

ADVANCED LABORATORY TECHNIQUES

FLUID ANALYSIS (CSF, SYNOVIAL, SEMINAL, URINE)



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جامعة ساوة الاهلية

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كلية التقنيات الصحية والطبية

Department of Medical Laboratories

قسم تقنيات المختبرات الطبية

. third Stage

المرحلة الثالثة

محاضرة رقم 8

Lecture No. 8

الجانب النظري

Theoretical

تدريسي المادة : م.م طيبة شاكر

(INTRODUCTION)

Cerebrospinal fluid (CSF) analysis

1. Definition:

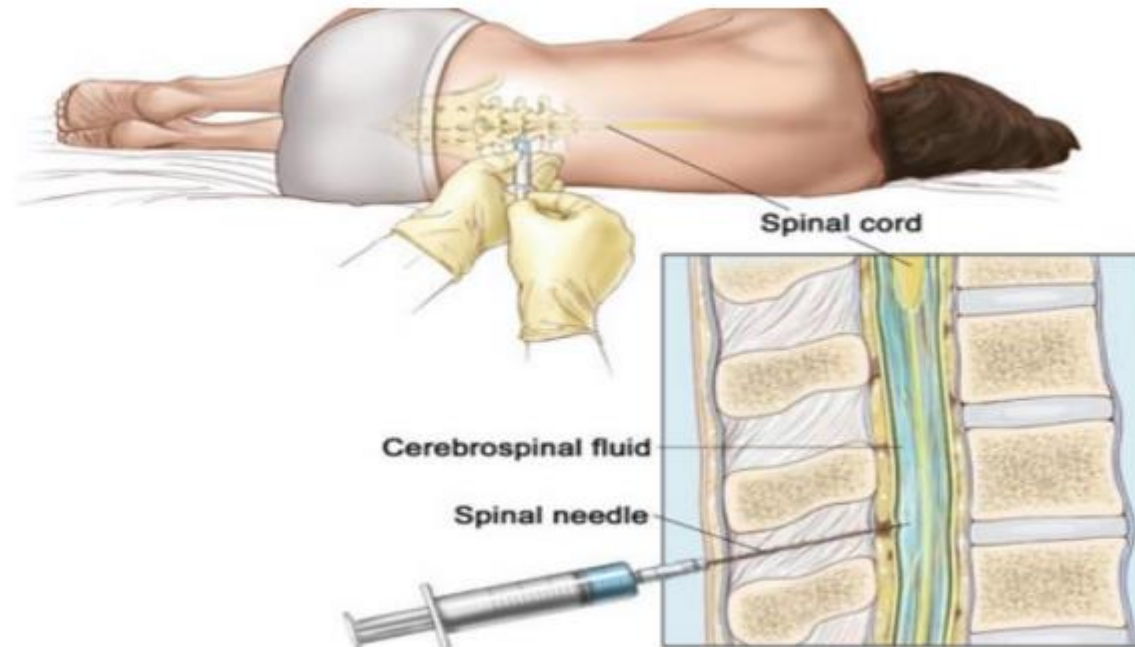
cerebrospinal fluid (CSF) is the clear fluid that surrounds the brain and spinal cord. It nourishes the central nervous system and protects it from mechanical shock.

2. Clinical importance:

CSF analysis is performed to diagnose:

- Meningitis (bacterial, viral, or fungal)
- Subarachnoid hemorrhage
- Central nervous system tumors or malignancies

CSF is a **clear, colorless, watery fluid** that **flows in and around your brain and spinal cord**. CSF acts like a **cushion** that helps protect them from sudden impact or injury. **It also removes waste products from the brain and helps your central nervous system work properly**



Sample collection:

- Collected by a physician using **lumbar puncture** between L4–L5 vertebrae.
- About 6–7 ml are collected into two sterile tubes:
 - Tube 1: for **biochemical and microscopic** examination.
 - Tube 2: for **bacteriological culture**.

