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GENERAL UROLOGY: UROLOGICAL SYMPTOMS, URINARY TRACT INFECTION, BASIC UROLOGICAL EMERGENCIES, UROLITHIASIS

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МИНИСТЕРСТВО ЗДРАВООХРАНЕНИЯ РЕСПУБЛИКИ БЕЛАРУСЬ
БЕЛОРУССКИЙ ГОСУДАРСТВЕННЫЙ МЕДИЦИНСКИЙ УНИВЕРСИТЕТ
КАФЕДРА УРОЛОГИИ

А. А. Гаврусев, Е. И. Юшко, А. В. Строцкий

ОБЩАЯ УРОЛОГИЯ: СИМПТОМЫ ЗАБОЛЕВАНИЙ, ИНФЕКЦИИ МОЧЕВЫХ ПУТЕЙ, НЕОТЛОЖНЫЕ СОСТОЯНИЯ, МОЧЕКАМЕННАЯ БОЛЕЗНЬ

GENERAL UROLOGY: UROLOGICAL SYMPTOMS, URINARY TRACT INFECTION, BASIC UROLOGICAL EMERGENCIES, UROLITHIASIS

Учебно-методическое пособие

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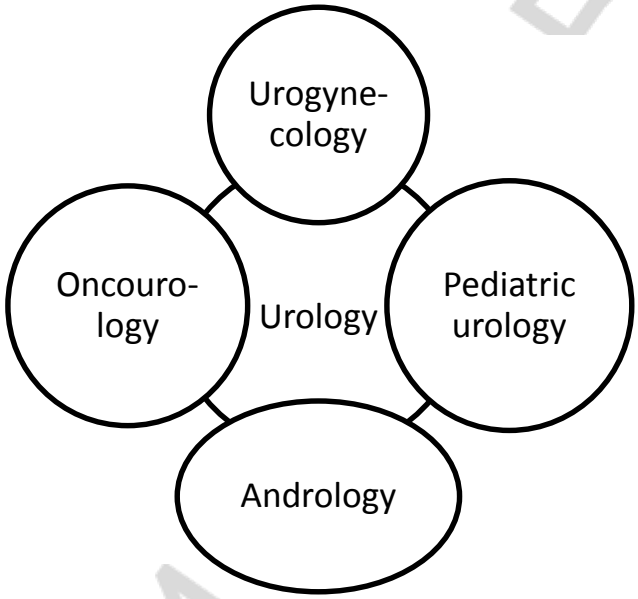
Introduction

UROLOGY AS A MEDICAL SPECIALTY

Urology is a medical specialty studying the etiology, pathogenesis, clinical manifestations, diagnosis, treatment, and prevention of male genitourinary tract diseases and female urinary tract diseases.

Urology is a unique specialty in medicine which covers all stages of a person's life namely prenatal, pediatric, adult, and advanced age.

Sub-specialistic fields of urology



Chapter 1. SYMPTOMS OF UROLOGICAL DISEASES

- Medical *semiotics* is the theory of signs of diseases (*symptoms*) and their combinations (*syndromes*).

Main urological syndromes and symptoms:

- ✓ Pain
- ✓ Disorders of urination
- ✓ Changes in urine (quantitative and qualitative)
- ✓ Common (general) symptoms
- ✓ Changes or anomalies of the external genitalia
- ✓ Semen changes and abnormal discharge from the urethra
- ✓ Disorders of male sexual function (sexual dysfunction)

➘ **Pain**

- The causes of pain in the genitourinary tract:

– obstruction in the urinary tract,

– inflammation.

- Pain can occur in the *kidneys, ureters, bladder, prostate, urethra, penis, testicles*.
- Pain description:

Intensity of pain	Severe, mild
Localization	Lumbar, suprapubic, iliac, perineum, genitals regions
Characteristic	Colicky, persistent, intermittent, aching, dull
Irradiation	Along the ureter, under the scapula, external genitalia

o *Renal colic* is a symptom complex that develops as a result of a sudden onset of obstruction of urine outflow from the kidney, which leads to a rapid increase pressure in the kidney collecting system, severe paroxysmal pain in the lumbar region with characteristic irradiation.

➘ **Disorders of urination**

Urinary frequency changes	*Pollakiuria* (*urnary frequency)*	Frequent daytime urination (more than 8 times a day)
	Oligakiuria	Abnormally rare urination (1-2 times a day)
	Nocturia	Frequent urination at night (more than 1 time) with normal diuresis or urinary urgency that awakens the patient from sleep
Urinary retention (ishuria)	*Acute*	Sudden inability to void with a full urinary bladder with strong urge
	Chronic	Presence of residual urine more than 50 ml after micturition
Urinary incontinence (urination outside the act of urination)	*False incontinence*	Urine is not passing by the urethra (there is a congenital or acquired defect in the urinary system)
	True incontinence	Urine escapes through urethra
Urinary incontinence (true)	*Urge incontinence*	Urine loss accompanied by urgency resulting from abnormal bladder contractions
	Stress incontinence	Urine loss resulting from sudden increased intra-abdominal pressure (e.g. laugh, cough, sneeze)
	Overflow incontinence	Urinary incontinence that occurs when the bladder is so full that it continually leaks urine, due to a blocked urethra (e. g. prostate enlargement) or weak bladder muscles or nerve damage
Stranguria	Slow painful frequent urination of small volumes caused by muscular spasms of the urethra and bladder	
Enuresis	Inability to control the flow of urine and involuntary urination mostly at night	

o *Dysuria* is painful urination that is usually caused by inflammation. Also, this term sometimes refers to all urination disorders.

o *Symptoms of the lower urinary tract* is a collective concept that includes *irritative* and *obstructive* symptoms, as well as urinary incontinence.

