



# Body Fluid Analysis

## Hematologic Approach

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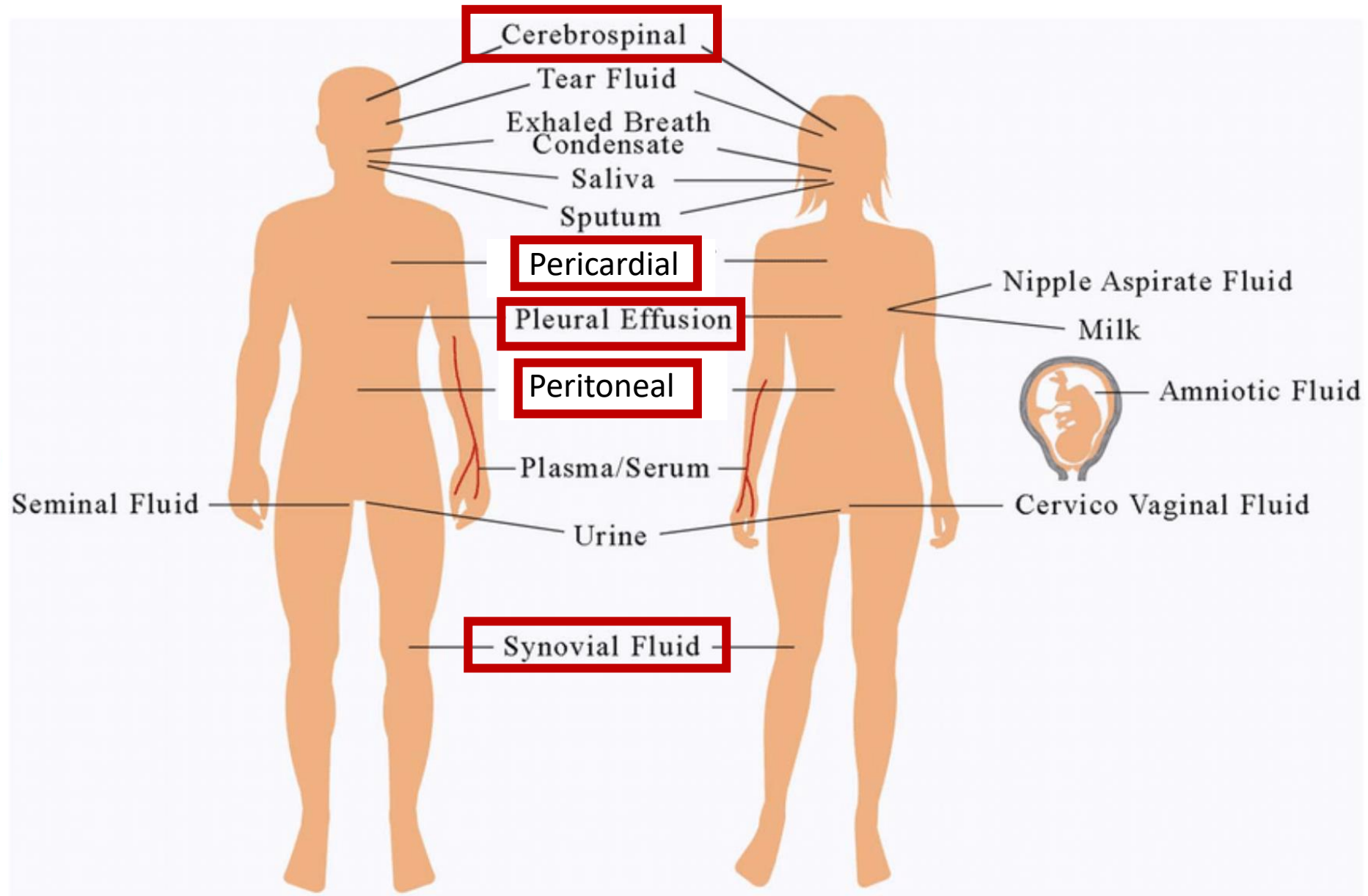
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# Collection and transport of body fluids



## Recommendations:

- Collection and transport of body fluids
  - Numeration and identification of cellular components
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- ✓ understanding, and explaining differences
  - ✓ steps to achieve worldwide uniformity



The distribution of 16 types of body fluids in human body.

