



Kharkov Regional Centre of Cardiovascular surgery

V.N. Karazin Kharkov National University

Department of Internal Medicine

Interviewing, physical examination, instrumental and laboratory tests for patients with affection and diseases of the kidneys

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2014

Urinary System

Inferior vena cava

Adrenal gland

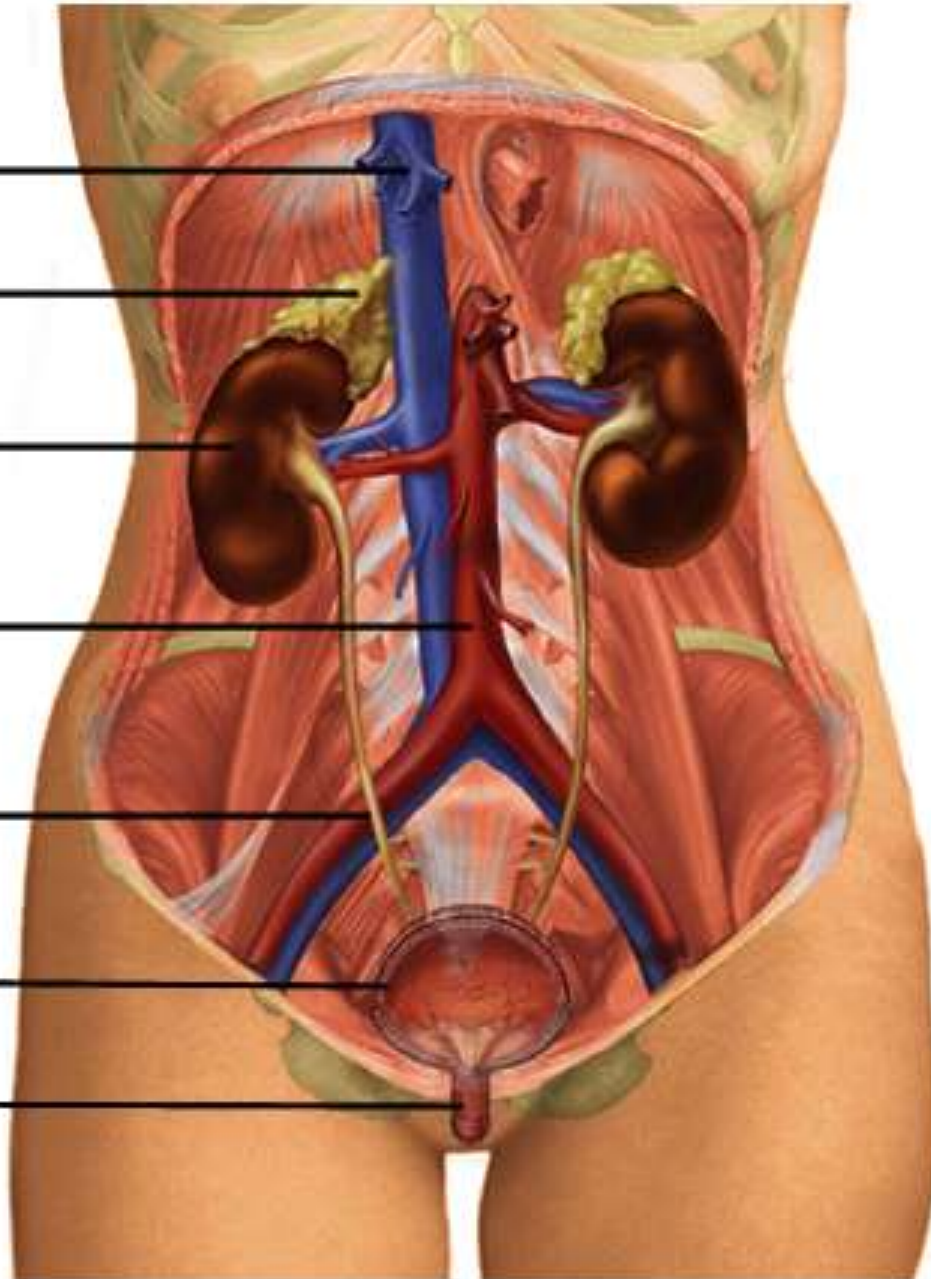
Kidney

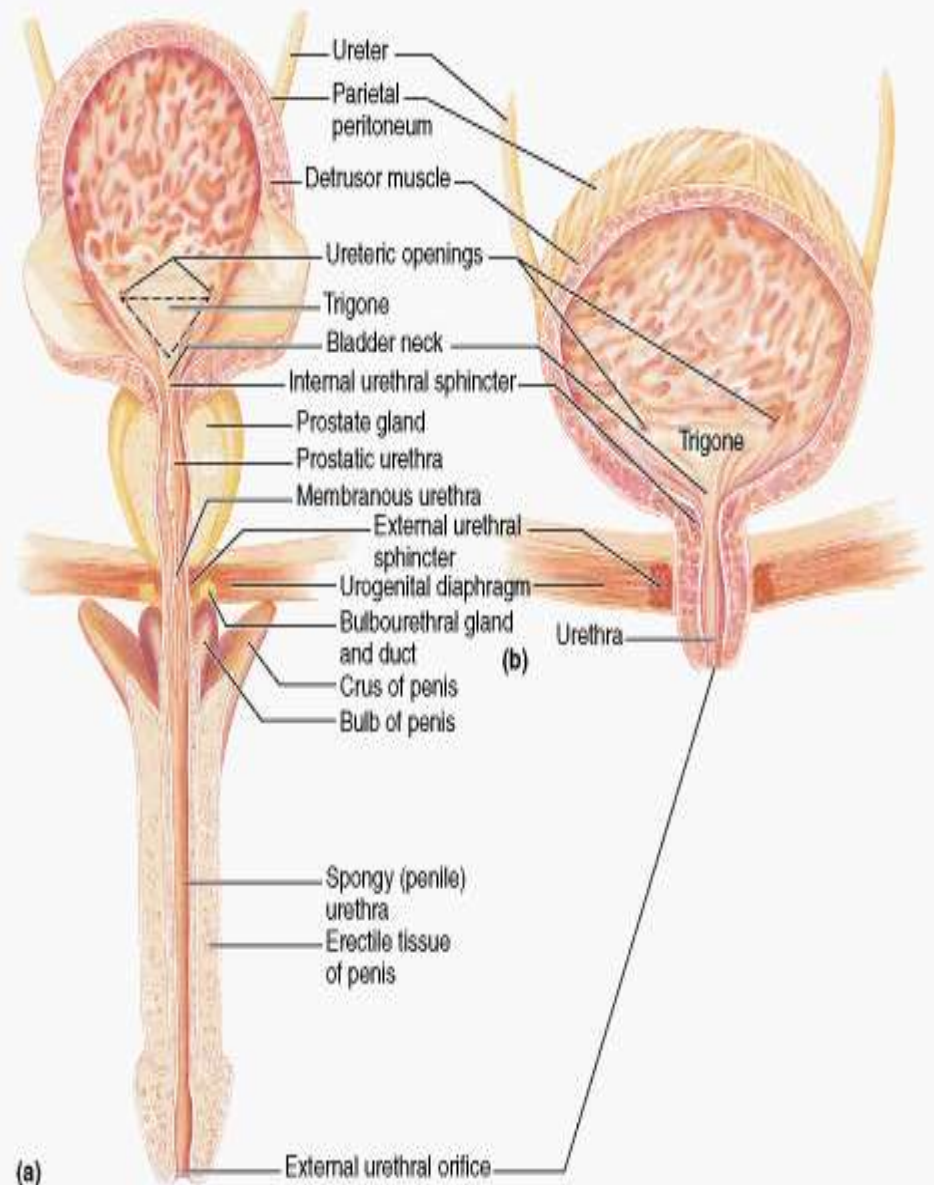
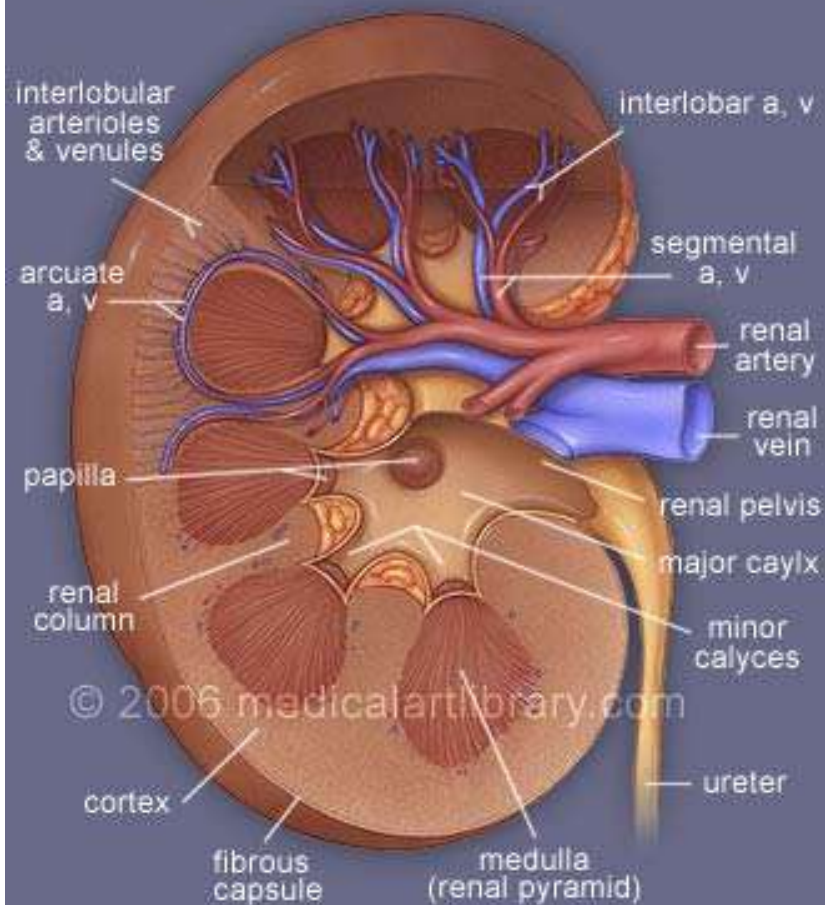
Aorta

Ureter

Bladder

Urethra



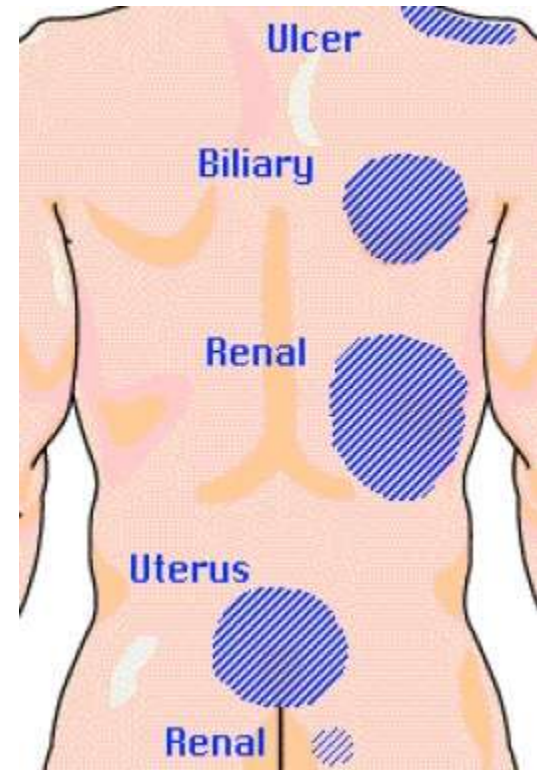


(a)

Complaints

Main complaints of patients with kidney diseases

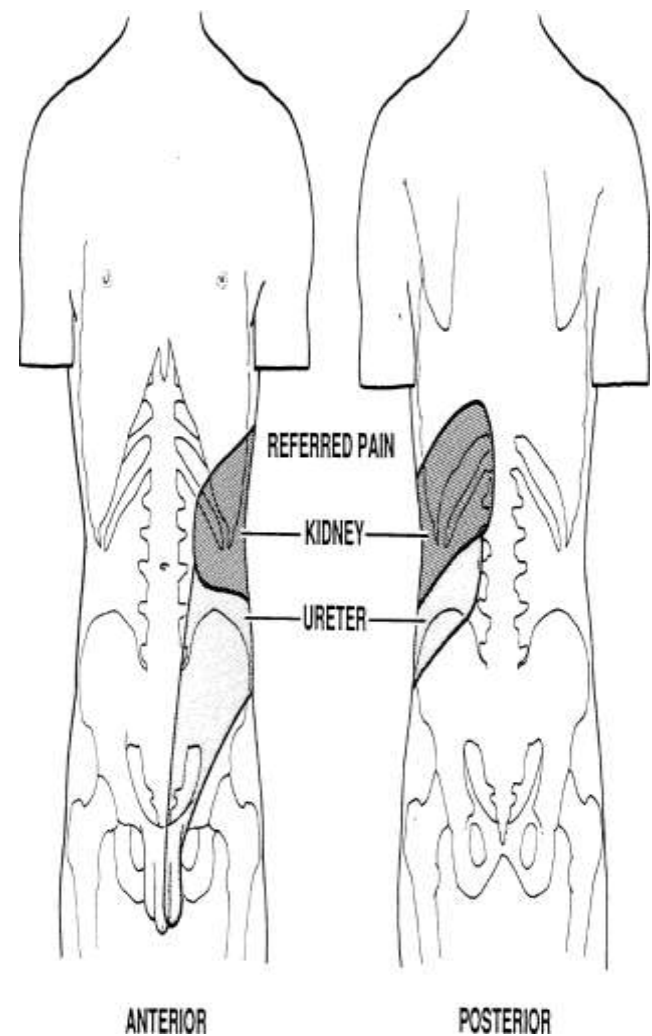
- Pain in lumbar region
- Disordered urination
- Oedema
- Headache
- Dizziness
- Deranged vision
- Dyspnoea
- Absence of appetite, nausea, vomiting, and elevated body temperature



Renal Pain

–Pain of renal origin often localizes in the lumbar region. It is necessary to remember that the renal tissue is devoid of pain receptors. The pain is felt when the capsule or the pelvis is distended. Pain arises due to distension of the renal capsule because of the inflammatory or congestive swelling of the renal tissue

–Dull and boring pain in the lumbar region occurs in acute glomerulonephritis, abscess or the perirenal cellular tissue, in heart decompensation ("congestive kidney") in chronic pyelonephritis (usually unilateral) and less frequently in chronic glomerulonephritis.

