



SYSTEMIC DISEASE AND KIDNEY INVOLVEMENT

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Overview



- Kidney disease definition
- Overview signs kidney disease
- Frequent systemic diseases affecting the kidneys
- Serious systemic diseases affecting the kidney

Kidney disease definition



Based on:

- GFR
- Albuminuria/ Proteinuria
- Haematuria
- Structural damage (Diagnostic imaging)

CKD classification 2011



Classification by severity				
Stage	Description	GFR ml/min/1.73m ²	Related terms	Classification by treatment
1.	Kidney damage with normal or ↑ GFR	≥ 90	albuminuria, proteinuria, hematuria	T if kidney transplant, recipient
2.	Kidney damage with mild ↓ GFR	60 – 89	albuminuria, proteinuria, hematuria	
3.	Moderate ↓ GFR	30 – 59	chronic renal insufficiency, early renal insufficiency	
4.	Severe ↓ GFR	15 – 29	chronic renal insufficiency, late renal insufficiency, pre-ESRD	
5.	Kidney failure	< 15 (or dialysis)	renal failure, ureamia, end-stage, renal disease	
				D if dialysis (hemodialysis, peritoneal dialysis)

GFR



- Measurement with a reference method:
 - Inulin (gold standard)
 - ^{51}Cr -EDTA
 - Iohexol
 - Iothamylate
- Estimation with a formula
 - MDRD
 - CKD-EPI

Creatinine clearance IS NOT the same as GFR!

Cockcroft-Gault formula estimates creatinine clearance.

Measurement GFR



- Expensive 300-500 euros
- Time consuming : 5 hours
- Limited ressources at clinical physiology departments
- Results are expressed as:
 - ml/min (absolute values)
 - ml/min per 1.73m^2

Who gets measured GFR?



- Cancer patients before and after cisplatin or carboplatin based treatments
- Some Diabetics
- Some CKD patients
- Living Kidney donors

GFR estimation formula



- Cheap
- Readily worldwide available (internet)
- Fast (10 seconds)
- Raised awareness of **CKD**
- Results are **always (until further)** expressed as:
 - ml/min per 1.73m^2
- **Can not be used in acute kidney failure (you use increasing creatinine and urine output)**

Albuminuria

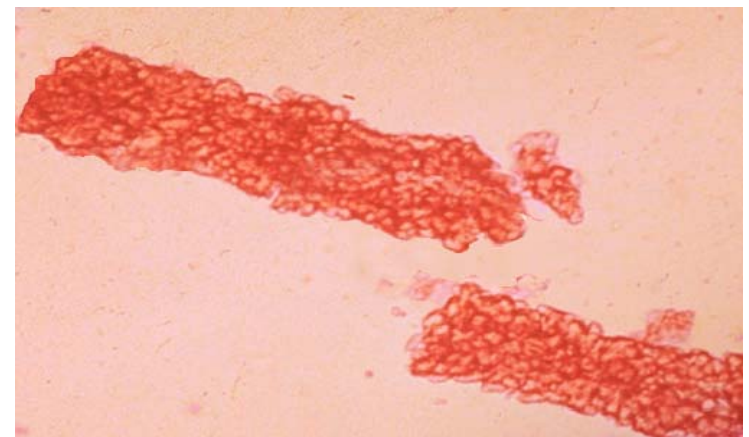
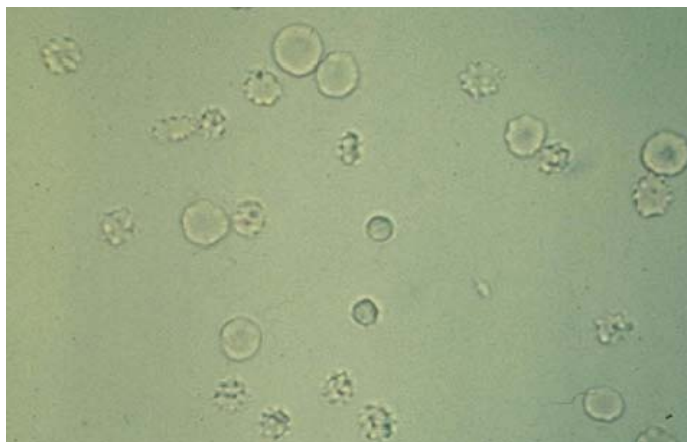