# Preanalytical Variables

**Specimen transport may be affected**

the **temperature**, could affect the integrity, degradation, or deterioration

The **transport time**, specimen integrity.

The **method of transport** may also affect the integrity of the specimen

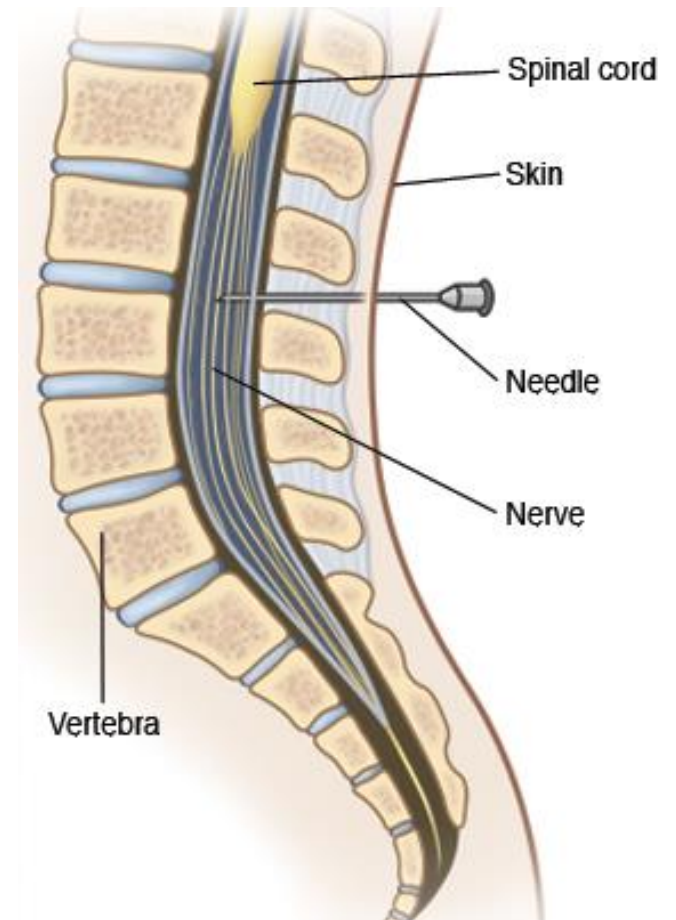
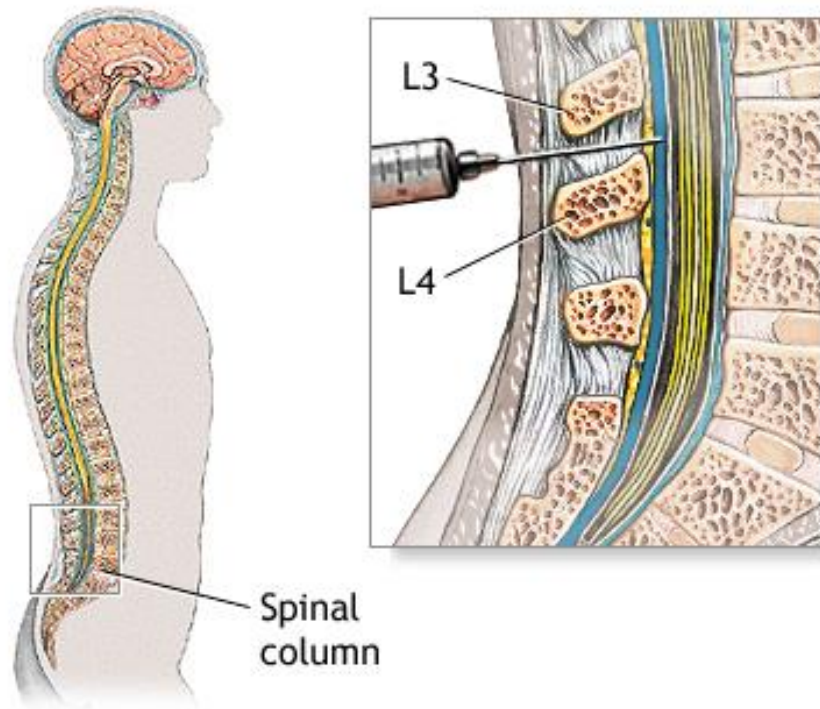
# Preanalytical Variables...

These specimens should be received with proper identification.