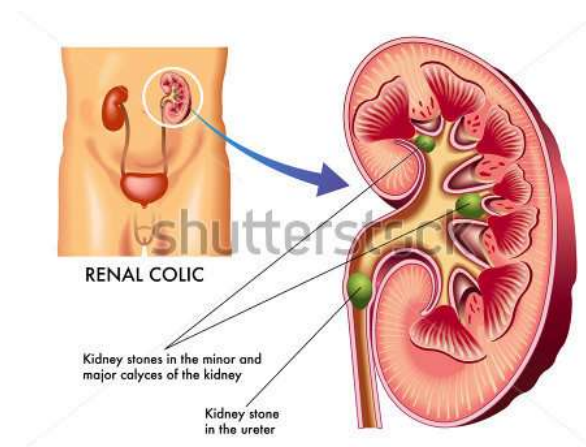


Renal pain causes

- **Renal infarction:** Sharp and suddenly developing pain on one side of the loin can be due to the renal infarction. The pain persists for several hours or days and then subsides gradually.
- **Pyelonephritis:** The pain is rather severe in acute pyelonephritis
- **Renal colic**

Renal colic (1)

- **Renal colic describes the severe pain felt from 'loin to groin' caused by a renal stone obstructing the flow of urine as it passes down through the ureter.**
- The pain typically begins in the abdomen and often radiates to the groin. The pain is often colicky (comes in waves) due to ureteric peristalsis, but may be constant. It may come in two varieties: dull and acute; the acute variation is particularly unpleasant and is often described as one of the strongest pain sensations felt by humans (being worse than childbirth, broken bones, gunshot wounds, burns, or surgery).



Renal colic (2)

- Patients with renal colic (like those with colic of other aetiology) are restless; they toss in bed. Patients with severe pain of other aetiology would usually lie quiet in their beds (movements may intensify the pain).
- It is necessary also to establish the agent that lessens or removes the pain. For example, atropine sulphate, hot water-bottle or warm bath in renal colic. Since these remedies only help in spasmodic pain by removing spasm of the smooth muscles, their efficacy in renal colic confirms the leading role of the ureter contraction in the pathogenesis of this pain.



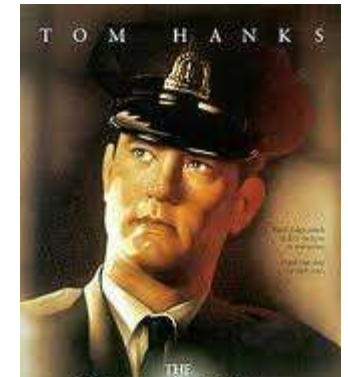
Bladder pain

- If the bladder is involved, pain is suprapubical.



Brainstorm break😊

- "The Green Mile" - The Greatest Urinary Tract Infection Movie of All Time😊
- Paul Edgecomb (Tom Hanks) has got an has a painful bladder infection (cystitis) that makes his bathroom trips excruciating.

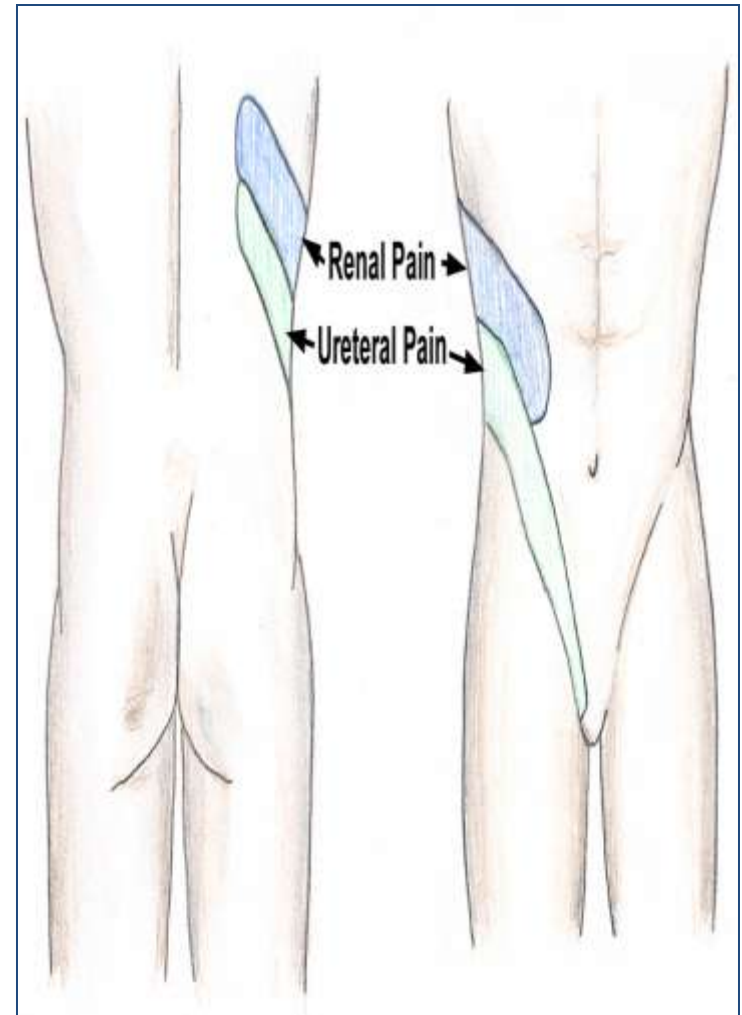


Associated symptoms with renal pain

- **Gastrointestinal symptoms**
 - Nausea
 - Vomiting
 - Ileus

Ureteral pain

- Usually acute and secondary to obstruction
 - Midureter (Rt side): referred to the right lower quadrant (McBurney's point) and simulate appendicitis
 - Midureter (Lt side) :referred over the left lower quadrant and resembles diverticulitis.
 - Scrotum in the male or the labium in the female.
 - Lower ureteral obstruction frequently produces symptoms of bladder irritability(frequency, urgency, and suprapubic discomfort)



Neurogenic pain of the T10–T12 costal nerves

- Renal pain may also be confused with pain resulting from irritation of the costal nerves, most commonly **T10–T12** which is:
 - not colicky in nature.
 - Severity of radicular pain may be altered by changing position

Dysuria

- **Dysuria is the sensation of pain, burning, or discomfort on urination**
- Dysuria is frequently accompanied by urinary frequency, hesitation (difficulty in beginning the flow of urine), slowness, or urgency (a sudden, compelling urge to urinate).
- In adult women, a history of external dysuria (pain as the urine passes over the inflamed vaginal labia) suggests vaginal infection or inflammation, whereas a history of internal dysuria (pain felt inside the body) suggests bacterial cystitis or urethritis.
- **Pain at the onset of urination is usually caused by urethral inflammation, but suprapubic pain after voiding is more suggestive of bladder inflammation or infection.**
- **Causes of dysuria**
 - Infections: pyelonephritis, cystitis, prostatitis, urethritis, cervicitis, epididymo-orchitis, vulvovaginitis
 - Hormonal conditions: hypoestrogenism, endometriosis
 - Malformations: bladder neck obstruction (e.g., benign prostatic hyperplasia), urethral strictures or diverticula
 - Neoplasms: renal cell tumor; bladder, prostate, vaginal/vulvar, and penile cancers
 - Inflammatory conditions: spondyloarthropathies, drug side effects, autoimmune disorders
 - Trauma: catheter placement, “honeymoon” cystitis
 - Psychogenic conditions: somatization disorder, major depression, stress disorders or anxiety, hysteria

Symptoms

Diuresis

Diuresis is defines as secretion of urine during a certain period of time

Diuresis can be:

1. **Positive** (the amount of urine excreted exceeds the volume of liquid taken) – occurs in resolution of edema after administration of diuretics.
2. **Negative** (the reverse ratio) - is observed in cases of liquid retention in the body or its excess excretion through the skin, by the lungs (e.g. in dry and hot weather).

Urinary frequency

- For most people, normal frequency is about 6 - 7 times in a 24 hour period.
- Pollakiuria (pollakis: Greek, meaning often) is an increased daytime frequency of urination.
- Frequent urination is the synonym - the need to urinate more often than usual

Causes:

- Frequent desire to urinate with excretion of scanty quantity of urine is the sign of cystitis.
- Overflow secondary to BPH
- Urethral pathology
- Rarely - a central or peripheral neurologic disorder

Nocturia

A healthy person urinates during night not more than once

Nocturia (derived from Latin nox, night, and Greek [τα] ούρα, urine), also called nycturia (Greek νυκτουρία), is the need to get up in the night to urinate, thus interrupting sleep (in contrast to enuresis, where urine is passed unintentionally during sleep).

Causes:

- 1. Cardiac nocturia:** nocturia after oliguria during day time occurs in cardiac decompensation and is explained by a better renal function at night, i.e .at rest
- 2. Renal nocturia:** nocturia may concur with polyuria in renal dysfunction, at the final stage of chronic glomerulonephritis, chronic pyelitis, vascular nephrosclerosis and other chronic renal diseases.

Isuria

Isuria is an excretion of urine at a uniform rate: urination at about equal intervals with evacuation of about equal portions of urine.

Cause:

- Chronic renal insufficiency

In the presence of chronic renal insufficiency at the stage when the kidneys are unable to control the amount and concentration of excreted urine in accordance with the amount of liquid taken, physical exertion, the ambient temperature, or other factors important for the liquid balance in the body.

Urinary hesitation and Slow urination

- Urinary hesitation is a difficulty in beginning the flow of urine and
- Slow urination is a slow urinary flow

Causes:

- Urethral obstruction due to benign prostatic hyperplasia
- Prostatitis
- Urinary Tract Infection
- Cystitis
- Medications: nasal decongestants, tricyclic antidepressants, and anticholinergics which may be used for incontinence



Incontinence

- **Incontinence is an inability to control urination voluntarily.**
- It may involve periodic involuntary urination, or a continual, slow trickle of urine from the urethra. Incontinence may result from urinary bladder or urethral problems, damage or weakening of the muscles of the pelvic floor, or interference with normal sensory or motor innervation in the region. Renal function and daily urinary volume are normal.

Urinary urgency

- **Urinary urgency is a sudden, compelling urge to urinate**
- An irritation of the lining of the ureters or urinary bladder can lead to the desire to urinate with increased frequency, although the total amount of urine produced each day remains normal. Detrusor muscle contractions may also lead to increased frequency in urination. When these problems exist, the individual feels the urge to urinate when the urinary bladder volume is very small. The irritation may result from urinary bladder infection or tumors, increased acidity of the urine, or detrusor hyper-reflexia.



Urge incontinence occurs when one leaks due to a strong urge and is unable to reach the toilet in time.

Urethral discharge

- Urethral discharge is any liquid other than urine or semen that comes out of urethra.
- Discharge can be milky white, brown, yellow, green or blood tinged.
- Urethral discharge is highly associated with urethritis.
- In men, urethral discharge and dysuria are the most common symptoms of sexually transmitted urethritis.



History

History of present illness (1)

The character of the renal disease course

- The patient must be asked about the character of the clinical course of the disease
- The clinical course of renal disease may be:
 1. **Gradual** (arteriolosclerosis, chronic diffuse glomerulonephritis, amyloidosis of the kidneys)
 2. **Recurrent with periodical exacerbations** (chronic pyelonephritis, chronic diffuse glomerulonephritis).
 - ✓ *Cause of exacerbations*
 - ✓ *Their frequency*
 - ✓ *Clinical signs*
 - ✓ *The character of therapy given and its efficacy*
 - ✓ *The causes inducing the patient to seek medical help again*

History of present illness (2)

Any current or previous renal or urologic disorders

- When interviewing the patient, it is necessary to establish the connection of the present disease with previous infections (recent travel to geographic regions that pose infectious disease risks), stones, urologic surgery, trauma, tumors, transfusion of incompatible blood, etc.
- Previous infections (tonsillitis, scarlet fever, otitis, acute respiratory diseases) is especially characteristic of acute glomerulonephritis. But it is sometimes difficult to establish the time of onset of the disease because some chronic affections of the kidneys and the urinary ducts can for a long time be latent.

History of present illness (3)

Any sexually transmitted disease

- Information should also be obtained about the patient's sexual and general medical history. In sexually active patients, urethritis or vulvovaginitis can be a likely cause of dysuria.
- A history of sexually transmitted disease (STD) can point to urethral scarring or a current STD, especially in patients with high-risk sexual behaviors.
- Patients who have diabetes mellitus may present with vulvovaginitis secondary to candidiasis.

History of present illness (4)

Any constantly used medications

- Drugs prescribed for diabetes mellitus, hypertension, cardiac disorders, hormonal disorders, cancer, arthritis, and psychiatric disorders are potential causes of renal dysfunction.
- The long-term use of NSAIDs, phenacetin, barbiturates, camphor, antibiotics (gentamicin, tetracyclines, penicillin G, cyclophosphamide and others) and some other medicines may seriously reduce renal function
- Dysuria can occur with the use of pumpkin seeds, the use of a number of topical hygiene products, including vaginal sprays, vaginal douches, and bubble baths.

History of present illness (5)

Chemical or environmental toxin exposure in occupational or other settings

- Acute tubular necrosis and following acute renal insufficiency can be caused by intentional (or by mistake) exposure in industrial or domestic poisoning, such as:
 - Corrosive sublimate
 - Preparations of bismuth
 - Phosphorus
 - Silver
 - Large doses of sulpha preparations

Past medical history

When interviewing the patient the doctor should clarify:

- A history of any chronic disease, which may affect kidney, such as diabetes mellitus, hypertension, tuberculosis, amyloidosis, parasitoses, collagenoses, blood diseases.
- Renal problems associated with previous pregnancy (e.g., proteinuria, high blood pressure, gestational diabetes, and urinary tract infections).

