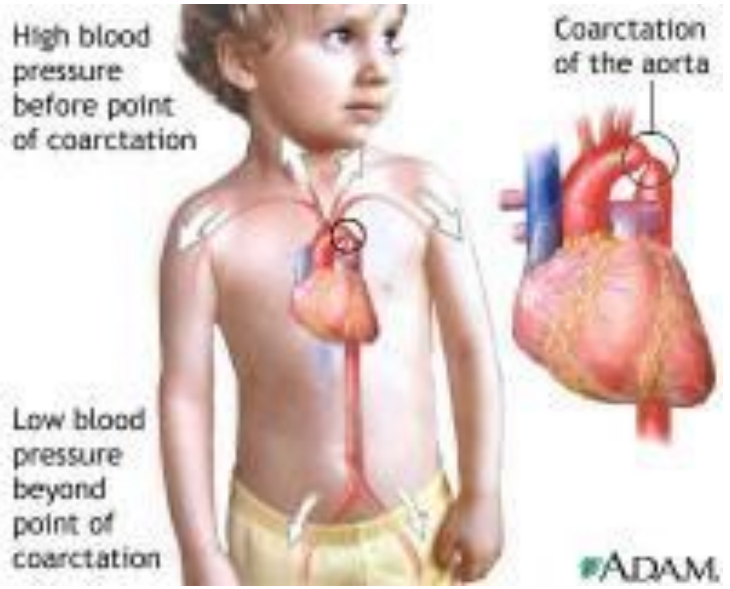
- Endocrin

Hypertyreosis, neurogen tu, phaeocromocytoma, hypercorticism

Hipertension

- Coarctatio aortae





Hipertension

- Th: ccb, bb, ACEI, ARB, diuretic.,vasodil.

Acute and chronic RF

Definition of AKI

A sudden, sustained, and usually reversible decrease in the glomerular filtration rate (GFR) occurring over a period of hours to days.

> 30 definitions used in published studies

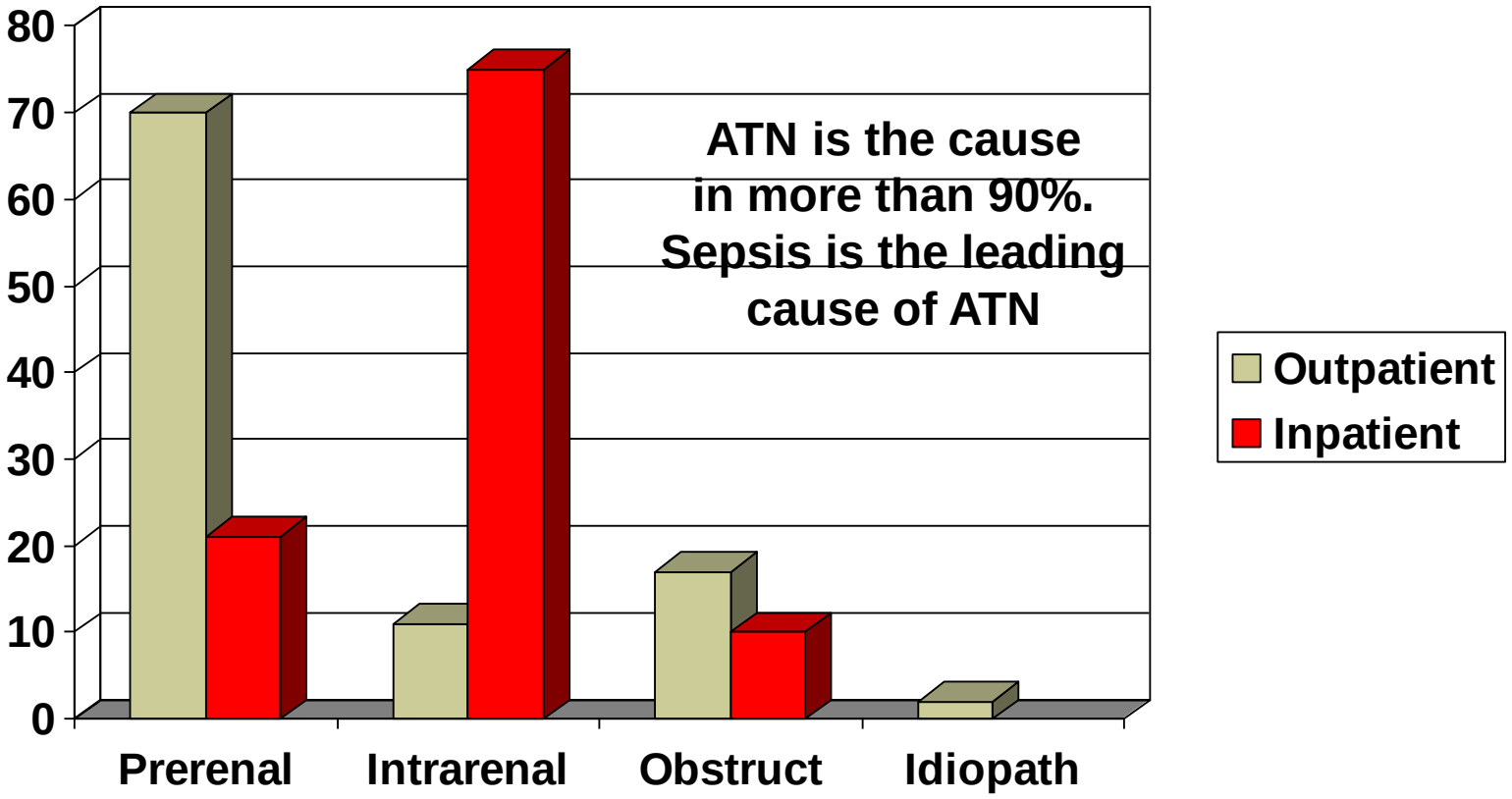
KDIGO Definition of AKI (2012)