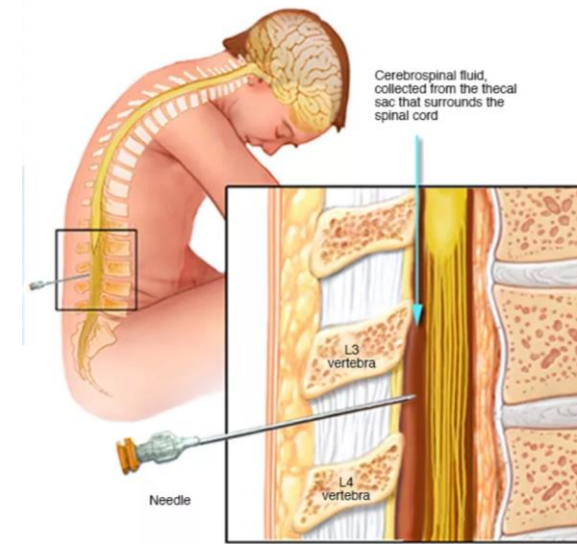
Label should include:

1. The name of the patient
2. The medical record number
3. The accession number
4. The location (unit)
5. The date and time of specimen collection
6. The list of the tests ordered

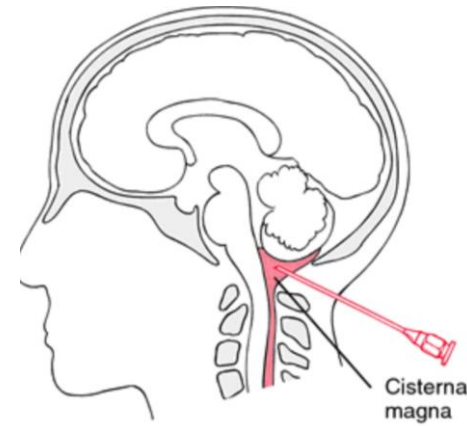
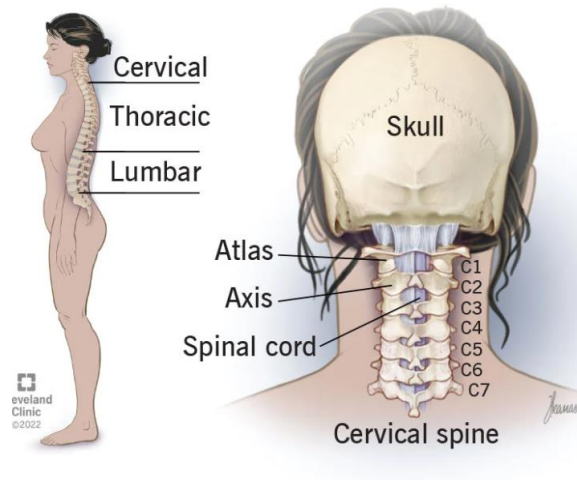
# Specimen Collection Cerebrospinal Fluid, CSF