Family history

The family history of the patient with a kidney disease is significant because some disorders have a familial inheritance pattern.

The patient is asked whether his or her close blood relatives have had renal problems such as:

- Stones
- Renal tumors (some types)
- Amyloidosis
- Some renal anomalies

General inspection of patient with kidney diseases

General level of consciousness

- The patient's general level of consciousness and level of alertness must be assessed, noting deficits in concentration, thought processes, or memory.
- Family members may report subtle changes. Such cognitive changes may be the result of an insufficient clearance of waste products when renal disease is present.

Inspection of the abdomen and the flank regions

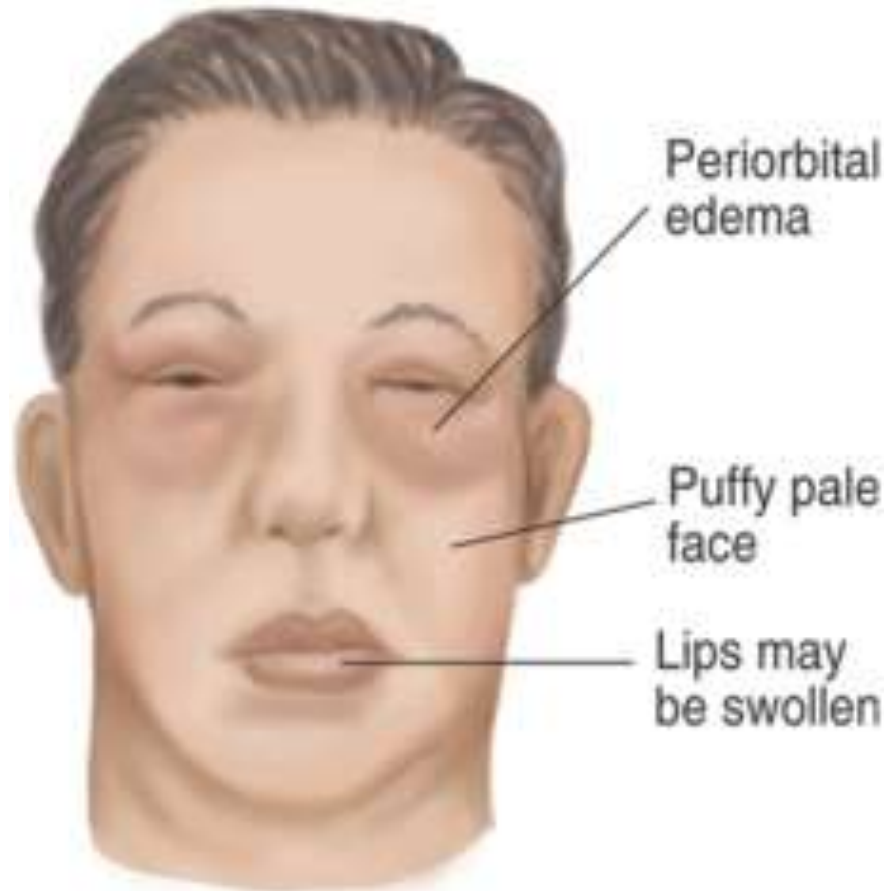
- Abdomen and the flank regions are inspected in both the supine and the sitting position.
- The client is observed for asymmetry (e.g., swelling) or discoloration (e.g., bruising or redness) in the flank region, especially in the area of the costovertebral angle.



Kidney stone pain is a radiating flank pain that can travel to the side and around to the lower abdomen.

Facies nephritica

- Puffy face.
- Baggy eyelids.
- Waxy pallor.



A face is edematous and often pale, swelling usually begins around eyes and may become slitlike when edema is severe

Facies nephritica



Waxy pallor

Cases of nephrotic syndrome

Facies nephritica



MINIMAL CHANGE DISEASE

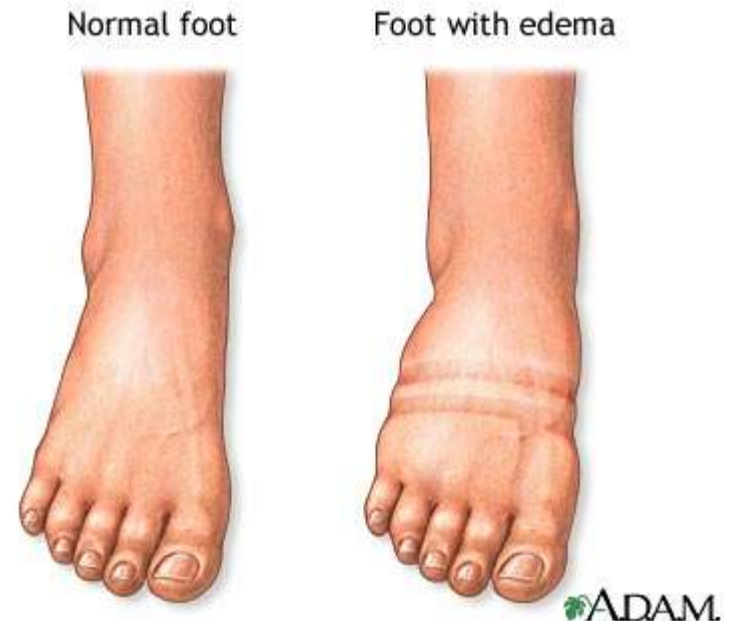
image of Eli A. Friedman, M.D.



Puffy face of renal edema, more
in the mornings.

Peripheral edema in renal diseases

In advanced cases of renal diseases accompanied by nephrotic syndrome there are signs of peripheral edema involving lower (pedal (foot), pretibial (shin)) and upper extremities, the sacral tissues or even anasarca.



Uremic frost

A pale frostlike deposit of white crystals on the skin caused by kidney failure and uremia. Urea compounds and other waste products of metabolism that cannot be excreted by the kidneys into the urine are excreted through the small superficial capillaries into the skin, where they collect on the surface.



Friable white crystals (“uremic frost”) on the face of a 62-year-old man with uremic encephalopathy.

Anasarca in renal diseases

Anasarca is defined as extreme generalized edema, characterized by widespread swelling of the skin due to effusion of fluid into the extracellular space and accumulation of serous fluid in cavities of the body, evoking ascites, hydrothorax, hydropericardium.

- It is usually caused renal failure/disease, cardiac failure, liver failure (cirrhosis of the liver) or severe malnutrition/protein deficiency.



Anasarca

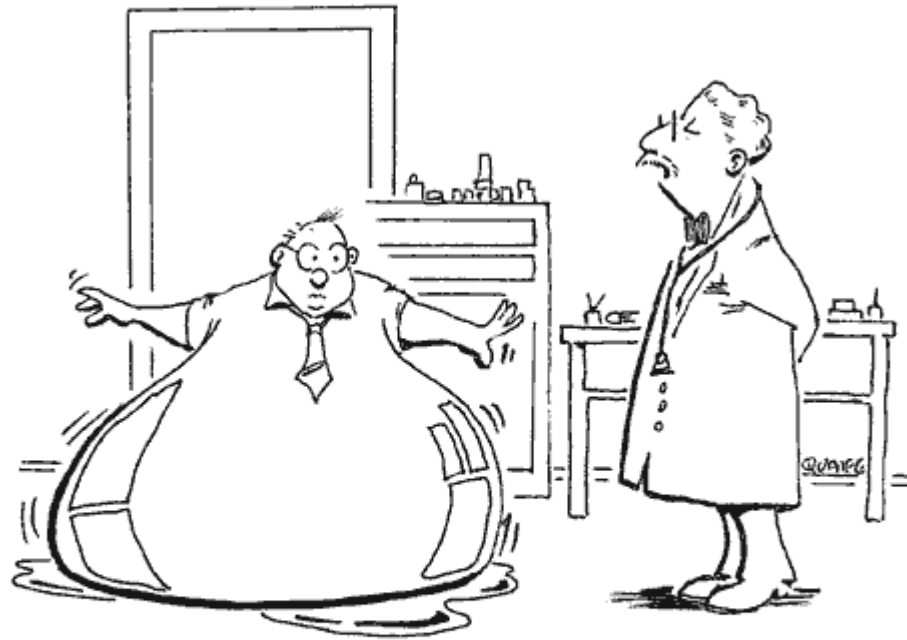
Anasarca in renal diseases



[http://intranet.tdmu.edu.ua/data/kafedra/internal/propedeutic_vn_des/classes_stud/пропедевтика/медицинский%20факультет/3%20курс/English/propedeutics/Lesson5\(12\)_intestinal_kidney_diseases.htm](http://intranet.tdmu.edu.ua/data/kafedra/internal/propedeutic_vn_des/classes_stud/пропедевтика/медицинский%20факультет/3%20курс/English/propedeutics/Lesson5(12)_intestinal_kidney_diseases.htm)

Brainstorm break😊

www.lightersideofdialysis.com



Your tests reveal that
you are retaining fluids!

Itching in patients with advanced kidney failure

•Itching in patients with advanced kidney failure or among patients on dialysis can be quite disabling – affecting sleep, interfering with work, and potentially compromising quality of life.

- The itching may be either generalized or localized.
- The prevalence of uremic itching reported in the literature ranges between 50 and 90%.
- Despite advances in the care of end-stage renal disease (ESRD) patients, the management of pruritus remains one of the most challenging clinical problems for the treating nephrologist.

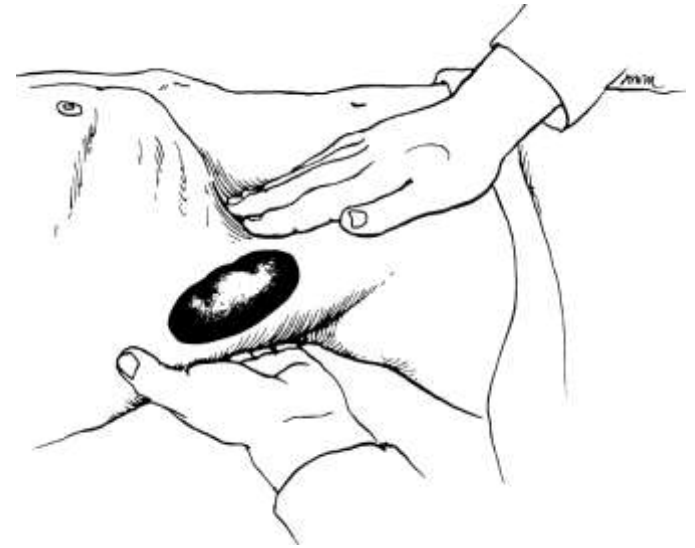
<http://www.uphs.upenn.edu/renal/Dec%20PDFs/uremic%20pruritis.pdf>



Physical examination of the urinary system

Technique of palpation of the kidneys

- It involves deep palpation.
- The client is in supine position and the examiner at the right side of the client. To palpate the left kidney, left hand is placed under the client's left flank with examiner's palm upward. The left hand elevates the left flank, displacing the kidney upward. The client should take a deep breath and examiner using the palmer surface of his right hand palpates the kidney. The technique is repeated for the right kidney.



Palpating the left kidney.

Interpretation of palpation of the kidneys

- In an healthy adult the kidneys usually are not palpable!
- However, the right kidney is frequently palpable in very thin patients and children.
- Palpable kidneys:
 1. An easily palpable or tender kidney is abnormal.
 2. The most common abnormality detected on examination of the kidneys is a mass

Technique of percussion of the kidneys

- **Percussion of the kidneys helps assess pain or tenderness.**
- **Percussion can be done in a sitting or standing position of a client. The examiner stands behind the client.**
- For indirect percussion the palm of nondominant hand is placed over the costovertebral angle (an angle made by the vertebral column and the costal margin). The examiner strikes this area with the ulnar surface of dominant hand, curled into a fist.
- For direct percussion, the examiner strikes the area over the costovertebral angle with the ulnar surface of his dominant hand, curled into a fist.



Costovertebral angle



Percussing the kidney

Interpretation of percussion of the kidneys

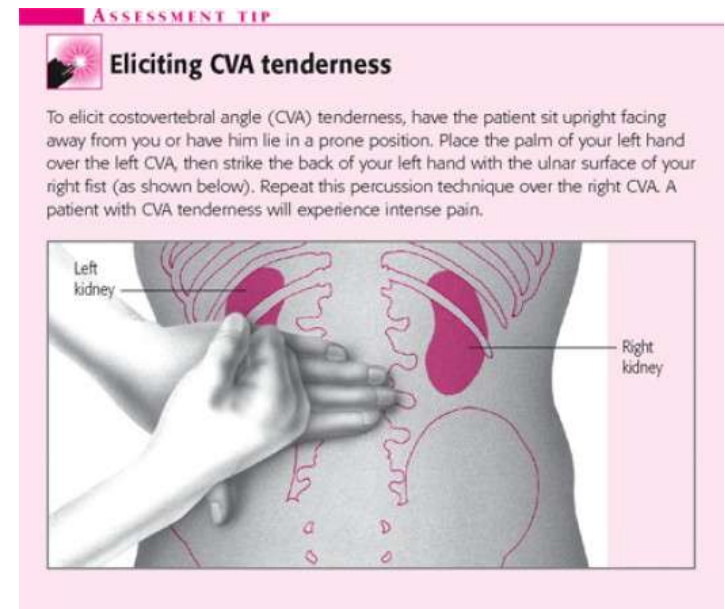
Since the kidneys lie directly below the costovertebral angle, tapping disturbs the inflamed tissue causing pain.

If the patient feels pain, the symptom "is positive". This is called the **Pasterhatsky's symptom** in Ukraine, Russia and Belarus.

