



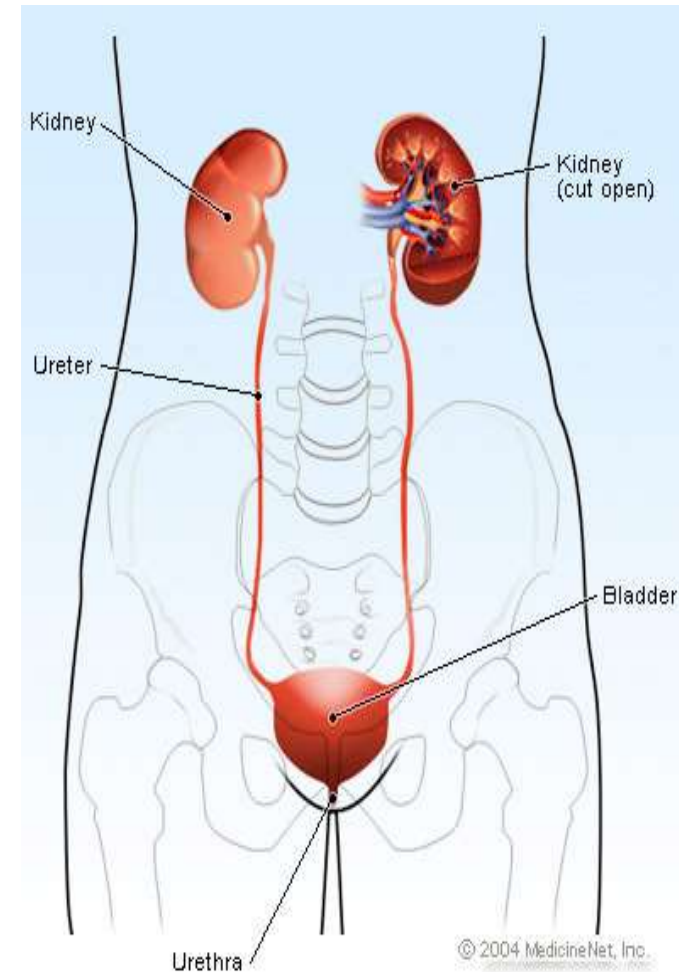
SIGNS AND SYMPTOMS OF URINARY SYSTEM DISEASES

LECTURE IN INTERNAL MEDICINE PROPAEDEUTICS

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Plan of the lecture

- The importance(value) of a human kidney
- Reminder
 - how do kidneys work
 - the primary function
 - purpose
- History-taking
- Patient's examination
 - clinical
 - laboratory
 - instrumental
- Spectrum of urinary system diseases
- Urinary system diseases' symptoms and syndromes
 - symptoms
 - urinary syndrome
 - nephrotic syndrome
 - nephritic syndrome
 - urinary tract obstruction syndrome
 - hypertensive syndrome
- Glossary of urinary pathology' terms

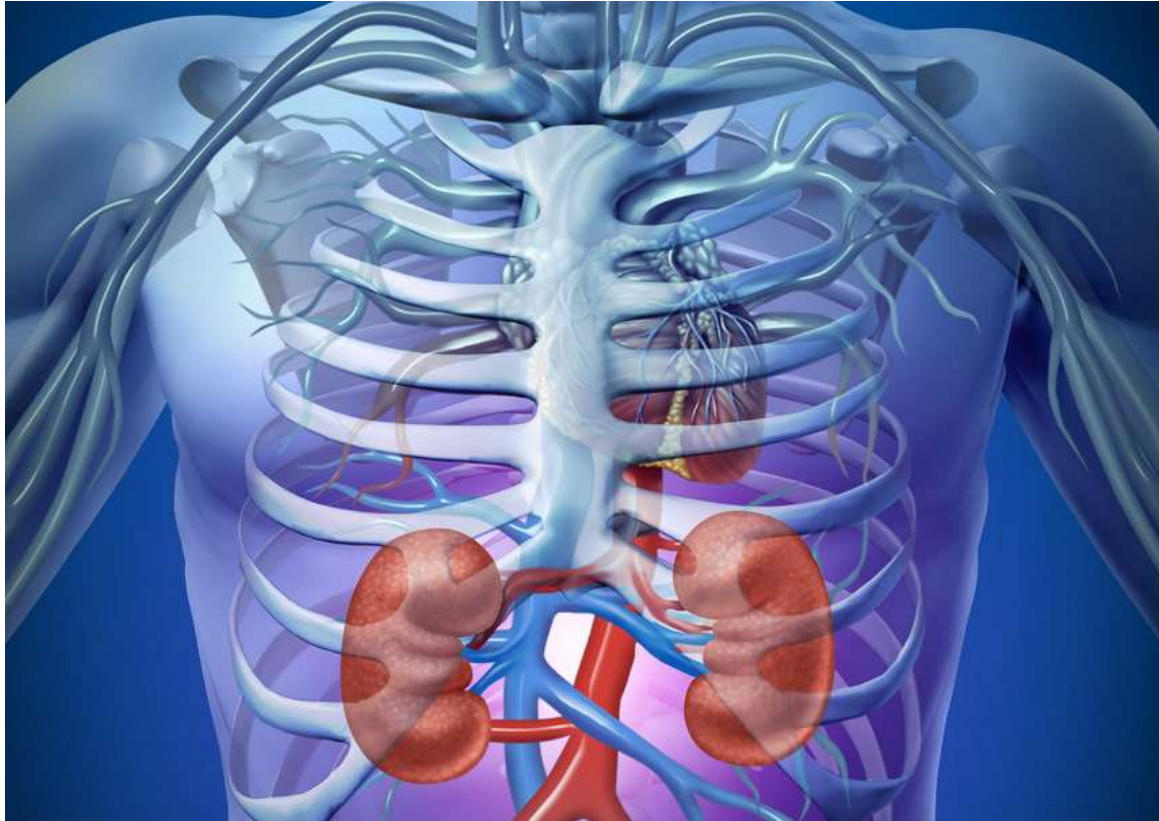


The price of a human kidney

The human kidney is the body's filter. It cleans 180 liters of liquid per day, retaining the good stuff and expelling the bad. Most fortuitously, humans are born with two kidneys. If one of them becomes damaged, the other one can pick up the slack. If both your kidneys fail, however, your body will be filled with harmful toxins. Without medical intervention, **such patients** will die within several weeks



Reminder: how kidneys work



<https://www.youtube.com/watch?v=aj-gbnOB4jM>

Reminder: the primary urinary system functions

- maintain homeostasis
- regulate fluids and electrolytes
- eliminate waste products
- maintain blood pressure (BP)
- involved with red blood cell (RBC) production
- involved with bone metabolism

Reminder: purpose

- General evaluation of health
- Diagnosis of disease or disorders of the kidneys or urinary tract
- Diagnosis of other systemic diseases that affect kidney function
- Monitoring of patients with diabetes
- Screening for drug toxicity (eg. sulfonamide or aminoglycosides)

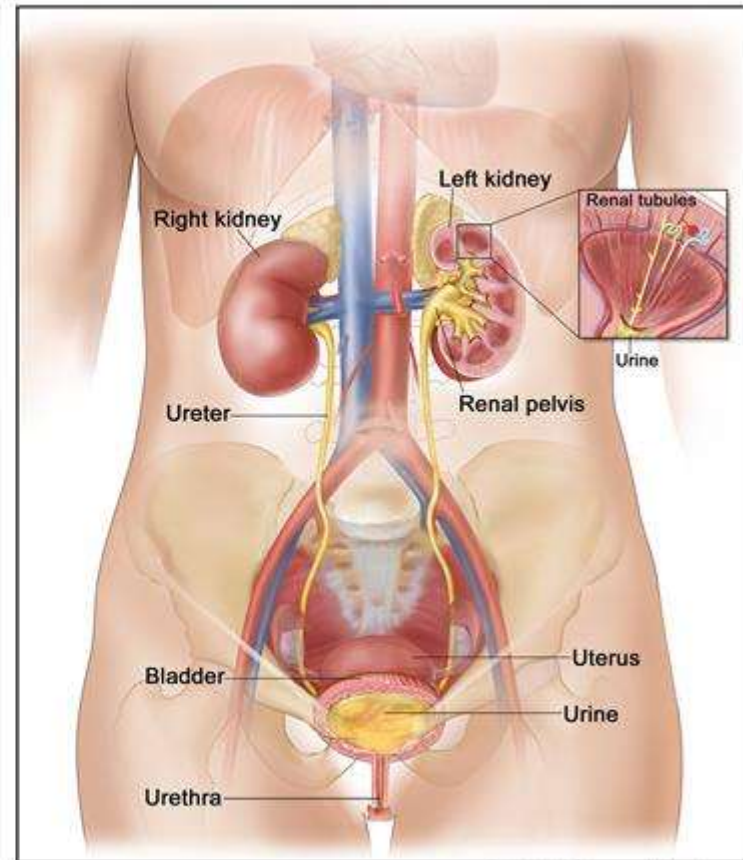
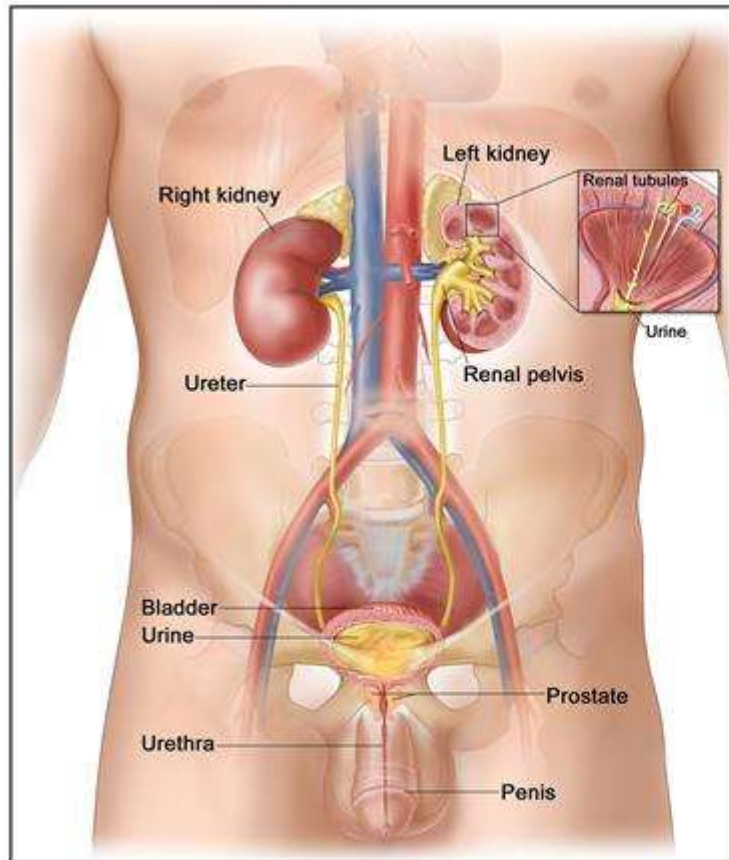
History-taking