– *Storage (irritative) symptoms:* frequency, urgency, urge incontinence, nocturia, dysuria, and sometimes enuresis;

– *Voiding (obstructive) symptoms:* hesitancy, intermittency, poor urinary stream, post-void dribbling, and use of abdominal straining to void.

➘ **Changes in the quantity and quality of urine**

o Normal urine has a straw yellow color, transparent. Normal daily diuresis is 1.5–2 litres.

Changes in urine volume (urine output)	*Polyuria*	An increase in the daily amount of urine more than two litres or frequent voiding in large volume
	Oliguria	Reduced daily urine output less than 600 ml
	Anuria	Urine does not enter the bladder from the kidneys or daily diuresis less than 100 ml
	Nicturia	The prevalence of nocturnal diuresis over daytime
Hematuria	The presence of blood in the urine. *Gross hematuria* is blood in the urine visible to the eye. *Microhematuria (erythrocyturia)* is determined by laboratory methods	
Pneumaturia	The passage of gas in the urine (fistula between the intestines and the bladder)	
Cloudy urine	Precipitation of phosphate, urinary tract infections	
Pyuria	Elevated white blood cell count. Dirty gray color with a significant amount or addition of pus in the urine	
Changes in urine color	Intake of certain medications (e.g. nitrofurans, aspirin, rifampicin, etc.)	

➘ **Common symptoms of urological diseases:**

- Fever, chills
- Weight loss, obesity
- General weakness, malaise
- Edema
- Changes of the skin (yellowness, dryness, etc.)
- Swelling or edema of the face, limbs
- Nausea, vomiting, bloating
- Gynecomastia

➘ **Pathological discharge from the urethra and sperm changes**

Urethral discharge	Purulent or scant discharge are typical of urethritis
Prostatorrhea	The emission of prostatic secretions during straining associated with urination or defecation
Spermatorrhea	Loss of seminal fluid without erection and ejaculation
Urethrorrhagia	Discharge of blood from the urethra outside the act of urination
Aspermatism(anejaculation)	The inability to secrete or ejaculate semen
Hemospermia	Bloody ejaculation
Pyospermia	Unusually high number of white blood cells in the semen

➘ Disorders of male sexual and reproductive functions

Infertility	Infertility is defined as the inability to achieve a pregnancy after one year of regular and unprotected sexual intercourse
Oligozoospermia	The spermatozoa count in the ejaculate is less than 15 million/mL
Asthenozoospermia	Less than 32% progressive motile spermatozoa
Teratozoospermia	Less than 4% normal forms spermatozoa
Azoospermia	Azoospermia is defined as the complete absence of sperm from the ejaculate
Aspermia	Aspermia is the complete lack of semen with ejaculation

Sexual dysfunction	Is difficulty experienced by an individual or a couple during any stage of a normal sexual activity
Erectile dysfunction	Is the inability to achieve or maintain an erection firm enough to have sexual intercourse
Premature ejaculation	Premature ejaculation is called sexual dysfunction, which consists in the inability to control ejaculation to the extent that it is sufficient for both partners to receive satisfaction from sexual intercourse

- Some diseases may be asymptomatic (chronic prostatitis, pyelonephritis, cancer).

➘ Anomalies of the external genital organs

Cryptorchidism	The absence of one or both testicles in the scrotum (testicles do not descend into the scrotum)
Monorchism	The state of having only one testicle within the scrotum
Anorchism	The disorder of sex development in which a male person is born without testes
Epispadias	The type of malformation of the penis in which the opening of the urethra is located on the upper (dorsal) aspect of the penis
Hypospadias	The variation in fetal development in which the urethral opening is ectopically located on the ventral aspect of the curved penis
Ectopic testis	The disorder of fetal development in which testis is palpated in a location outside the normal path of descent such as the perineum or femoral area
Phimosis	The foreskin is tight and cannot be retracted over the glans penis
Paraphimosis	The medical emergency in which the retracted foreskin cannot be pulled forward to cover the glans penis
Hydrocele	The abnormal quantity of peritoneal fluid between the parietal and visceral layers of the tunica vaginalis of the testis
Varicocele	The dilatation of the collection of veins (pampiniform plexus) surrounding the testis and extending up into the spermatic cord
Ambiguous genitalia	The disorder of sex development in which an infant's external genitals don't appear to be clearly either male or female
Testicular tumor	The palpable dense masses in the scrotum

Chapter 2. EXAMINATIONS OF UROLOGICAL PATIENTS

- ✓ History taking
- ✓ Physical examination
- ✓ Laboratory examination
- ✓ Radiological diagnostics
- ✓ Instrumental examination

INTERVIEW

– *Survey*

– *Clarification of complaints. Questionnaires* (diseases of the prostate gland, disorders of urination, sexual function)

– *Medical and family history*

PHYSICAL EXAMINATION

Inspection or general observations	Skin, subcutaneous fat layer, mammary glands, edema, asymmetry of the lumbar region, hematomas, protrusion of the anterior abdominal wall, external genitalia
Palpation	Abdomen, region of the kidneys, bladder, external genitalia, lymph nodes
Percussion	Bladder, abdominal cavity, kidneys
Auscultation	Renal, femoral artery
Digital rectal examination (DRE)	Prostate, seminal vesicles, bulbourethral glands, anus, rectum
Transillumination	Scrotum, abdominal cavity in children under 1 year old
Neurologic examination	Sensory examination, testing of reflexes in the genital area (bulbocavernosus reflex)

LABORATORY EXAMINATION

o The following specimens are used for laboratory tests: urine, blood, discharge from the urethra, prostate secretions, ejaculate, and urogenital tissue. Laboratory tests:

Urinalysis	Macroscopic examination (color, appearance) Relative density Chemical tests (pH, protein, glucose, bacteria) Microscopic examination (leucocytes, bacteria, erythrocytes, other findings) Urine dipstick
Blood tests	Full blood count (FBC) Biochemistry of blood plasma (creatinine, urea, electrolytes, sugar, total protein, bilirubin, ALT, AST, GGTP, calcium, phosphorus, other values) Coagulation tests
Renal function tests	Glomerular filtration rate (GFR) Blood urea nitrogen (BUN) to serum creatinine (SCr) ratio

Microbiological tests	Bacterial cultures Cell culture technique Selective cultures (for tuberculosis, trichomoniasis)
Infection localization tests	Two-glass test Three –glass test Four-glass test (Stamey-Mears)
Hormonal tests	Reproductive hormones (testosterone, FSH, LH, prolactin, GnRH) Thyroid function and parathyroid tests Adrenal hormones
Tumor markers	Prostate-specific antigen (PSA) Alpha-fetoprotein (AFP), human chorionic gonadotropin (HCG), lactate dehydrogenase (LDH)
Immunological tests	Immunogram Enzyme immunoassay (ELISA)
Molecular biological tests	Polymerase chain reaction (PCR)
Histological studies	Urine cytology Analysis of biopsied material
Researches of samples from the genital tract	Microscopic examination of urethral discharge (urethral swabs) Analysis of expressed prostatic secretion (EPS) Seminal fluid analysis (SFA)
Studies of stone constituents	Urine, blood, and formal stone analysis

URINARY TRACT IMAGING

Radiologic examination	Plain abdominal radiography or KUB (kidneys, ureters, and bladder)
	Intravenous excretory urography (IVU)
	Retrograde pyelography (RPG)
	Antegrade pyelography
	Cystography: – retrograde – antegrade – static – voiding (micturating) cystourethrography
	Urethrography: – retrograde – voiding
	Computed tomography scan with or without contrast enhancement (CT scan)
	Renal angiography
Radionuclide imaging	– Renography, scintigraphy – Diuretic scintigraphy – Whole body bone scan – Positron emission tomography (PET)
Ultrasonography	– Transabdominal – Transrectal – Scrotal and penile ultrasonography – Doppler imaging (Doppler scan)
Magnetic resonance imaging (MRI scan)	

INSTRUMENTATION OF THE URINARY TRACT

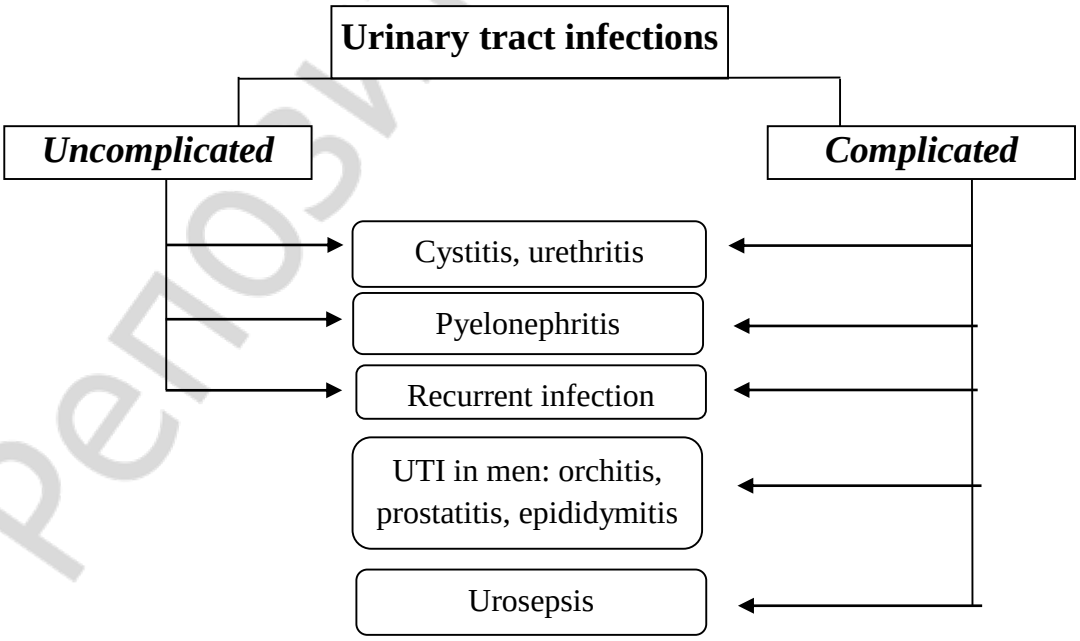
Urethral (bladder) catheterization	
Endoscopic instrumentation	Urethroscopy
	Cystoscopy (rigid, flexible)
	Ureteric catheterization
	Ureterorenoscopy (rigid, flexible)
Biopsy	Prostate biopsy (transrectal, transperineal)
	Renal fine-needle aspiration biopsy (FNAB)
	Testis biopsy
Urodynamics	Uroflowmetry (urine flow rate)
	Cystometry (pressure-flow)
	Urethral pressure profilometry
	Videourodynamics
	Sphincter electromyography

Chapter 3. URINARY TRACT INFECTION

Urinary tract infections (UTIs) are infections of the urinary tract and male genital organs by microflora which leads to the development of inflammatory process. The diagnosis of UTI can be interpreted as a group of the infectious and inflammatory diseases of one or more genitourinary tract segments without specific localization of pathological process and in absence of the direct kidney damage.