Physical examination of CSF Normal CSF:

- Clear & colorless Viscosity: ~equal to water (increased with increased proteins)
- Color and/or turbidity of CSF: observed only in pathological circumstances.
- Turbid CSF Bacteria ,WBCs cells or pus cells: suggestive of a CNS infection (meningitis or encephalitis)
- Blood : suggestive of hemorrhage
- Red & brown colour : Blood
- Yellow colour 1- Jaundice (bilirubin in CSF) 2- Xanthochromia (hemoglobin breakdown pigments in CSF) Xanthochromic CSF suggests that a subarachnoid hemorrhage has recently occurred.

Normal CSF Analysis

Normal Physical Examination	
Appearance & Color	Clear ,Colorless
pH	7.4
Daily Secretion	450-500 ml
Specific Gravity	1.006-1.007
Normal Microscopic Examination	
Lymphocytes	1-5 /H.P.F
Normal Chemical Examination	
Protein	15-45 mg/dl
Glucose	50-80 mg /dl
Chloride	115-130 mmol /L
Calcium	1.0-1.40 mmol/L
Phosphorus	0.4-0.7 mmol/L
Magnesium	1.2-1.5 mmol/L
Potassium	2.6-3.0 mmol/L
Normal Microbiological Examination	
No pathogenic microorganisms	