(patient's interviewing)

- gathering of information
- patient's narrative
- biomedical perspective
- psychosocial perspective
- context

Patient's clinical examination

men and women' urinary tract

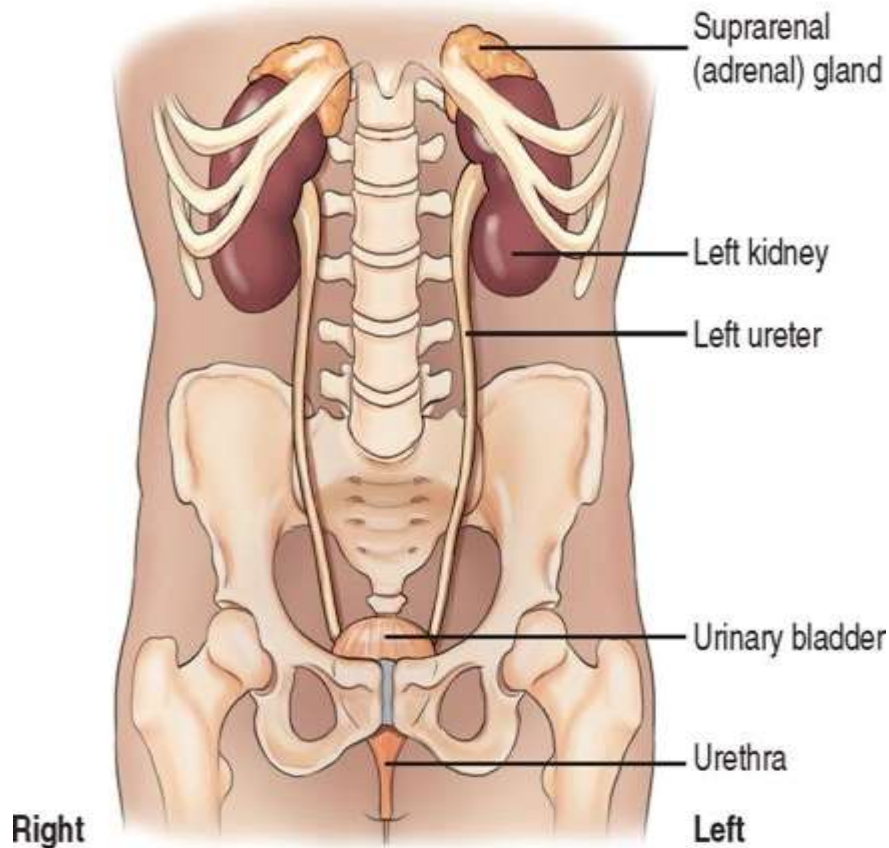


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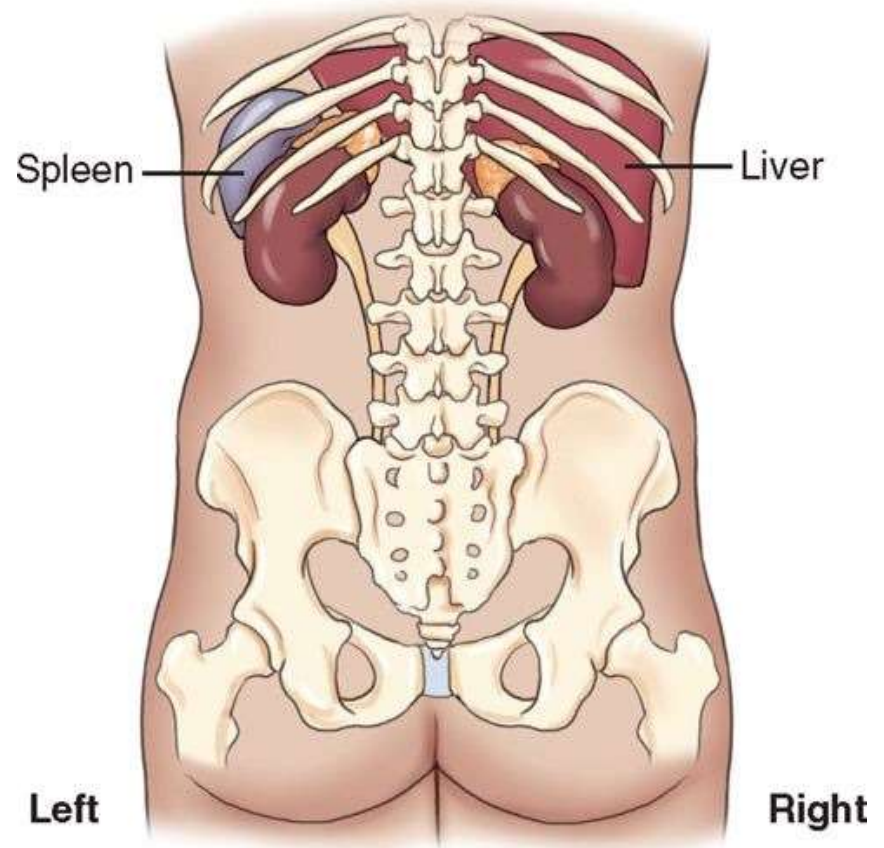
Patient's clinical examination

kidney skeletotomy

Anterior view



Posterior view



Patient's clinical examination

palpation of the right kidney



Physician Assistant Physical Assessment Ii

Patient's clinical examination

kidney pain localization



[Kidney Pain](#)

Patient's clinical examination

physical assessment: inspection

- general state of health- fatigue, lethargy, diminished alertness
- skin- pallor, yellow-gray, excoriations, changes in turgor, bruises, texture(e.g. rough, dry skin)
- mouth: stomatitis, ammonia breath
- face, extremities- generalized edema, peripheral edema, bladder distention, masses, enlarged kidney
- abdomen-abdominal contour for midline mass in lower abdomen (may indicate urinary retention) or unilateral mass
- weight: weight gain secondary to edema, weight loss and muscle wasting in renal failure

Patient's clinical examination

physical assessment: percussion, palpation, auscultation

- kidney - **percussion** (to detect areas of tenderness by costovertebral test, normally will feel a thudding sensation or pressure but not tenderness) and **palpation** (contour, size, tenderness, and lump) - in adult ordinary(usually) **it** won't be palpable because of their deep location. Presence of tenderness and pain indicates a kidney infection or polycystic kidney disease.
- bladder - **percussion** of the area over the bladder (5cm) above the symphysis pubis to detect difference in sound, percussion toward the base of the bladder, normally produces a tympanic sound, **palpation** normally gives firm and smooth feelings, in adults bladder may not be palpable
- urethral meatus - **inspection** for swelling, discharge and inflammation
- **auscultation**: the abdominal aorta & renal arteries are auscultated for a bruits, which indicate impaired blood flow to the kidneys

Patient's laboratory examination

blood and urine tests

Blood

- Serum Creatinine (0.5 – 1.2 mg/dl)
- Blood Urea Nitrogen (10-20 mg/dl)
- BUN/Creatinine Ratio (12:1 to 20:1 mass)

Urine

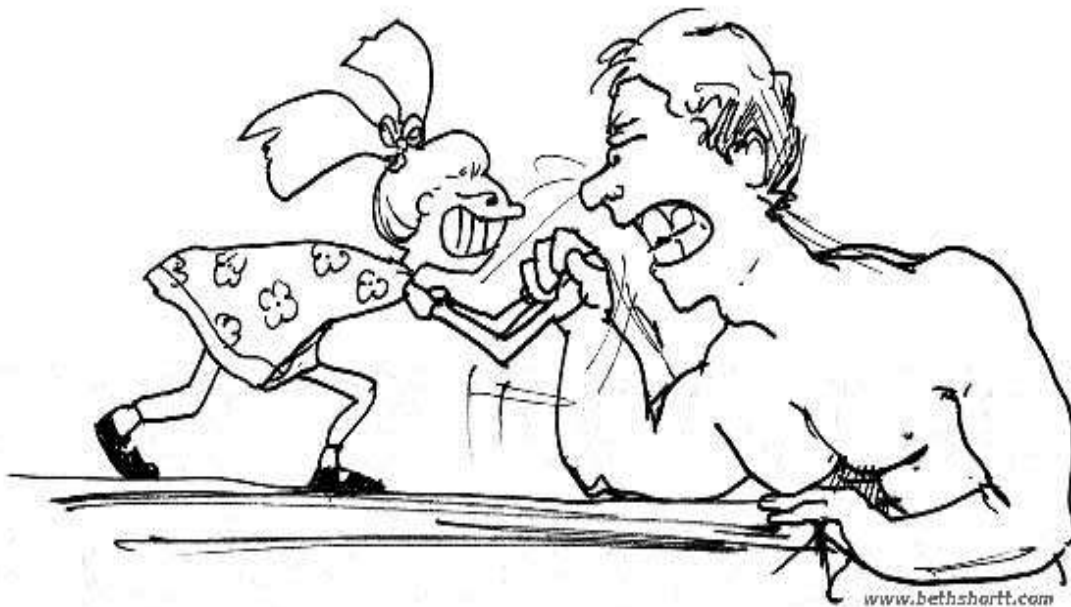
- Urinalysis
- Urine for C&S
- Composite (e.g., 24hr) urine collections
- Creatinine Clearance Test (is used to estimate Glomerular Filtration Rate)
- Urine Electrolytes
- Osmolality (plasma; urine)



Patient's laboratory examination

Glomerular Filtration Rate (GFR) is preferable to creatinine to evaluate the kidney function

- creatinine comes from muscle
- the normal creatinine ranges depend on body (muscle, lean) weight which in turn also depends on age and gender



The little girl has normal kidney function and a creatinine level 6 mg/dL

The body-builder has normal kidney function and a creatinine of 12 mg /dL

For the girl, a creatinine of 12 mg/dL would be very poor kidney function.