Defined by any of the following:

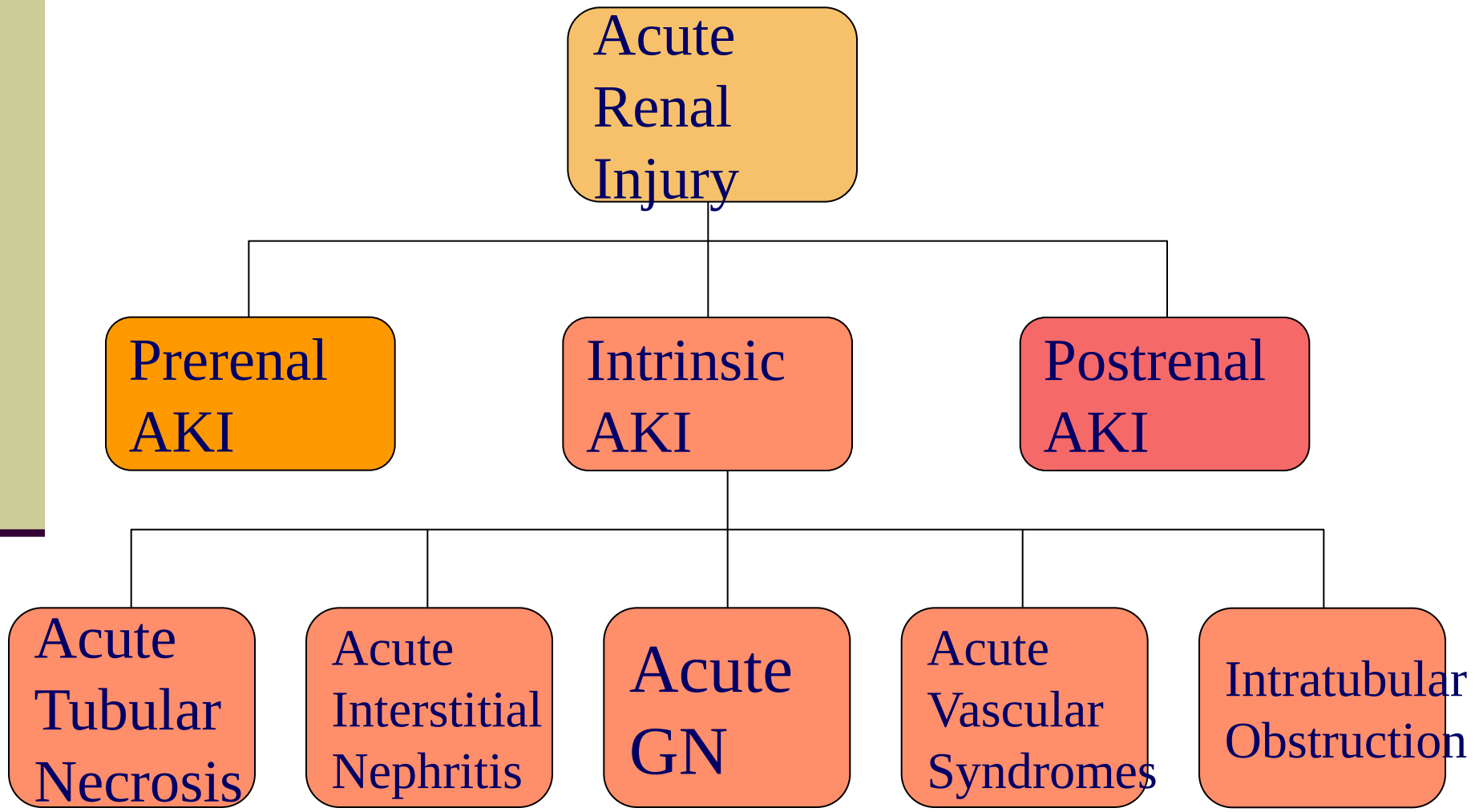
- Increase in SCr by ≥0.3 mg/dL within 48 hours
- Increase in Scr by ≥1.5 times baseline, which is known or presumed to have occurred within the prior seven days
- Urine volume <0.5 mL/kg/h for six hours