UTI classifications:

- ✓ Upper urinary tract infection: *pyelonephritis*
- ✓ Lower urinary tract infection: *cystitis, urethritis*
- ✓ Male genital infection: *prostatitis, orchitis, epididymitis*



Uncomplicated UTI	An episode of acute or recurrent infection of the lower (*uncomplicated cystitis*) and / or upper (*uncomplicated pyelonephritis*) urinary tract in non-pregnant women in the absence of anatomical and functional changes in the urinary system and the absence of concomitant diseases
Complicated UTI	All cases of UTI that are not uncomplicated. Patients have an increased risk of complicating factors
Recurrent UTI	Relapses of uncomplicated or complicated UTI with an episode frequency of at least 3 per year or 2 for 6 months
Urosepsis	The systemic, life-threatening response of the body to the presence of infection in the genitourinary organs which is accompanied by manifestations of systemic inflammation, symptoms of organ dysfunction and hypotension associated with tissue hypoxia
Cystitis	Infectious and inflammatory process in the bladder wall localized mainly in the mucous membrane
Urethritis	Urethral inflammation caused mainly by sexually transmitted infections
Pyelonephritis	Nonspecific infectious and inflammatory process simultaneously or sequentially affecting the parenchyma (interstitial tissue of the kidney and tubules of the nephrons) and the pyelocaliceal system of the kidney
Asymptomatic bacteriuria	The presence of bacteria in the urine without any clinical and laboratory signs of infectious and inflammatory urological diseases
Prostatitis	Infectious and inflammatory disease of the prostate gland
Epididymitis	Infectious and inflammatory disease of the epididymis of the testis
Orchitis	Infectious and inflammatory testicular disease

➘ Cystitis

Classification

– *Acute uncomplicated cystitis*
– *Recurrent*
– *Complicated*

○ The term *chronic cystitis* is also used in practice. Cystoscopy reveals the following types of chronic cystitis: *follicular cystitis, cystitis cystica, malacoplakia, squamous metaplasia, alkaline encrusted cystitis*.

Diagnosis

Acute cystitis	clinical presentation, urinalysis
Recurrent, complicated, chronic	history, urinalysis, bacteriological culture of urine, examination by a gynecologist, examination for STIs, ultrasound of the urinary system, cystoscopy with biopsy

Antibacterial treatment of acute cystitis

Drugs of first choice	*Fosfomycin trometamol* 3 g single dose, *pivmecillinam* 400 mg tid for 3 days, and *nitrofurantoin macrocrystal* 100 mg bid for 5 days
Alternative antibiotics	*Cephalosporins* for 5 days

➘ **Complicated UTI**

Complicated infection factors:

– Functional or anatomical abnormalities of the urinary tract
– Male gender
– Pregnancy
– Elderly patient
– Diabetes
– Immunosuppression
– UTI in children
– Previous antibacterial treatment
– Permanent urinary catheter
– Nosocomial infection

➘ **Pyelonephritis**

o *Acute pyelonephritis* is suggested by flank pain, nausea and vomiting, fever (> 38 °C), or costovertebral angle tenderness. Pyelonephritis can occur in the absence of symptoms of cystitis.

Classification

Uncomplicated or nonobstructive	No stasis of urine from the kidneys
Complicated or obstructive	Develops as a result of obstruction at any site in the urinary tract
Acute pyelonephritis	– *Uncomplicated* (otherwise called acute serous) – *Complicated*
Chronic pyelonephritis	Renal inflammation induced by recurrent or persistent renal infection, vesicoureteral reflux, or other causes of urinary tract obstruction
Other types of renal infections	– *Infected hydronephrosis and pyonephrosis* – *Emphysematous pyelonephritis* – *Xanthogranulomatous pyelonephritis* – *Renal or perinephric abscess*

Diagnosis:

– History, symptoms
– Urinalysis, general and biochemical blood tests
– Bacteriological urine culture
– Ultrasound of the urinary system
– Excretory urography
– CT

Oral therapy in mild and moderate cases of acute uncomplicated pyelonephritis (outpatients)

Initial empiric antimicrobial therapy	*Fluoroquinolones (levofloxacin, ciprofloxacin)* for 7–10 days
Alternatives	Third-generation oral *cephalosporin (cefpodoxime proxetil, ceftibuten)*

Therapy in severe cases of acute uncomplicated pyelonephritis (hospital treatment)

Initial parenteral therapy	– *Fluoroquinolones (levofloxacin, ciprofloxacin)* – *Carbapenem* (*ertapenem, imipenem/cilastatin, meropenem*)
Alternatives	– *Cephalosporins (ceftazidime, cefotaxime, ceftriaxone, cefepime),* – *Piperacillin/tazobactam,* – *Aminoglycosides (amikacin)*

o After improvement, the patient‘s medications can be switched to an oral regimen using one of the antibiotics to complete the 1–2-week course of therapy.

Treatment of acute complicated pyelonephritis

o The treatment of acute complicated pyelonephritis involves decompression of any obstruction and drainage of larger abscesses in the urinary tract.

Urinary decompression methods	– *Ureteral catheterization or stent placement* – *Percutaneous puncture nephrostomy* – *Open nephrostomy*
Antibiotics recommended for *initial empirical treatment*	*Fluoroquinolone,aminopenicillin, cephalosporin, aminoglycoside, carbapenem*
Surgical treatment for pyelonephritis complications	*Pyelotomy, nephrostomy, kidney decapsulation, excision of the carbuncle, drainage of the abscess, drainage of the perinephric space. Nephrectomy* is used according to absolute indications

Chapter 4. BASIC UROLOGICAL EMERGENCY

o Non traumatic urological emergency will be presented in this chapter.

✓ Hematuria
✓ Anuria
✓ Acute urinary retention
✓ Renal colic
✓ Acute Scrotum

HEMATURIA

o *Hematuria* is the presence of blood in the urine.