Patient's laboratory examination

Glomerular filtration rate (GFR) and estimated GFR (eGFR)

- GFR is a test of how much the kidneys are filtering
- Norm = about 100 mL/min (This means that the kidneys are removing all the creatinine found in 100mls of blood every minute)
- Measured GFR - Injecting a tiny amount of a radioactive substance and measuring how quickly it disappears from the blood, or appears in the urine, is used to calculate GFR
- eGFR - Using blood tests, age, sex, and sometimes other information to estimate the GFR from the MDRD equation (eGFR). This isn't as good as measuring it, but is much simpler as it requires just one blood test.
- Creatinine clearance (blood creatinine measurements by collecting urine for 24 hours and measuring how much creatinine is in the urine at the same time as finding out how much is in the blood. *(If any urine produced during the 24 hours is not collected the result will not be accurate).*

Patient's laboratory examination

equations for eGFR and Ccr

– Abbreviated MDRD (Modification of Diet in Renal Disease) equation for eGFR

- $\text{eGFR (ml/min/1.73 m}^2\text{)} = 186 \times (\text{S.cr})^{-1.154} \times (\text{age})^{-0.203} \times (0.742 \text{ if female}) \times (1.210 \text{ if Black})$

Normal GFR is about 100ml/minute/1.73m²

– Cockcroft-Gault equation (in fact gives the creatinine clearance (CCr))

- $\text{CCr (ml/min)} = (140 - \text{age}) \times \text{lean body weight (kg)} \times 0.85 \text{ (if female)} / 72 \times \text{S.cr (mg/dl)}$

Normal creatinine clearance is about 100ml/minute

Patient's laboratory examination

staging of CKD based on eGFR

Stage	eGFR (ml/min)	Description
1	>90	Damage with normal or increased GFR
2	60-89	Mild decrease in GFR
3A	45-59	Moderate decrease in GFR
3B	30-44	Moderate decrease in GFR
4	15-29	Severe decrease in GFR
5	<15	Kidney failure
5D	<10	Dialysis

Patient's laboratory examination urinalysis



<https://www.youtube.com/watch?v=6TCIOB1vUvI>

Patient's laboratory examination

urinalysis

- collection of urine specimens
 - first voided morning (most common)
 - random (for emergency)
 - clean-catch, midstream (for urine culture)
- Attention:* need to be examined within 1 hour
- urine specimens examination
 - physical (appearance, volume, specific gravity (SG))
 - chemical
 - microscopic examination
 - urine for culture and sensitivity

Urine specimens examination

physical appearance

- Color
 - normal, pale to dark yellow (urochrome)
 - abnormal
 - some drugs cause color changes
 - red urine (hematuria, hemoglobinuria, myoglobinuria, pseudohematuria)
 - yellow-brown or green-brown urine (bilirubin: obstructive jaundice)
- Clarity
 - normal, clear
 - abnormal, cloudy
 - crystals or nonpathologic salts
 - phosphate, carbonate in alkaline urine
 - uric acid in acid urine
 - various cellular elements (leukocytes, RBCs, epithelial cells)

Urine specimens examination

physical appearance: red urine

- microscopic hematuria (urinary tract source (urethra or bladder, prostate, ureter or kidney), non-urinary tract source (vagina, anus or rectum))
- pseudohematuria (myoglobinuria, hemoglobinuria, phenolphthalein laxatives, phenothiazines, porphyria, rifampin, pyridium, bilirubinuria, phenytoin, pyridium, red diaper syndrome, foods (beets, blackberries, rhubarb))
- causes of asymptomatic gross hematuria (acute cystitis, bladder cancer, benign prostatic hyperplasia, nephrolithiasis, benign essential hematuria, prostatitis, renal cancer, pyelonephritis, prostate cancer, urethral stricture)

Urine specimens examination

physical: urine volume

- normal adult average – (400 – 2000) ml/24h
- increase average (polyuria) – > 2000 ml/24h
 - physiological (water intake, some drugs, intravenous solutions)
 - pathologic (CKD, diabetes mellitus, diabetes insipidus)
- decrease average (oliguria - < 400 ml/24h, anuria - < 100ml /24h)
 - prerenal (hemorrhage, dehydration, congestive heart failure)
 - postrenal (obstruction of the urinary tract, may be stones, carcinoma)
 - renal parenchymal disease (acute tubular necrosis, chronic renal failure)

Urine specimens examination

physical: specific gravity (SG)

- density of the urine (compares the density of urine to the density of water)
- normal average **in adults**: 1.001 - 1.040
- increased (dehydration, fever, vomiting, diarrhea, diabetes mellitus, other glycosuria, congestive heart failure, syndrome of inappropriate ADH secretion (SIADH), adrenal insufficiency)
- decreased (urine volume ↓ and SG ↑) in diabetes insipidus (urine volume ↑ and SG ↓)

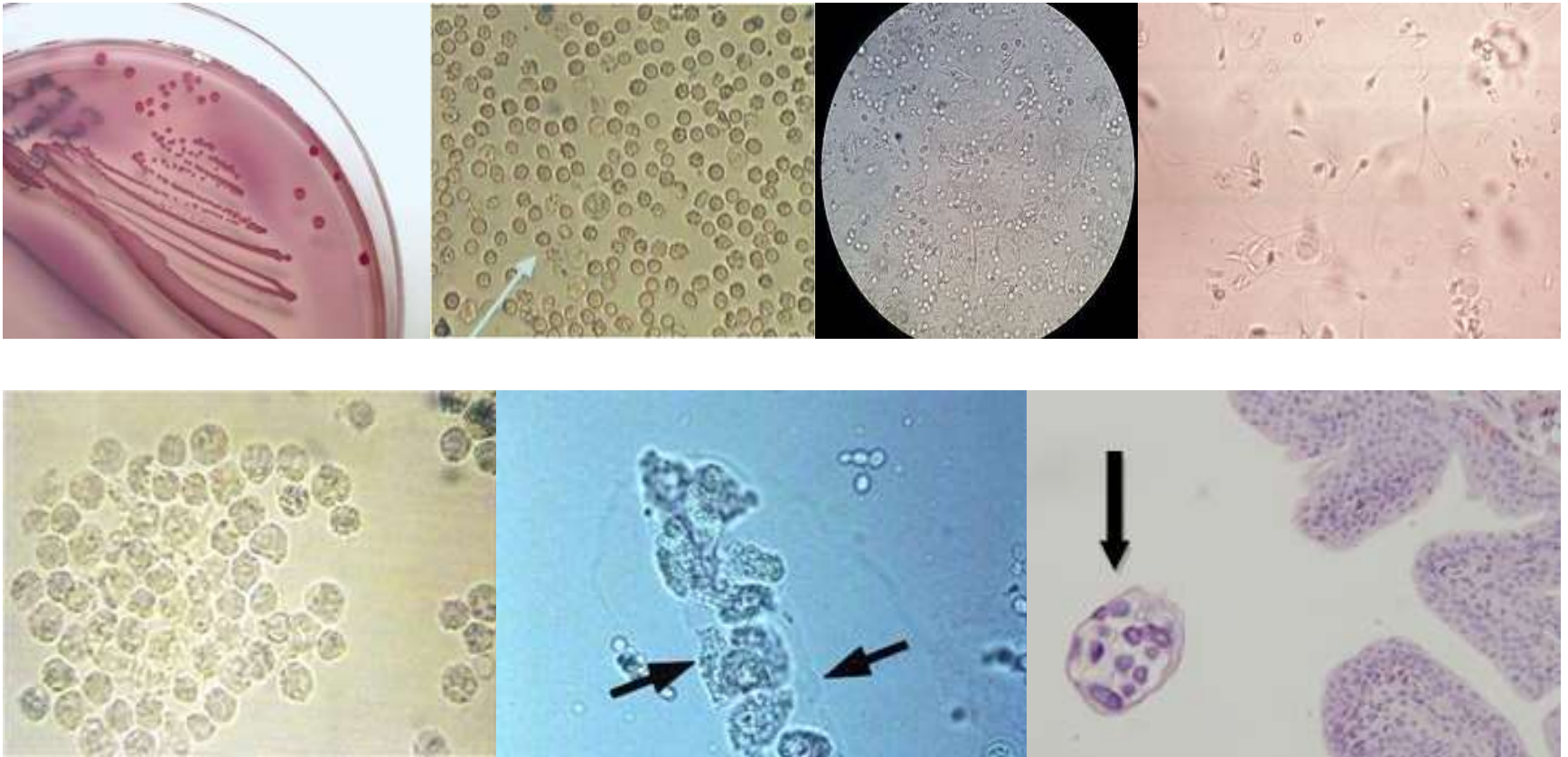
Urine specimens examination

physical: chemical examination

- urine PH: **normal** 5 - 9 (depends on diet), **increased** (alkaline urine: drugs (sodium bicarbonate), classic renal tubular acidosis, alkalosis (metabolic or respiratory), **decreased** (acid urine: drugs (ammonium chloride), acidosis (metabolic or respiratory))
- protein: **normal** <150mg/24h), higher > 150mg/24h (proteinuria: heavy >4.0 g/24h, moderate 1.0 - 4.0 g/24h, minimal <1.0 g/24h, microalbuminuria 30 mg - 300 mg/24 h) - glomerular (glomerular diseases damage glomerular basement membrane but tubular function is normal, selective proteinuria, heavy proteinuria, acute glomerulonephritis), tubular (renal tubular disease damage tubular function but glomerular is normal, moderate proteinuria, pyelonephritis), "overflow", functional, extra-renal
- glucose: normally negative, positive in diabetes mellitus, Cushing's syndrom, renal tubular dysfunction
- ketones: normally negative, ketonuria - diabetic, nondiabetic, hyperemesis of pregnancy, patients with vomiting or diarrhea
- occult blood: normally negative
- Bilirubin, urobilinogen: normally negative
- nitrites: normally negative, positive in presence of bacteria
- leukocyte esterase: bacteria, fungal, parasitic, tumor, nephritis

