

Urinary syndromes

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Introduction

Kidney anatomy

Differential diagnosis of kidney disease

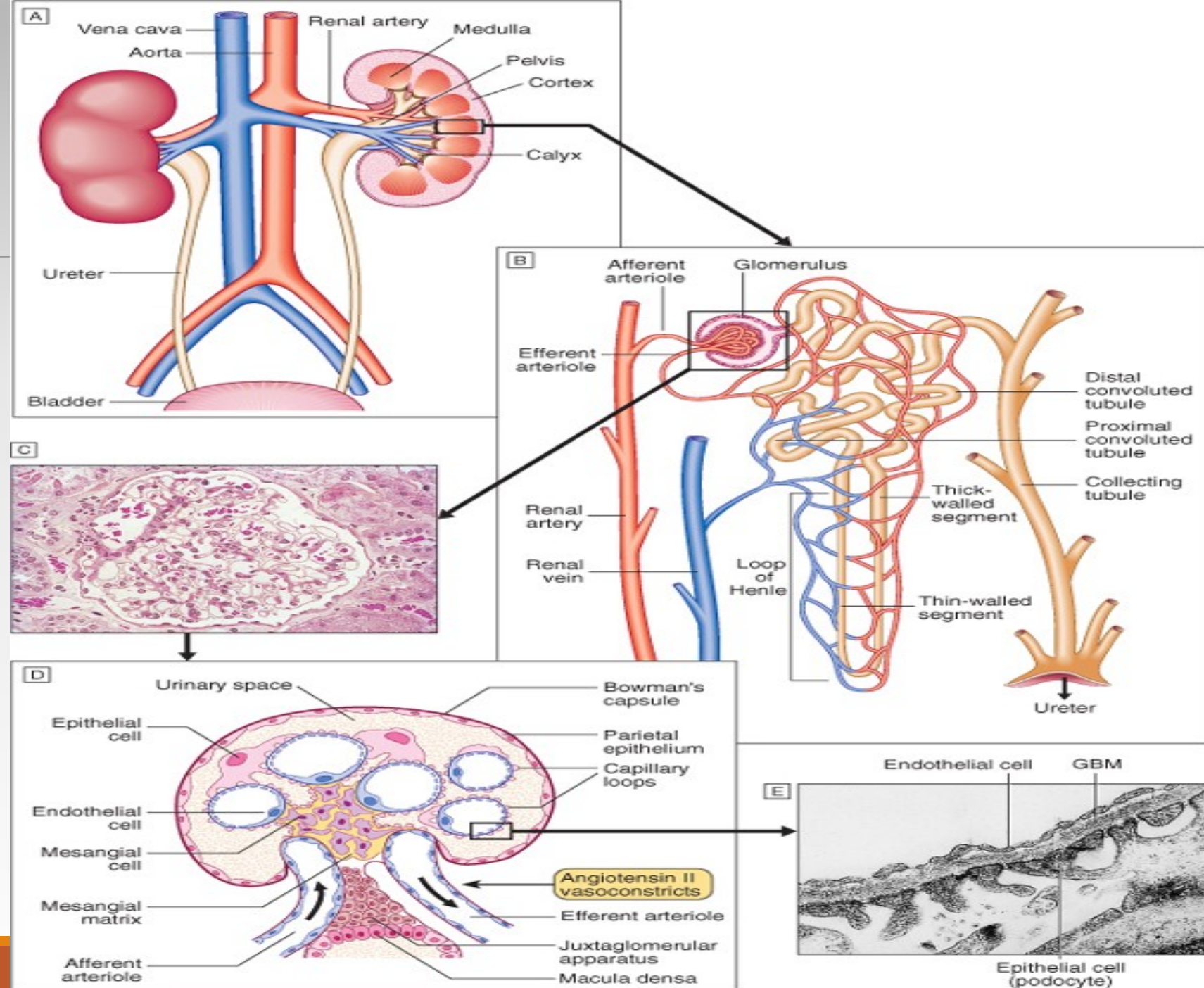
Kidney examination

Urine examination

Urinary syndromes

Diagram of urinary syndromes

Anatomy



Functions of the kidneys

Excretion of ammonium, urea and creatinine (products from protein metabolism)

Excretion of uric acid (products from nuclei acids)

Regulate the body fluid volume and concentration of minerales

- Sodium, Potassium, Chloride, Calcium, Phosphorus, Magnesium
- Under control of many hormonal and haemodynamics signals (RAAS, ADH, volumoreceptors...)