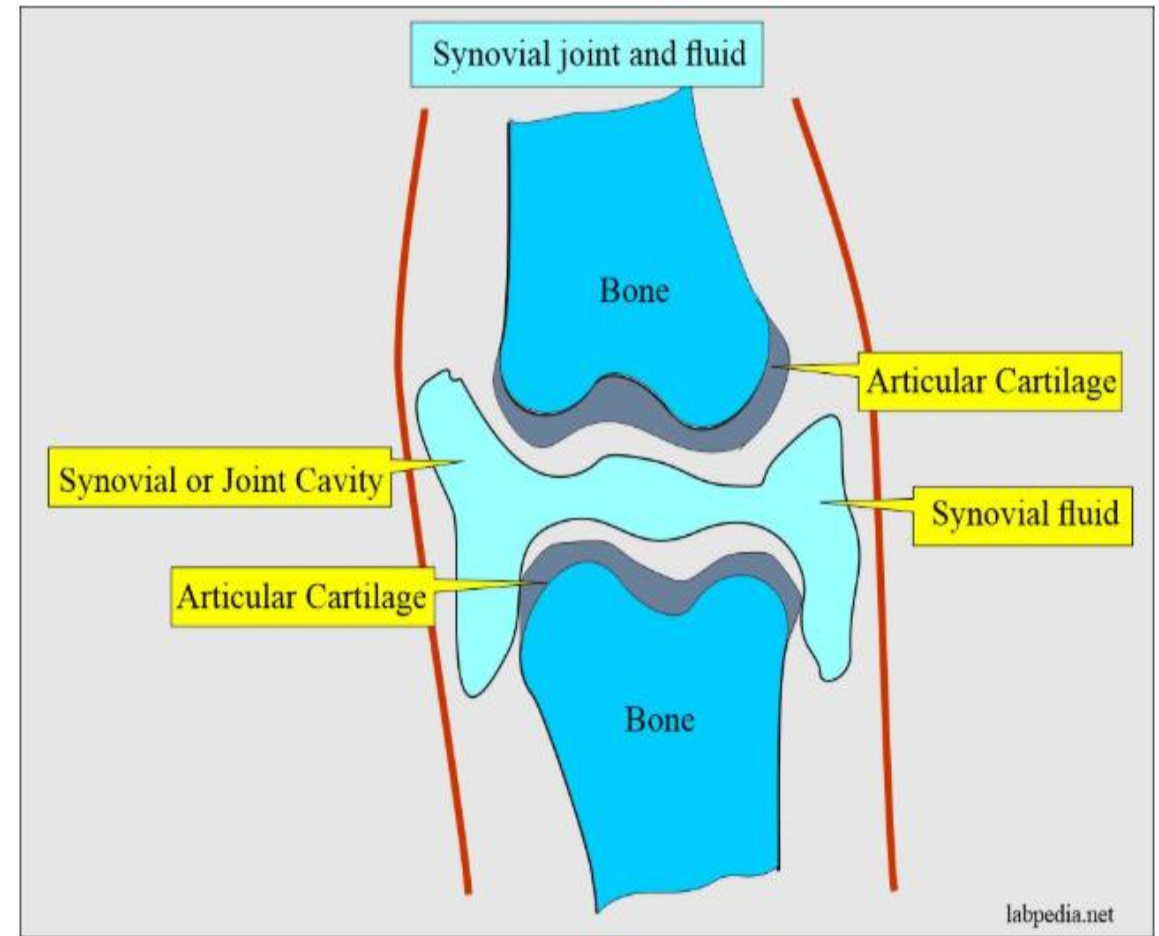
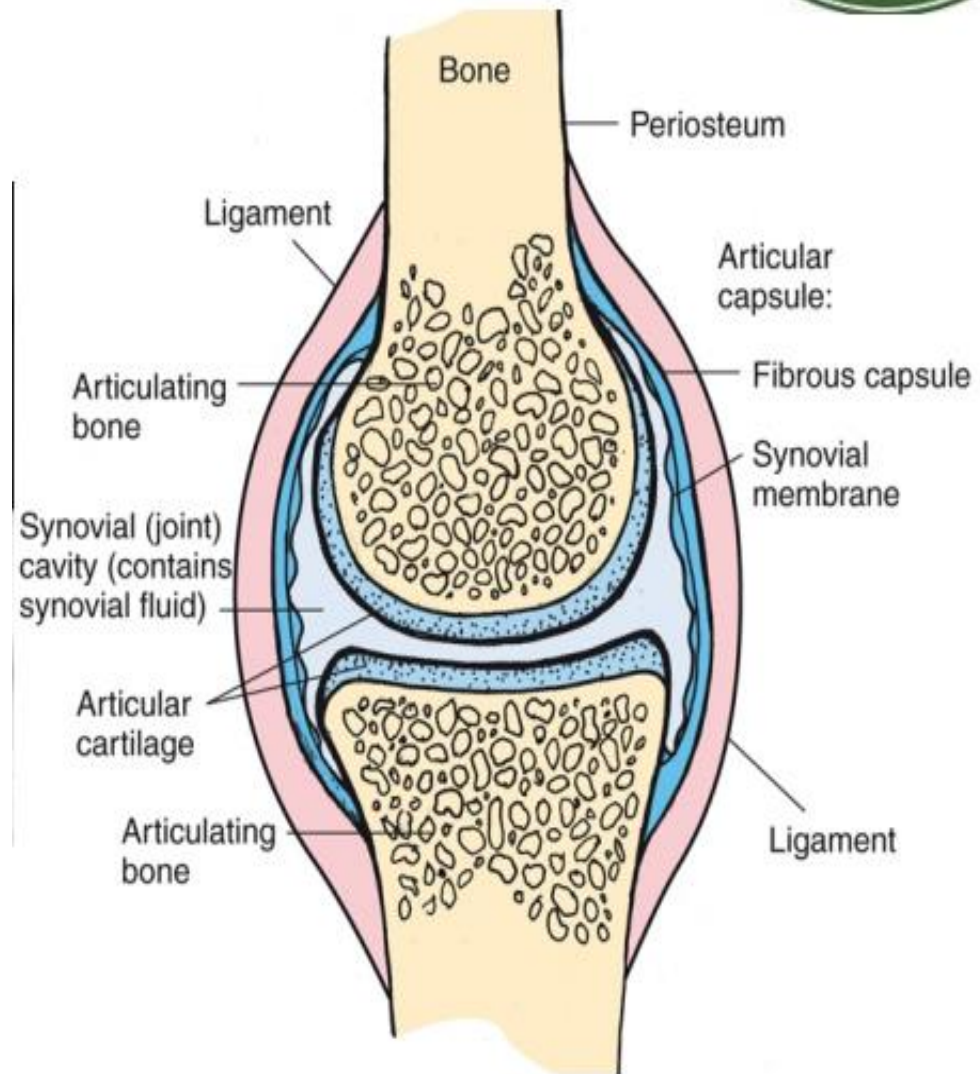
Synovial fluid analysis

1. Definition:

synovial fluid is a viscous fluid found in joint cavities. It is analyzed to diagnose **arthritis**, **joint infection**, or **gout**.