(Creatinin 1mg/dl=88,4 umol/l)

Akut veseelégtelenség etiológia



AKI (acut kidney injury)



Acute Kidney Injury

Index	Prerenal Azotemia	Oliguric AKI (ATN)
BUN/P_{Cr} Ratio	>20:1	10-15:1
Urine sodium (U_{Na}), meq/L	<20	>40
Urine osmolality, mosmol/L H_2O	>500	<400
-Fractional excretion of sodium	<1%	>2%
-FEUrea	<35%	>35%
Response to volume	Cr improves with IVF	Cr won't improve much
Urinary Sediment	Bland, Hyaline	**granular casts, cellular debris, tubular epithelial cells**

Management of AKI: general principle

- No therapy to date have shown efficacy in treating AKI.
- Identify the etiology and treat the underlying cause
- Optimization of hemodynamics to increase renal perfusion
- Lack of benefit – low dose dopamine, loop diuretics only if markedly fluid overload
- Identify and aggressively treat infection (early removal of foley catheters, and minimize indwelling lines)

Management of AKI: treat complications

- **Correct fluid imbalances**: strict I/O's, daily wts. determine fluid balance goals daily, dialysis
- **Electrolyte imbalances** (low K/phos diet, binder)
- **Metabolic acidosis** (Bicarb deficit)
- **Nutrition**: adjust TPN/ adequate calories, low protein,
- **Medication dosing**: adjustment for eGFR to avoid under or over dosing, timing for dialytic therapy, reassess dosing for renal recovery or dialysis modality)
- **Procedural considerations** (prefer non-contrast CT, appropriate to delay contrast exposure, prophylaxis)

INDICATIONS FOR DIALYSIS IN ACUTE RENAL FAILURE

- **PERICARDITIS**
- **NEUROPATHY**
- **MENTAL STATUS CHANGE**
- **SEIZURES**
- **BLEEDING**
- **TOXINS----*ETHYLENE GLYCOL, METHANOL***
- **PROPHYLACTIC**

~recent studies fail to document benefit

上医医未病之病

中医医将病之病

下医医已病之病

～黄帝：内经～

2600 BC - Huang Dee Nai-Chang
1st Chinese Medical Text

Ancient Chinese Medical Text

- The inferior doctor treats actual illness.
- The mediocre doctor treats the disease before evident.
- **The superior doctor prevents illness.**

2600 BC - Huang Dee Nai-Chang

1st Chinese Medical Text

Take Home Messages: AKI

- It involves high cost of management, carries a high morbidity and mortality risks.
- AKI is increasingly common.
- The most common cause of in-hospital AKI is ATN that results from multiple acute insults (sepsis, ischemia, or nephrotoxin).
- No drug treatment has been shown to limit the progression of, or speed up recovery from AKI.
- Review medications and adjust dose
- Recognize risk factors
- The Best Treatment is PREVENTION and avoid further renal damage!!!

Chronic Kidney Disease (CKD)

- Involves progressive, irreversible loss of kidney function

Creatinin normal range

Cont…

- The normal values of S.creatinine are :

AGE	*RANGE(mg/dl)*
Cord	0.6-1.2
Newborn	0.3-1.0
<3 years	0.17-0.35
3-5 years	0.26-0.42
5-7 years	0.29-0.48
7-9 years	0.34-0.55
9-11 years	0.35-0.64
11-13 years	0.42-0.71
13-15 years	0.46-0.81
Adult Male	0.7-1.3
Adult Female	0.6-1.1

(Creatinin 1mg/dl=88,4 umol/l)

GFR normal range

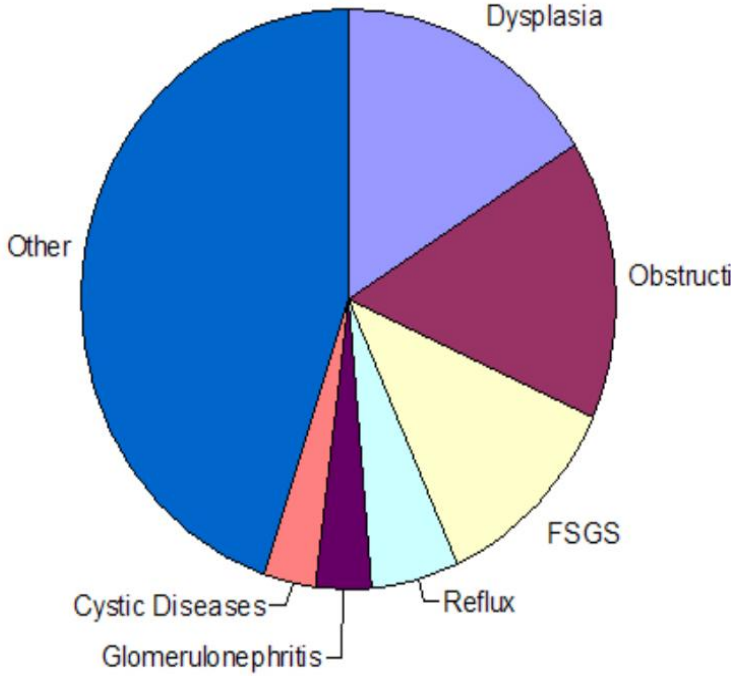
Table 24. Normal GFR in Children and Young Adults