Regulate the acid-base balance (HCO_3^- , H^+)

The kidneys are main source of some hormone (volume and metabolic effect)

- Renin, erythropoetin, calcitriol – vit D3

Signs of renal disease

Early signs:

Albuminuria: ≥ 30 mg/24h **A2**
or albumin/creatinine ratio $\geq 3,0$ mg/mmol

Mild decrease of eGFR: **CKD G2 and G3a**

Oliguria < 500ml/24h urine

Advanced signs:

Proteinuria: ≥ 300 mg/24h **A3**

Oliguria and elevated plasma creatinine

Hypalbuminemia < 35 g/l

Edema

Anuria: 0-100ml/24h urine

Investigation of renal and urinary tract disease

Personal history

Physical examination

Laboratory work up (creatinine, eGFR, potassium, albumin, immunology)

Noninvasive imaging techniques (ultrasound, IVU, pyelography, CT, MRI, radionuclide)

Invasive techniques (cystoscopy, pelvi-ureteroscopy, angiography, renal biopsy)

Urinalysis

Physical examination

Palpation:

Bimanual palpation
(Israeli's touch)

Healthy kidney is not palpable



Physical examination

Palpation:

Ureteral points

Pain during renal colic



Physical examination

Percussion:

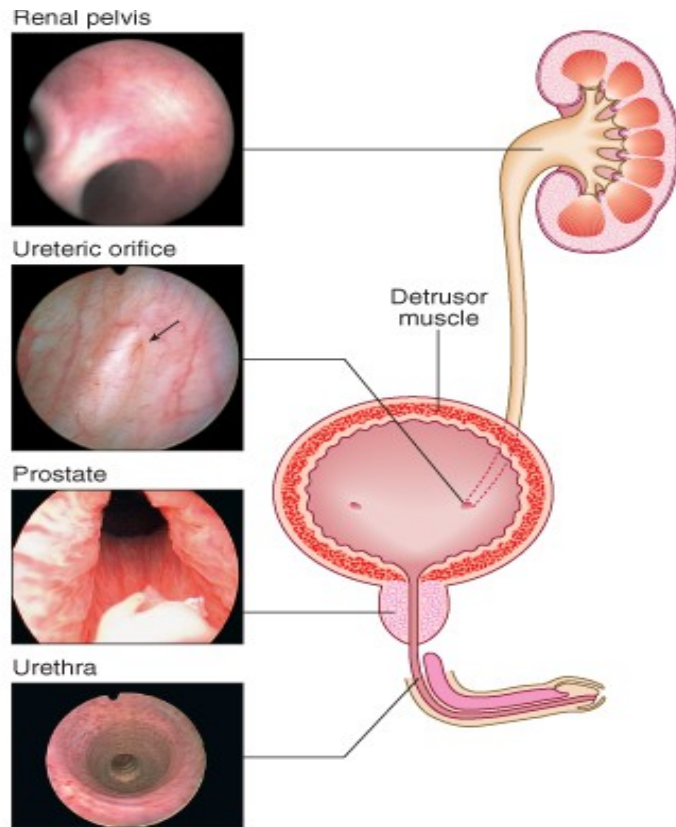
Tapottement

Pain in inflammation

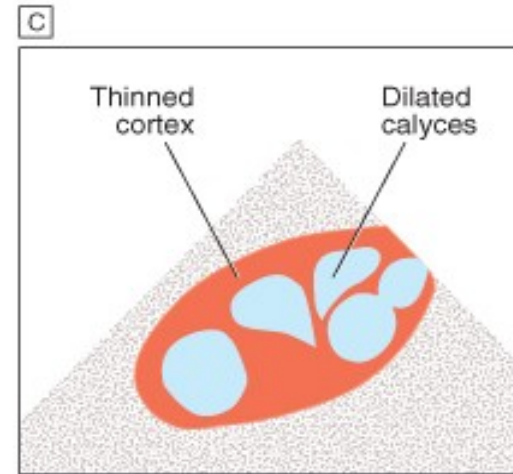


Some imaging techniques

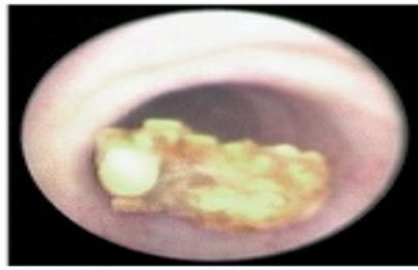
Endoscopic view of urinary tract



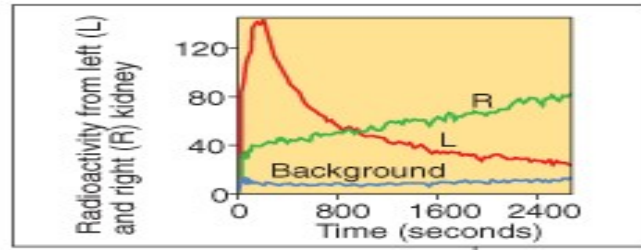
Ultrasonography



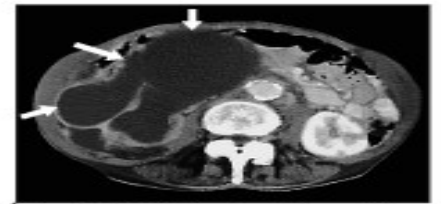
Some imaging techniques



Stone in ureter (ureteroscopy)