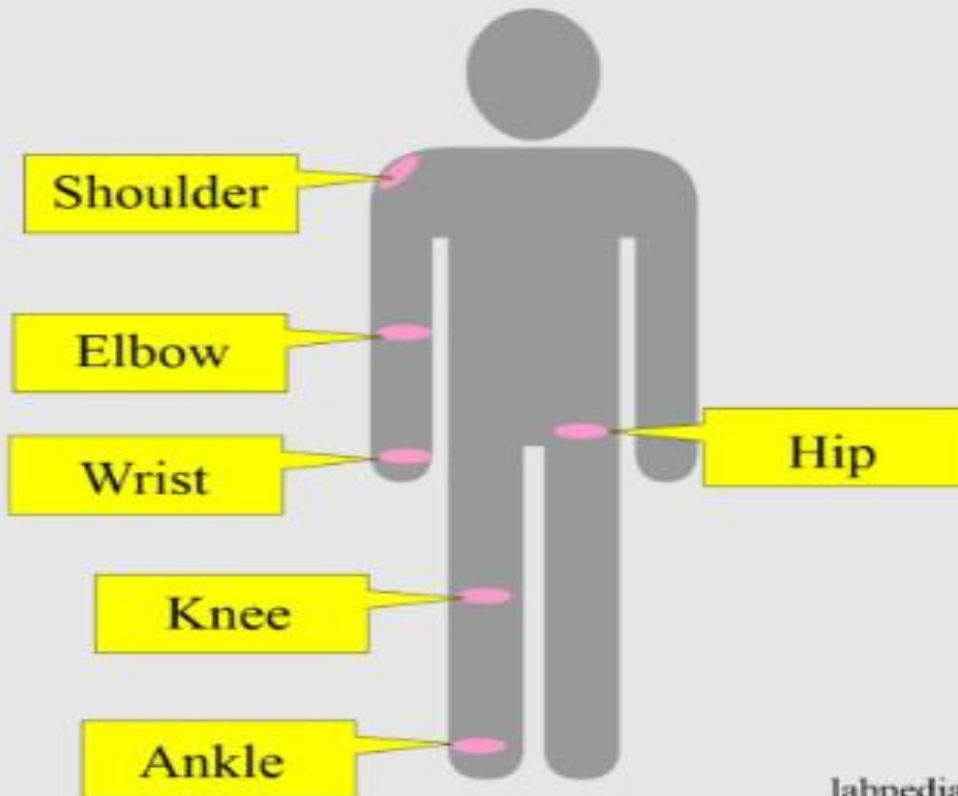
2. Collection:

- Collected by **arthrocentesis** (joint aspiration) using sterile technique by a trained physician.
- Place the sample in a **sterile tube** without anticoagulant.



Synovial fluid and cavity for aspiration

Aspiration sites of Joint spaces



Synovial fluid analysis: Synovial fluid aspiration sites

Synovial FLUID

➤ Composition of Synovial fluid fluid:

- Volume: 30-40 ml
- Hyluronic acid: Secreted by synovium membrane.
- Lubricin secreted by synovial cell.
- Type A CELL: Macrophage: remove the debris from the fluid
- Type B Cell: Fibroblast: secrete hyaluronic acid n proteins
- Proteinases
- Collagenases