- Spot albumin creatinine ratio
 - >30mg/g microalbuminuria
 - >300 mg/g proteinuria
- If proteinuria:
 - 24 hours urine collection to measure protein
 - >3 grams/24 hours : Nephrotic syndrome

Haematuria



- Urine dipstick
 - If positive
 - Urine Microscopy
 - Erythrocytes
 - Red cell blood cast: Red blood cells may stick together and form red blood cell casts. Such casts are indicative of glomerulonephritis, with leakage of RBC's from glomeruli, or severe tubular damage.



Positive dipstick for blood



- Can be positive in different situations
 - Haemolysis: urine and serum are red (free hemoglobine in both, no erythrocytes), raised LDH, supressed haptoglobine
 - Rhabdomyolysis: urine is red (free myoglobine in the urine), raised CK
 - Bleeding from the urether, bladder
 - Differential diagnosis between nephrology causes and urological causes
 - Erythrocytes in the urine and red cell casts : nephrology causes
 - Erythrocytes alone: urological causes
 - Other causes:
 - Oxalic acid (rabarb...)
 - Porphyria
 - Rifampicin etc

Urine microscopy

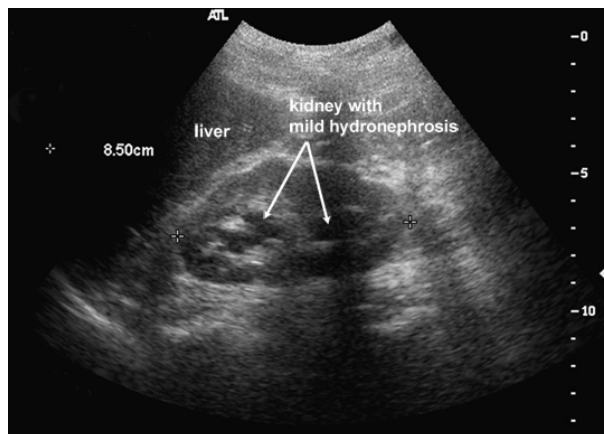
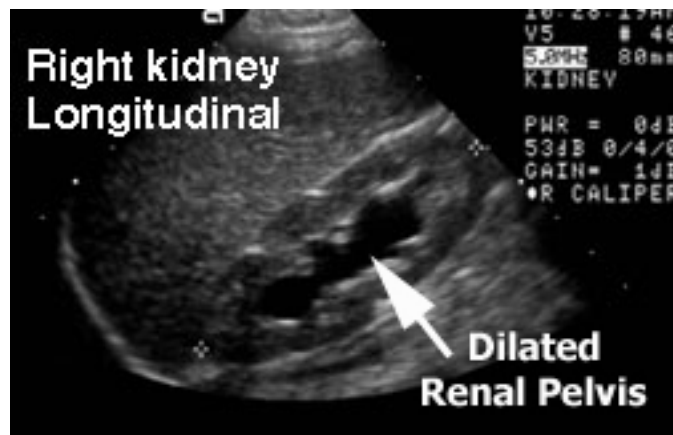


- Red blood or white blood cell casts in urine: glomerulonephritis
- Telescoped urinary sediment is one in which red cells, white cells, oval fat bodies, and all types of casts are found in more or less equal profusion :
 - 1) lupus nephritis
 - 2) malignant hypertension
 - 3) diabetic glomerulosclerosis
 - 4) rapidly progressive glomerulonephritis