- CSF is usually collected by **lumbar puncture (LP)**



but may also be obtained by **lateral cervical** or **cisternal puncture**



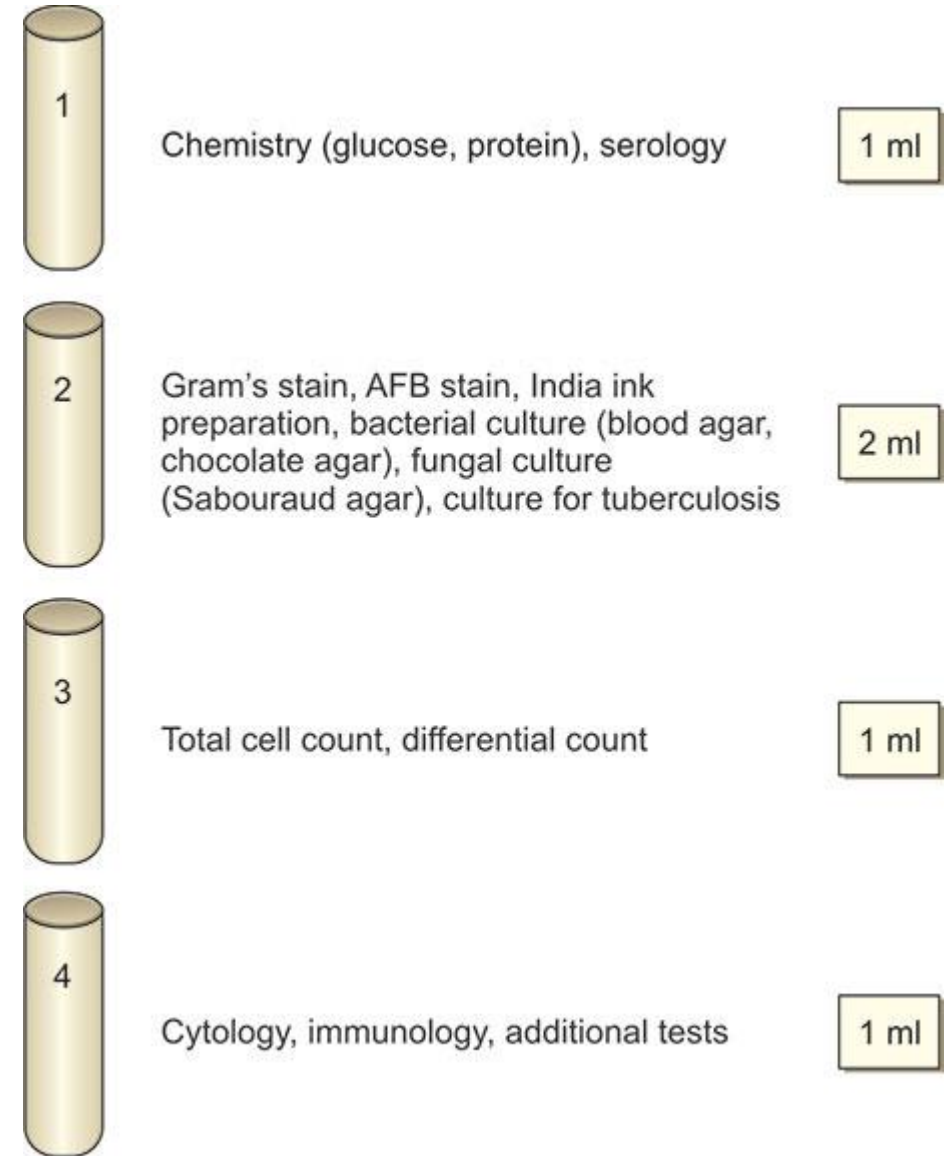


➤ fluid is collected into 3 or 4 tubes for chemical, microbiologic, and cellular analysis.

➤ The tubes should **be labeled** according to the sequence of collection.

➤ **No anticoagulant** is necessary, since spinal fluid does not clot

except occasionally if the puncture is traumatic



# Specimen Collection....

Since the volume of CSF is relatively small, the total amount collected is limited and usually varies from **10 to 20 mL** in adults.

**Up to 8 mL** may be safely removed from the smallest infant.

## Total CSF volumes:

Adult: 85 - 150 ml

Neonate: 10 - 60 ml

Adult Rate of Formation: 500 ml/day

	Total protein (g/l)	Glucose ratio	Lactate (mmol/l)	Cell count (per 3.2 $\mu$ l)	Typical cytology
Normal values <sup>a</sup>	<0.45	>0.4–0.5	<1.0–2.9	<15	MNC
Disease					
Acute bacterial meningitis	↑	↓	↑	>1000	PNC
Viral neuro-infections (meningo/encephalitis)	= /↑	= /↓	=	10–1000	PNC/MNC
Autoimmune polyneuropathy	↑	=	=	=	
Infectious polyneuropathy	↑	=	=	↑	MNC
Subarachnoidal haemorrhage	↑	=	=	↑	erythrocytes, macrophages, siderophages MNC
Multiple sclerosis	=	=	=	= /↑	MNC
Leptomeningeal metastases	↑	= /↓	NA	= /↑	malignant cells, mononuclears

CSF, cerebrospinal fluid; MNC, mononuclear cells; PNC, polymorphonuclear cells. ↑/↓, increased/decreased; =, within normal limits; NA, evidence not available. <sup>a</sup>Normal values are given for lumbar CSF in adults.