Synovial fluid Function

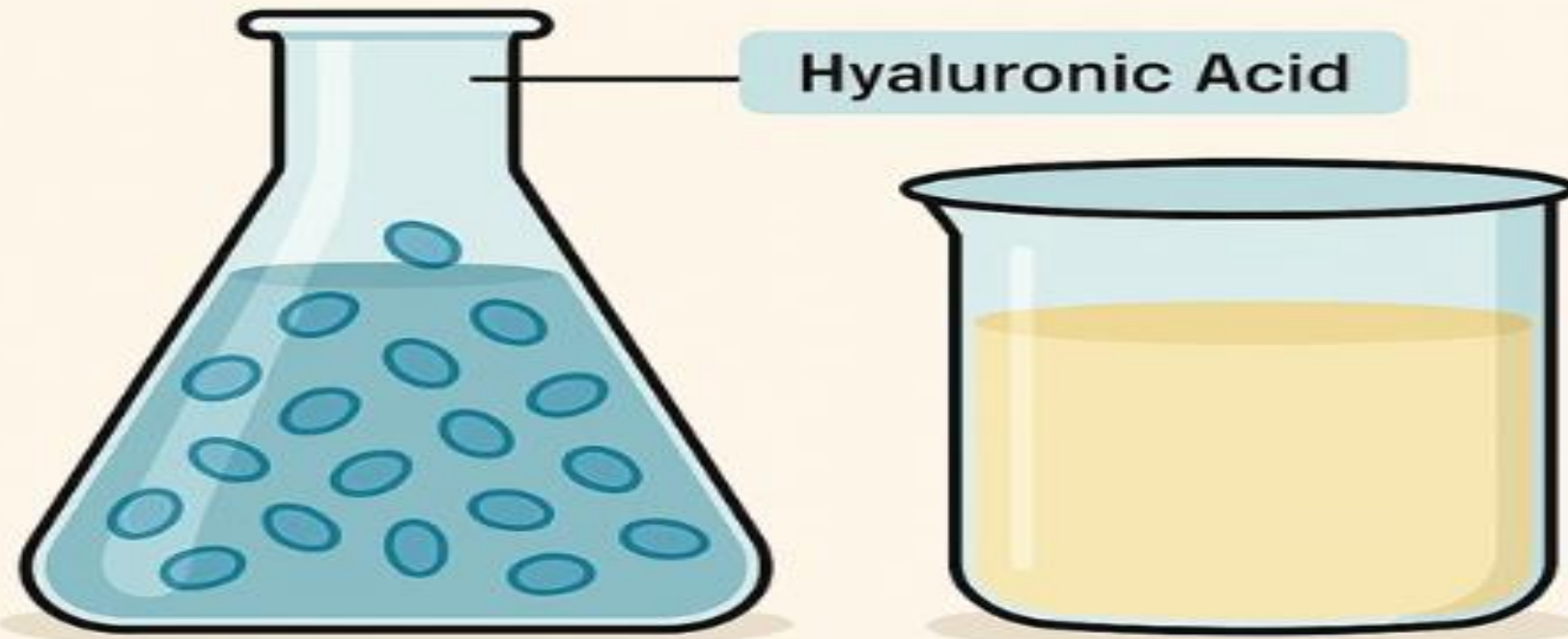
- 1 Nutrients for cartilage
- 2 Acts as lubricant
- 3 Hyaluronic acid is responsible for viscosity and lubrication
- 4 Reduce the friction
- 5 Provide nutrients
- 6 Lessens the shock of joint compression

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Synovial fluid functions

MAJOR DIFFERENCES BETWEEN SYNOVIAL FLUID and OTHER BODY FLUIDS

The high content of hyaluronic acid in synovial fluid is the major difference compared to other body fluids derived from



SYNOVIAL FLUID

OTHER BODY FLUIDS

Synovial fluid examination

Tube 1



Culture

Tube 2



Chemistry

Tube 3



Microscopy
(Heparin)

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Test	Normal	Non inflammatory	Inflammatory	Septic
Clarity	Transparent	Transparent	Translucent- opaque	Opaque
Color	Clear	Yellow	Yellow, opalescent	Yellow-green
Viscosity	High	High	Low	Variable
WBCs/mm ³	<200	200–2000	2000–10,000	> 50,000
PMN%	<25	~25	> 50	> 75
Culture	Negative	Negative	Negative	Often positive
Glucose (mg/dL)	Nearly = to plasma	Nearly = to plasma	~25, lower than plasma	<25, even lower than plasma

Seminal Fluid Analysis

1. Purpose:

To evaluate **male fertility** by assessing the functional characteristics of spermatozoa.