Isotope renogram in right PUJ obstruction



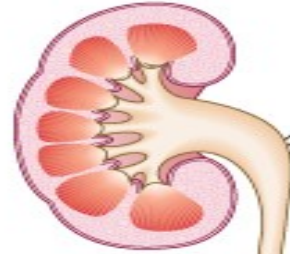
Right PUJ obstruction with dilated renal pelvis (arrows) (CT)



PUJ obstruction (antegrade pyelogram)



Ureterocele (IVU)

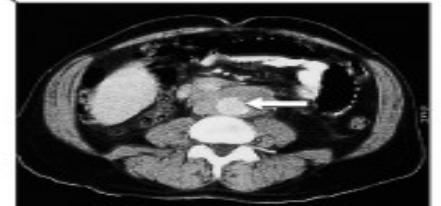
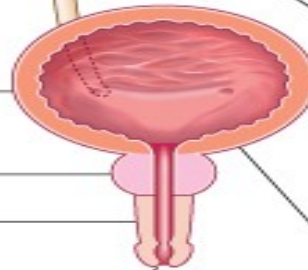


Transitional cell carcinoma of ureter (retrograde pyelogram)

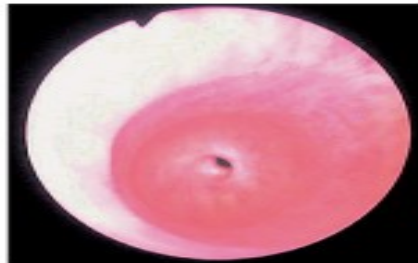
Ureteric tumour



Benign prostatic hypertrophy



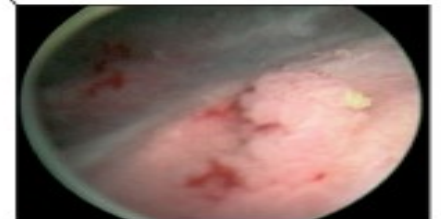
Retroperitoneal fibrosis (CT) with dilated ureter (arrow)



Urethral stricture



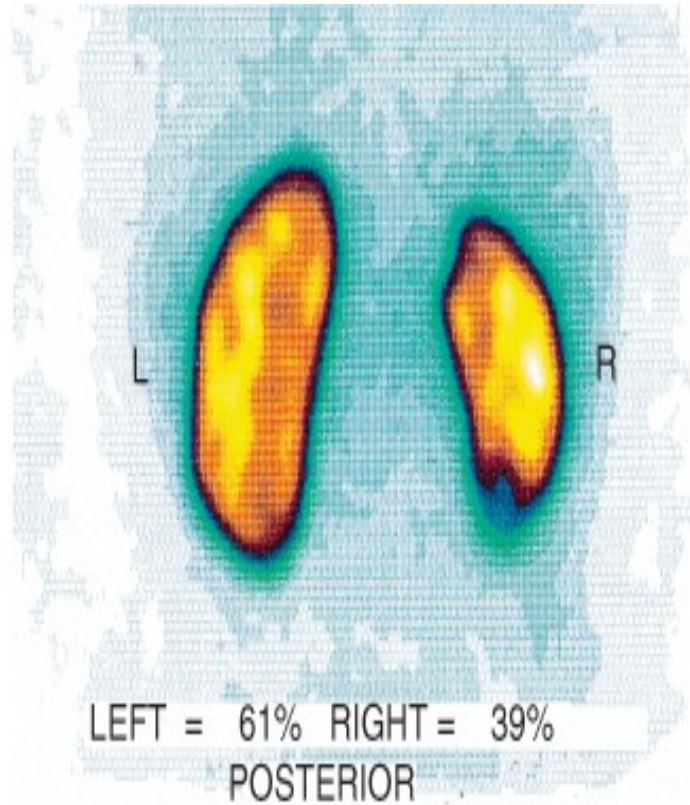
Meatal stenosis



Transitional cell carcinoma of bladder

Some imaging techniques

Dimercaptosuccinic acid labeled by ^{99m}Tc DMSA renogram



Retrograde pyelography



Renal biopsy

Obtaining a tissue sample - examination microscopically, histological conclusion = subsequent treatment

It is performed with a needle under sonographic control

There must be normal blood pressure and blood coagulation testing, monitoring 24h in the hospital

Indication:

- Suspected of rapidly-progressing glomerulonephritis (GN)
- Proteinuria and hematuria of unclear origin
- Nephrotic syndrome of unclear cause
- Acute renal failure of unclear cause
- Suspected kidney disease in systemic diseases
- Rapid worsening of renal failure in treated glomerulopathy
- Suspected kidney transplant rejection

Differential diagnosis of acute kidney injury (AKI)

Pre-renal

Decrease of intravascular volume (hypotension) (fluid)