# Specimen Collection

## Serous Fluid

Serous fluids may be aliquoted

- *Specimens should be **gently agitated** during collection, before aliquoting, and before testing for cell counts and differentials.*

**EDTA** is the recommended anticoagulant for cell counts and differentials.

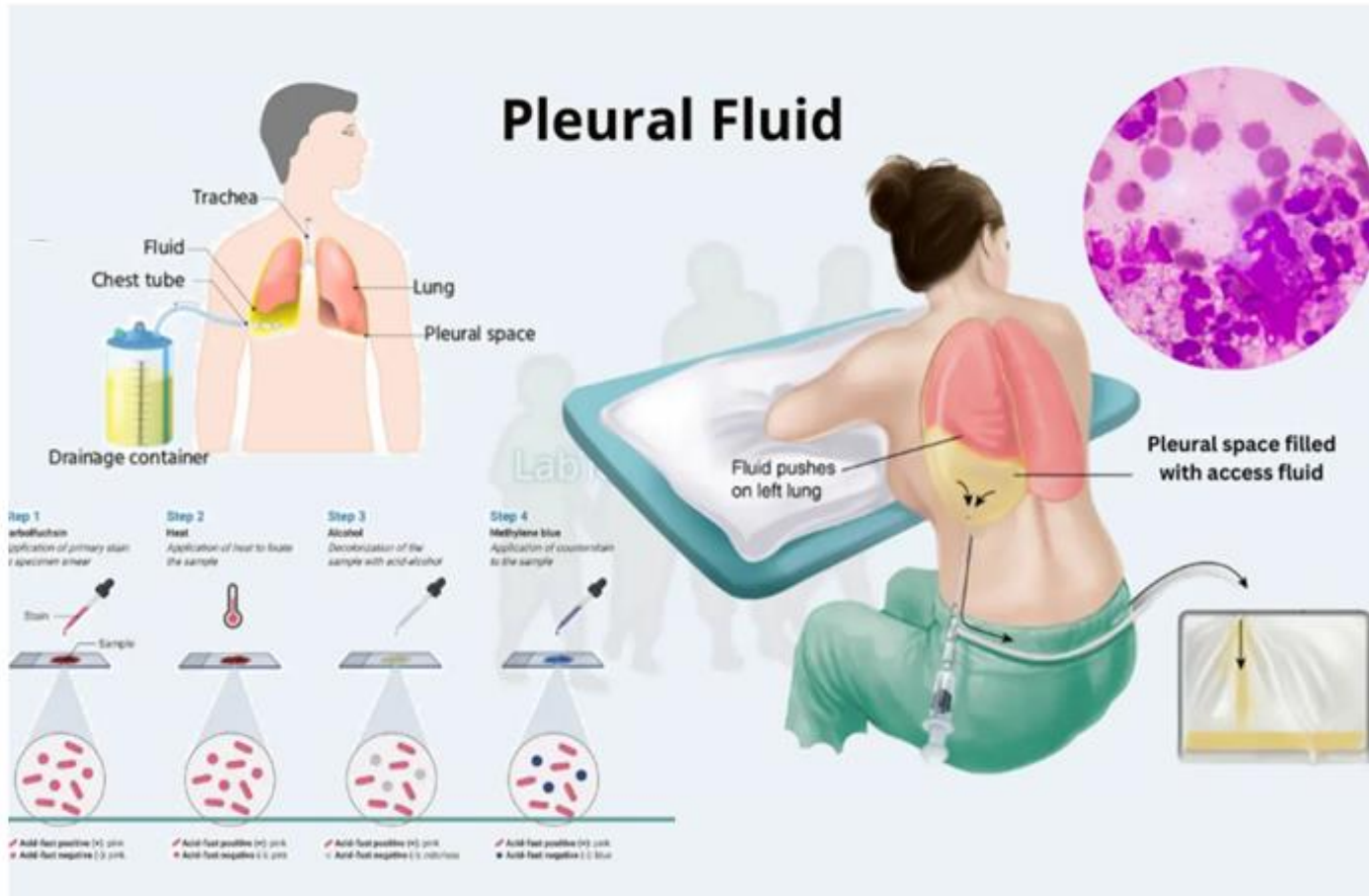
*Refrigerated storage* is adequate for cell counts and differentials for **up to 24 hours**.

Although testing can be done on small volumes of fluid, **5 to 8 mL** is recommended in the event follow up studies are needed (e.g., flow cytometry).