Urine specimens examination

physical: microscopic, urine for culture and sensitivity

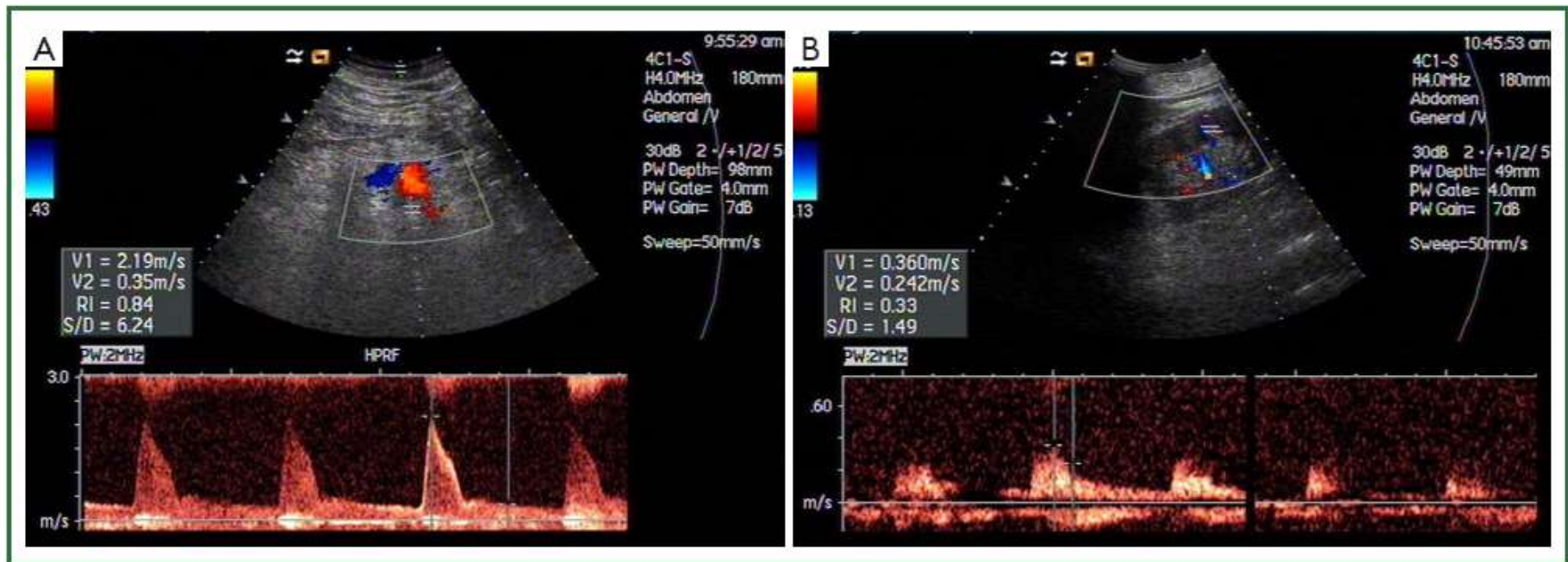


RBCs, WBCs, epithelial cells, bacteria, casts (cylindrical moulds, indicate damage to the glomerular basement membrane or tubule)

Patient's instrumental examination

- Ultrasonography (B-mode scan, Doppler flow examination of renal vessels or duplex ultrasound scanning)
- radiographic examinations
 - kidneys, ureter, bladder X-ray
 - intravenous urography
 - computed tomography
 - cystography and cystourethrography
- other diagnostic tests
 - renal arteriography (angiography)
 - renal biopsy
 - renography (kidney scan)
 - magnetic resonance Imaging (MRI)

Patient's instrumental examination sonography



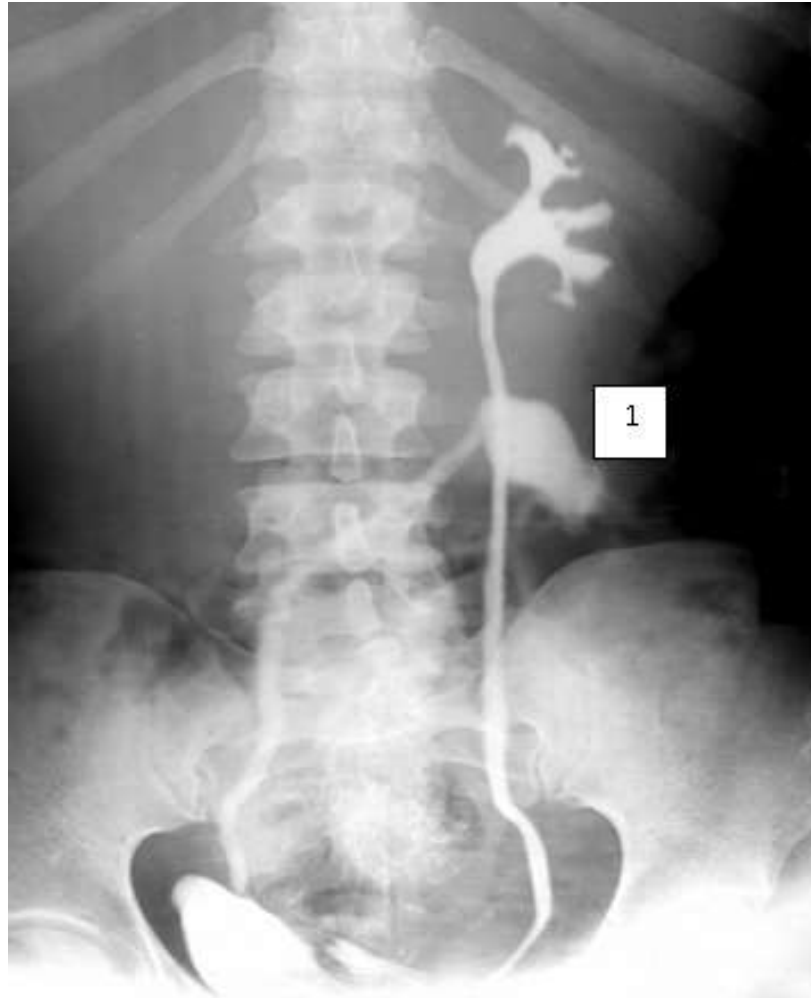
Refractory hypertension with massive proteinuria

Patient's instrumental examination renal arteriography



http://intranet.tdmu.edu.ua/data/kafedra/internal/vnutrmed2/classes_stud/en/med/lik/ptn/Internal%20medicine/6%20course/21.%20Management%20of%20%20patients%20with%20urinary%20syndrome.htm

Patient's instrumental examination urography



http://intranet.tdmu.edu.ua/data/kafedra/internal/vnutrmed2/classes_stud/en/med/lik/ptn/Internal%20medicine/6%20course/21.%20Management%20of%20%20patients%20with%20urinary%20syndrome.htm