Age (Sex)	Mean GFR ± SD (mL/min/1.73 m^2)
1 week (males and females)	40.6 ±14.8
2–8 weeks (males and females)	65.8 ±24.8
>8 weeks (males and females)	95.7 ±21.7
2–12 years (males and females)	133.0 ±27.0
13–21 years (males)	140.0 ±30.0
13–21 years (females)	126.0 ±22.0

*Data based on three studies.[69-71]

Abbreviation: SD, standard deviation

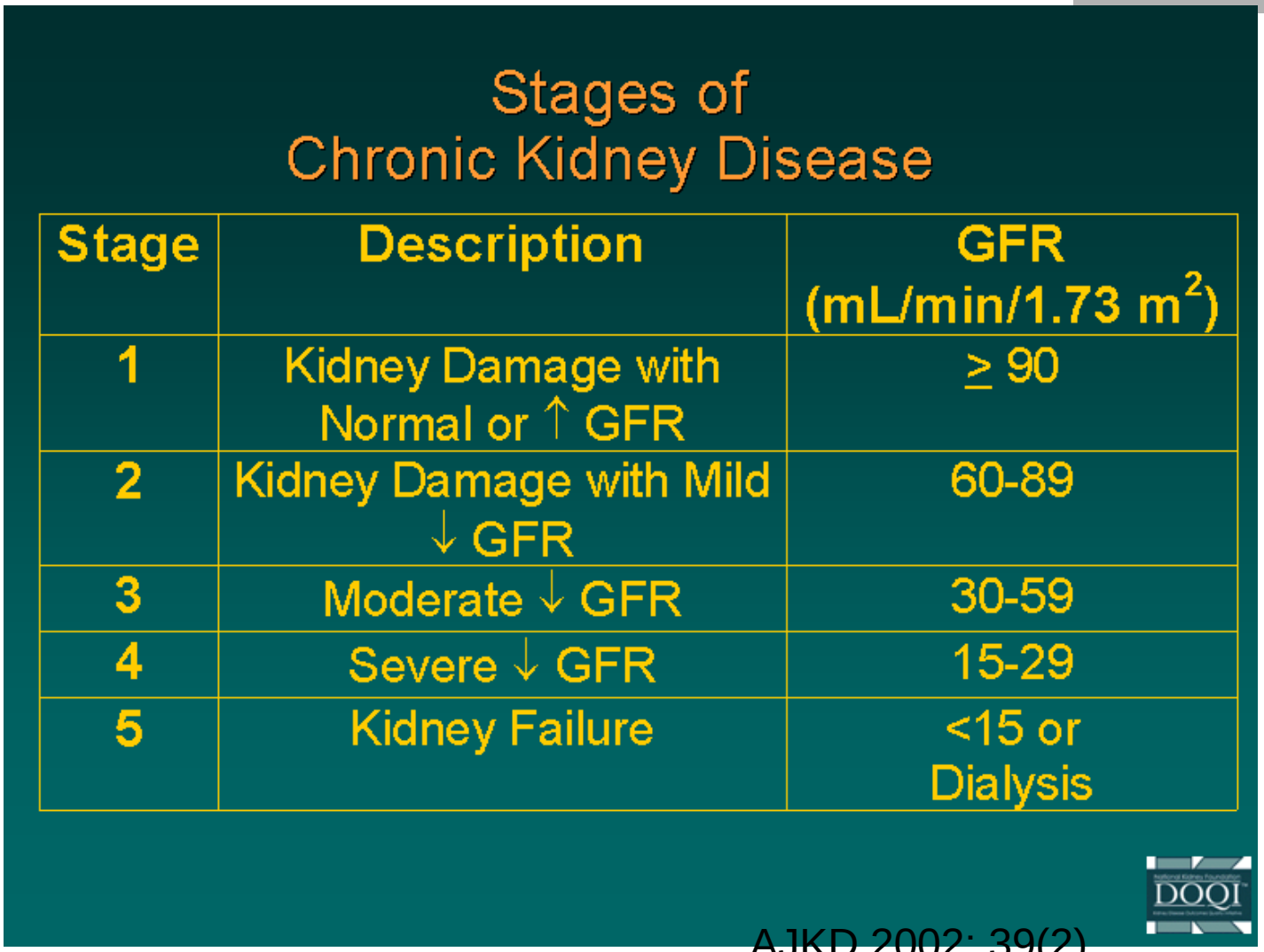
Causes of Pediatric Renal Failure



Recipient and Transplant Characteristics	N	%
Total	10632	100.0
Sex		
Male	6298	59.2
Female	4334	40.8
Race		
White	6296	59.2
Black	1820	17.1
Hispanic	1806	17.0
Other	710	6.7
Primary Diagnosis		
Aplasia/hypoplasia/dysplasia kidney	1681	15.8
Obstructive uropathy	1630	15.3
Focal segmental glomerulosclerosis	1246	11.7
Reflux nephropathy	549	5.2
Chronic glomerulonephritis	340	3.2
Polycystic disease	323	3.0
Medullary cystic disease	287	2.7
Congenital nephrotic syndrome	277	2.6
Hemolytic uremic syndrome	273	2.6
Prune Belly	268	2.5