# Serous Fluid

<b>Analysis</b>	<b>Container</b>	<b>Recommendation</b>
pH analysis	heparinized syringe	sampling done in anaerobic conditions; analyze promptly using a blood gas analyzer
Cell count, differential cell count	EDTA-anticoagulated tube	after collection, mix well
Biochemical analyses	non-additive or heparin-anticoagulated containers/tubes	allow complete clotting of samples collected in non-additive containers/tubes at room temperature; bloody and turbid serous fluids may be unsuitable for analysis
Glucose, lactate	tubes with glycolitic inhibitors	lactate: specimen chilling during transportation to the laboratory

EDTA - ethylenediaminetetraacetic acid.

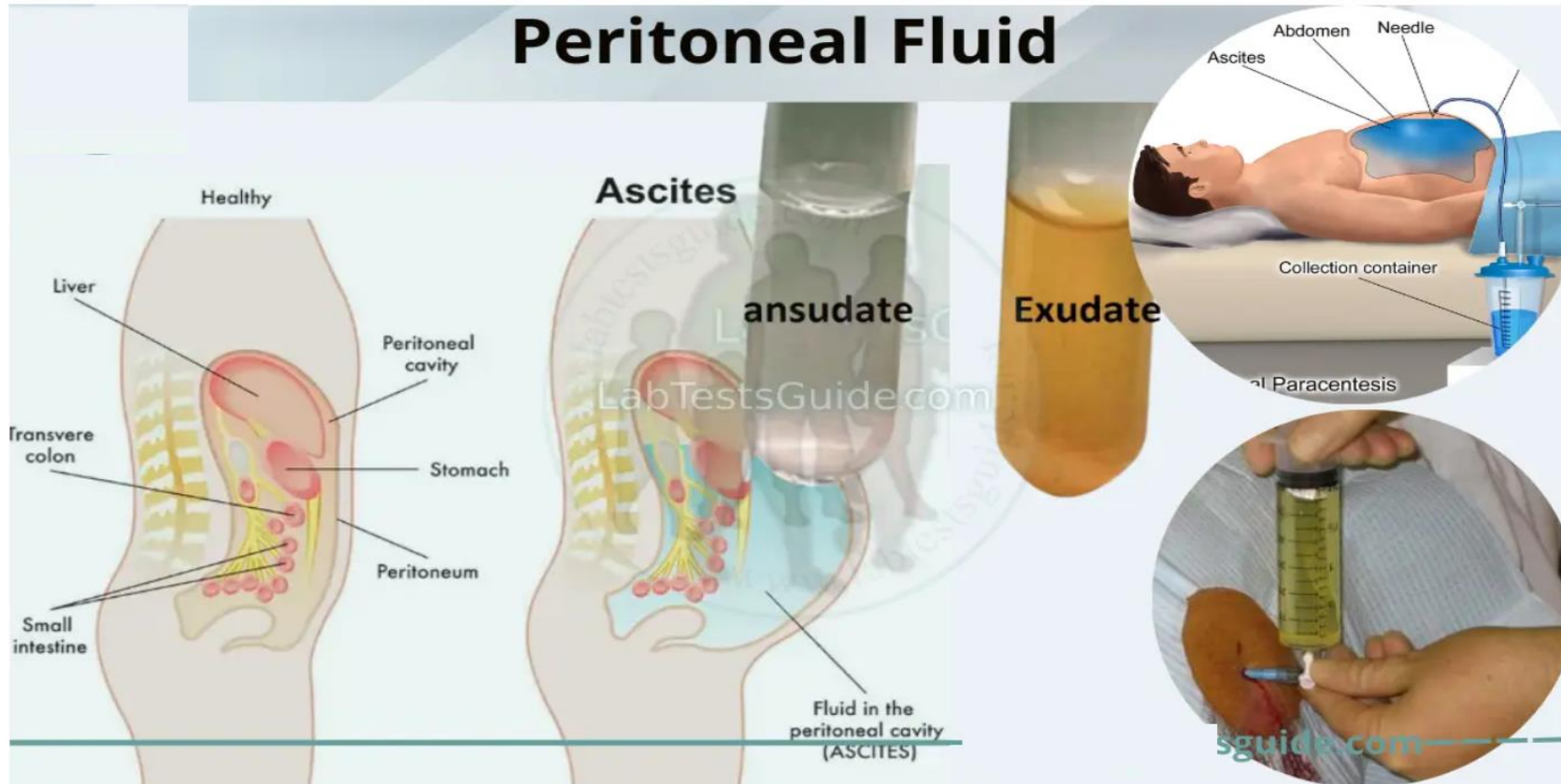


**Pleural fluid** is a fluid that is found between the layers of the pleura. The pleura is a two-layered membrane that covers the lungs and lines the chest cavity.