Renal artery stenosis

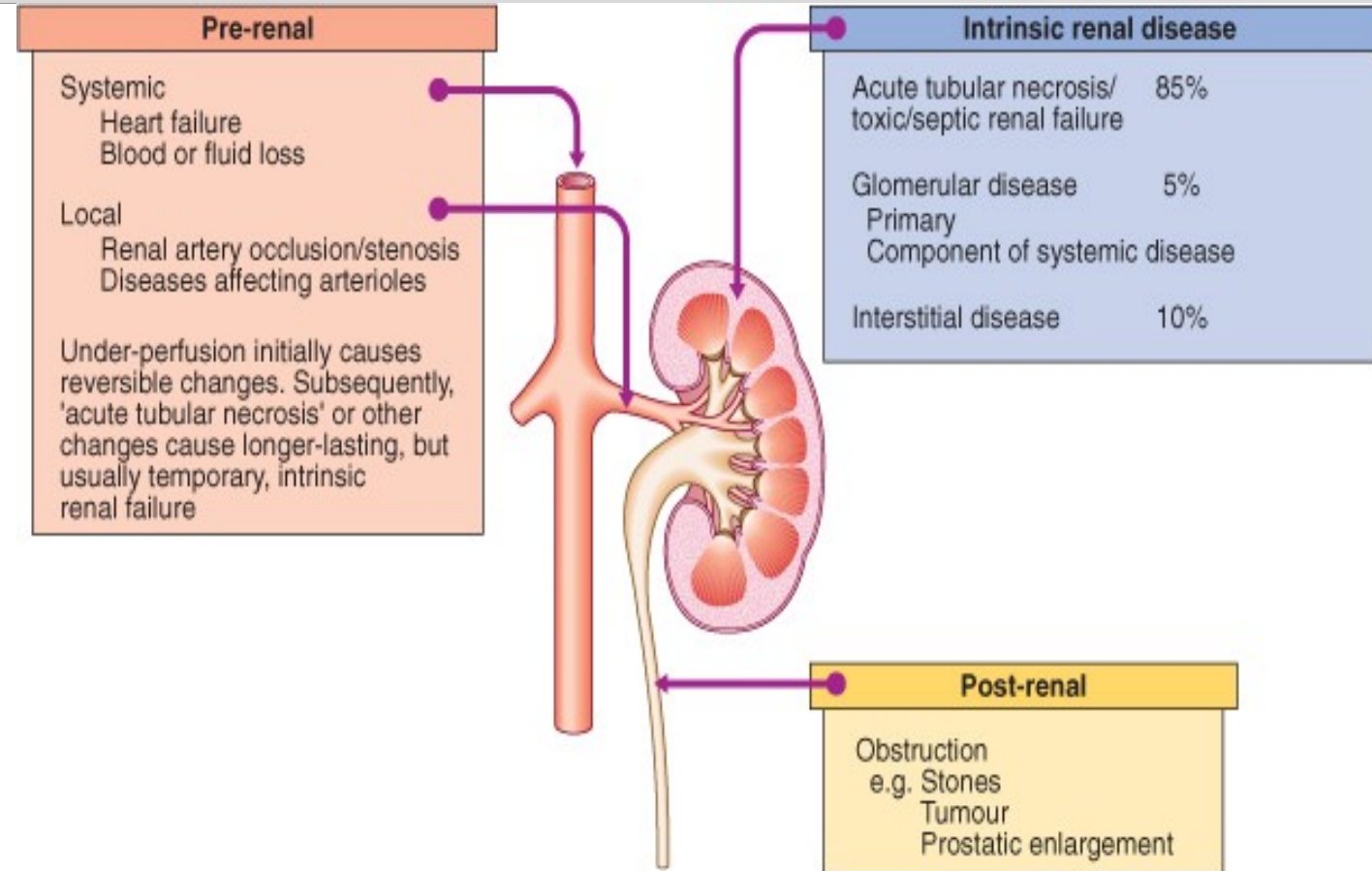
Heart failure (diuretics)

Renal

Renal parenchymal disease (nephrological care)

Post-renal

Obstruction (urological care)



Differential diagnosis of chronic kidney disease (CKD)

Pre-renal

Hypertension atherosclerotic disease (large artery)