2. Collection:

- Collected by **masturbation** into a clean, dry, sterile container after **3–5 days of abstinence**.
- The sample must reach the laboratory **within 30 minutes** and liquefy within **15–30 minutes** at room temperature.

A Semen Analysis is a simple test that allows us to check sperm production. It's also known as a sperm count test and it allows us to see how many sperm are in the ejaculate, how they're shaped and how they move.

Semen parameter	Minimum normal value	Explanation
Volume	1.5 ml	How much fluid there is measured in millilitres – approximately ½ teaspoon
Concentration sperm	16 million per ml	How many sperm are in each millilitre
Total Motility	42%	The total proportion of sperm that are moving (Grade A, B, C)
Grade A rapidly moving Grade B slowly Grade C non-progressive Grade D immotile	A & B: 30% D: 20 %	A: quickly progressing forward B: slowly progressing forward C: moving but not going forward D: not moving – may or may not be dead
Normal morphology	4%	Proportion of sperm with normal head and tail shape

EXAMINATION:

•MACROSCOPIC EXAMINATION:

- Volume: 2–5 mL (normal)
- Appearance: opalescent gray
- Viscosity and pH measurement (normal $\approx$ 7.2–8.0)

•MICROSCOPIC EXAMINATION:

- Count sperm cells using **Neubauer counting chamber**.
- Assess **motility, morphology, and viability**.
- Stain with **Leishman or Giemsa** for morphology study.

Abnormalities in count, motility, or morphology may indicate infertility or accessory gland dysfunction.

Urine Analysis:

A urinalysis (UA), also known as routine and microscopy (R&M), is an array of tests performed on urine. A part of a urinalysis can be performed by using urine test strips, in which the test results can be read as color changes. Another method is light microscopy of urine samples.

Tests:

•Physical Examination:

- Color, clarity, odor, and specific gravity.

•Chemical Examination:

- Performed using **urine dipsticks** to detect glucose, protein, blood, nitrite, and leukocyte esterase.
- **Protein estimation** may be done by **turbidimetry** using trichloroacetic acid.

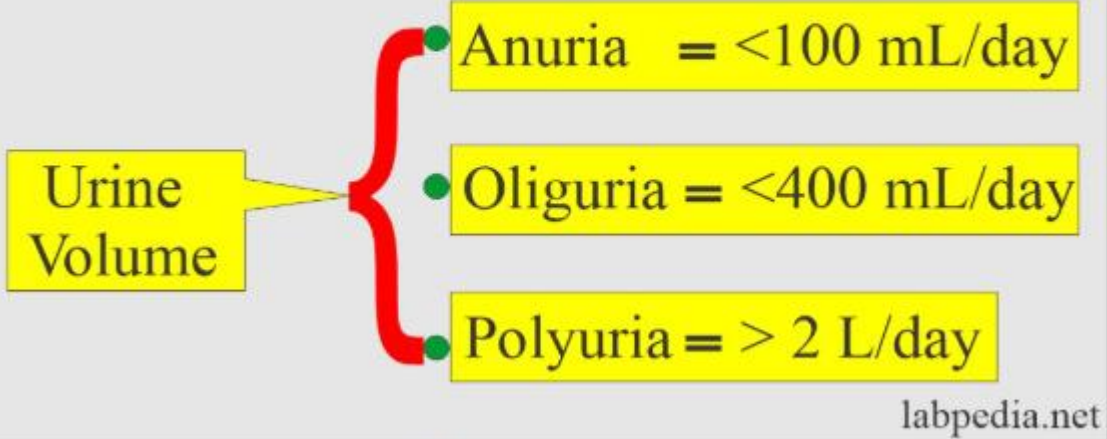
•Microscopic Examination:

- Examine sediment for **cells, bacteria, casts, and crystals** after centrifugation.