In English language countries if the patient feels pain it is defined as **costovertebral angle tenderness, also known as Murphy's punch sign** (first described by the American surgeon John Benjamin Murphy) (Latin: succusio renalis)

The symptom is positive in next of the following renal diseases:

1. Pyelonephritis (inflammation of the kidney and upper urinary tract)
2. Nephrolithiasis (renal stone)
3. Paranephritis (inflammation of the connective tissue around the kidney, perinephric abscess)
4. Inflammation of pelvis
5. The symptom is also positive in myositis and radiculitis that is why this decreases the its diagnostic value

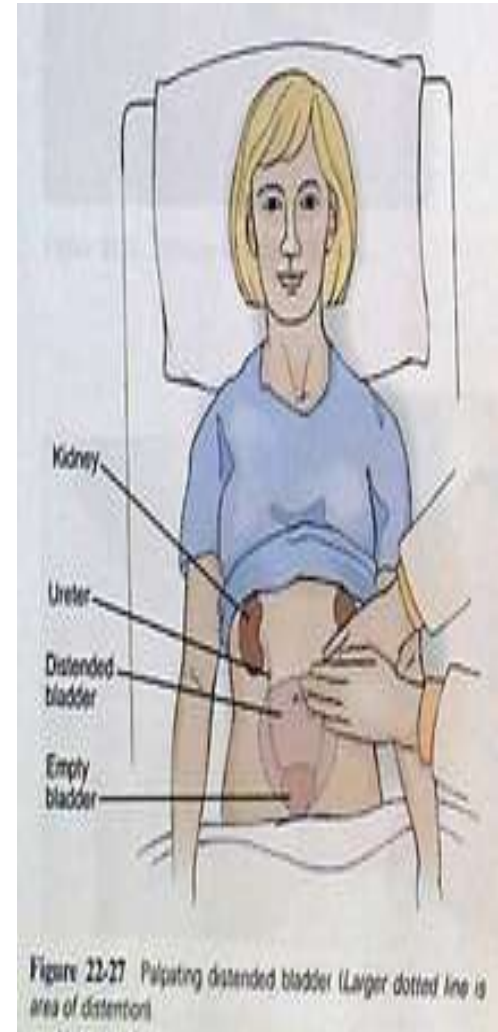


Urinary bladder palpation

- **Bladder palpation can be used to confirm distention and urinary retention.**
- An empty bladder is not palpable.
- A full bladder presents as a pelvis mass which is typically, regular, smooth, firm, and oval-shaped. It arises in the midline. The lower border cannot be felt. The upper border may reach as high the umbilicus. Size may be expressed in finger breadths above the pubic symphysis.

A full bladder is distinguished from other pelvic masses by:

- presence of other features of urinary difficulty
- pain, in acute urinary retention
- discomfort on examination - palpation typically worsens urge to micturate
- dullness to percussion



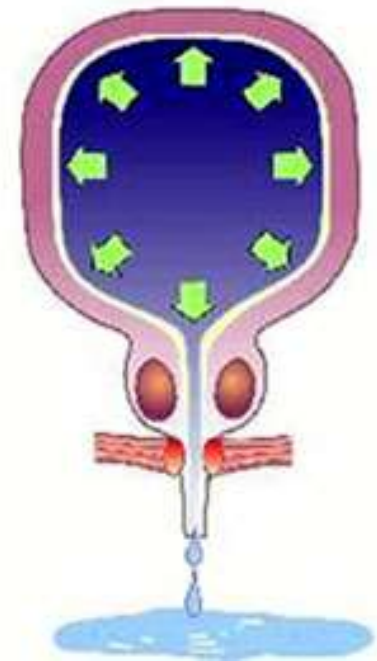
Distended Bladder Following Pelvic Fracture



A female patient was brought to the Emergency Department (ED) following a motor vehicle injury. Examination revealed a hugely distended lower abdomen with a palpable 'mass' and positive pelvic compression test suggesting pelvic fracture. After urethral catheterization and drainage of more than 3000ml of urine, the 'mass' disappeared completely. The patient was managed non-operatively.

<http://www.trauma.org/index.php/main/image/1438/>

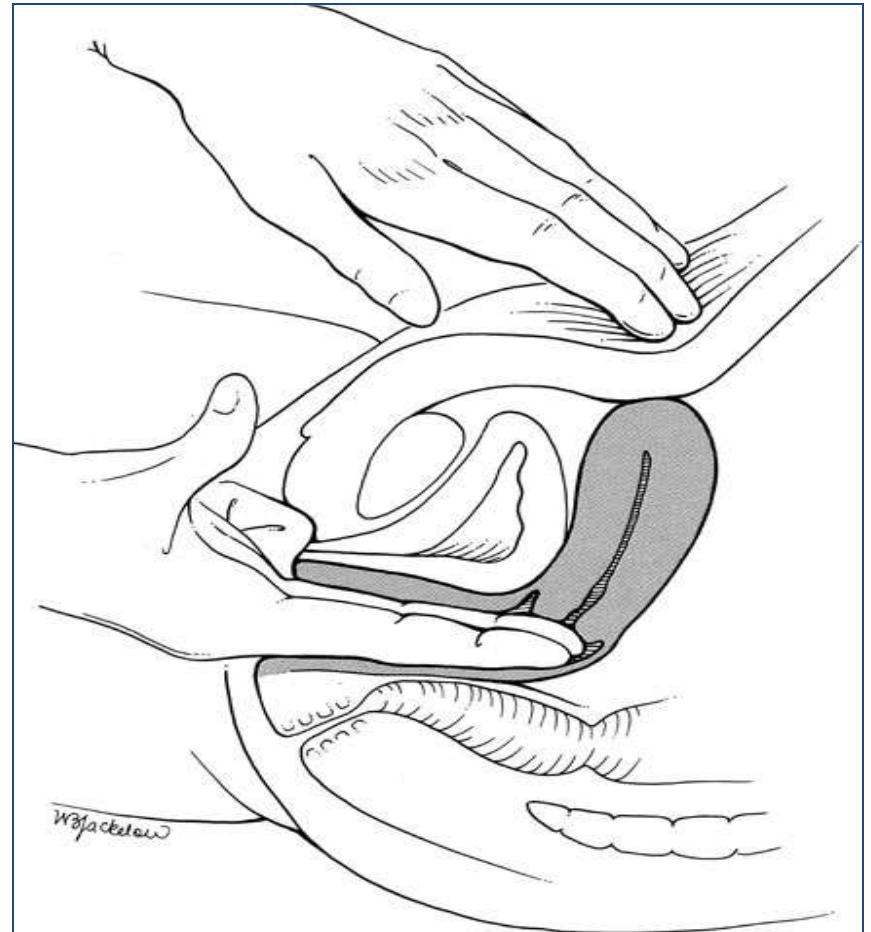
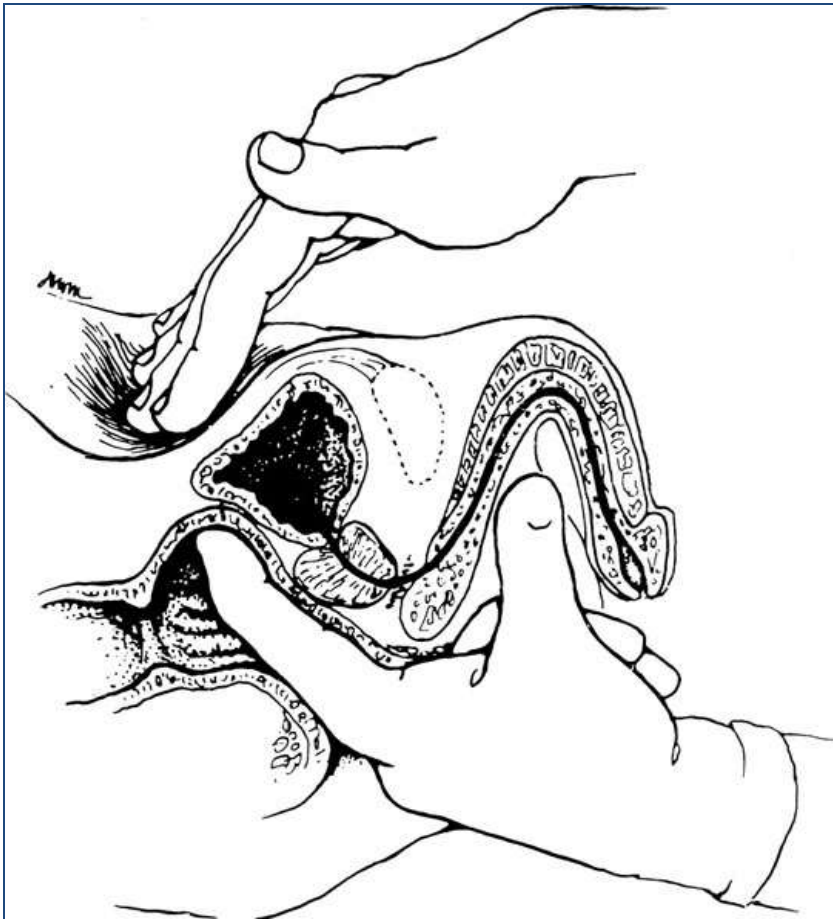
Distended Bladder



Overflow incontinence occurs when further physical stress is added to an already full bladder.

Bimanual examination of the bladder

A bimanual examination, best done under anesthesia, is very valuable to assess bladder tumor extension



Urinary bladder percussion

Bladder percussion used to determine the extent of bladder distention

Normal bladder percussion:

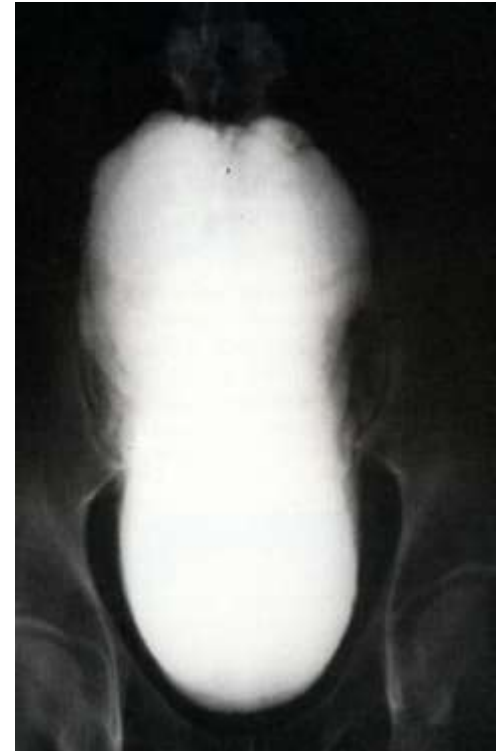
- Gentle tapping over the bladder area - above the symphysis pubis - normally should elicit no response, because normally, even a full bladder cannot be percussed

Bladder distention:

- Dullness or drum sound to percussion in the lower abdomen suggests bladder distention



Normal
Bladder:
sounds “flat”
to percussion

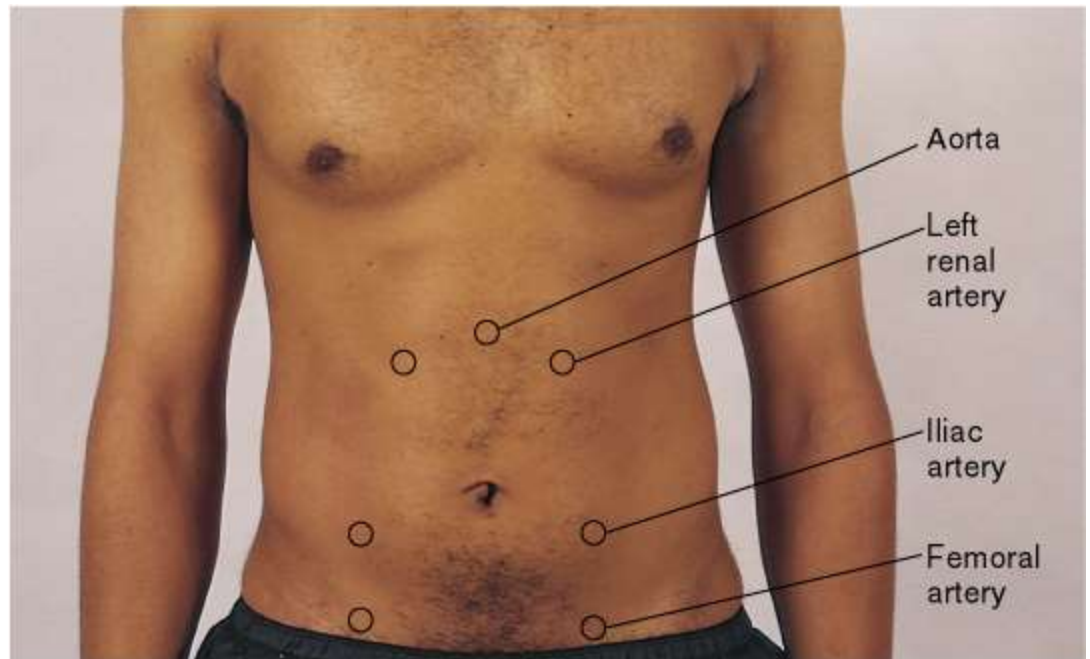


Urinary
Retention:
sounds like a
drum to
percussion

From: Jong M. Choe, MD, Director of Continence Program
Division of Urology, University of Cincinnati College of Medicine
Veterans Administration Medical Center

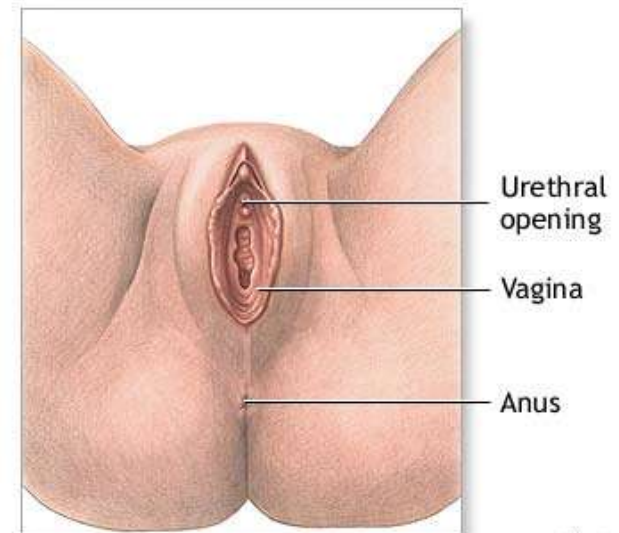
Auscultation of renal arteries

- A bruit is usually associated with blood flow through a narrowed vessel as in renal artery stenosis.
 - renal artery stenosis
 - aneurysm



Inspection of the urethra

- Using a good light source and wearing gloves, the nurse inspects the urethra by examining the meatus and surrounding tissues.
- The skin and mucous membranes of surrounding tissues are inspected, and the presence of lesions, rashes, or other abnormalities of the penis or scrotum or of the labia or vaginal orifice is documented. Any unusual discharge such as blood, mucus, and purulent drainage is noted.
- Urethral irritation is suspected when the client reports discomfort with urination.