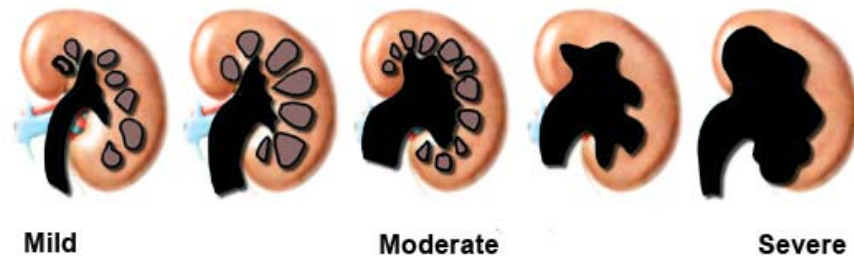
Structural damage



- Hydronephrosis



Degrees of Hydronephrosis



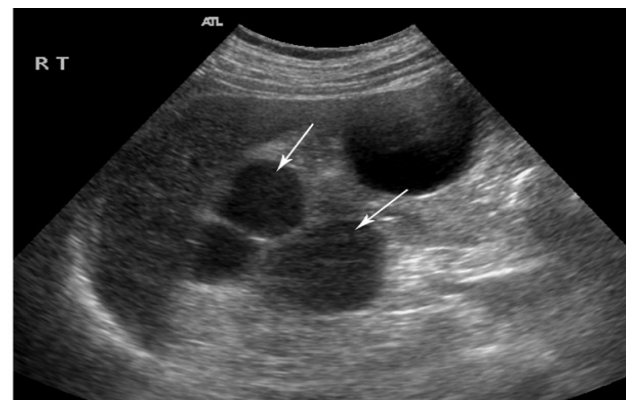
Structural damage



- Polycystic kidney disease



(a)



(b)



(c)

CKD classification 2011



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Other?



Do not forget persistent hypertension!

- Hypertension causes CKD and CKD causes hypertension.(National Kidney Foundation)

Frequent systemic diseases with kidney involvement



- Biopsy registers (ERA-EDTA)
 - But up to 30% in some european countries unknown

Frequent systemic diseases with kidney involvement



- Diabetes
- Hypertension

The two diseases alone are responsible for 2/3 of chronic kidney disease

Other frequent systemic diseases



- Glomerulonephritis
- Lupus and other diseases that affect the body's immune system.
- amyloidosis
- Myelomatosis etc

Diabetes nephropathy



- High Hb1Ac
- Albuminuria
- Declining GFR
- Biopsy not necessary in presence of diabetic retinopathy
- Increasing numbers in western countries
- GFR < 30, referral to nephrologist

Hypertensive nephropathy



- High blood pressure
- Albuminuria
- Declining GFR
- $\text{GFR} < 25$, referral to nephrologist
- Biopsy not necessary
- Special situations
 - red or white blood cell casts : glomerulonephritis
 - Telescoped urinary sediment
 - malignant hypertension
 - Renal arterial stenosis:
 - Difficult to control despite 3-4 antihypertensive drugs
 - Flash pulmonary oedema

Glomerulonephritis



A whole range of diseases!

Biopsy is needed

10% of dialysis patients in Denmark have glomerulonephritis

Many classifications

- Histopathological
- Primary or secondary glomerulopathy
- Causes etc etc

Glomerulonephritis



Glomerular changes:

- Minimal change (children)
- Ig A nephropathy (common)- Related to Schonlein-Henoch (hæmaturia)
- FSGS, serious condition (proteinuria)
- Membranous nephropathy (cancer, infectious diseases: **hepatitis B/ C**). Proteinuria / nephrotic syndrome

Glomerulonephritis



Tubular or interstitium changes

- Pyelonephritis
- Interstitiel nephritis
- Urate nephropathy
- ATN (Acute tubular necrosis)
- Nefrocalcinosis