Categories of hematuria

Gross hematuria	It is visible blood in urine
Microscopic hematuria	It refers to the detection of blood on urinalysis or urine microscopy (more than 3 red cells per high-power microscopic field)
Initial	It has a source in the distal urethra
Terminal	It has a source in the proximal urethra or bladder neck
Total	It has a source in the bladder or upper tract
Glomerular	It is usually nephrologic hematuria
Non-glomerular	Various types of urological and non-urrological hematuria due to febrile illness, exercise, menstruation, nephrolithiasis, cystitis, malignancy, injury by instrumentation and others
Intermittent or persistent	
Painful or painless, asymptomatic or symptomatic	
Renal or nonrenal	
Idiopathic	Approximately 20% of patients will have idiopathic hematuria

Etiology of hematuria

Urologic	Tumors of the genitourinary system Urolithiasis Kidney cysts, polycystic kidney disease, medullary sponge kidney Urinary tract infections Injuries to the kidneys, ureters, bladder
Nephrologic	Glomerulonephritis, IgA nephropathy Lupus nephritis, Wegener's granulomatosis, Goodpasture syndrome, Alport syndrome Interstitial nephritis caused by systemic diseases (sarcoidosis, lymphoma, Sjogren's syndrome), metabolic disorders (hypercalciuria, hyperuricosuria) Interstitial nephritis of drug etiology (antibiotics, diuretics, non-steroidal anti-inflammatory, anticonvulsants, antitumor drugs)
Vascular	Arteriovenous fistula, renal artery stenosis, thrombosis or renal artery thromboembolism, renal vein thrombosis
Hematologic	Leukemia, lymphoma, sickle cell anemia, use of blood thinners
Infectious	Tuberculosis, schistosomiasis, kidney damage in hepatitis B and C, syphilis, toxoplasmosis, cytomegalovirus, Epstein-Barr virus

Examination

Physical examination	Complaints, history Assess heart rate, blood pressure, level of consciousness, respiratory rate, circulating blood volume, ECG, lymph nodes, external opening of the urethra Palpation of the abdomen. Digital rectal, and vaginal examination Consultation and examination of a nephrologist, a hematologist, and an infectious disease specialist
Laboratory diagnostics	Urinalysis Urine microscopy Full blood count Biochemistry of blood plasma Coagulation tests Urine cytology

Imaging	Ultrasound of the kidneys, ureters, and bladder Radiologic examination (plain abdominal radiography, intravenous excretory urography) Abdominopelvic CT scan MRI abdomen and pelvis Cystoscopy

Treatment

o *Gross hematuria* – indication for examination and treatment of the patient in the *urology department*.

Conservative therapy (for nephrological, hematological, infectious causes of hematuria)	Hemostatic therapy Antibacterial Anti-inflammatory and infusion therapy Glucocorticoids and cytostatics
Surgery (indications)	Recurrent hematuria due to urological diseases (tumors, strictures, stones) Gross hematuria, leading to the development of anemia, blood clots in the bladder Hematuria due to kidney and bladder injury Kidney and bladder tumors, BPH

o The type of surgical treatment depends on the cause of the disease (kidney resection or nephrectomy, embolization of bleeding vessels, transurethral or open prostatectomy, etc.).

ANURIA

o *Anuria* is a pathological condition in which urine from the upper urinary tract does not enter the bladder or when the daily diuresis is less than 100 ml. Anuria may be one of the symptoms of acute kidney injury (AKI), but AKI can occur without changes in daily diuresis. At the same time, anuria can occur with normal renal function due to obstruction of the urinary tract and further lead to irreversible damage to the kidneys.

Classification

Prerenal	It results from decreased renal perfusion due to severe hypotension
Renal (intrarenal)	Structural injury in the kidney results in intrinsic or renal anuria
Postrenal	It occurs after acute obstruction of the urinary flow

Ethiology

Prerenal	Hypovolaemia (haemorrhage) Impaired cardiac function (acute myocardial infarction) Systemic vasodilatation (anti-hypertensive medications, anaphylaxis)
Renal	Vascular, glomerular, tubular, and interstitial causes include the following: – Nephrotoxic drugs (antibiotics, antineoplastic drugs, contrast media, diuretics, NSAIDs) – Acute post-infectious glomerulonephritis, lupus nephritis – Bilateral renal artery stenosis, vein thrombosis
Postrenal	Extrarenal obstruction (prostate hypertrophy, bladder, prostate or cervical cancer) Intrarenal obstruction (nephrolithiasis, blood clots)