Urinalysis

Macroscopic examination

- Macroscopic analysis deals with those procedures or examinations, which are accomplished without the aid of a microscope.
- Before performing microscopic or chemical tests on a urine specimen, a macroscopic examination is accomplished.

Included in this category are measurements of:

- Odour
- Foam
- Volume
- Color
- Appearance
- pH
- Specific gravity

Odour

- Fresh urine from a healthy patient usually has a very slight aromatic odour, which is due to certain volatile constituents.
- After standing for a long time, the bacterial decomposition of urea produces a characteristic odor of ammonia.
- The ingestion of certain foods (for example, asparagus) produces a characteristic odor (sweet, fruity, maple syrup, mousy, etc.)



Foam

- A slight amount of white foam is formed when normal urine is shaken.
- The presence of bile/bilirubin and certain chemicals or drugs in the urine usually produces a **yellow foam**.
- Proteinuria causes a marked increase in the **white foaming** quality of urine.



VOLUME

- The total 24-hour volume of urine voided by the normal adult is influenced by food and fluid intake, temperature, exercise, seasonal change, and the use of diuretics. It should be noted that the amount of urine excreted might fall above or below the normal range without the existence of a pathological condition.

Normal urine production is 1 ml/kg/hr

The average adult produces between 750 and 2,000 ml of urine during a 24-hour period, with a median of about 1,400 ml.

- **Abnormalities of urine volume can be classified as one of the three following conditions:**

1. Polyuria – which is an abnormal increase in the total volume of urine excreted - **more than 2,000 ml/24-hours**. Polyuria is associated with such pathological conditions as Type II diabetes (mellitus), Type I diabetes (insipidus), certain tumors of brain and spinal cord, acromegaly, myxedema, and certain kidney diseases. The nonpathologic cause is usually increased fluid intake.

2. Oliguria - which is a reduction in the total volume of urine excreted - **less than 500 ml/24-hours**. This condition is associated with febrile states, excessive vomiting, severe diarrhea, or extreme dehydration. Nonpathological causes are decreased fluid intake and excessive sweating.

3. Anuria. This term literally means "no urine" and refers to a complete lack of **urine excretion**. It results from blockage of the kidneys or urinary tract, certain bacterial infections of the kidneys, and prolonged states of dehydration. There are not any nonpathological causes.

Oliguria

- **Olig-** (or **oligo-**) is a Greek prefix meaning small or few .

Oliguria is defined as a urine output that is less than:

- <1 mL/kg/h in infants
- < 0.5 mL/kg/h in children and in adults as well
- <500 mL per 24h in adults

Etiology:

1. **Prerenal** (blood-flow related): Dehydration, Vascular collapse, Low cardiac output
2. **Renal** (intrinsic kidney disorders): acute tubular necrosis, primary glomerular diseases or vascular lesions.
3. **Postrenal** (outlet obstruction): any mechanical or functional obstruction to the flow of urine. The most common cause is a blocked catheter.

History:

In communicative patients, a marked urge to void suggests outlet obstruction

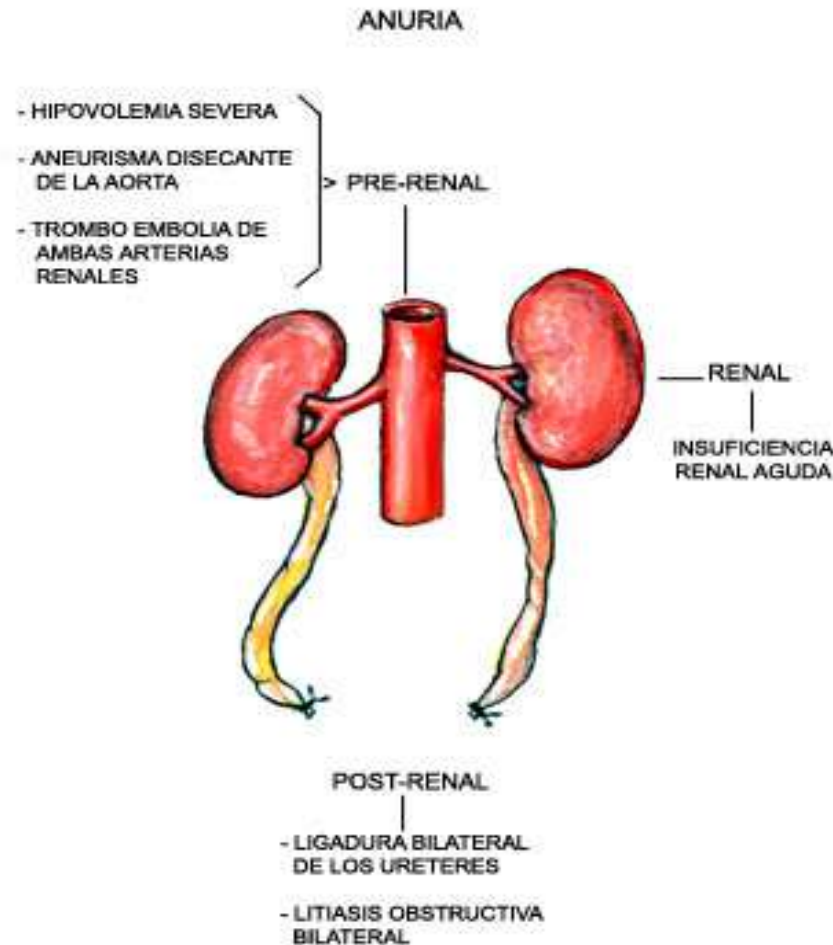
Thirst and no urge to void suggest volume depletion.

In obtunded (and presumably catheterized) patients, a sudden decrease in urine flow in a normotensive patient suggests catheter occlusion (eg, caused by a clot or kinking) or displacement, whereas a gradual decrease is more likely due to acute tubular necrosis or a prerenal cause.

Physical examination: Signs of acute kidney injury, of the underlying disease, focal infection and cardiac failure should be sought. Palpable bladder distention indicates an outlet obstruction.

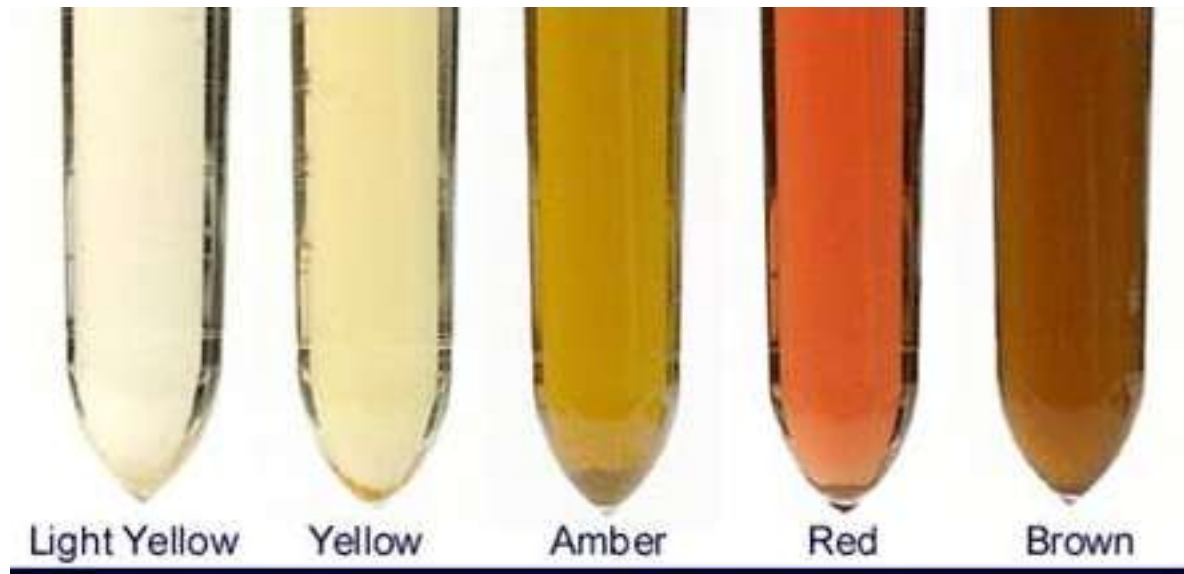
Anuria

Anuria is defined as passage of less than 50 milliliters of urine in 24 h (0-50 ml/day).



COLOR

- Normal urine color results from various pigments which are collectively referred to as **urochrome**.
- The various shades of yellow in urine specimens vary with the intensity of the urochrome present and with the specific gravity.
- Urine can show a typical coloration because of pathological conditions and as a result of the ingestion of certain substances, including food pigments, dyes, drugs, and so forth.

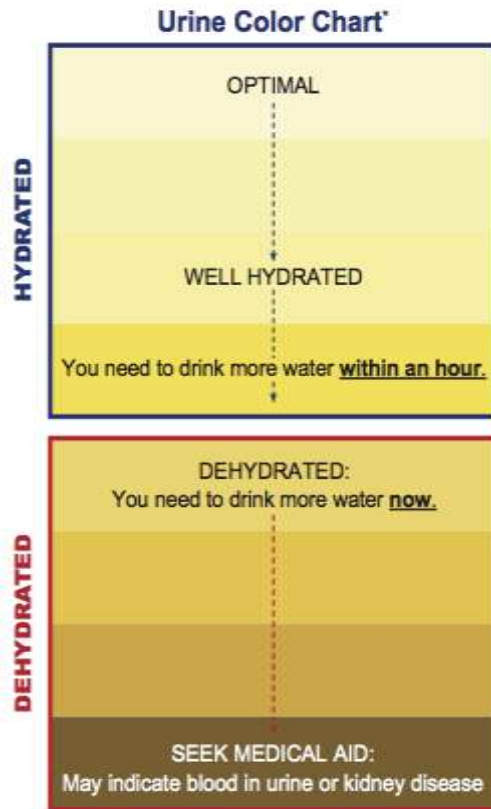


Examples of Urine Color

Urine color chart

Dehydration Urine Color Chart

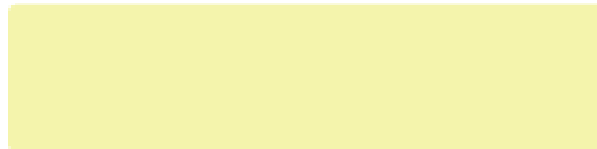
The following Dehydration Urine Color Chart will help you use your urine color as an indicator of your level of dehydration and what actions you should take to help return your body back to a normal level of hydration.



*This color chart is not for clinical use.



BOY SCOUTS OF AMERICA®



Doing ok. You're probably well hydrated. Drink water as normal.



You're just fine. You could stand to drink a little water now, maybe a small glass of water.



Drink about 1/2 bottle of water (1/4 liter) within the hour, or drink a whole bottle (1/2 liter) of water if you're outside and/or sweating.



Drink about 1/2 bottle of water (1/4 liter) right now, or drink a whole bottle (1/2 liter) of water if you're outside and/or sweating.



Drink 2 bottles of water right now (1 liter). If your urine is darker than this and/or red or brown, then dehydration may not be your problem. See a doctor.

COLOR

Normal urine has a color of straw, yellow, or amber.

- Urines that are concentrated are usually amber; very dilute specimens may be almost colorless.
- In addition, a yellow color may be produced by the following substances:
- Food colors
- Cascara--a laxative.
- Phenacetin--to ease fever or pain.
- Atabrine® (brand name)--an anti-malarial.
- Azulfidine® (brand name)



COLOR

very pale yellow, greenish-yellow, or nearly colorless

- A specimen that is a can be the result of several pathological conditions, specifically:
- Severe iron deficiency.
- Chronic kidney disease.
- Diabetes mellitus.
- Diabetes insipidus.

Red, Pink, or Reddish-Orange

- A highly concentrated urine resulting from fever, inadequate water intake, or
- excessive water loss may also appear
- (1) Beets.
- (2) Dilantin® (brand name).
- (3) Food colors.
- (4) Blood.
- (5) Azo Gantrisin® (brand name).
- (6) Senna in alkaline urines.
- (7) Pyridium® (brand name).
- (8) Porphyrin.
- (9) Hemoglobin.
- (10) Povan® (brand name).
- (11) Rhubarb in alkaline urines.
- (12) Phenolsulfophthalein.
- (13) Myoglobin.
- (14) Bromsulphalein.
- (15) Chromogenic bacteria. are orange in color.

Green urine

- Food:** Asparagus, drinking green beer, black licorice.
- Drugs:** Cimetidine, Promethazine, Amitriptyline, Flutamide, Indomethacin, Methocarbamol, Methylene blue, Mitoxantrone, Propofol, Phenylbutazone, Triamterene
- Condition:** Hartnup Disease, Indicanemia, Indicanuria
- Infection:** Pseudomonas Infection
- Dyes:** Carboic Acid, Flavine derivatives, Indigo Blue, Methylene Blue, Resorcinol



<http://lifeinthefastlane.com/2009/11/unusual-urine-002/>

Green urine

You are looking after a 23 year old male who has a subarachnoid haemorrhage and the nurse calls because the patient has started to pass unusual urine:



This phenomenon usually occurs in the setting of propofol being administered by infusion in at least a moderately high dose.