Familial nephritis	241	2.3
Cystinosis	221	2.1
Membranoproliferative glomerulonephritis - Type I	186	1.7
Pyelo/interstitial nephritis	184	1.7
Idiopathic crescentic glomerulonephritis	181	1.7
SLE nephritis	159	1.5
Renal infarct	140	1.3
Berger's (IgA) nephritis	135	1.3
Henoch-Schonlein nephritis	113	1.1
Membranoproliferative glomerulonephritis - Type II	85	0.8
Wegener's granulomatosis	66	0.6
Wilms tumor	56	0.5
Drash syndrome	55	0.5
Oxalosis	55	0.5
Membranous nephropathy	47	0.4
Other systemic immunologic disease	34	0.3
Sickle cell nephropathy	16	0.2
Diabetic glomerulonephritis	11	0.1
Other	1110	10.4
Unknown	663	6.2

From NAPRTCS Annual Report. 2010. Accessed March 25, 2013 at www.naprtcs.org

Stages of chronic Kidney Disease



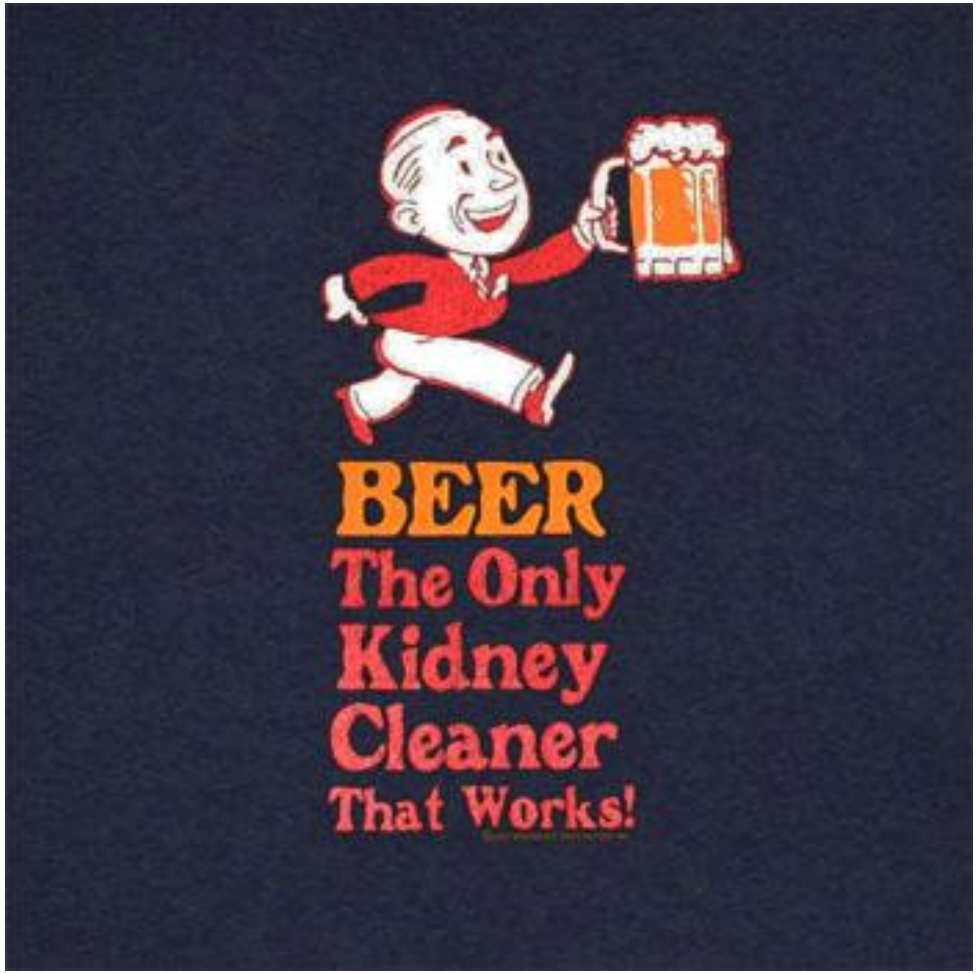
Diagnostic Studies

- History and physical examination
- Laboratory tests
  - BUN
  - Serum creatinine
  - Creatinine clearance
  - Serum electrolytes
  - Protein-creatinine ratio (first morning void)