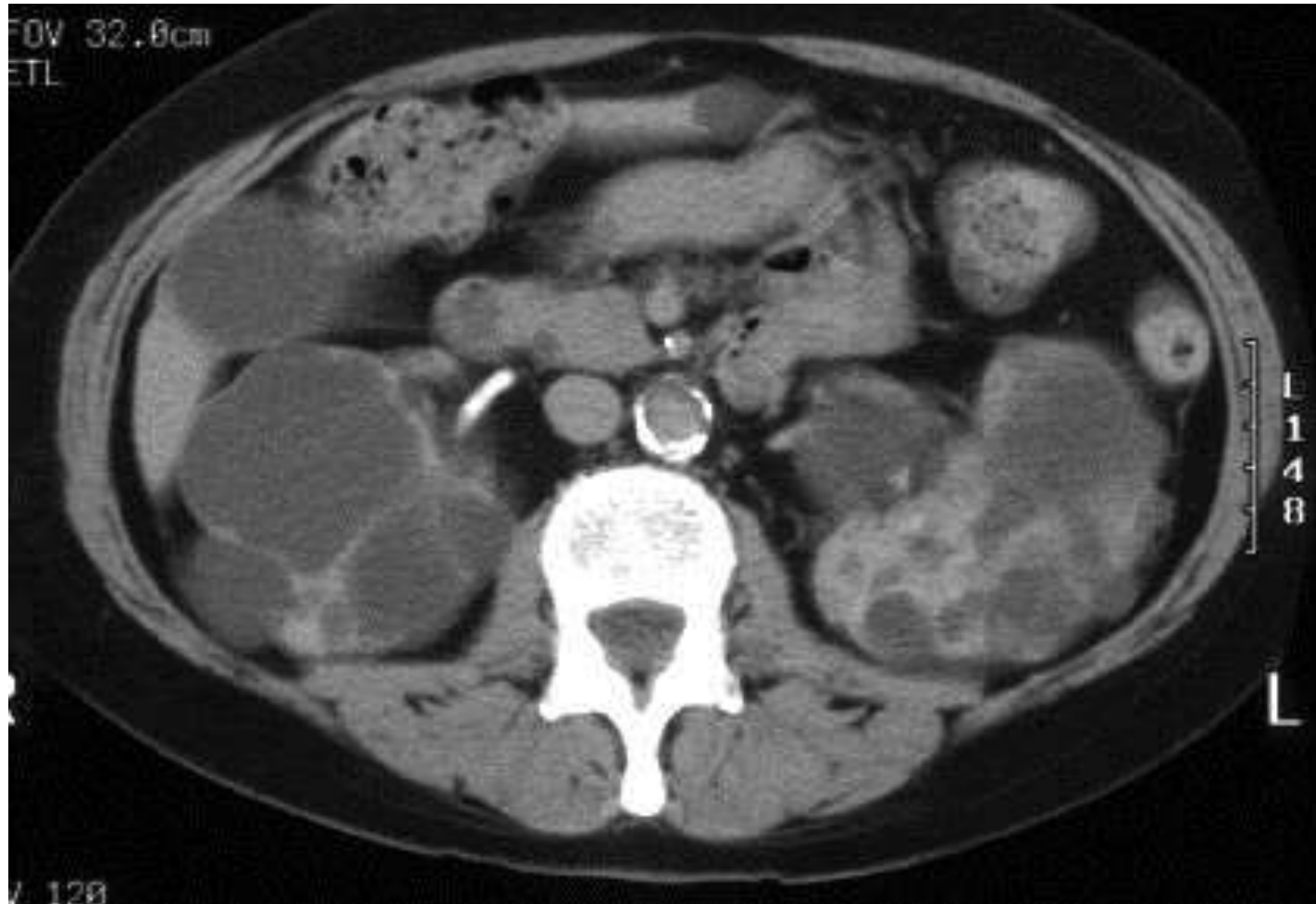
Patient's instrumental examination

radiolucent stones



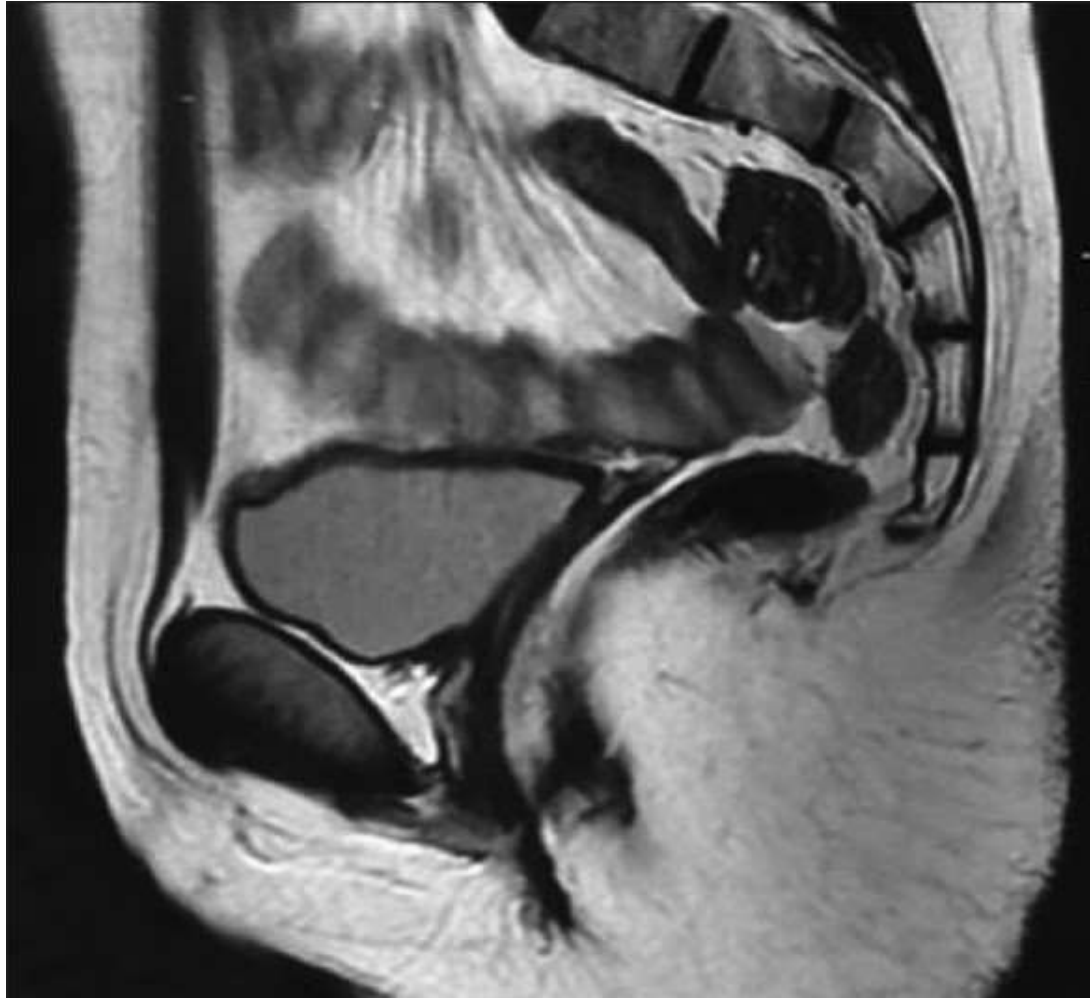
Bladder calculi (stones)

Patient's instrumental examination computer tomography



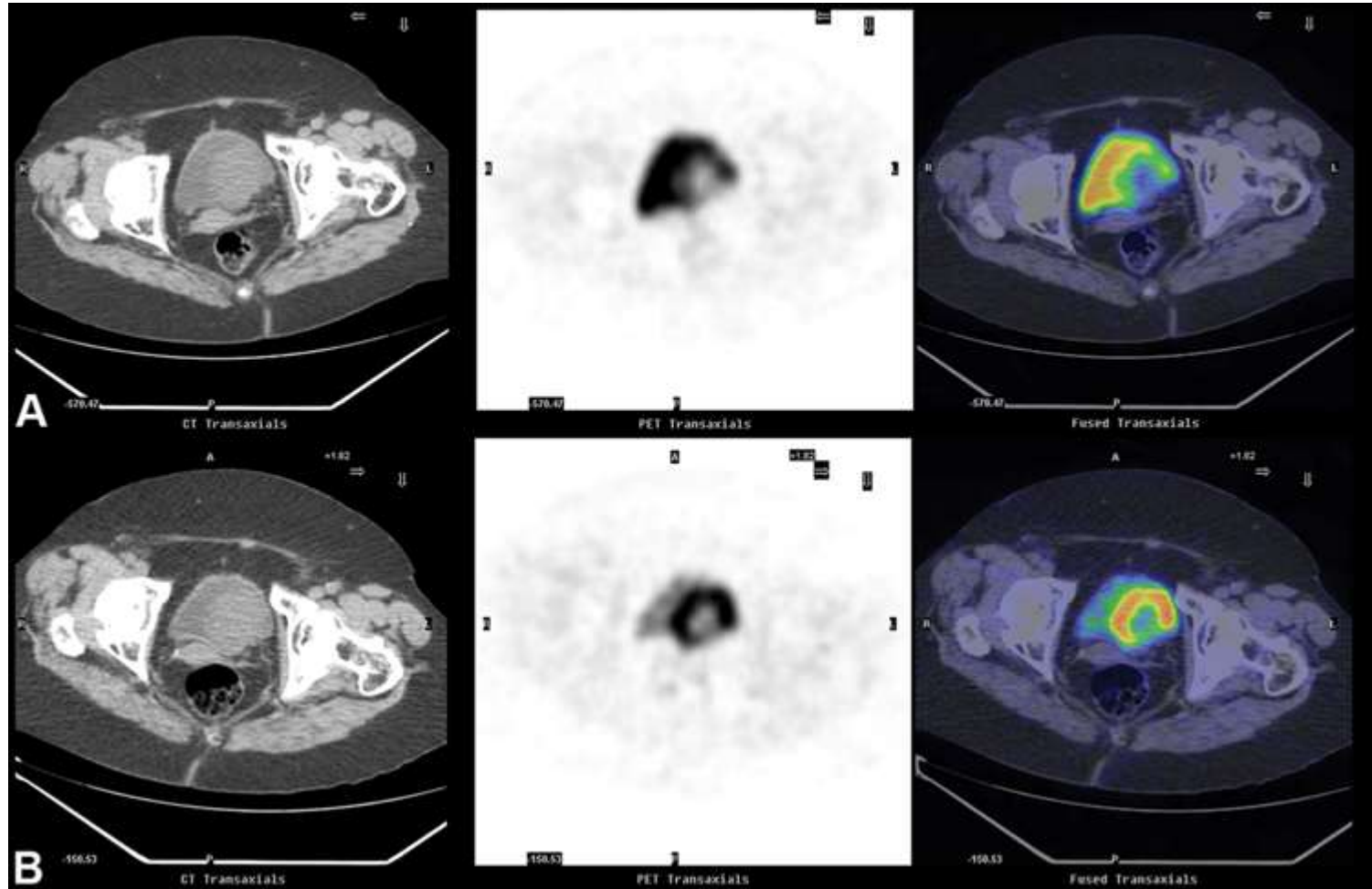
[Cystic Diseases of the Kidney](#)