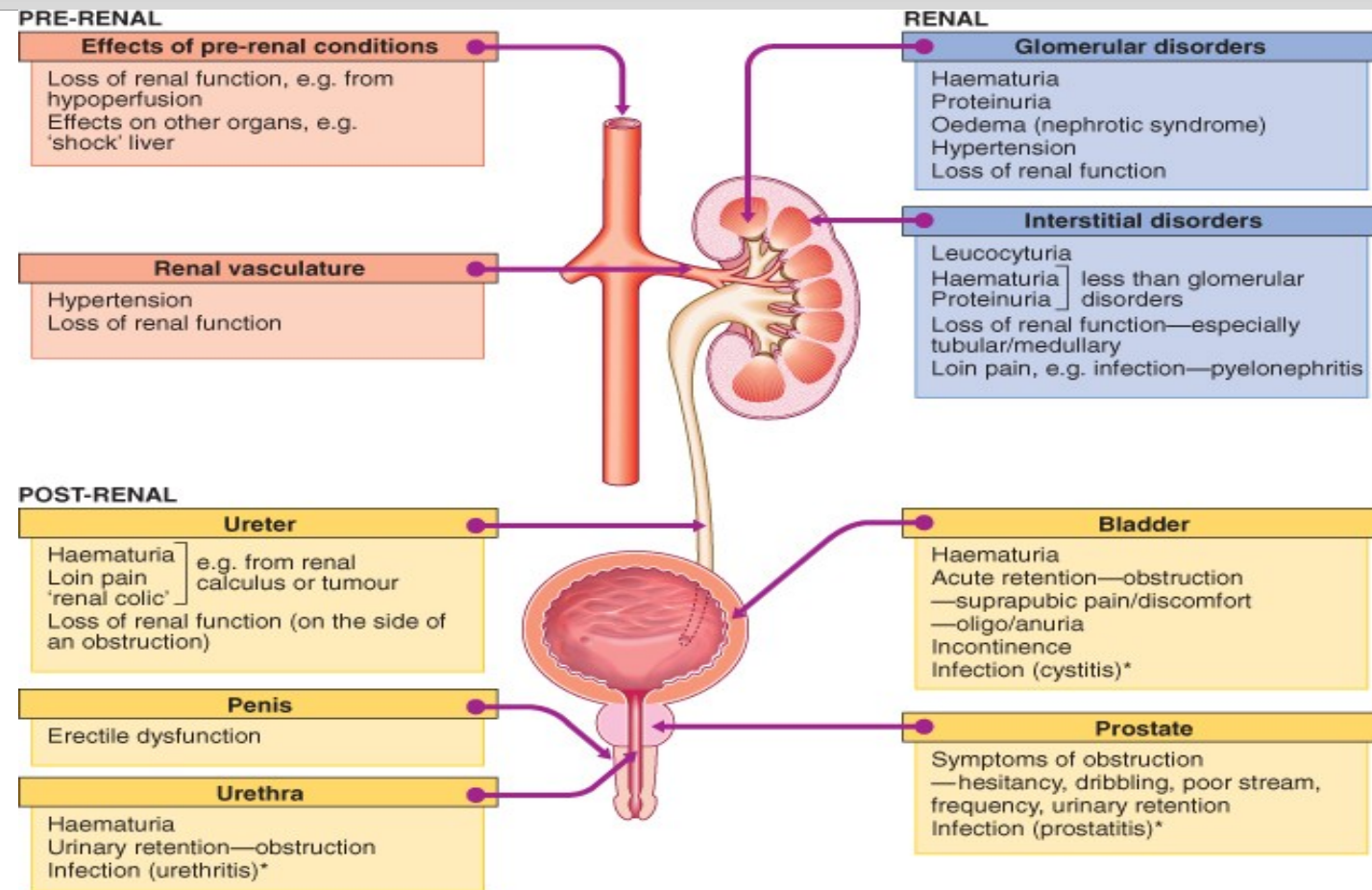
Renal

Glomerular disorders (core, GN, diabetic nephropathy, hypertension – small arteries)

Interstitial disorders (medulla, tubuli, renal pelvis)

Post-renal

Obstruction (urological care, renal calculi, tumours, prostate enlargement, infection)



Urine examination

Preparation:

Disinfection around the urethra

Medium urine flow

Catheterized urine (females)

Morning urine (more concentrated)

Collected urine for 3, 10, 24 hours

Urine chemically: (paper, instrument)

PH

Glycaemia

Proteins

Hemoglobine

Bilirubine

Urobilinogene

Ketones

Urine examination

Urinary sediment:

Addis (10 hours night urine)

- Erythrocyte 1-2 mil/24h
- Leukocyte 1-4 mil/24h
- Casts 100 000/24h

Hamburger (3 hours urine)

- Erythrocyte 2000/min
- Leukocyte 4000/min
- Casts 60-70/min

Microscopic examination

Hematuria (blood in urine)

Leukocyturia (white blood cells, inflammation)

Cylinders (castings of precipitate from canals)

Crystals (depends on PH urine, stones)

Microbiological examination of urine

Sampling of morning urine

Careful disinfection of the external orifice of the urethra

Medium current flow/catheterized urine

At room temperature as soon as possible send for culture examination

Culture media, bacterial type/antibiotic sensitivity, up to 24 hours, $> 10^5$ bacteria

The most common pathogens: E coli, enterobacter, klebsiela

Syndromes

Leukocyturia

Proteinuria

Hematuria

Leukocyturia

Presence of white blood cells in urine

- Urinary tract infections (UTI)
- women
- the elderly
- diabetes
- pregnancy
- stones
- Pus in urine (pyuria, turbid urine = bacterial inflammation)

Sterile urine leukocyturia (culture negative)

- Gonorrhoea
- Trichomonas, TBC, fungi, mycoplasmas, chlamydia
- Tubulointerstitial nephropathy
- Prostate or bladder cancer
- Injury of urethra
- Urinary stones, vesicoureteral reflux

Proteinuria

Urine protein quantitatively:

Albuminuria (30-300mg/24h)

Proteinuria (over 300mg/24h)