<http://lifeinthefastlane.com/2010/02/unusual-urine-003/>

Red Color

Blood
or
Hemoglobin
or
Erythrocytes
or
Myoglobin

Food:

- Blackberries and beets

Drugs:

- The anesthetic propofol, phenytoin, phenothiazines, e.g., Compazine

Poisons:

- Chronic lead and mercury poisoning

Dyes:

- Eosin



Reddish-orange discoloration of urine due to uric acid crystalluria after recurrent seizures



Reddish-orange discoloration of urine. Note the sedimented uric acid crystals in the urinary catheter.

http://www.nature.com/ki/journal/v81/n12/fig_tab/ki201261f1.html

Orange urine

Dehydration or jaundice:

Urine may appear 'orange-ish' as a result of dehydration or jaundice (hyperbilirubinemia).

Medications: Rifampicin, Idarubicin, Ferrioxamine, Oxamniquine, Phenazopyridine,, Sulfasalazine, Warfarin

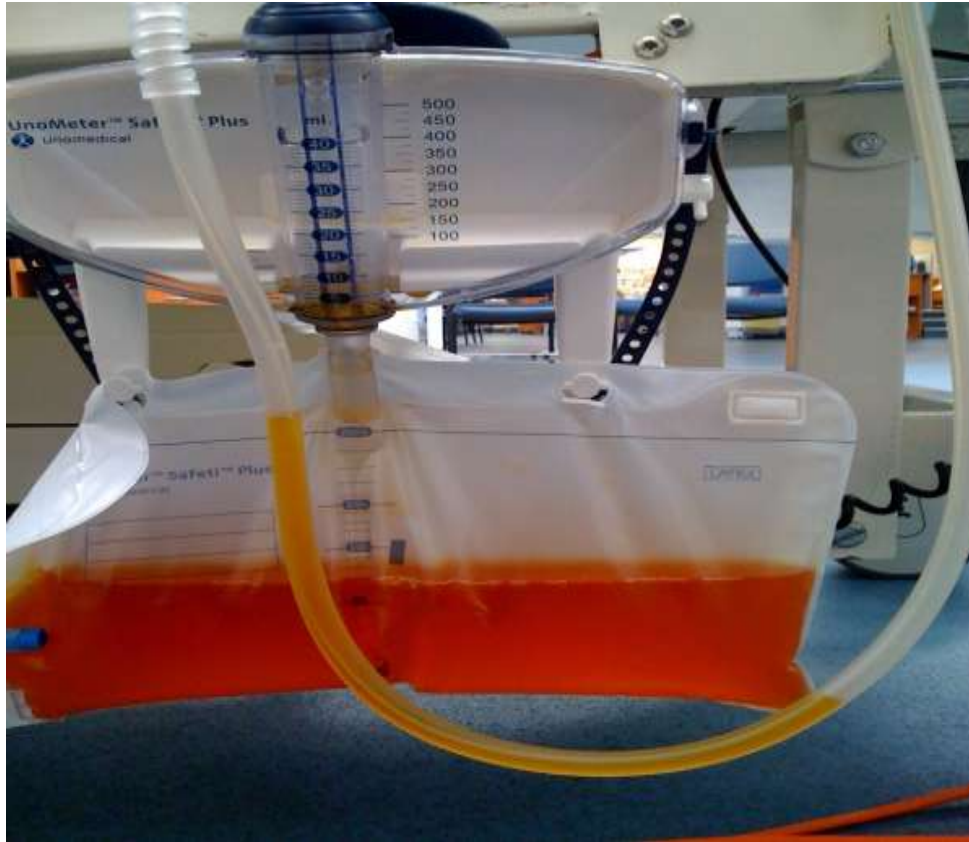
Foods, supplements, and vitamins:

- Carotenes — e.g. vitamin A, orange juice, pumpkin, and carrots

N.B.! Hypercarotenemia is associated with yellowish skin without scleral icterus (in contrast to jaundice). It can also cause orange discolouration of cerebrospinal fluid

- Beets and blackberries — urine tends to be red-coloured
- B-complex vitamins
- Food dyes
- Senna
- Disorders that cause hypercarotenemia:
 - diabetes mellitus
 - dietary excess of carotenoids
 - Hyperlipidemia
 - Hypothyroidism
 - Porphyria

Orange urine



This patient had a cerebral abscess and was being treated with rifampicin. The orange colour is benign. Other body secretions such as sweat and tears – as well as CSF – may also be discoloured.

<http://lifeinthefastlane.com/2009/09/unusual-urine-001/>

Brown or black urine

- **Food:** Ingestion of large amounts of rhubarb, fava beans, or aloe can cause dark brownish black urine
- **Medications:**
 - Excessive L-dopa or melanin excretion as well as copper or phenol poisoning
 - Metabolites of the antihypertensive medication methyldopa may turn black on contact with bleach (which is often present in toilet bowls).
 - Other medications causing brown or brown-black urine are chloroquine and primaquine, furazolidone, metronidazole, nitrofurantoin, cascara/senna laxatives, methocarbamol, and sorbitol.
- **Diseases:**
 - Melanoma - Melanin and melanogen, found in the urine of such patients will darken standing urine from the air-exposed surface
 - Alcaptonia, a rare hereditary disease, the urine will turn dark after being exposed to the air over a period of time due to the presence of homogentisic acid.
 - Tyrosinosis (Urinary hydroxyphenylpyruvic acid excretion will also cause urine to be brown-black in color)

Brown-Black Urine



<http://lifeinthefastlane.com/wp-content/uploads/2010/06/Brown-Black-Urines.jpg>

GENERAL APPEARANCE OF THE URINE SAMPLE

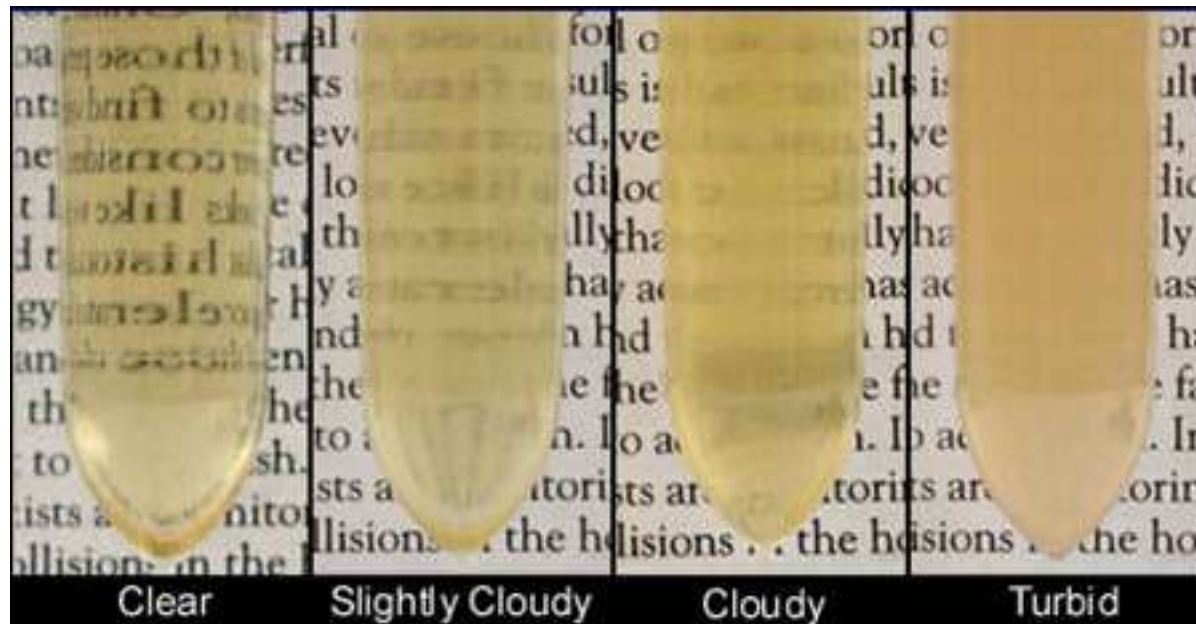
- The general appearance of a urine specimen should be evaluated routinely.

Normally, fresh urine is clear without visible particles

Four types of urine sample are distinguished:

1. Clear – normal urine
2. Hazy – the urine sample which contains a small amount of particles.
 - Normal urine specimens may have a hazy appearance.
 - Haziness may be due to mucus, epithelial cells, phosphates or amorphous urates
3. Cloudy - the urine sample which contains moderate to large amounts of visible particles.
 - Cloudiness may be caused by crystallized mineral salts that have precipitated due to long standing, or to the increase of bacteria when urine is left standing at room temperature. Cloudiness may also result from pathological conditions that produce blood or pus. The bacteria resulting from acute infections may also produce a cloudy urine.
4. Turbid

Examples of Urine Clarity



Specific gravity

- Specific gravity measures the kidney's ability to concentrate urine.
- Specific gravity is a comparison of the density of urine to the density of distilled water, which is regarded as 1.000.
- Generally, the greater the volume of urine excreted, the lower the specific gravity.
- There is considerable variation in the specific gravity range of 1.003 to 1.030

MICROSCOPIC EXAMINATION OF ORGANIZED SEDIMEN

red blood cells

white blood cells

epithelial cells

casts

ERYTHROCYTES

Normally are absent in urine sediment or up to 1-2 RBC/hpf.

Shape of RBCs which can be seen in urine:

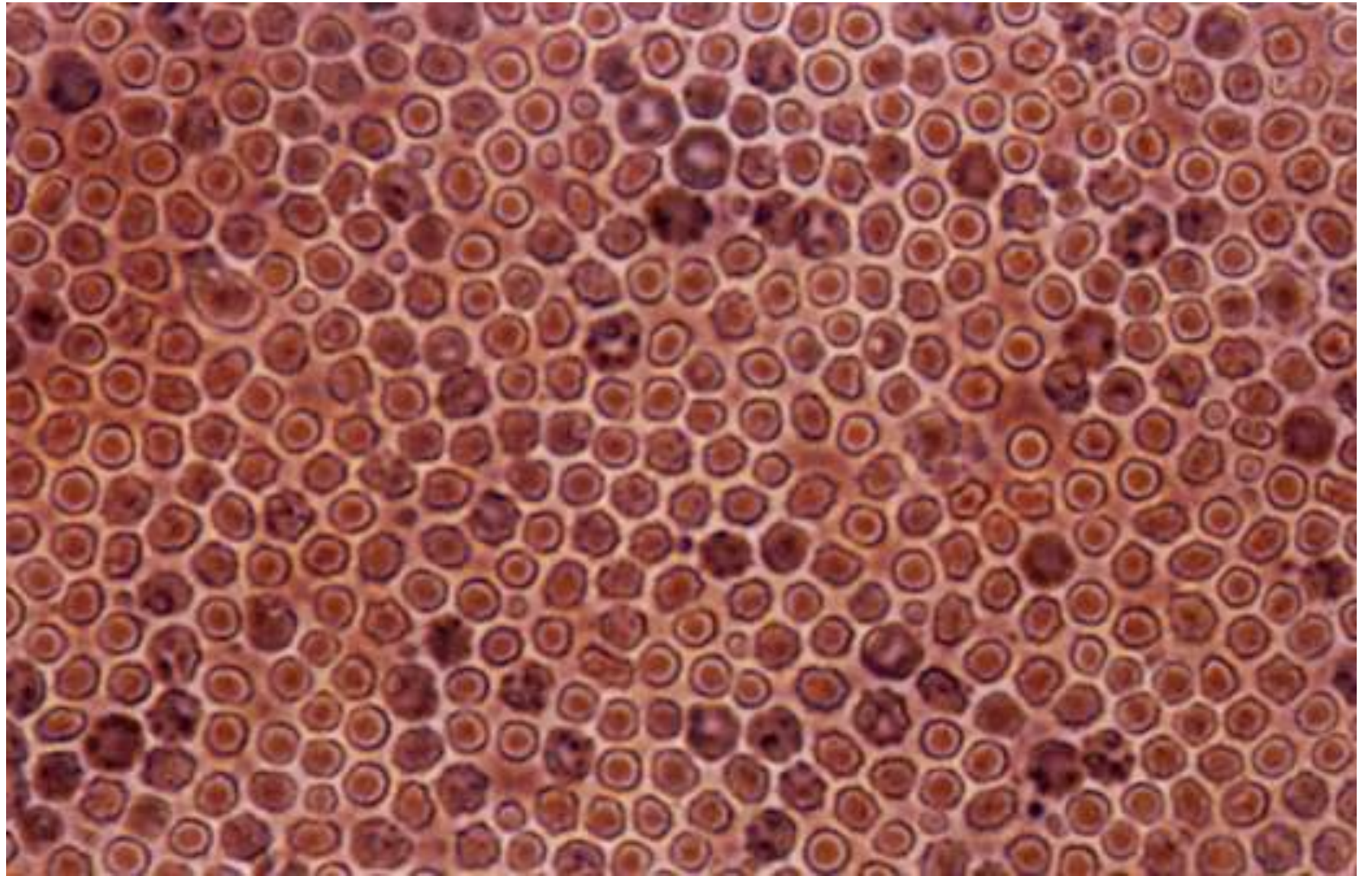
- **Intact RBCs**
- **Crenated RBCs** have star-like shapes with margins displaying numerous sharp edges. This is due to the effect of osmotic pressure removing the internal RBC fluid and thus collapsing the cell encountered in concentrated urine.
- **"Ghost" RBCs** have a larger than normal diameter due to swelling in the dilute urine.

Hematuria

- Hematuria is the presence of red blood cells in the urine.