Glomerulonephritis



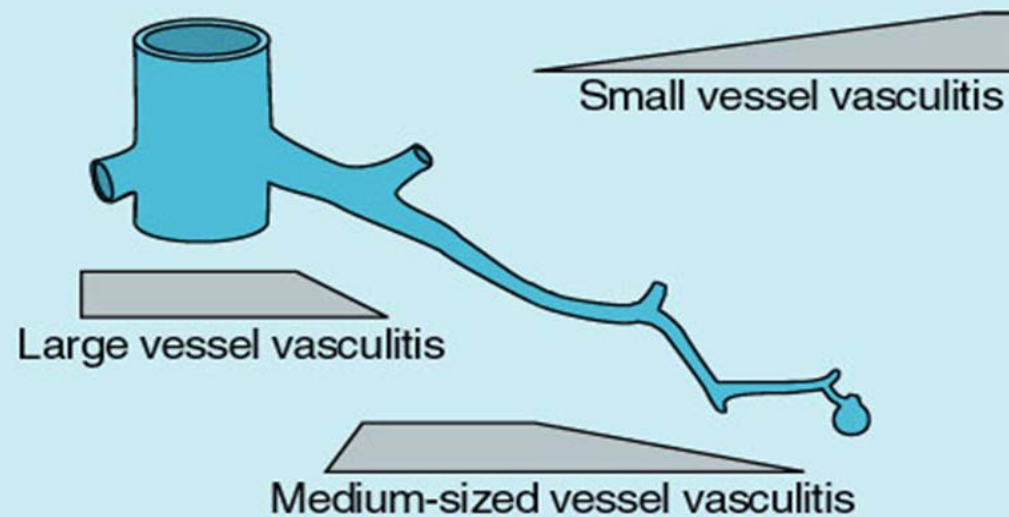
Vasculitis: serious, rapid progression

- ANCA positive
 - Wegeners Granulomatosis
 - Microscopic polyangiitis (skin, kidneys, weight loss, nerves)
- Anti GBM (glomerular basal membrane)
- Good Pasture syndrome (pulmonary haemorrhage)
- Churg Strauss (asthma, eosinophilia, fever, vasculitis)

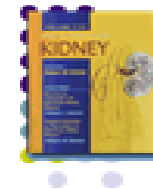
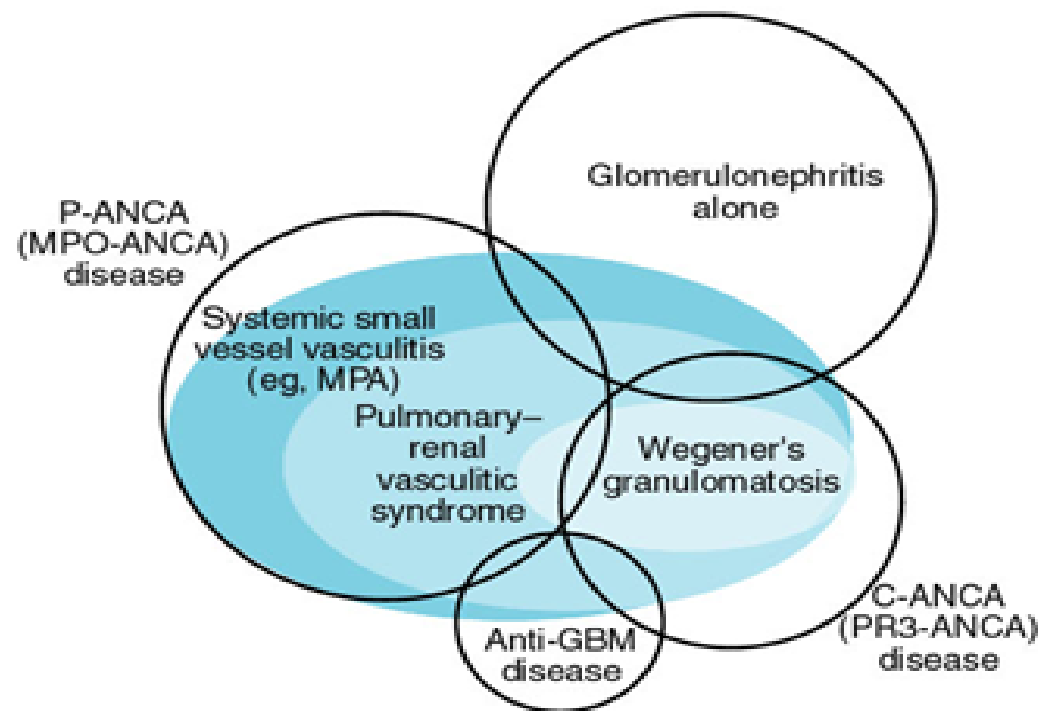
Vasculitis