Patient's instrumental examination magnetic resonance imaging

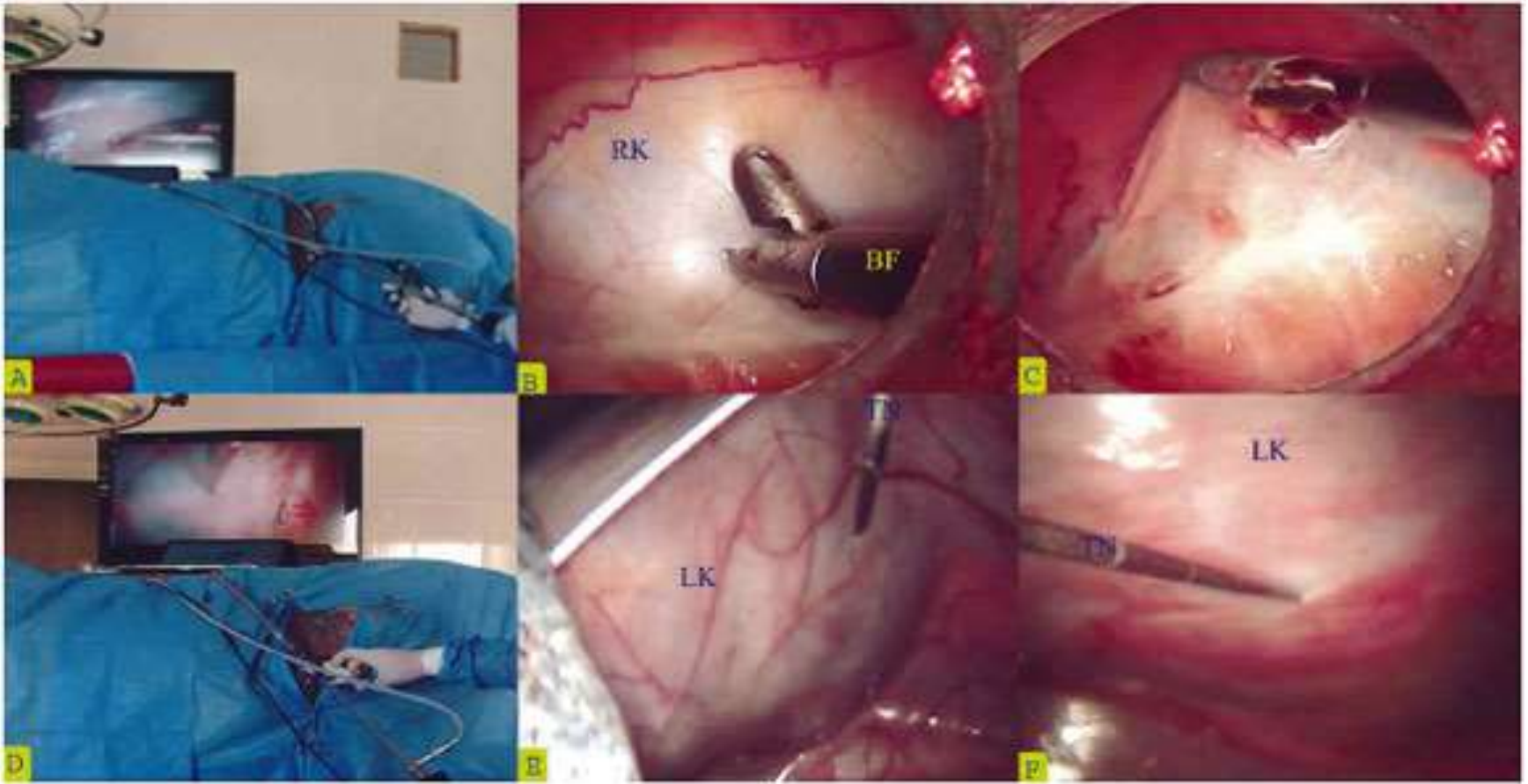


Gonadal dysgenesis

Patient's instrumental examination positron emission tomography

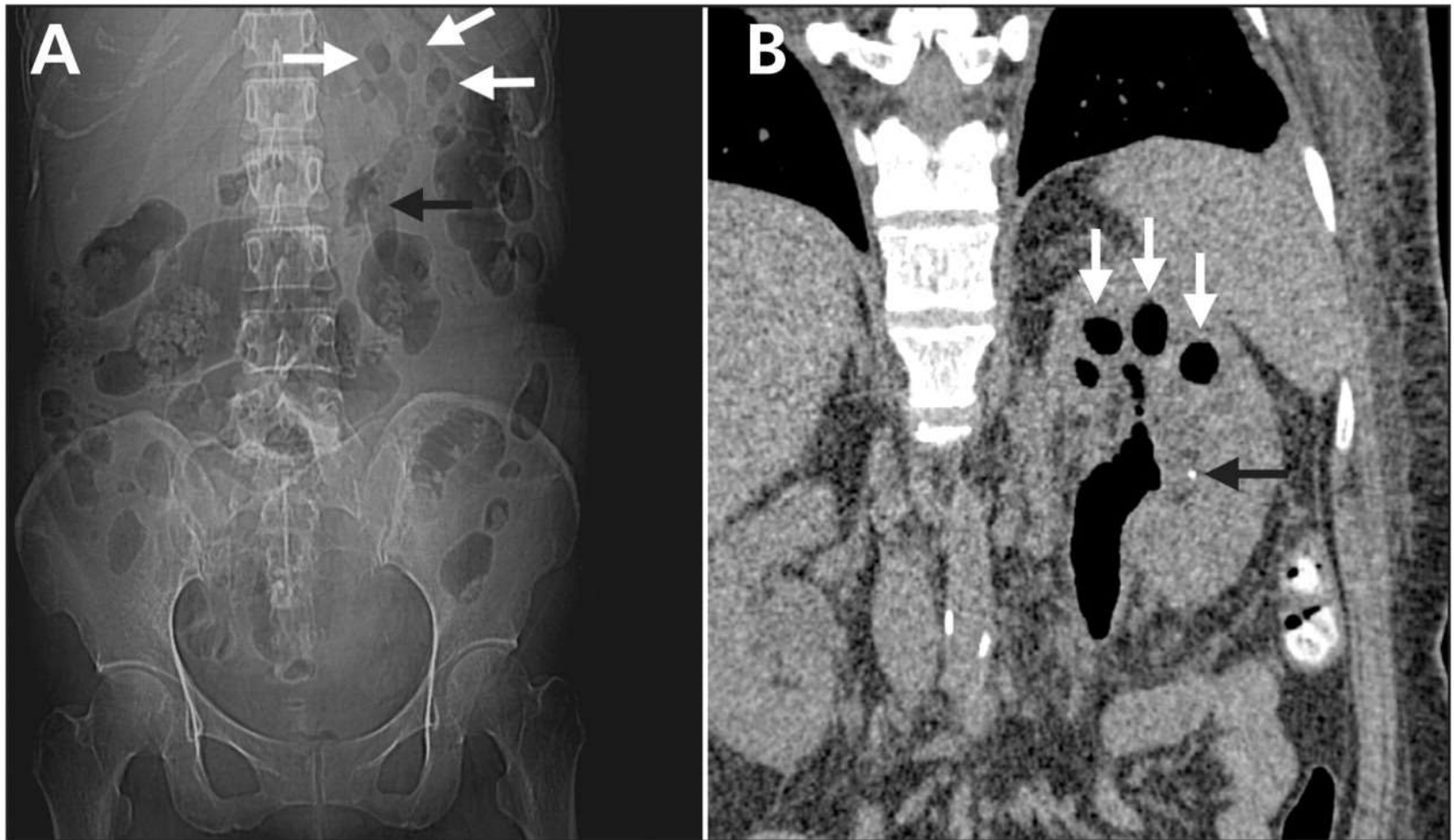


Patient's instrumental examination laparoscopic renal biopsy



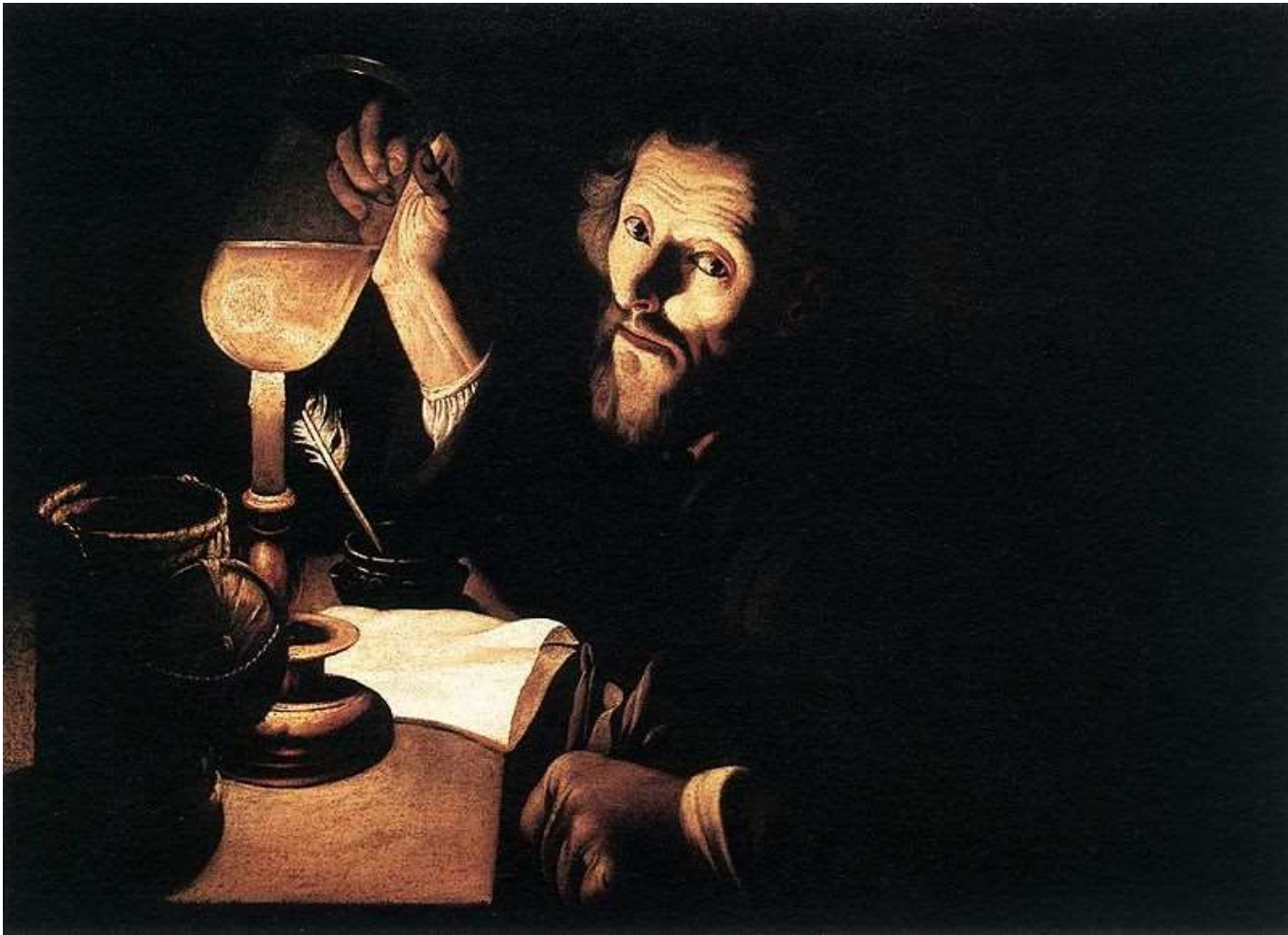
Patient's instrumental examination

plain radiography & abdominal computed tomography



[A Case of left Flank Pain](#)

Patient's instrumental examination urine by Bigot



<http://www.davidicke.com/forum/showthread.php?t=11956&page=1069>

Spectrum of urinary system diseases

- Congenital abnormalities
- Interstitial nephritis
- Glomerulonephritis
- Cystic kidney disease
- Renal vascular disease
- Nephrotic syndrome
- Renal failure
- Infections of the urinary tract
- Obstruction of the urinary tract
- Urinary tract calculi and nephrocalcinosis
- Malignancy of the urinary tract eg CA bladder
- Incontinence

Urinary system diseases' symptoms and syndromes

symptoms

- pain
- proteinuria
- azotaemia, leading to uraemia
- haematuria
- urinary casts
- hypertension
- oliguria or anuria
- oedema
- polyuria
- renal/ureteric colic
- dysuria
- renal failure
- general symptoms of abnormal renal function