Diagnosis of anuria

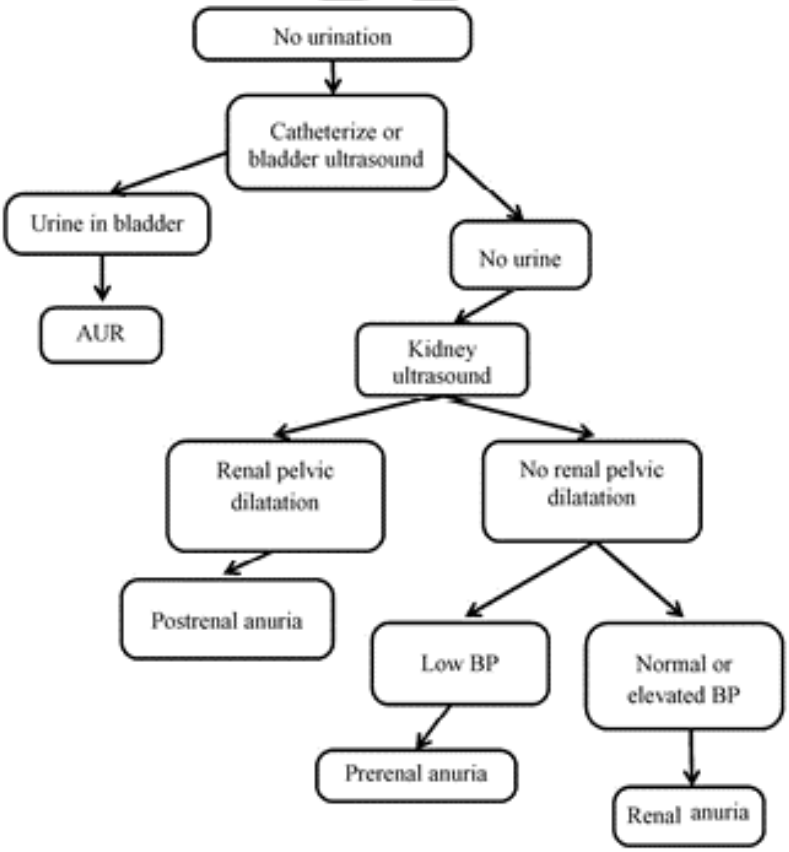
o At the beginning of the diagnosis, acute urinary retention must be excluded. Comparison of the manifestations of anuria and acute urinary retention:

Anuria	Acute urinary retention
There is no urge to urinate	There is urge to urinate
The bladder is empty	The bladder is full of urine
Suprapubic pain is absent	Presence of suprapubic pain
The patient is calm	The patient is restless
Hyperazotemia	Normazotemia
Catheterization does not produce urine, and does not eliminate anuria	Catheterization produces urine and eliminates acute urinary retention

o Clinical manifestations. The patient has clinical manifestations of the disease that causes anuria (see etiology of anuria).

Symptoms of uremia	Anorexia, dry mouth, ammonia breath, thirst, nausea, vomiting, constipation, then diarrhea
Symptoms of central nervous system damage	Asthenia, headache, muscle pain, cramps, confusion, coma
Signs of pulmonar and cardiovascular failure	Shortness of breath, hypotension, bradycardia, arrhythmia
Peripheral edema	It is possible
Laboratory signs	Hyperazotemia, hyperkalemia, hyponatremia, anemia, an increase in the content of chlorides, metabolic acidosis, impaired water and salt metabolism, a decrease in the content of bicarbonates, hypocoagulation

Algorithm for suspected anuria



Treatment

Postrenal anuria	Upper urinary tract drainage: – ureteral catheterization, – percutaneous nephrostomy, – open nephrostomy
Prerenal anuria	Hemodynamic support, intravenous fluid resuscitation
Renal anuria	Treatment of underlying kidney disease

ACUTE URINARY RETENTION

- *Acute urinary retention* (AUR) is defined as the inability to pass urine voluntarily in the presence of a strong urge to void and a full urinary bladder which is usually associated with lower abdominal discomfort and pain.

Etiology

Obstruction of the urethra	Benign prostatic hyperplasia (BPH), urethral stricture, phimosis/ paraphimosis, bladder stones and clots, cystocele, tumors.
Medications/drugs	Antihistamines, anticholinergics, tricyclic antidepressants, opioid analgesics, and other
Neurologic impairment	Brain or spinal cord infections or injuries, diabetes, stroke, multiple sclerosis, pelvic injury or trauma, heavy metal poisoning, urinary retention after surgery
Urinary tract infection or inflammatory causes	Acute urethritis and prostatitis

Examinations

Symptoms	Inability to urinate Painful, urgent need to urinate Pain or discomfort in the lower abdomen Abdominal distention (full urinary bladder)
Physical examination	History Lower abdominal palpation Rectal examination Genital/pelvic examination Neurological evaluation
Laboratory tests	Urinalysis, urine culture Blood chemistries (electrolytes, blood urea nitrogen, and creatinine levels) Prostate-specific antigen (PSA)
Imaging	Bladder ,renal, pelvic ultrasound Computed tomography (CT), magnetic resonance imaging (MRI)
Complications	UTIs Bladder damage Kidney damage

Treatment

Prompt bladder decompression	Urethral catheterization (Foley, Coude or Nelaton catheters) Suprapubic catheterization (cystostomy)
Contraindications to catheterization	Suspected urethral injury (blood at urethral meatus, perineal or scrotal hematoma) History of known prostate or bladder neck surgery

	Complicated lower UTI (acute bacterial prostatitis, urethritis)
Indications for suprapubic cystostomy	AUR in a patient with contraindications for urethral catheterization Failure of transurethral catheterization or AUR in which a urethral catheter cannot be passed
Medical management	Alpha-adrenergic blockers (*tamsulosin, doxazosin*)
Surgical therapy	Prostatectomy or transurethral resection of the prostate, internal urethrotomy

RENAL COLIC

o *Renal colic* describes the acute, severe, and paroxysmal flank pain caused by acute upper urinary tract obstruction.

Evaluation

Causes of renal colic	Renal or ureteral stones Congenital abnormalities Ureteral strictures Extrinsic compression of the ureter (secondary to malignancy or inflammatory conditions)
Clinical manifestations	Upper ureteral or renal pelvic obstruction - flank pain or tenderness Lower ureteral obstruction - pain that may radiate to the ipsilateral testicle or labium The location of the pain may change as the stone migrates Nausea, vomiting Dysuria and urinary urgency (occur when the stone is located in the distal ureter) Gross or microscopic hematuria.
Differential diagnosis	Renal cell carcinoma Ectopic pregnancy Aortic aneurysm Acute intestinal obstruction or appendicitis
Imaging	Abdominal plain film Intravenous pyelography (IVP) Ultrasonography Computed tomography (CT) scan

Therapy

Conservative	Pain relief: *NSAIDs, nonnarcotic analgesics, opioids*
Indications for intervention to relieve obstruction and/or remove the stone	Pain refractory to analgesics Obstructed upper tract with infection Renal function is impaired because of the stone.
Decompression (drainage of obstructed kidney)	Placement of an indwelling ureteral stent Percutaneous placement of a nephrostomy tube

ACUTE SCROTUM

o *Acute scrotum* is defined as an acute painful swelling of the scrotum or its contents accompanied by local signs and general symptoms.