Causes of Hematuria:

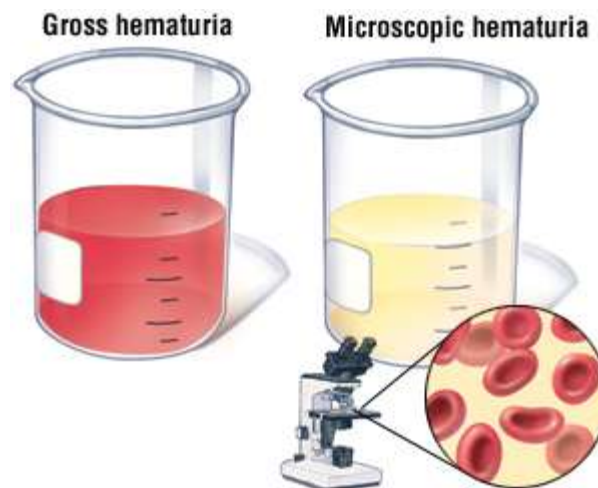
- ❖ Kidney disease
- ❖ Lesions along the urinary tract
- ❖ Conditions unrelated to kidney and urinary tract



Classification of hematuria

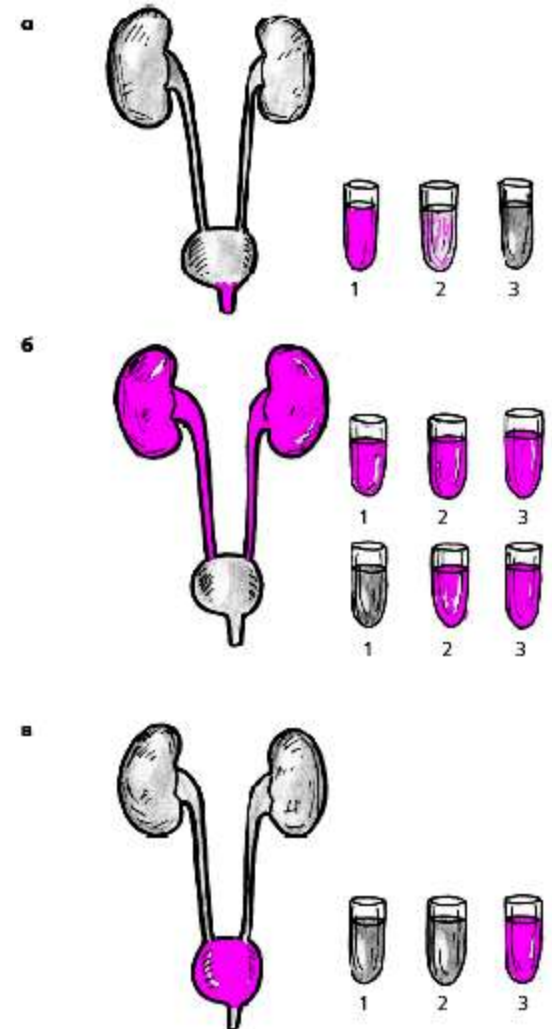
Hematuria may be grossly visible (macroscopic hematuria) or detectable only on urine examination (called microscopic hematuria).

- Gross hematuria, or macroscopic hematuria, is defined as blood that can be seen with the naked eye.
- Microscopic hematuria is defined as the presence of more than 3 red blood cells (> 3 RBC) per high power field (HPF) in the centrifuged urinary sediment.



Three-Bottle Specimen

1. First portion - blood is contained mainly in the first portion of the urine specimen - the bleeding point is probably in the urethra.
2. All portions or Second+Third portions - kidney or ureter.
3. Third portion- the bladder.



Leukocytes

Normally there are up to 0-2 leukocytes per high power field (HPF) or 10 per microlitre (μl) or mm^3 .

- Pyuria - is the condition of urine containing pus.
- Pyuria is defined as the presence of > 10 leucocytes per microlitre (μl) or cubic millimeter (mm^3). It can be sign of a bacterial urinary tract infection.
- Sterile pyuria is the presence of elevated numbers of white cells (>10 white cells/ mm^3) in urine which appears sterile using standard culture techniques.

Urinary casts

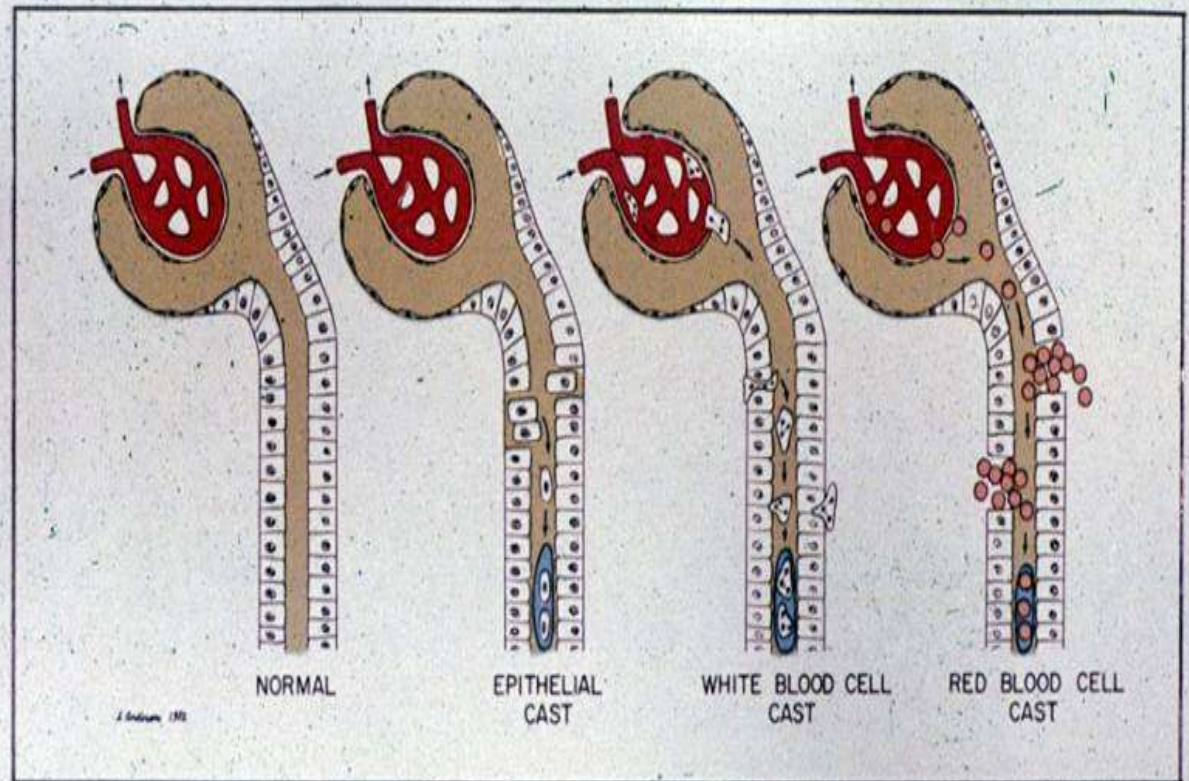
- Urinary casts are cylindrical structures produced by the kidney and present in the urine in certain disease states. They form in the distal convoluted tubule and collecting ducts of nephrons, then dislodge and pass into the urine, where they can be detected by microscopy.

Cast formation

- All casts have a matrix of Tamm- Horsfall mucoprotein to which other proteins or elements may be added. They are generally associated with a positive reagent-strip test result for protein. They may contain RBCs, WBCs, renal epithelial cells, fat globules, bacteria, and degenerated forms of any of these structures, which are seen as granules. Aggregates of plasma proteins, including fibrinogen, immune complexes, and globulins, may also be seen as granules within a cast.

Cast

Cellular Casts are named for the types of cells they contain



Types of casts

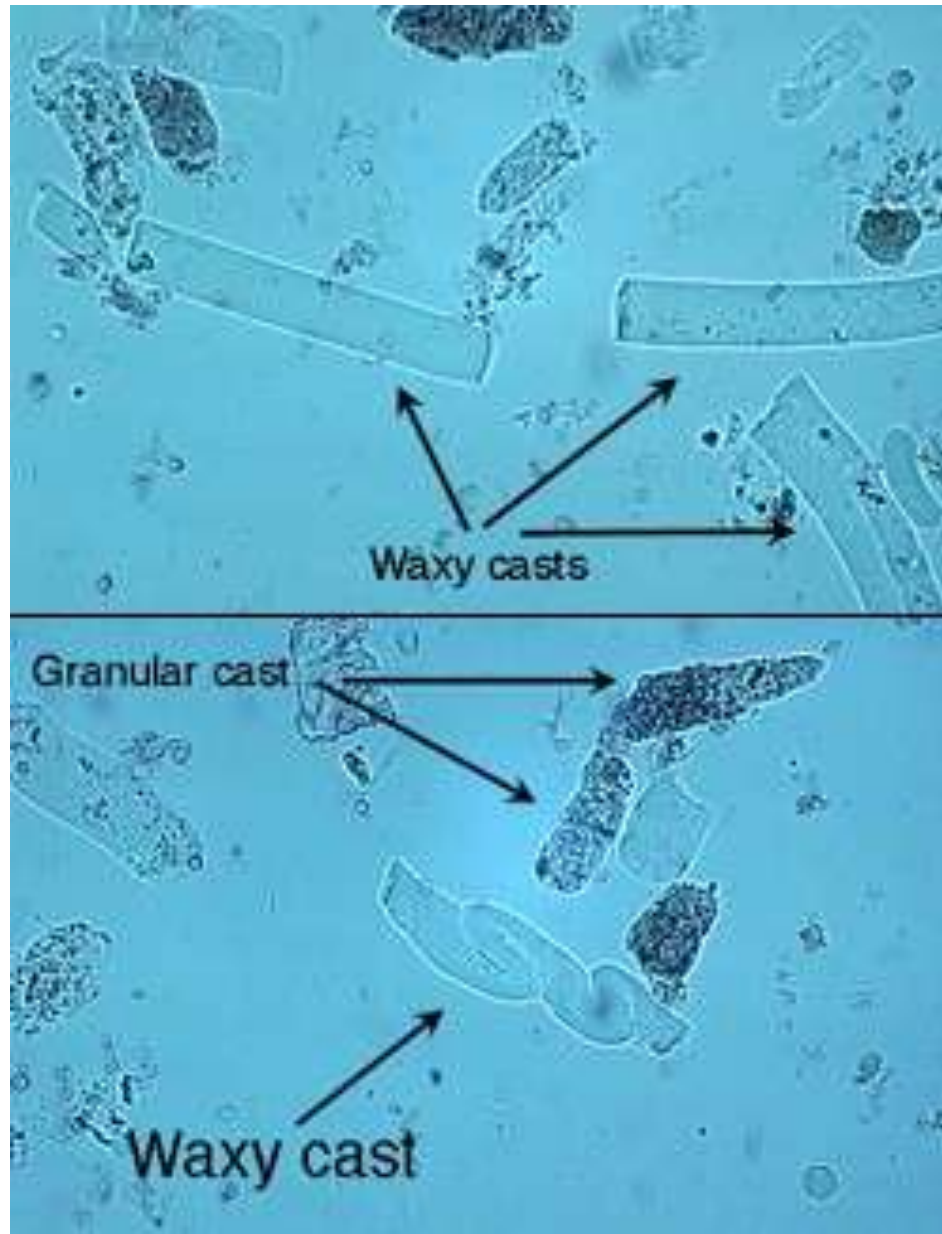
1 Acellular casts

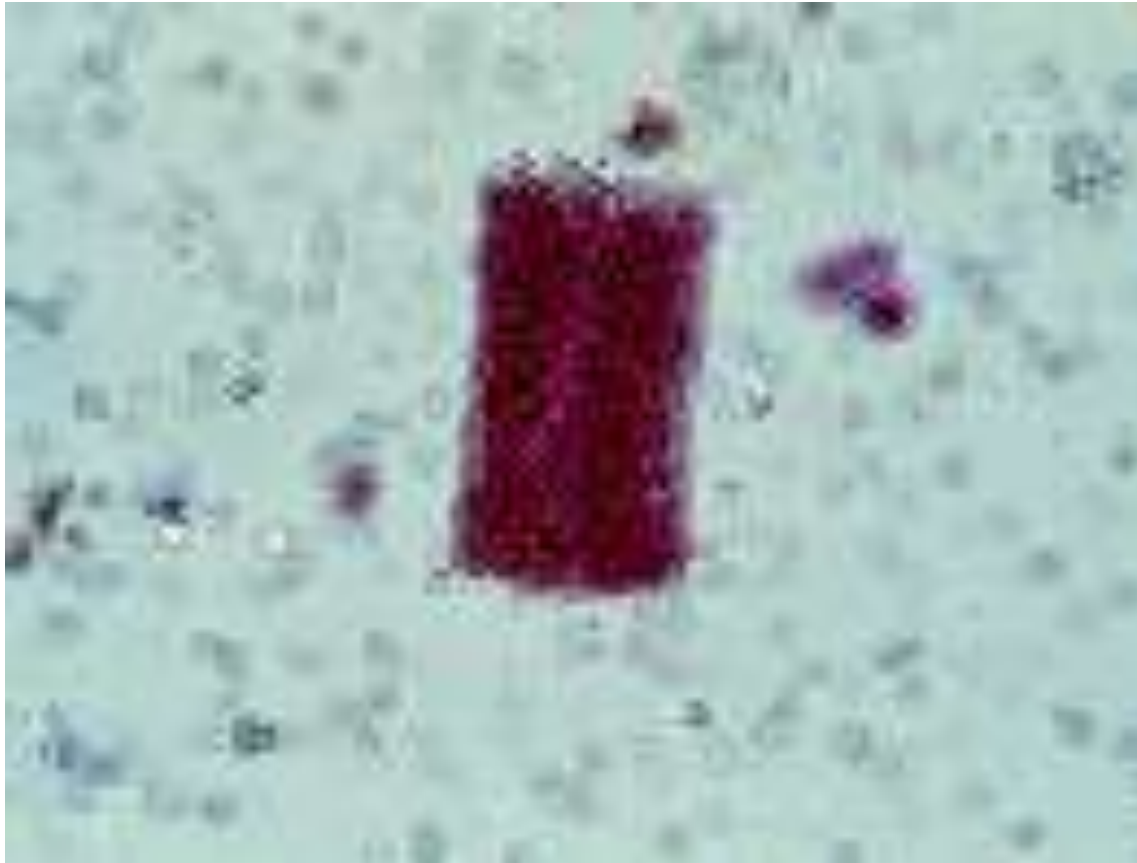
- 1.1 Hyaline casts
- 1.2 Granular casts
- 1.3 Waxy casts
- 1.4 Fatty casts
- 1.5 Pigment casts
- 1.6 Crystal casts

2 Cellular casts

- 2.1 Red blood cell casts
- 2.2 White blood cell casts
- 2.3 Bacterial casts
- 2.4 Epithelial cell casts

Casts





A broad red blood cell cast from a patient with Goodpasture's syndrome. Red blood cell casts are most frequently associated with glomerulonephritis

CHEMICAL TESTS FOR SUBSTANCES IN URINE

1. Urine PH
2. Protein
3. Glucose
4. Ketones
5. Occult blood
6. Bilirubin
7. Urobilinogen
8. Nitrites

Procedure

- Dip strip briefly, but completely into well mixed, room temperature urine sample.
- Withdraw strip.
- Blot briefly on its side.
- Keep the strip flat, read results at the appropriate times by comparing the color to the appropriate color on the chart provided.