Urinary system diseases' symptoms and syndromes

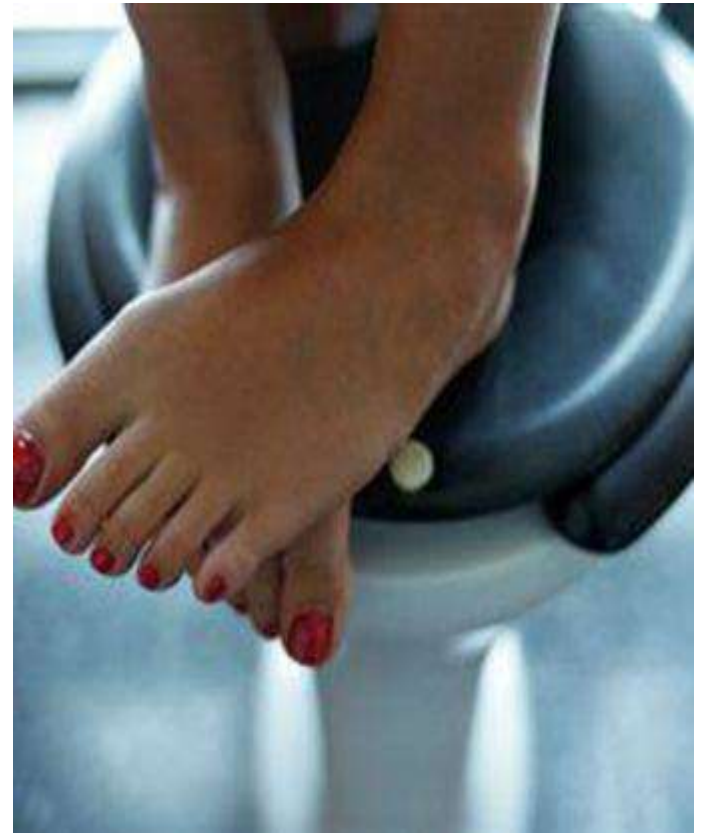
urinary syndrome: definition, symptoms

Definition

quantitative and qualitative
changes in urine

Symptoms

- changes in the volume and composition of the urine output
- changes in the rhythm of urinary excretion
- changes in the volume and composition of the blood



Urinary system diseases' syndromes

nephrotic syndrome: definition, criteria, types

Definition

Clinical and laboratory syndrome characterized by massive proteinuria, which lead to hypoproteinemia (hypoalbuminemia), hyperlipidemia and pitting edema in results from increased permeability of glomerular basement membrane (GBM) to plasma protein

Criteria

- hematuria (RBC in urine, gross hematuria)
- hypertension ($\geq 140/90$ mmHg)
- azotemia (renal insufficiency - Increased level of serum BUN , Cr)
- hypocomplementemia (decreased level of serum c3)

Types

idiopathic (90%), secondary (10%, anaphylactoid purpura , systemic lupus erythematosus, HBV infection, atc), congenital

Urinary system diseases' symptoms and syndromes

nephrotic syndrome: pathophysiology

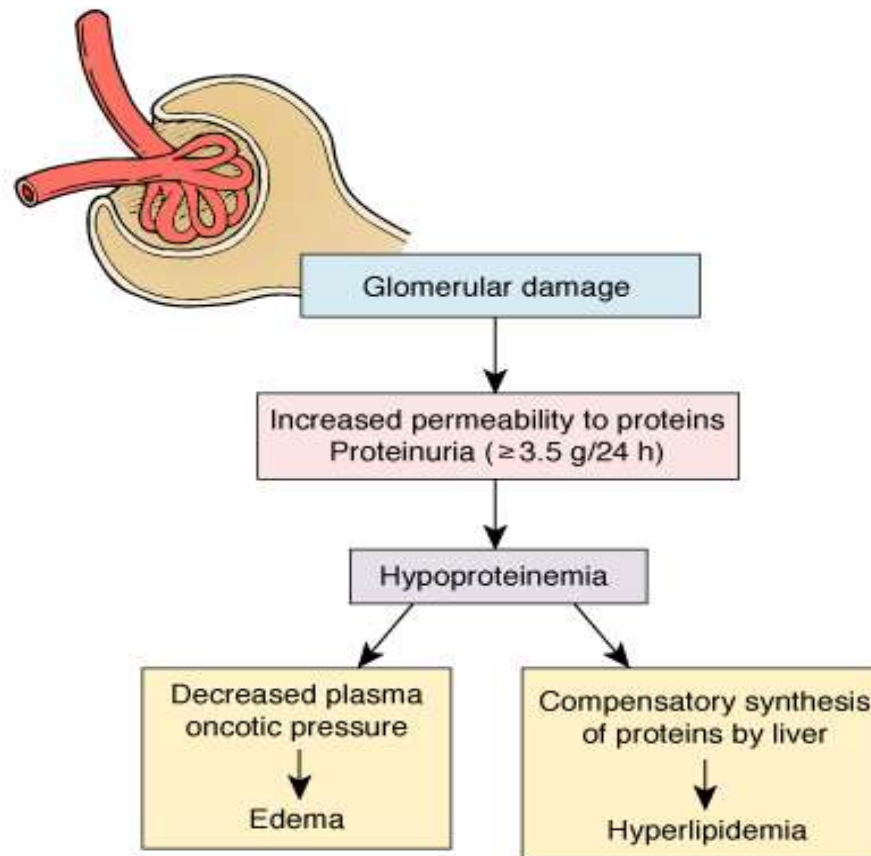


Figure 35-10 Pathophysiology of the nephrotic syndrome.

Urinary system diseases' symptoms and syndromes

nephrotic syndrome: degrees and types of proteinuria

Degrees

- mild $< 0.5\text{g/m}^2/\text{day}$
- moderate $0.5 - 2\text{g/m}^2/\text{day}$
- severe $> 2\text{g/m}^2/\text{day}$

Types

- Selective (where proteins of low molecular weight .such as albumin, are excreted more readily than protein of HMW)
- Non selective (LMW+HMW are lost in urine)

Urinary system diseases' symptoms and syndromes

nephrotic syndrome: symptoms, differential diagnosis

Symptoms

Edema (varying degrees) is the common symptom

Local: edema of face (facial edema), edema around eyes (periorbital swelling) , in lower extremities Generalized (anasarca), edema of penis and scrotum

Other clinical symptoms

fatigue, lethargy

loss of appetite, nausea and vomiting ,abdominal pain , diarrhea

body weight increase

urine output decrease

pleural effusion (respiratory distress)

Blood tests (serum protein $<5.5\text{gm/dL}$, albumin $<2.5\text{gm/dL}$, cholesterol $>220\text{mg/dl}$)

Urine tests (proteinuria, oliguria (during stage of edema formation), microscopic hematuria 20%, large number of hyaline casts)

Differential diagnosis of generalized edema

Urinary system diseases' symptoms and syndromes

main in nephrotic syndrome (all words contain letter O)

1. Massive prOteinuria
2. HypOprOteinemia (peeing oout albumin)
3. Oedema (ONcotic pressure in the blood goes down)
4. HyperchOlesterolemia (hyperlipidemia/hyperlipiduria)
5. HypercOagulable state (thrOmbotic and thrOmbobolic complications)



Urinary system diseases' syndromes

nephritic syndrome: definition, criteria, types

Definition

Clinical and laboratory syndrome associated with disorders affecting the kidneys, more specifically glomerular structures, and characterized by having a thin glomerular basement membrane and small pores in the podocytes of the glomerulus, large enough to permit proteins (proteinuria) and red blood cells (hematuria) to pass into the urine

Criteria

- hematuria , with red blood cell (RBC) casts present in the urine
- proteinuria (<3.5 g/day)
- hypertension
- uremia, due to retention of waste products
- variable renal insufficiency, with azotemia, oliguria (low urine output <400 mL/day)

Types

- post-streptococcal glomerulonephritis
- crescentic glomerulonephritis (rapidly progressive glomerulonephritis)

Urinary system diseases' symptoms and syndromes

nephritic syndrome: symptoms, differential diagnosis

Symptoms

- hematuria (e.g. cola coloured)
- proteinuria
- Hypertension (with headache)
- oliguria
- flank pain
- general symptoms
- post-infectious (2-3 weeks after strep-throat/URTI)

Differential diagnosis

- malignancy (older patients)
- UTI
- trauma



Urinary system diseases' symptoms and syndromes

nephritic syndrome (characterized by inflammation; both words contain letter i)

Nephritic syndrome features **PHARAOH**

Proteinuria

Haematuria

Azotaemia (elevated blood nitrogen levels)

Red blood cell casts

Anti-streptolysin O titres if post-streptococcal infection

Oliguria (output <0.5ml/kg/hour)

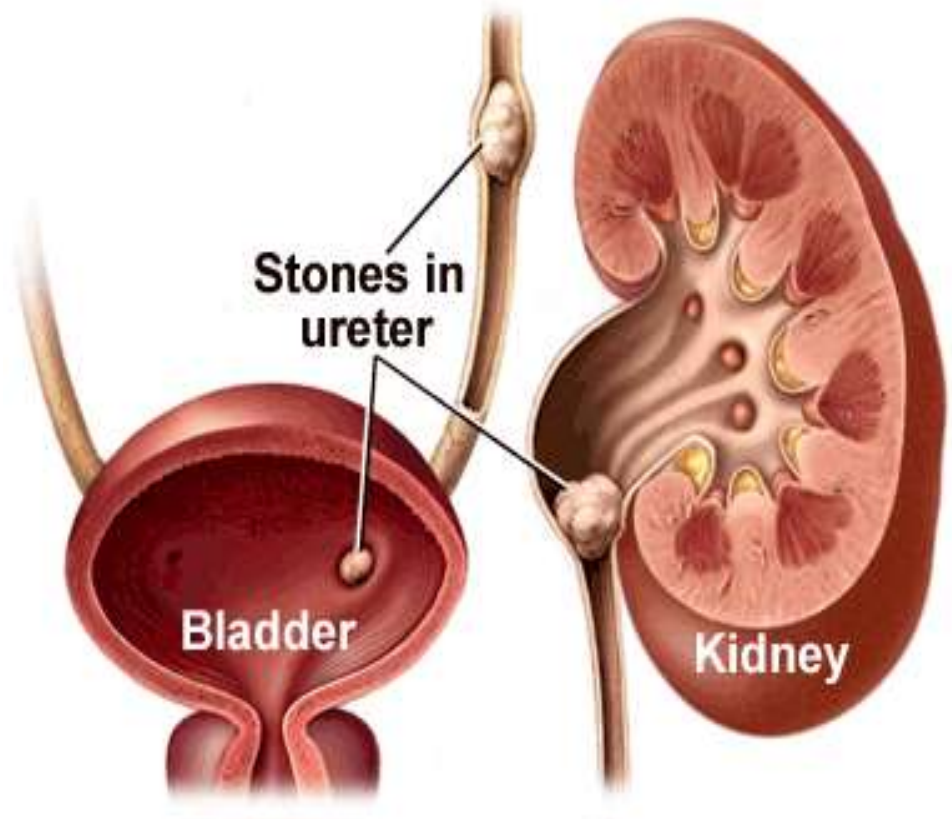
Hypertension



Urinary system diseases' symptoms and syndromes

urinary tract obstruction syndrome

- urinary tract obstruction can occur at any point in the urinary tract, from the kidneys to the urethral meatus
- it can develop secondary to calculi, tumors, strictures, anatomical abnormalities, or functional abnormalities
- obstructive uropathy can result in pain, urinary tract infection, loss in renal function, or, possibly, sepsis or death



Urinary system diseases' symptoms and syndromes

urinary upper tract obstruction syndrome

Symptoms of obstruction of the upper tract are typified by the symptoms of ureteral stricture or ureteral or renal stone. The principal complaints are pain in the flank radiating along the course of the ureter, gross total hematuria (from stone), gastrointestinal symptoms, chills, fever, burning on urination, and cloudy urine with onset of infection, which is the common consequence of obstruction or vesicoureteral reflux

Nausea, vomiting, loss of weight and strength, and pallor are due to uremia secondary to bilateral hydronephrosis
Anemia, leukocytosis, microscopic hematuria/

Ureter

- In the early stages intravesical pressure is normal
- Later added stretch effect at the lower end of the ureter induces further hydronephrosis
- Finally because of increased pressure the ureteral wall becomes attenuated



Urinary system diseases' symptoms and syndromes

urinary mid tract obstruction syndrome

Typified by the **symptoms** of urethral stricture, benign prostatic hyperplasia, neurogenic bladder, and tumor of the bladder involving the vesical neck.