Causes of acute scrotum

Ischemia	Testicular torsion, appendiceal torsion, thrombosis
Infectious conditions	Acute epididymitis, epididymo-orchitis, abscess, gangrenous infections (Fournier's gangrene)

o *In adults* acute epididymo-orchitis is the most common cause of an acute scrotum. *In children* torsion of a testicular appendix or testicle are most common causes.

Testicular torsion

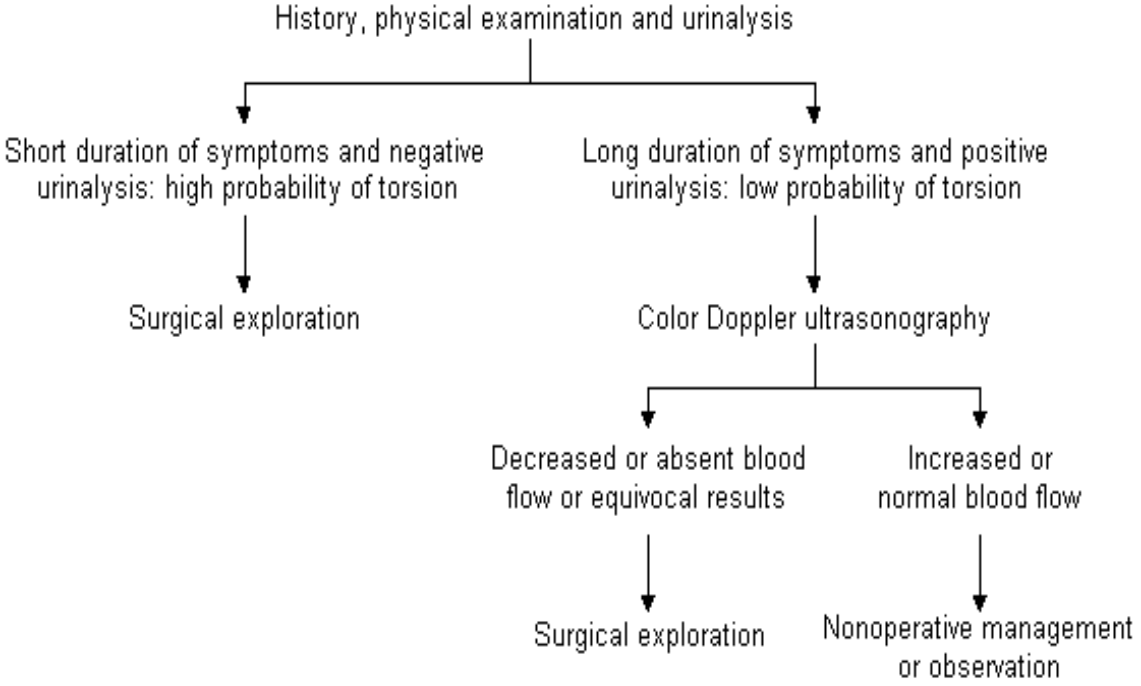
Clinical presentation

– Abrupt onset of severe testicular or scrotal pain;
– Isolated or may radiate to the lower abdomen;
– Associated nausea and vomiting.

Investigation

– *Physical examination*. The scrotum may be edematous, indurated and erythematous. The testis may be lying horizontally. The cremasteric reflex is absent.
– *Color Doppler ultrasound* (decreased testicular perfusion).

Management



– *Surgical detorsion and fixation (orchiopexy)* is indicated and it never should be delayed!
– Orchiopexy of both testes is recommended
– *Orchiectomy* is performed if the testicle is nonviable. Detorsion within 4 to 6 hours — 100 % viability, detorsion after 12 hours — 20 % viability, and detorsion after 24 hours — 0 percent viability!

Torsion of the appendix testis or appendix epididymis

o The pain is more gradual than with testicular torsion. Reactive hydrocele (transilluminate). Tenderness can be localized to the exact location of the appendix testis. Tender appendix testis, normal testis and epididymis.

Acute epididymo-orchitis

o Inflammation of the epididymis is more common among sexually active adolescents and men. (*Chlamydia, N. gonorrhea, E. coli, and viruses* are the most common microbial agents).

Clinical manifestations:

– *Scrotal swelling, pain, and tenderness with erythema*.

– In case of epididymitis *pain and swelling* isolated to the epididymis.

Investigation:

– History– *frequency, dysuria, urethral discharge, and/or fever*.

– Urinalysis, Gram-stained smear and culture of urethral swab specimen, PCR for *N. gonorrhea and C. trachomatis*.

Treatment:

– *Antibiotics*

– *Analgesics*

– *NSAIDs*

– *Ice packs, scrotal elevation*

Chapter 5. UROLITHIASIS

o *Urolithiasis or kidney stone disease* is the process of stones formation in the urinary tract, including the kidney, bladder, ureter, and urethra.