Using Reagent Strips

- BRIEFLY dip the strip in urine.
- Colors are matched to those on the bottle label at the appropriate times.
- **Timing is critical for accurate results.**



Reagent Strips



TESTS AND READING TIME

LEUKOCYTES

2 minutes



NITRITE

60 seconds



UROBILINOGEN

60 seconds



PROTEIN

60 seconds



pH

60 seconds



BLOOD

60 seconds



SPECIFIC GRAVITY

45 seconds



KETONE

40 seconds



BILIRUBIN

30 seconds









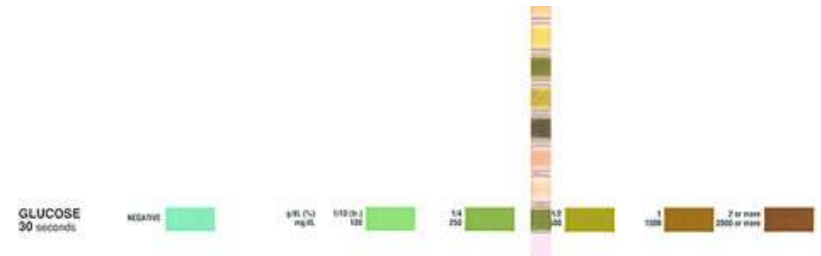
GLUCOSE

30 seconds



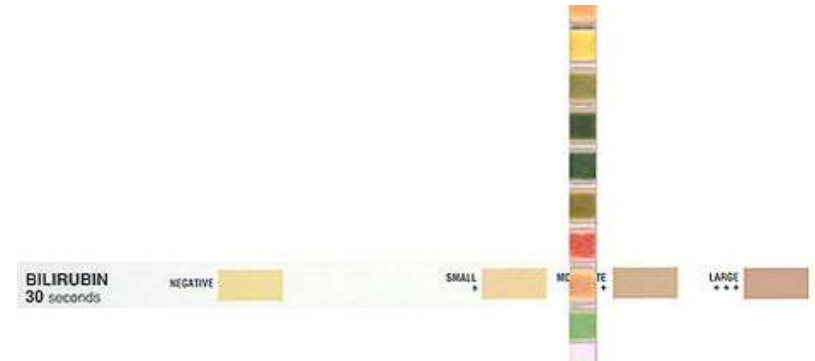
Glucose

	Negative
	Trace (100 mg/dL)
	+(250 mg/dL)
	++ (500 mg/dL)
	+++ (1000 mg/dL)
	++++ (2000+ mg/dL)









- Presence of glucose (glycosuria) indicates that the blood glucose level has exceeded the renal threshold.
- Useful to screen for diabetes.

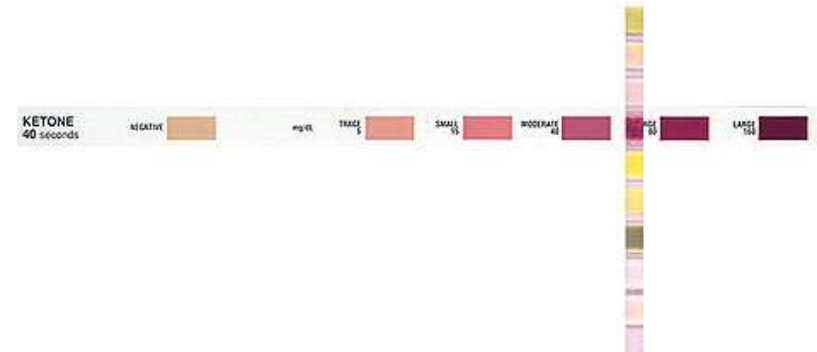
Bilirubin



- Bilirubin is a byproduct of the breakdown of hemoglobin.
- Normally contains no bilirubin.
- Presence may be an indication of liver disease, bile duct obstruction or hepatitis.
- Since the bilirubin in samples is sensitive to light, exposure of the urine samples to light for a long period of time may result in a false negative test result.

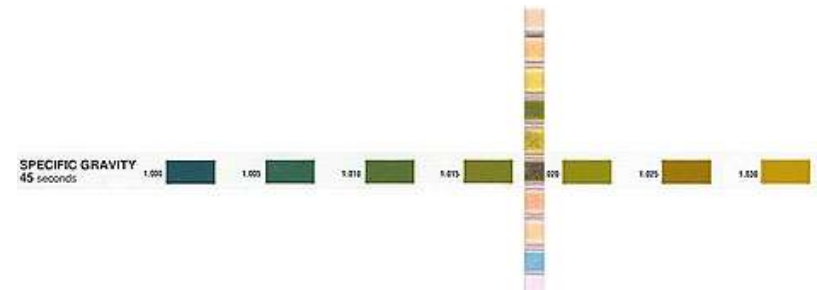
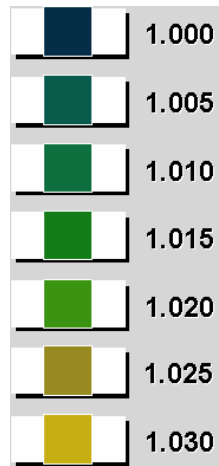
Ketones

	Negative
	Trace (5 mg/dL)
	+ (15 mg/dL)
	++ (40 mg/dL)
	+++ (80 mg/dL)
	++++ (160+ mg/dL)



- Ketones are excreted when the body metabolizes fats incompletely (ketonuria)

Specific Gravity



- Specific gravity reflects kidney's ability to concentrate.
- Want concentrated urine for accurate testing, best is first morning sample.
- Low – specimen not concentrated, kidney disease.
- High – first morning, certain drugs

Urine PH

- **Normal PH**

The average is about 6

Range from 5~9 (depends on diet)

- **Higher PH**---alkaline urine

1.drugs: sodium bicarbonate

2.classic renal tubular acidosis

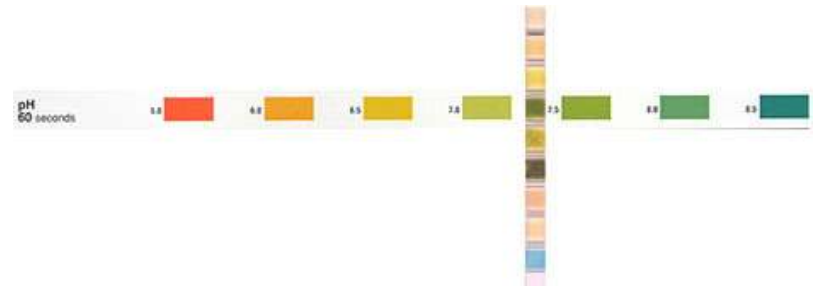
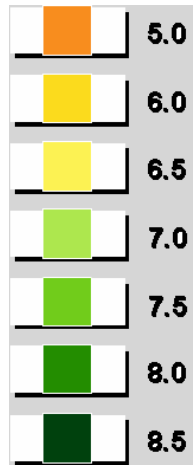
3.alkalosis (metabolic or respiratory)

- **Lower PH**---acid urine

1.drugs: ammonium chloride







2. acidosis (metabolic or respiratory)

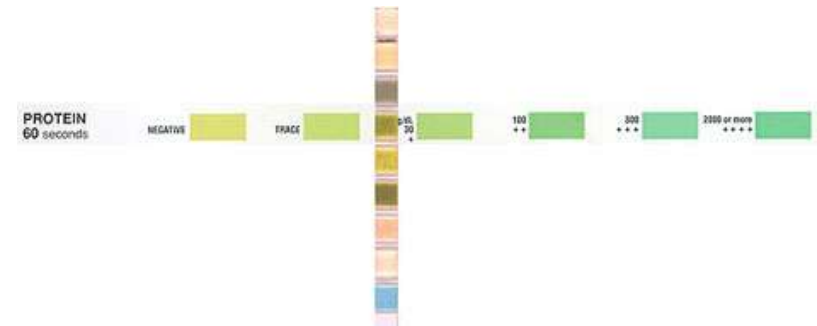
Ph



- pH measures degree of acidity or alkalinity of urine

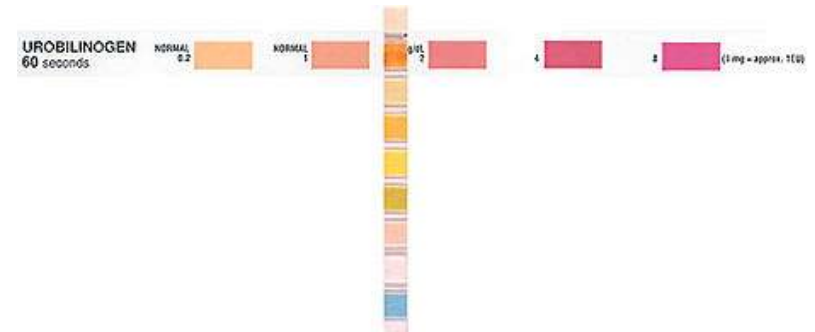
Protein

	Negative
	Trace
	+(30 mg/dL)
	++(100 mg/dL)
	+++ (300 mg/dL)
	++++ (2000 mg/dL)



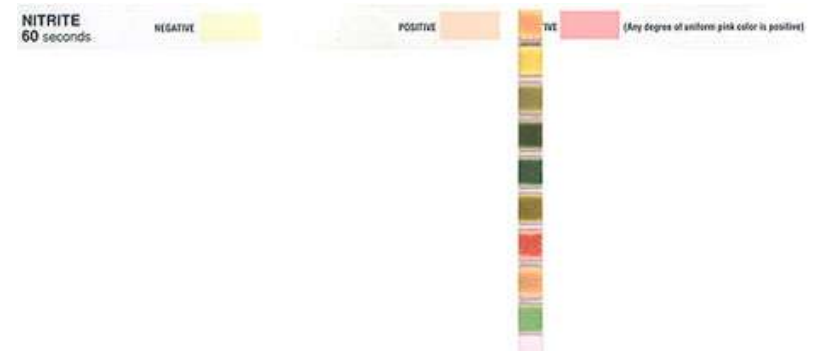
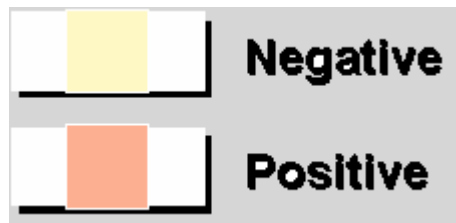
- Presence of protein (proteinuria) is an important indicator of renal disease.
- False negatives can occur in alkaline or dilute urine or when primary protein is not albumin.

Urobilinogen



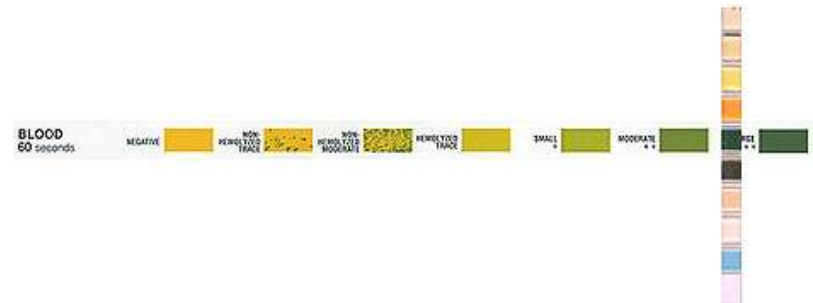
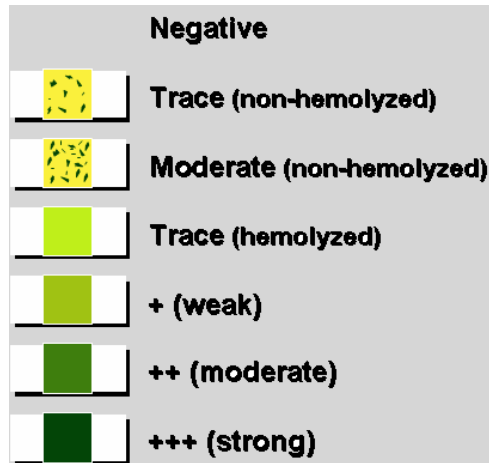
- Urobilinogen is a degradation product of bilirubin formed by intestinal bacteria.
- It may be increased in hepatic disease or hemolytic disease

Nitrite



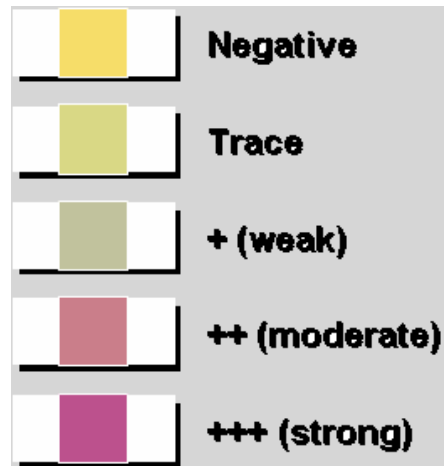
- Nitrite formed by gram negative bacteria converting urinary nitrate to nitrite

Blood



- Presence of blood may indicate infection, trauma to the urinary tract or bleeding in the kidneys.
- False positive readings most often due to contamination with menstrual blood.

Leukocytes



- Leukocytes (white blood cells) usually indicate infection.
- Leucocyte esterase activity is due to presence of WBCs in urine while nitrites strongly suggest bacteriuria.

**To be continued next Monday
Till we meet again!**