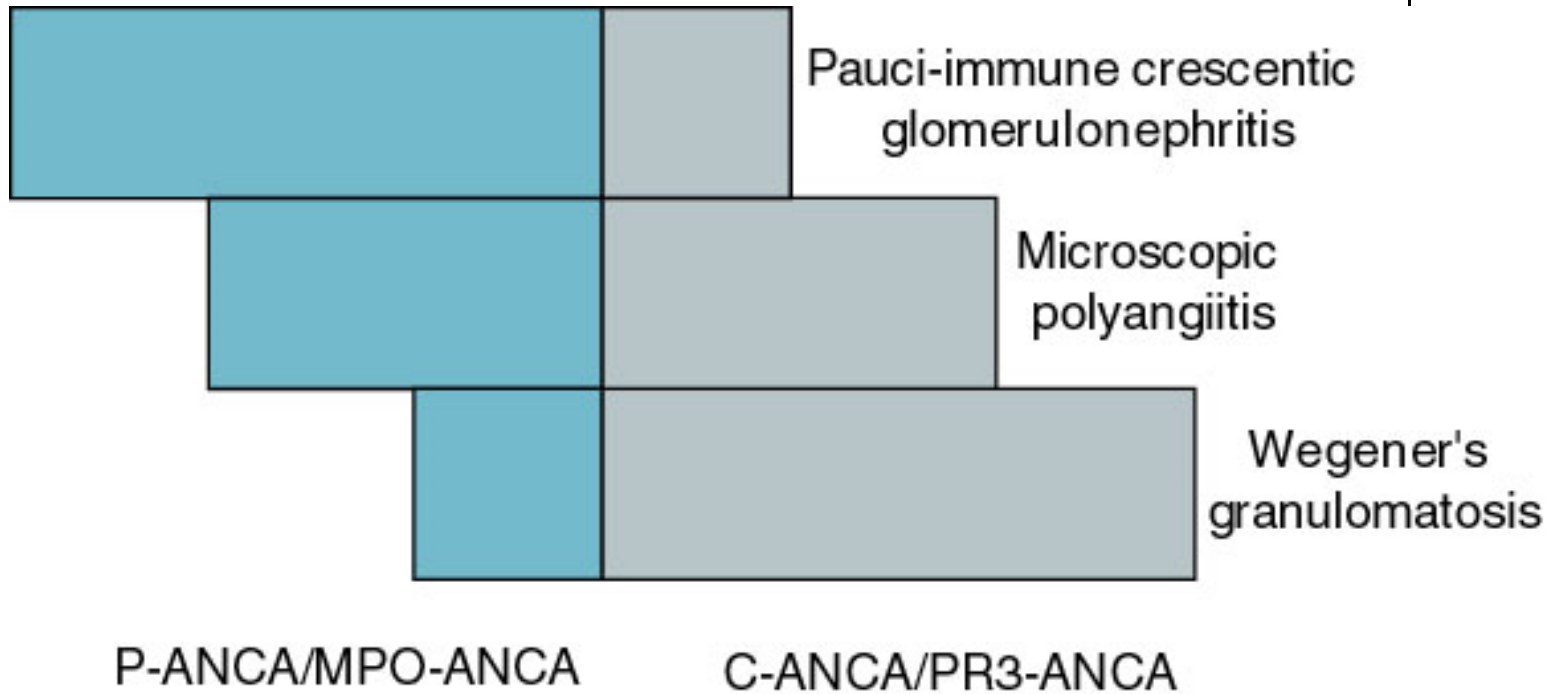
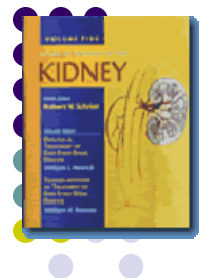