Types of urine sample

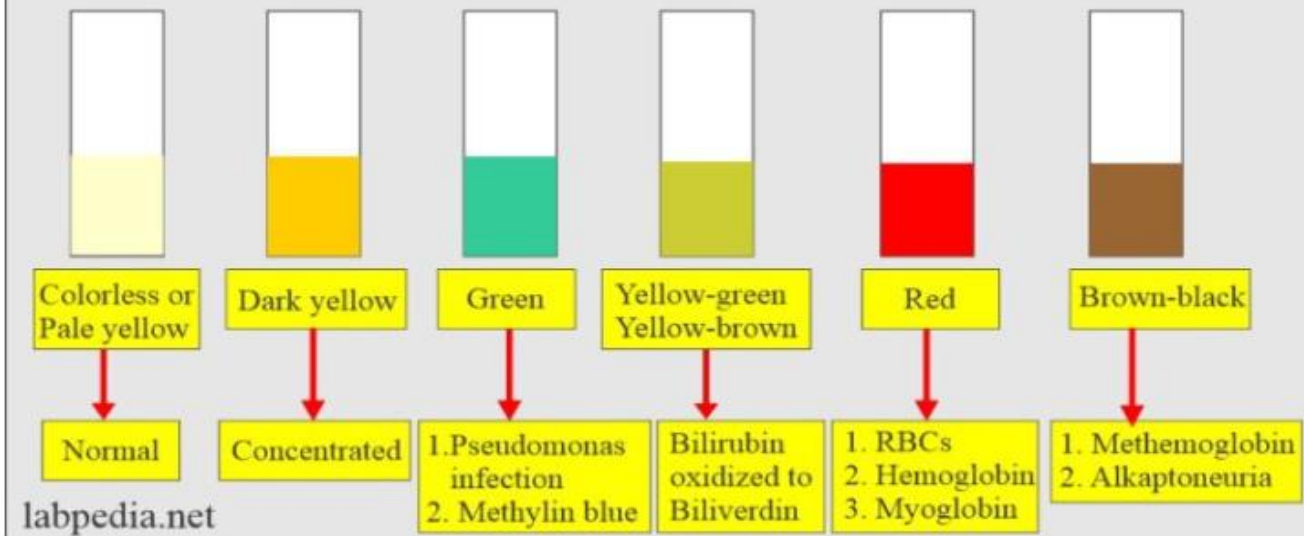
Sample type	Sampling	Purpose
Random specimen	No specific time most common, taken anytime of day	Routine screening, chemical & FEME
Morning sample	First urine in the morning, most concentrated	Pregnancy test, microscopic test
Clean catch midstream	Discard first few ml, collect the rest	Culture
24 hours	All the urine passed during the day and night and next day 1 st sample is collected.	used for quantitative and qualitative analysis of substances
Postprandial	2 hours after meal	Determine glucose in diabetic monitoring
Supra-pubic aspirated	Needle aspiration	Obtaining sterile urine

Urine classification on the basis of volume



Urine classification based on volume

Various colors of the urine



Various colors of urine

Urine Turbidity

Physiological causes

1. Mucus
2. Squamous epithelial cells
3. Presence of spermatozoa
4. Crystaluria
5. Contrast media
6. Fecal contamination



Pathological causes

1. White blood cells
2. Red blood cells
3. Presence of bacteria
4. Presence of yeast
5. Abnormal crystals
6. Lymph fluids and lipids

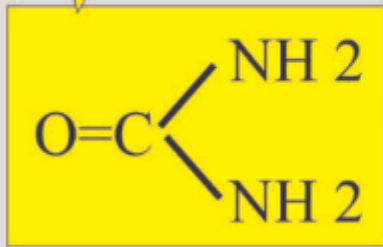
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Urine Odor