Collaborative Care

- Conservative therapy
- Correction of extracellular fluid volume overload or deficit
- Nutritional therapy
- Erythropoietin therapy
- Calcium supplementation, phosphate binders
- Vitamin D
- Treat the hyperkalaemiaű
- Adjustment of drug dosages to degree of renal function

Vesepótló kezelés

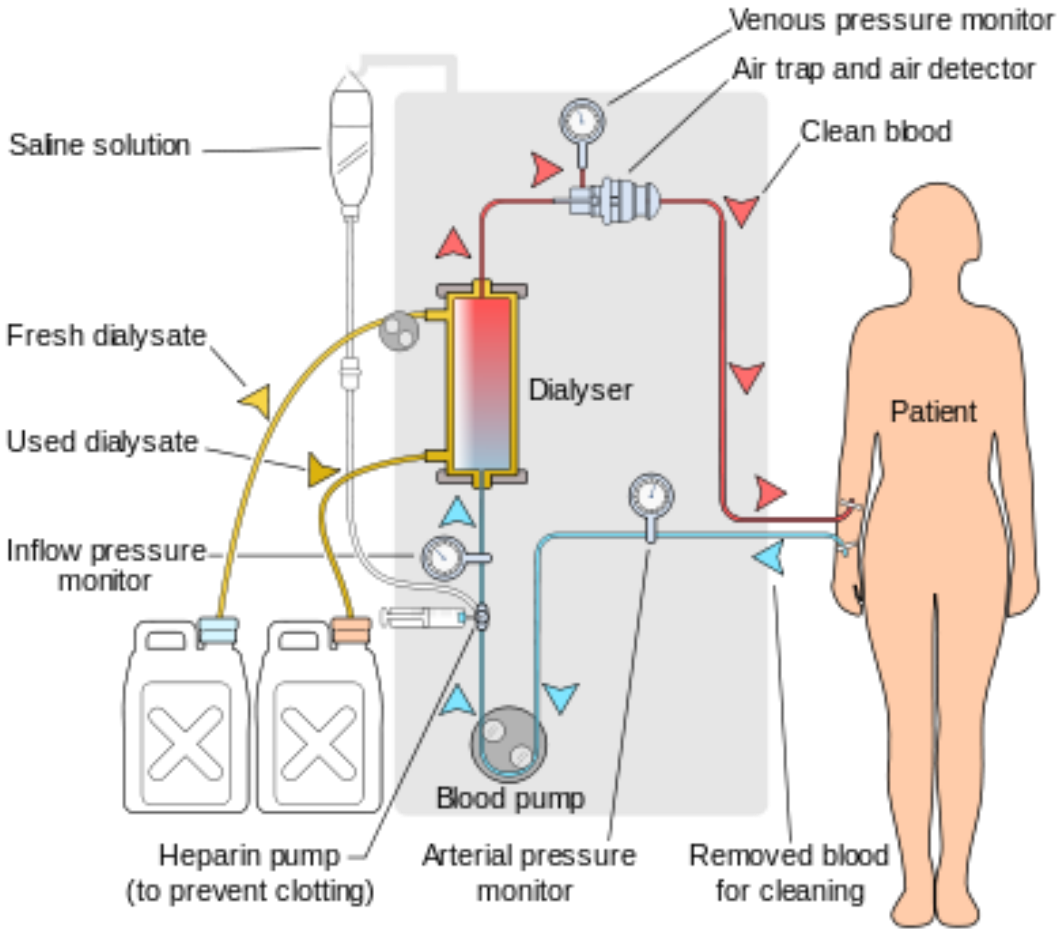


Hemodialysis

- Removal of soluble substances and water from the blood by diffusion through a semi-permeable membrane.

- Blood removed from patient into the extracorporeal circuit.
- Diffusion and ultrafiltration take place in the dialyzer.
- Cleaned blood returned to patient.