Distribution of renal vascular involvement



Vasculitis





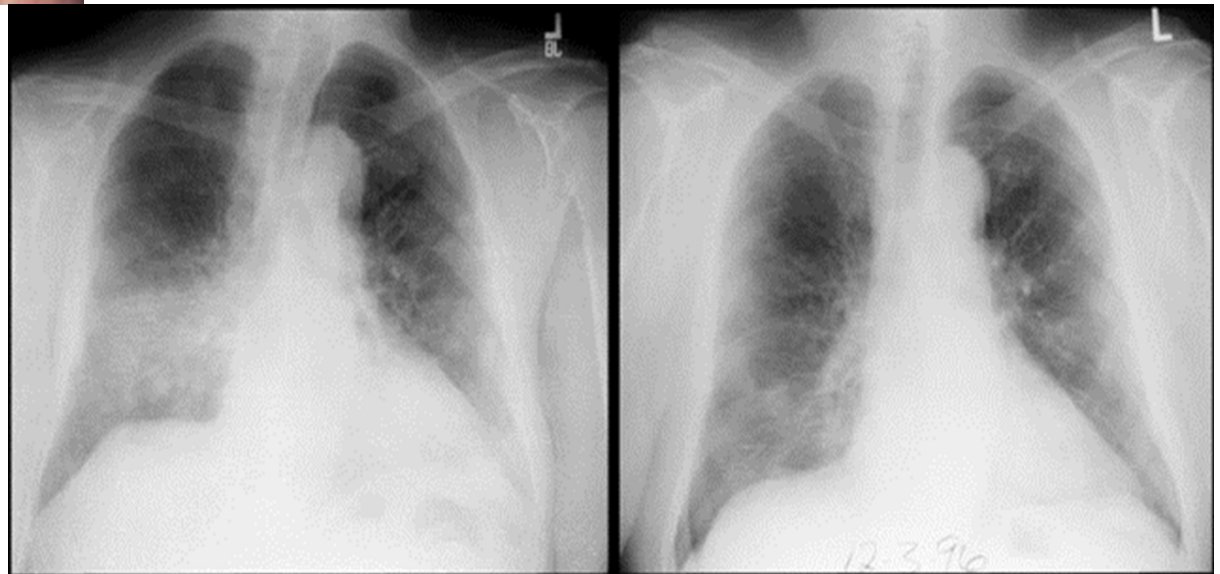
Serious systemic diseases



Wegeners Granulomatosis:

- Small vessel vasculitis
- Granulomatous inflammation with necrosis
- Incidens 1 patient per 100.000 inhabitants
- More common in North Europe
- Typical men, middle age
- Affectation
 - Granulomes
 - 92% ear nose throat
 - 85-90% pulmonary involvement
 - 90% kidney involvement
 - Skin
 - Joints
 - heart etc etc
- One of the diseases classified as **Rapid progressive glomerulonephritis**
- Severe disease 90% mortality without treatment
- Mortality in the acute phase 10-20%

Wegeners Granulomatosis: diagnosis



Saddle nose



Wegeners Granulomatosis: diagnosis



High clinical suspicion

- Pulmonary symptoms
 - Haemoptysis
 - Infiltrates that do not respond to antibiotics
- Kidney symptoms
 - Rapid decline kidney function
 - Increasing creatinine
 - Declining urine output (worse prognosis)
 - Albuminuria/haematuria
 - Positive microscopy with casts
 - **YOU NEED TO ORDER ANCA TITLES**
 - **Contact to nephrologist on call**

Plasmapheresis



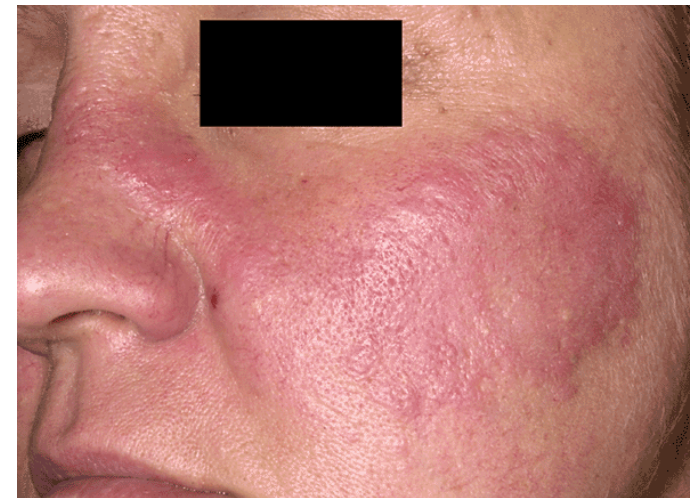
- When we "remove" something from the plasma
 - Myelomatosis with hyperviscosity or kidney affection
 - Wegeners Granulomatosis with kidney affection
 - Anti GBM disease etc
- When we "add" something to the plasma
 - HUS-TTP (adults, not E-coli related)
 - ADAMS 13 factor