The principal symptoms are hesitancy in starting urination, lessened force and size of the stream, and terminal dribbling; hematuria, which may be partial, initially, with stricture or total with prostatic obstruction or vesical tumor, cloudy urine (due to complicating infection), acute urinary retention. Anemia, leukocytosis, microscopic hematuria.

Stages

- compensation - the bladder musculature becomes hypertrophied → the thickness may double or triple, hypertrophied muscle may be seen endoscopically → superimposed with secondary infection (edema of the submucosa, infiltrated with plasma cells, lymphocytes, and polymorphonuclear cells)
- decompensation - large obstructing gland can be palpated rectally and observed cystoscopically, may appear as a mild obstruction cystoscopically



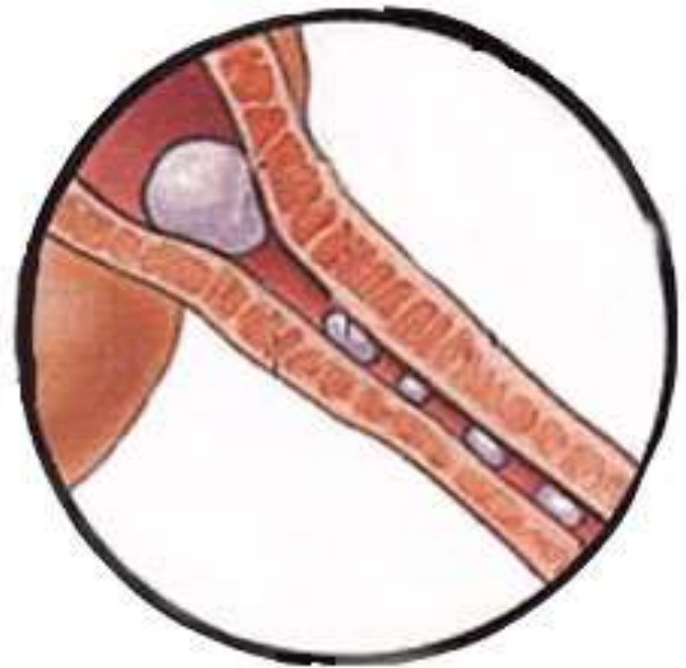
Urinary system diseases' symptoms and syndromes

urinary lower tract obstruction syndrome

The principal symptoms are hesitancy in starting urination, lessened force and size of the stream, and terminal dribbling; hematuria, which may be partial, initially, with stricture or total with prostatic obstruction or vesical tumor; cloudy urine (due to complicating infection), acute urinary retention. Anemia, leukocytosis, microscopic hematuria.

Obstruction → Hydrostatic pressure proximal → dilation of the urethra → The wall of the urethra becomes thin → formation of diverticulum → Infected urine + urinary extravasation → periurethral abscess.

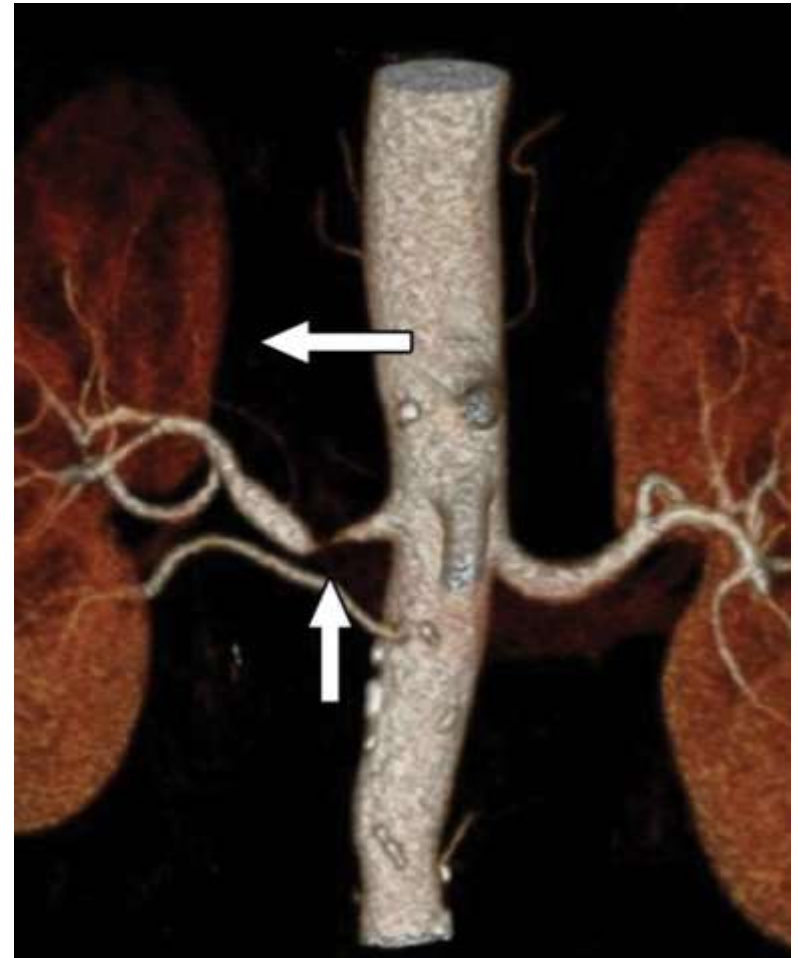
Typified by the symptoms of urethral stricture, benign prostatic hyperplasia, neurogenic bladder, and tumor of the bladder involving the vesical neck.



Urinary system diseases' symptoms and syndromes

hypertensive syndrome

- elevated $\geq 140/90$ mm Hg blood pressure (renal or renovascular hypertension), caused by a narrowing in the arteries that deliver blood to the kidney (renal artery stenosis)
- when the kidneys receive low blood flow, they respond by releasing hormones that stimulate the body to retain sodium and water, blood vessels fill with additional fluid, and blood pressure increases
- the narrowing in one or both renal arteries is most often caused by atherosclerosis, or hardening of the arteries
- symptoms: headache, confusion, blurred or double vision, bloody (pink-colored) urine, nosebleed, bruits over affected renal artery
- hypertension can cause chronic kidney disease



Glossary of urinary pathology' terms 1

angioedema - regions or areas of subcutaneous swelling caused by an allergic reaction to food or drugs (i.e., lips, other parts of the mouth, eyelids, hands and feet)

anuria - complete cessation of urinary secretion by the kidneys; also called anuresis

bacteriuria - presence of bacteria in the urine

bradycardia - slowness of heartbeat, usually <50 beats per minute

bronchospasm - contraction of the bronchi and bronchiolar muscles, producing restriction of air passages

diuretic - an agent that increases excretion of urine

isosthenuria – a state in CKD in which the kidney cannot form urine with a higher or a lower SG than that of protein-free plasma; SG of the urine becomes fixed around 1.010, irrespective of the fluid intake

fecaluria - fecal matter in the urine

glucosuria -glucose in the urine

hematuria - blood in the urine

hypotension - below normal arterial blood pressure.

hyposthenuria - the secretion of urine of low SG due to inability of the kidney to concentrate the urine normally . SG is not necessarily equal to that of plasma

Glossary of urinary pathology' terms 2

laryngospasm - glottic aperture' closure within the glottic opening of the larynx

lithotripsy - shatter large kidney stones into small particles

micturition -the act of voiding or urination

nephroptosis - excessive downward movement of the kidney when erect

nocturia - excessive urinating at night (can be normal and more common with aging (once or twice during the night). Nocturia can also be a sign of an underlying condition, such as CKD, diabetes or urinary infection)

oliguria - excretion of a diminished amount of urine in relation to fluid intake (hypouresis, oligouresis)

pneumouria - gas in the urine, as the result of a fistula between the bladder and the intestine

pollakiuria - an excessive frequent urination . It may result from partial obstruction, such as in prostatic enlargement, or it may be of nervous origin

polyuria -passage of a large volume of urine in relation to fluid intake

proteinuria - the presence of excessive serum proteins in the urine (albuminuria)

renal agenesis -absence of formation of a kidney

renal failure - the inability of a kidney to excrete metabolites at normal plasma levels, or the inability to retain electrolytes under conditions of normal intake

Glossary of urinary pathology' terms 3

retention - the inability to void, which may be due to obstruction in the urethra or lack of sensation to urinate

syncope - loss of consciousness caused by reduced cerebral blood flow; also called "fainting "

tachycardia - rapid heartbeat, usually >100 beats per minute

uremia - an excess in the blood of urea, creatinine, and other nitrogenous end products of protein and amino acid metabolism; often present with chronic renal failure (azotemia)

urinary incontinence - involuntary passage of urine through the urethra; commonly caused by failure of voluntary control of the vesical and urethral sphincters

urinary reflux - backward or return flow of urine from bladder into ureter and kidney (vesicoureteral reflux); a common cause of pyelonephritis, in which the backflow of urine may carry bacteria that can produce infection in the kidney

urinary tract infection (UTI) - infection that frequently occurs in both adults and children and that is caused by bacteria, viruses, fungi, or certain parasites; commonly caused by vesicoureteral reflux

urticaria - an eruption of wheals (hives) often caused by hypersensitivity to food or drugs