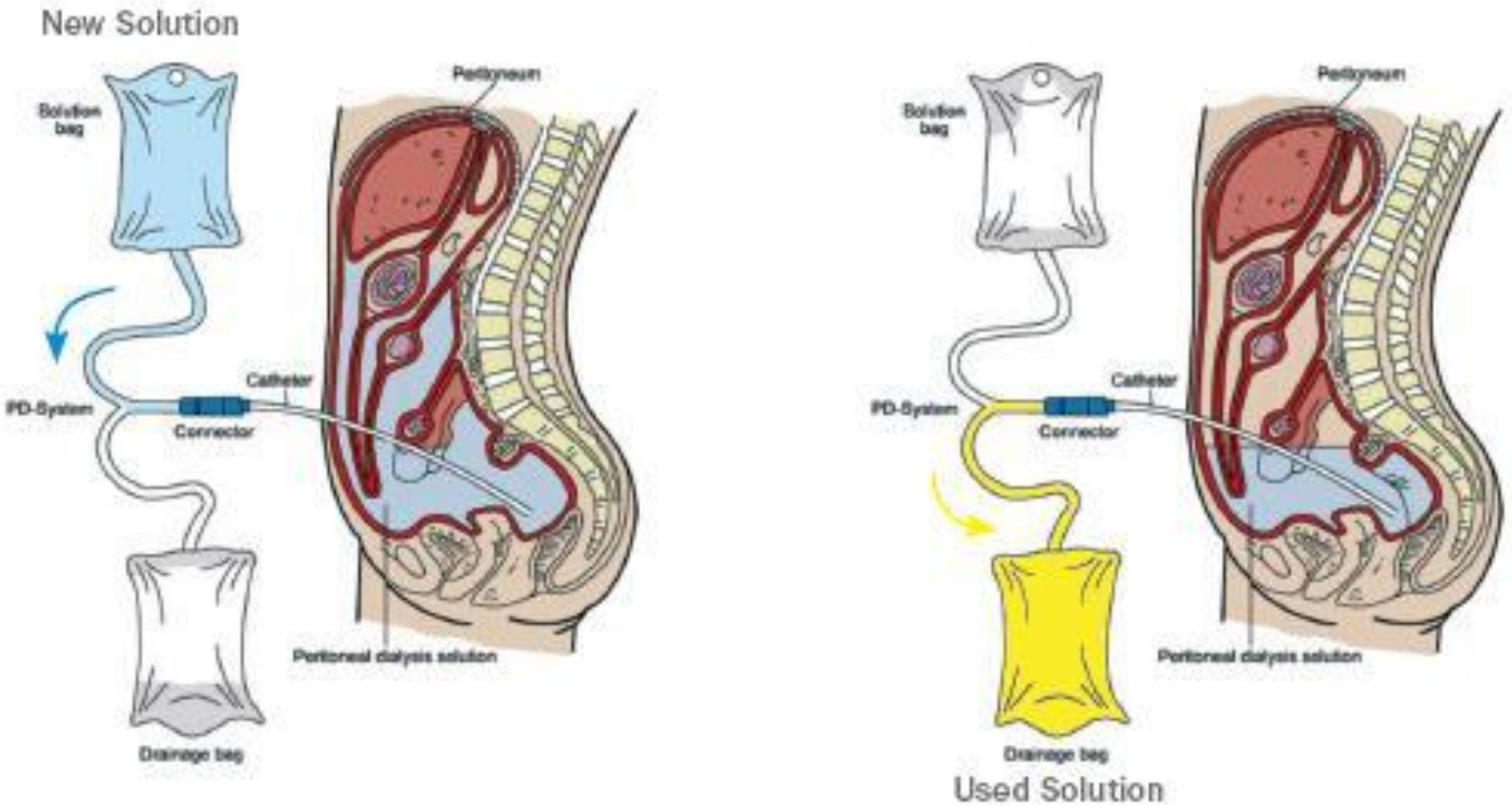
HD


Venous pressure monitor
Air trap and air detector
Saline solution
Clean blood
Fresh dialysate
Dialyser
Patient
Used dialysate
Inflow pressure monitor
Blood pump
Heparin pump (to prevent clotting)
Arterial pressure monitor
Removed blood for cleaning