Small up to 1.5 g/24h

Medium 1,5 to 3.5 g/24h

Big above 3.5 g/24h

Selective: mainly albumin

Non-selective: globulins, fibrinogen

Urine protein according to origin:

Renal

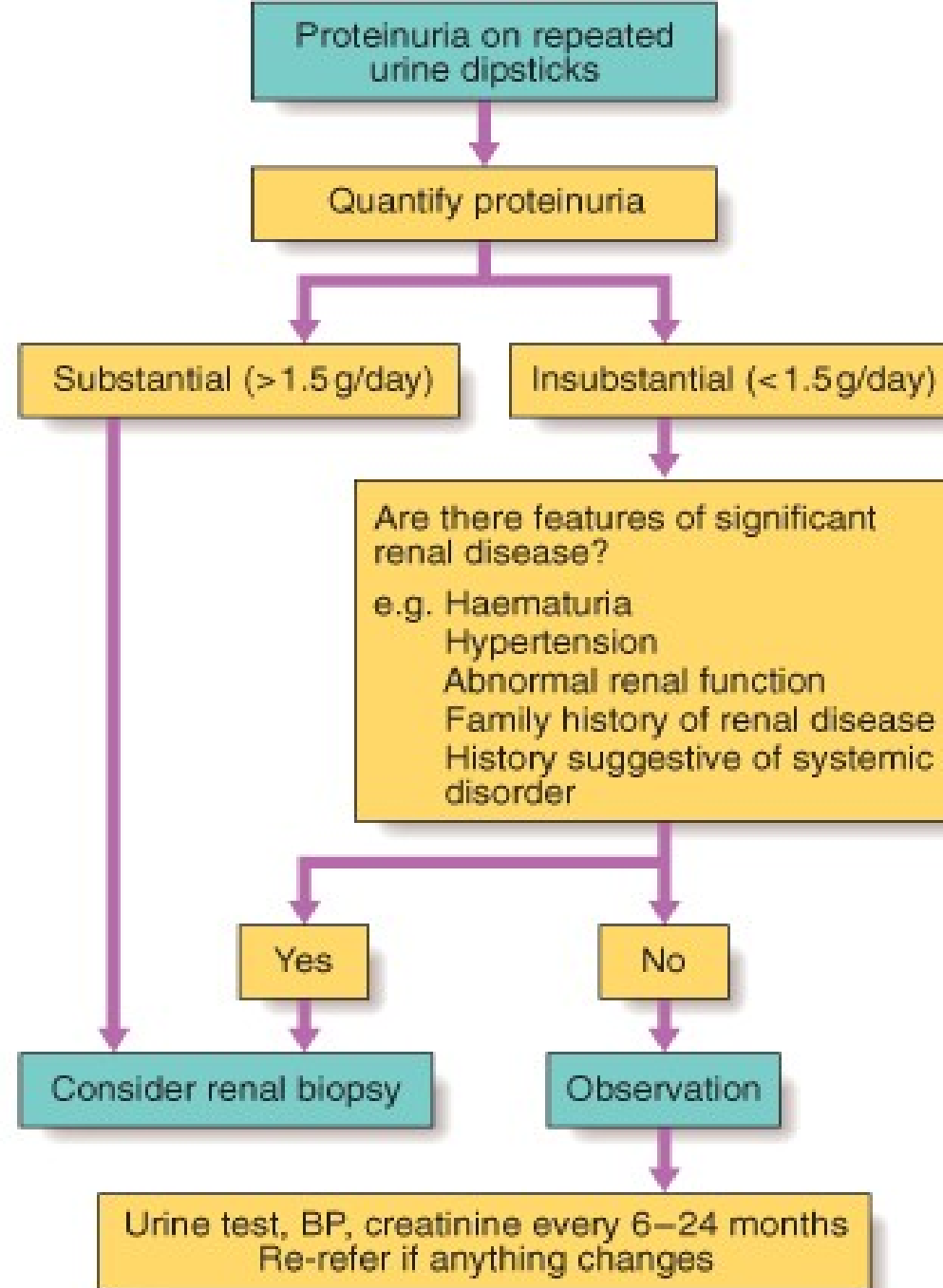
Glomerular (diseases of the ball)

Tubular (canal diseases)

Prerenal (increased serum protein concentrations – paraprotein, Bence-Jones)

Postrenal (tumors, urinary tract inflammation, heart failure)

Differential dg of proteinuria



Hematuria

Microscopic:

(It does not change the color of the urine)

Phase contrast (GN x urinary tract)

Glomerulonephritis (+ protein, cylinders)

Urinary stones, tumors

Infections (+ leukocytes + bacteria)