Urea

Breakdown

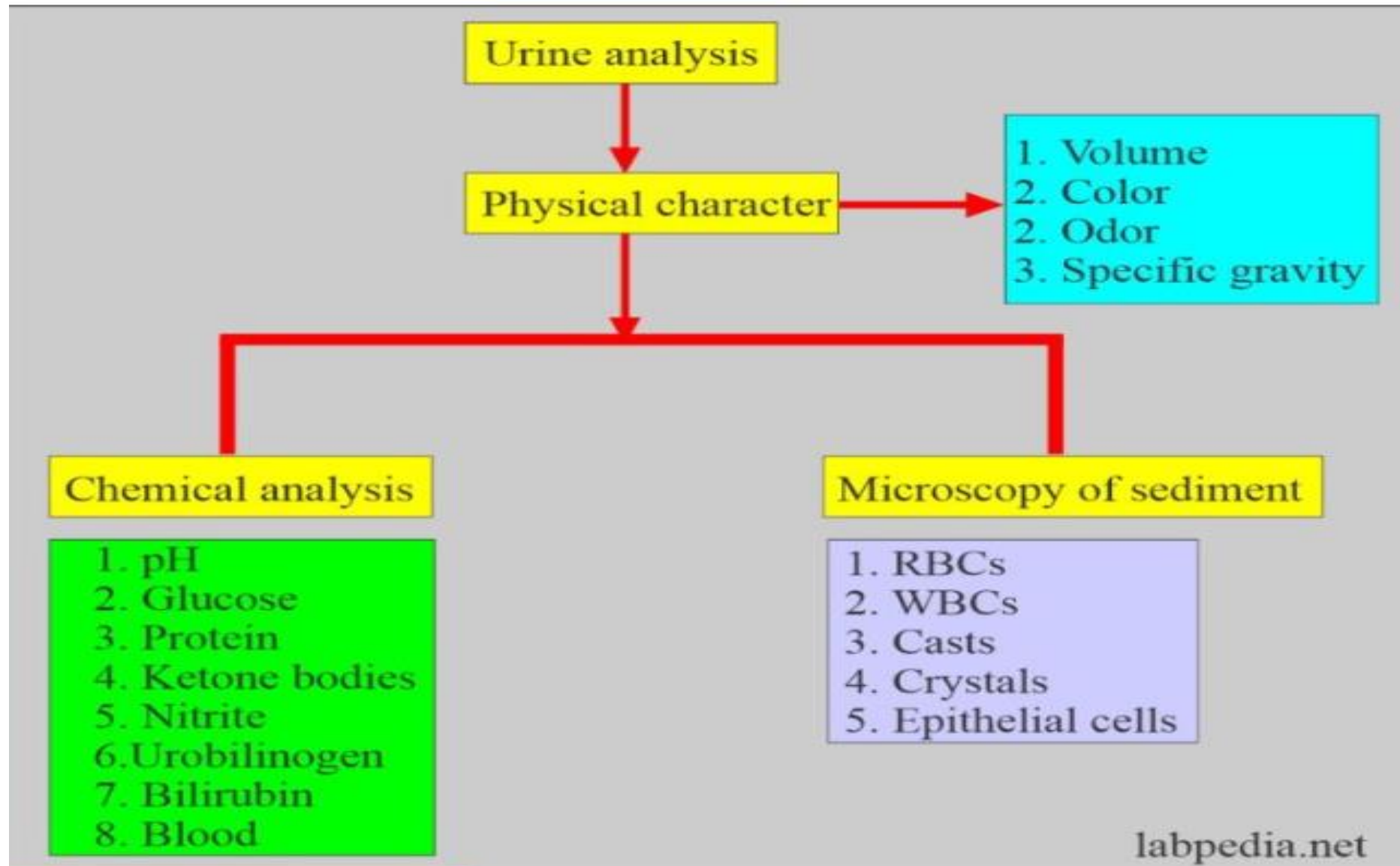
Ammonia



Ammonia odor

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Urine ammonia smell



QUIZ:

Each type of biological fluid (CSF, synovial, seminal, and urine) provides different diagnostic information about the body.

If you had only one sample type available for a patient with systemic infection symptoms, which fluid would you choose to analyze first — and why?

ANY QUESTION?

*Thank
You*