Etiology and pathogenesis

- Stones classification (by etiology)

Non-infections stones	Calcium oxalate and phosphate Uric acid
Infection stones	Magnesium ammonium phosphate (struvite) Carbonate apatite
Genetic causes	Cystine Xanthine
Drug stones	Drug-induced stone formation

- Causes and risk factors

Disorders of urinary tract	Congenital abnormalities (medullary sponge kidney, horseshoe kidney, ureterocele); ureteral stricture; vesico-uretero-renal reflux; foreign bodies of urinary tract; traumatic injuries.
Liver and digestive tract disorders	intestinal resection, Crohn's disease, malabsorptive conditions)
Endocrine diseases	Hyperparathyroidism; metabolic syndrome
Focuses of infection of the urogenital system	The urease-producing pathogens: Proteus, Klebsiella, Pseudomonas, and Staphylococcus
Genetic	Primary hyperoxaluria, cystinuria, xanthinuria

Injuries those leads to immobilization	Fractures of the vertebral column and limbs; osteomyelitis; diseases of the bones and joints
Climate and geographical causes	Dry and hot climate with a high vaporization; decrease of water supply
Medication	Calcium supplements, vitamin D supplements, ascorbic acid in megadoses (> 4 g/day), calcium-containing antacids, sulphonamides, triamterene, indinavir
Family history	Urolithiasis in parents
Lifestyle, dietary	Obesity, sedentary lifestyle, high blood pressure, meat-rich food

- Kidney stones: composition, frequency
– Calcium stones — 80 %;
– Uric acid stones — 5–10 %;
– Struvite/infection stones — 10 %;
– Cystine stones — < 1 %.

- Theories of stones formation. Theories to explain urinary stone disease are incomplete.

Nucleation (saturation)	Stone originate from crystals in supersaturated urine
Stone matrix	Matrix or organic material contributes to the initiation of stones formation
Inhibitors and promoters of crystal formation	Deficiency of inhibitors crystal growth (citrate, magnesium, zinc, glycosaminoglycans). Promoters (Bacterial infection, uric acid, matrix)
Fix particle theory (*Randall's plaque theory*)	Erosion and deposition of urinary salts as Randall's plaque at the apex of renal papillae
Stasis or lack of urine flow	The most common cause of bladder stones is urinary stasis

- Stages of stone formation

Supersaturation ➔ *Nucleus formation* ➔ *Crystalliztion* ➔ ➔ *Aggregation* ➔ *Crystal formation*

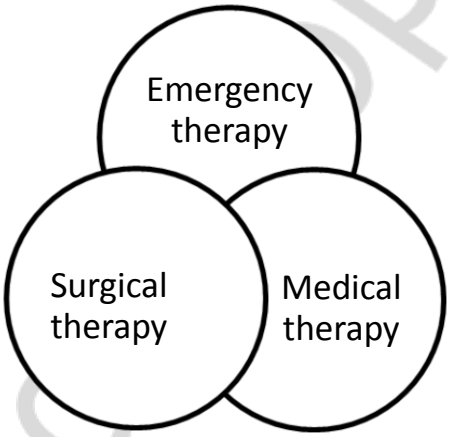
- X-ray characteristics of stones

Radiopaque	Radiolucent
Calcium oxalate *Calcium phosphates* *Cystine (poor radiopacity)*	*Uric acid* *Xanthine* *Ammonium urate*

Diagnostic evaluation

Medical history and physical examination. Clinical manifestations	Pain in the loin, renal colic Nausea and vomiting Urination disorders Blood in the urine Fever or chills Repeated urinary infections Asymptomatic stones
Lab tests	Blood tests Urinalysis Blood coagulation test Biochemical work-up of blood Complete metabolic evaluation Analysis of stone composition Urine culture Parathyroid hormone
Imaging tests	Renal ultrasonography Plain films (Kidney-ureter-bladder -KUB) Intravenous urography Retrograde pyelography Computed tomography (Gold standard is a non-contrast helical CT of the abdomen and pelvis) Nuclear renal scanning

Disease Management



- Emergency therapy

– Acute therapy of renal colic. Pain relief

Non-steroidal anti-inflammatory drugs (NSAIDs)	*Diclofenac, Ibuprofen, Ketorolac*
Nonnarcotic analgesics	*Acetaminophen*
Opioids	*Tramadol, Hydromorphine, Fentanyl, Pethidine*

– Indications for intervention to relieve obstruction and/or remove the stone:

- Pain refractory to analgesics;
- Obstructed upper tract with infection (fever, elevated WBC, signs of infection on urine analysis and microscopy);
- Renal function is impaired because of the stone (solitary kidney obstructed by a stone, bilateral ureteric stones, or preexisting renal impairment);
- Obstruction unrelieved for >4 weeks.

– Urgent decompression of obstructed collecting systems:

- Placement of an indwelling ureteral stent;
- Percutaneous placement of a nephrostomy tube.

– Management of sepsis in obstructed kidney:

- Urgent decompression is necessary to prevent further complications in infected hydronephrosis, renal obstruction;
- Antibiotics (ampicillin, gentamicin, ciprofloxacin, levofloxacin).

• Medical therapy

– Medical expulsive therapy. α-blockers – tamsulosin, hydration up to 2L/ day of fluid intake (for distal ureteral stones)

– Stone prevention/oral chemolysis

Uricosuric agents	*Allopurinol*, *Febuxostat* (long-term to treat gout due to high uric acid levels)
Alkalinizing agents	*Potassium citrate*, *Sodium bicarbonate*, *Citric acid* (for uric acid stones)
Thiazide diuretics	*Hydrochlorothiazide* (help to treat hypercalcicuria)

• Surgical therapy

Extracorporeal shock wave lithotripsy (SWL)	External shock waves are concentrated over the area of the stone
Ureteroscopy and laser lithotripsy	Direct visualization and fragmentation of the stone with a laser
Percutaneous nephrostolithotomy (PCNL)	Percutaneous removal of large stones or staghorn calculi
Laparoscopy	For large proximal ureteral stones
Open surgery	Last treatment option

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CONTENTS

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