Interstitial nephritis

Infectious diseases other than kidneys

After extreme physical stress

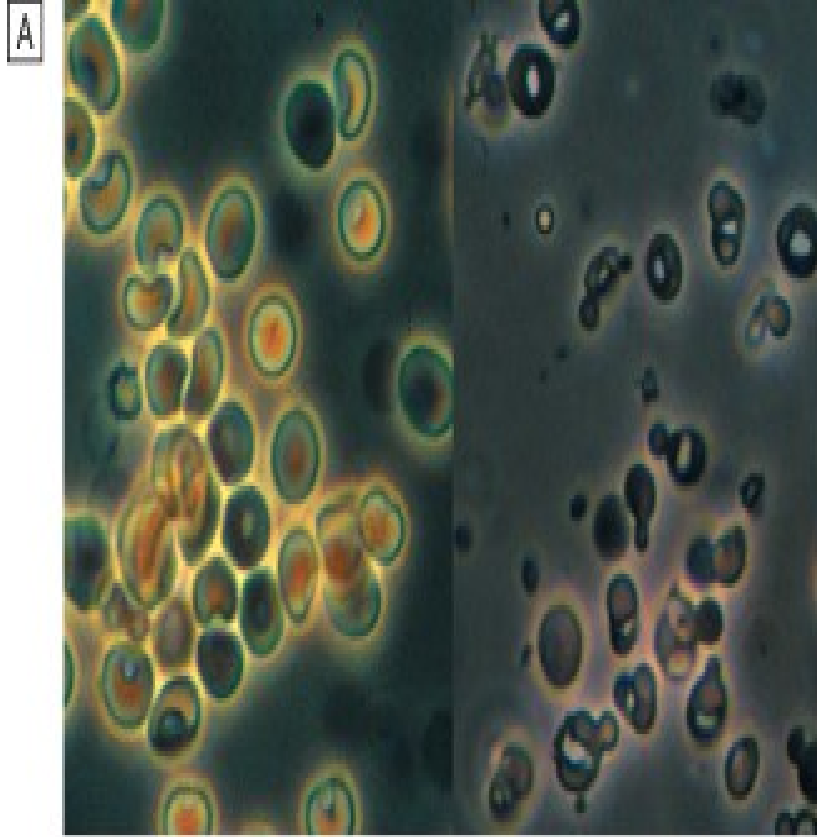
Macroscopic:

(Changes color, 1 ml or more of blood/liter of urine)

False (porphyry, beetroot, rifampicin !!)

- Urinary stones
- Tumors
- Trauma
- TBC (+ leukocyturia without bacteria)
- Kidney cysts
- Cystitis, infection
- Clotting disorder (blood diseases)