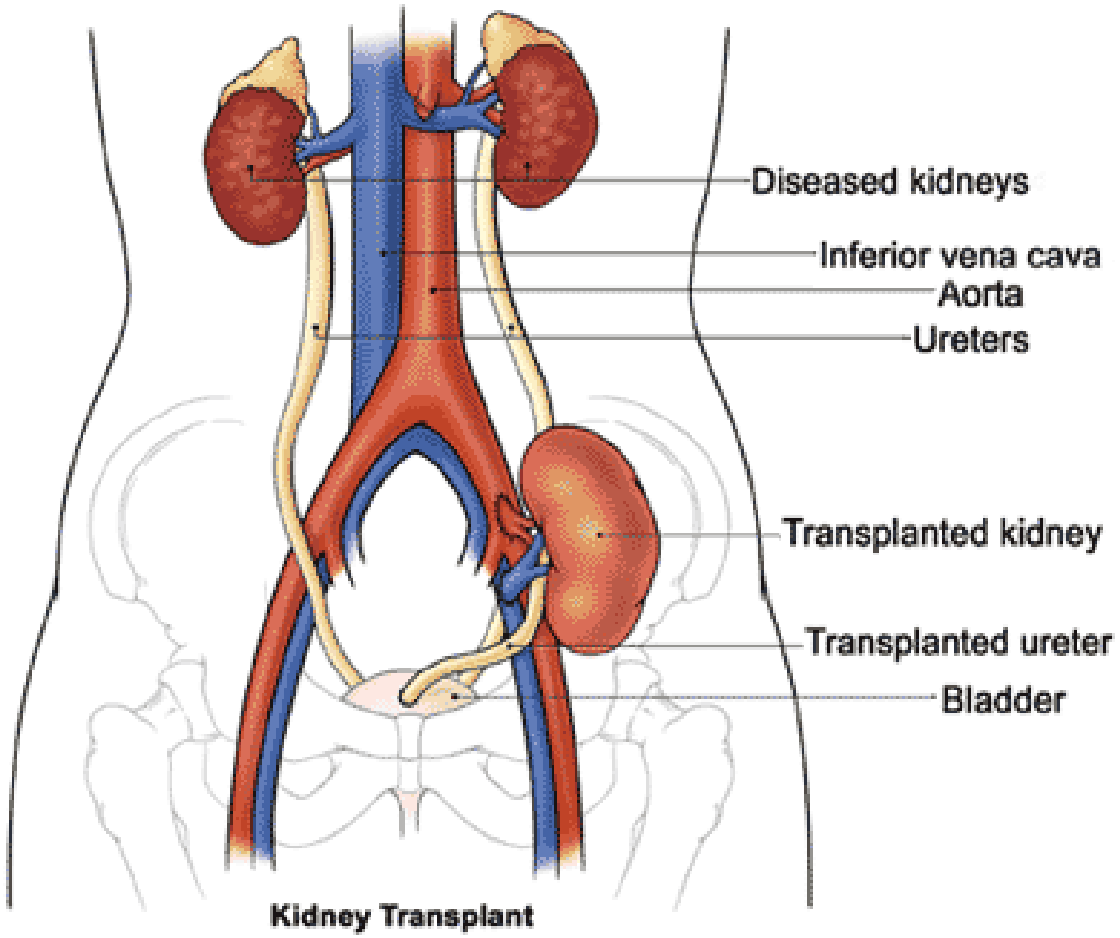
Peritoneal Dialysis

- Removal of soluble substances and water from the blood by diffusion through a semi-permeable membrane that is intracorporeal (inside the body).

PD


New Solution
Solution bag
Peritoneum
Catheter
PD-System
Connector
Peritoneal dialysis solution
Drainage bag
Solution bag
Peritoneum
Catheter
PD-System
Connector
Peritoneal dialysis solution
Drainage bag
Used Solution

Transplantation



Kidney Transplant

Advantages

- Restoration of “normal” renal function
- Freedom from dialysis
- Return to “normal” life

Disadvantages

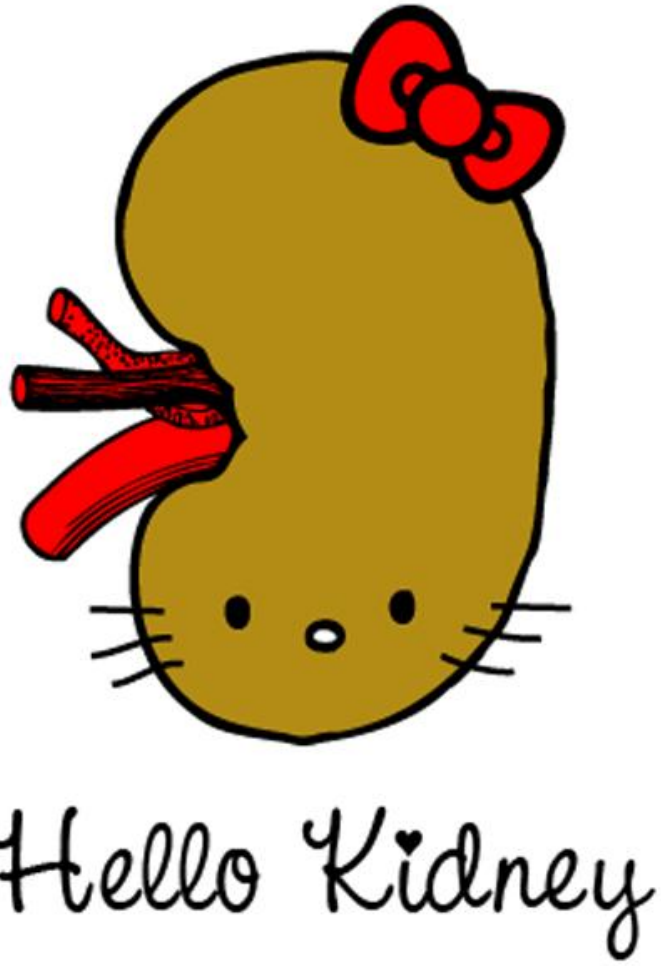
- Life long medications
- Multiple side effects from medication
- Increased risk of tumor
- Increased risk of infection
- Major surgery

Key Concepts (I)

- Kidney transplantation is the most cost-effective modality of renal replacement
- Transplanted patients have a longer life and better quality of life
- Early transplantation (before [pre-emptive] or within 1 year of dialysis initiation) yields the best results
- Living donor kidney outcomes are superior to deceased donor kidney outcomes

Key Concepts (2)

- Early transplantation is more likely to occur in patients that are referred early to nephrologists
- Refer for transplant evaluation when eGFR $\leq$ 20 cc/min/1.73m^2
- Success of transplantation results from a delicate balance between the suppression of the immune system to prevent rejection and the long-term side-effects of immunosuppression


Hello Kidney

Köszönöm a figyelmet!

SE, II. sz. Gyermekgyógyászati Klinika