Nephrology emergency situation

SLE



- Typical malar rash or skin changes
- Fever
- Malaise
- Thrombocytopenia etc etc
- ANA screening positive
- Albuminuria/Haematuria
- Positive urine microscopy
 - Requires kidney biopsy
 - Nephrologist referral



Contrast nephropathy



- Definition:

Serum creatinin increase of 25% eller $44\mu\text{mol/l}$ from the value before intravenous administration of contrast in the first 3 days after investigation

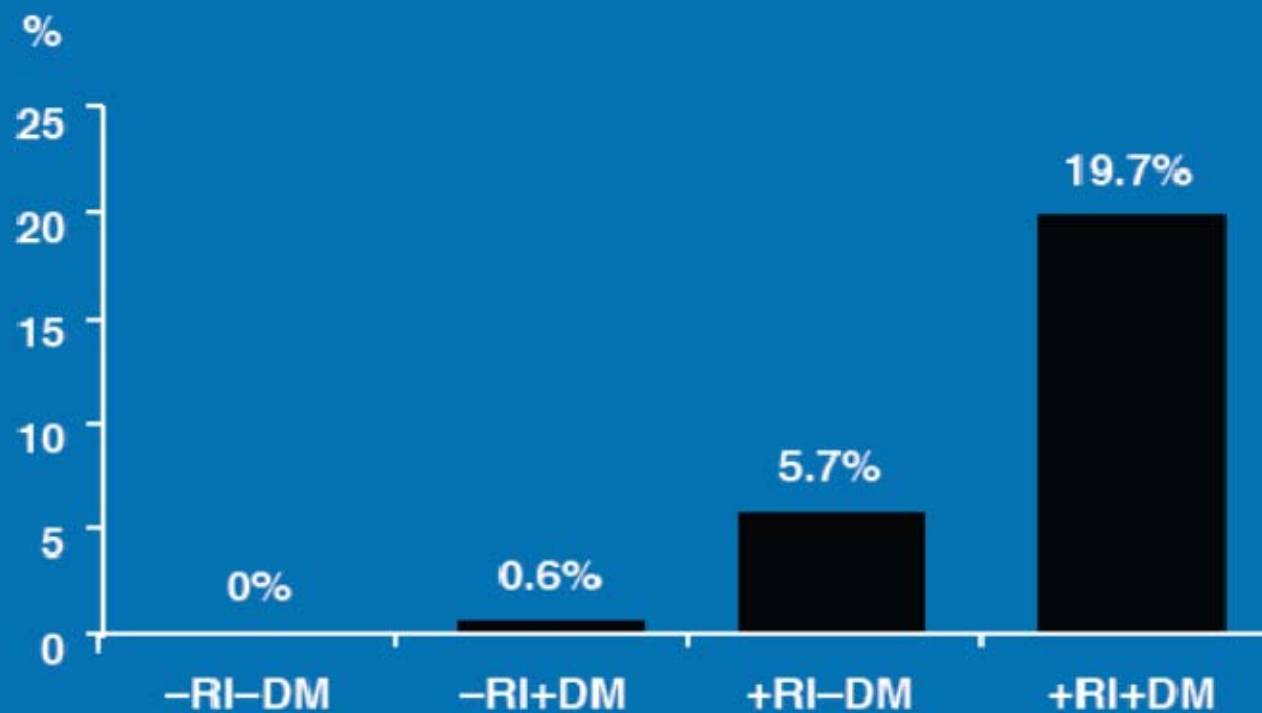
Contrast Induced Nephropathy: CIN

Contrast nephropathy



- CIN is associated with a significant mortality and morbidity
- CIN is the 3rd most frequent cause of ATN amongst inpatients
- Risk for CIN in patients with CKD is 10-44%
- Risk for CIN with patients with a normal kidney function is 5%
- Risk in outpatients is about 11%

Incidence of CIN in patients undergoing cardiac angiography (n=1,196)



Rudnick et al., 1995



” The risk and severity of CIN increases proportionally to the number and severity of the risk factors “



Summary



To identify kidney involvement:

- Creatinine/GFR levels
- Urine dipstick
- Urine microscopy
- Ultrasound

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THANKS

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