Hematuria

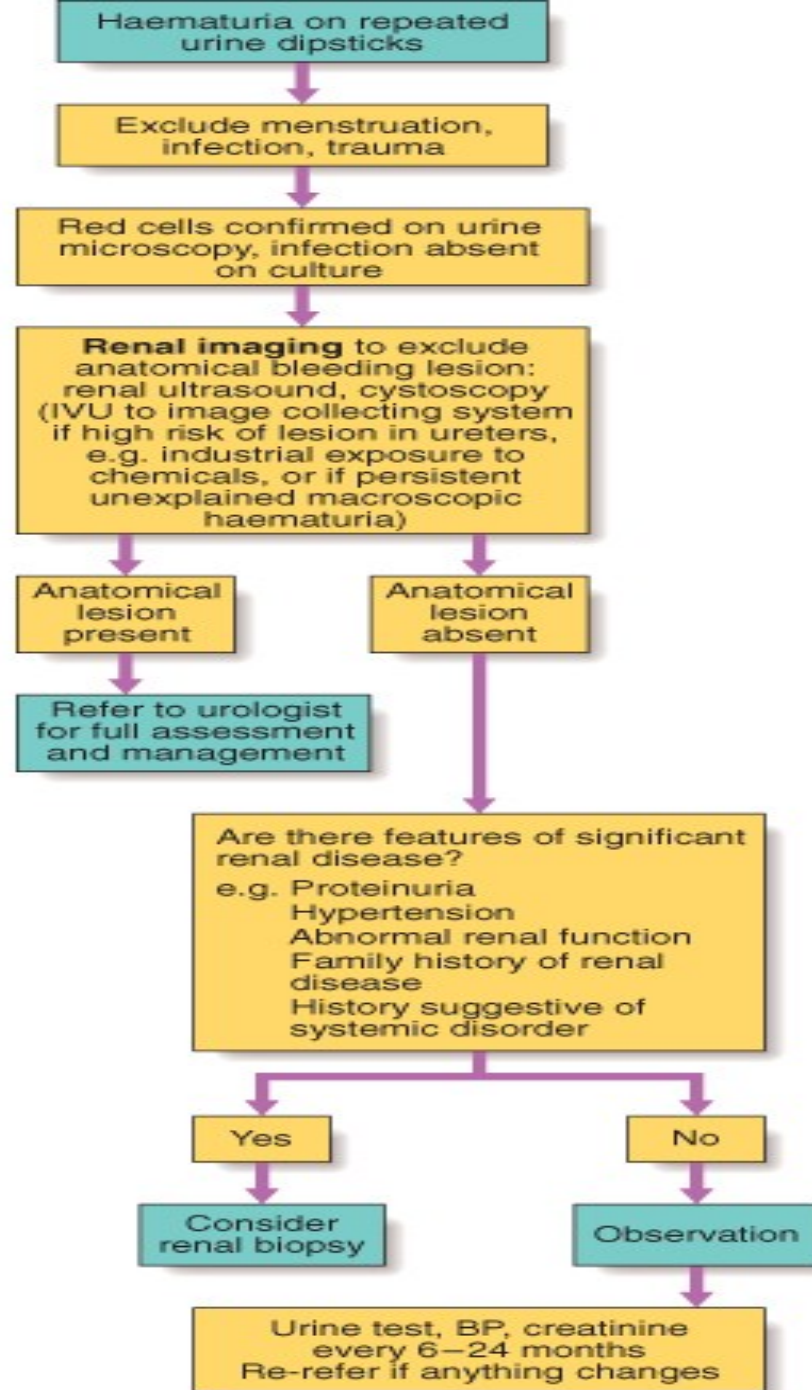


Phase contrast erythrocytes

Left: normal erythrocytes from urine tract

Right: damaged erythrocytes after passing through the glomerulus - GN

Differential dg of hematuria



Urinary syndromes

1. Small isolated proteinuria
2. Small isolated hematuria
3. Big isolated selective proteinuria
4. Big non-selective proteinuria
5. Proportional proteinuria and hematuria
6. Macroscopic hematuria

1. Small isolated proteinuria

Amount of protein **up to 2g/24h.**

It can be intermittent (stress, orthostatic) or permanent.

It is typical for:

Diabetic nephropathy, early stage

Congestive heart failure,

Benign nephrosclerosis,

Remission glomerulonephritis,

Hypertensive renal disease.

2. Small isolated hematuria

Microscopic hematuria and proteinuria $\leq 300\text{mg}/24\text{ hr}$.

It is typical for:

IgA - nephropathy

Vasculitis

Alport's syndrome

Thin basal membrane nephropathy

3. Big isolated selective proteinuria

Proteinuria > **5g/24h**

Erythrocytes are not present or only in negligible quantities.

It is clearly diagnostic for minimal glomerular changes in Nephrotic syndrome.

4. Big non-selective proteinuria

Proteinuria > **5g/24h** and **mild hematuria**

It is typical for:

membranous and membranoproliferative glomerulonephritis (GN)

diabetic nephropathy

amyloidosis

focal segmental glomerulosclerosis as part of Nephrotic syndrome.

5. Proportional proteinuria and hematuria

Membranoproliferative and mesangioproliferative GN

3 types according to proteinuria and erythrocyturia:

- Small proteinuria $\leq 2\text{g}/24$ hours with microscopic hematuria
- Medium proteinuria 2-5 g/24 h, micro- to macroscopic hematuria
- Big proteinuria $> 5\text{g} / 24$ hours with macroscopic hematuria

6. Macroscopic hematuria

Macroscopic hematuria with mild proteinuria $<1.5\text{g}/24\text{h}$

In some acute intestinal or respiratory diseases

In IgA-nephropathy

In thin basal membrane nephropathy

Clinical syndromes

Combination of extrarenal symptoms, urinary findings, severity of the renal disorder and rate its progression.

Clinical syndromes

Syndrome	Diagnostic symptoms	Clinical symptoms
Asymptomatic urine abnormality	Small proteinuria, hematuria, sterile pyuria	
Acute nephritic syndrome (GN)	Proteinuria, hematuria, leukocyturia, cylinders, damaged erythrocytes	Edema, hypertension, oliguria, azotemia,
Acute kidney injury (AKI)	Increase of plasma urea, creatinine, oligo/anuria	Edema, hypertension, proteinuria, hematuria, pyuria
Chronic kidney disease (CKD)	Azotemia more than 3 months, anemia, ↑ phosphates	Hypertension, proteinuria, edema hematuria, polyuria, nycturia
Nefrotic syndrome	Proteinuria > 3,5g/d, dyslipidemia, hypalbuminemia	Edema
Urinary tract obstruction	Hydronephrosis, urinary retention, oliguria, anuria, azotemia	Dysuria, hematuria, pyuria
Urinary tract infection (UTI)	Bacteriuria > 10 ⁵ , pyuria, ↑ CRP, polakisuria	Febrilie, smal proteinuria, hematuria, azotemia
Renal tubular syndromes	Electrolyt disorders, metabolic acidosis, polyuria	Tubular proteinuria, hematuria
Uremic syndrome	Azotemia > 3M, dyspeptic disorders, multiorgan disorders, Kussmauls breathing, prutitus	Edema, hypertension, anemia
Renal stones	Renal colic, hydronephrosis	Hematuria, pyuria

Clinical conclusions

The standard is the examination of urine and urinary sediment

- Elementary with paper stick, if positive quantitatively
- Morning urine sample

When finding erythrocytes and proteins we think of glomerulopathy

- Phase contrast microscopy and quantitative examination

When leukocytes and bacteria are found - UTI

- Bacteriuria itself is often a contamination