The area that contains pleural fluid is known as the pleural space.

Normally, there is a small amount of pleural fluid in the pleural space.

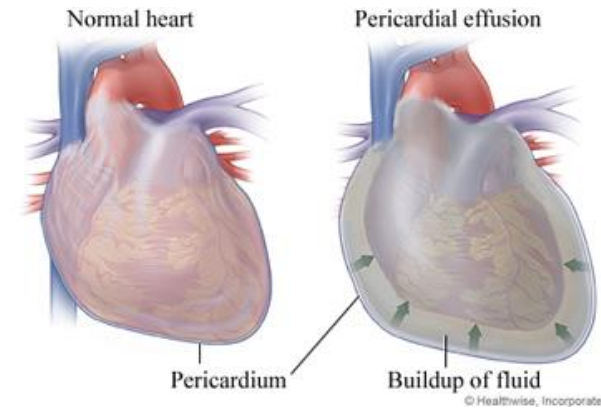
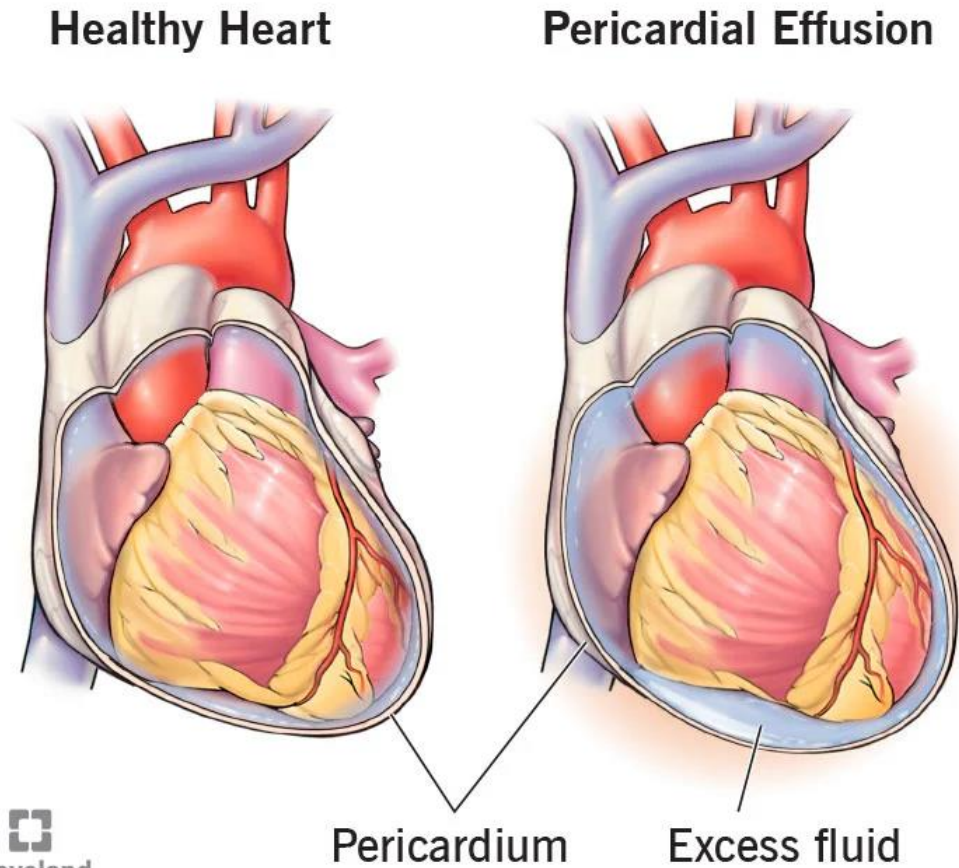
# Peritoneal Fluid



**Peritoneal fluid** is a clear, pale-yellow fluid that is found in the peritoneal cavity, which is the space between the lining of the abdominal cavity and the abdominal organs.



## Pericardial Effusion

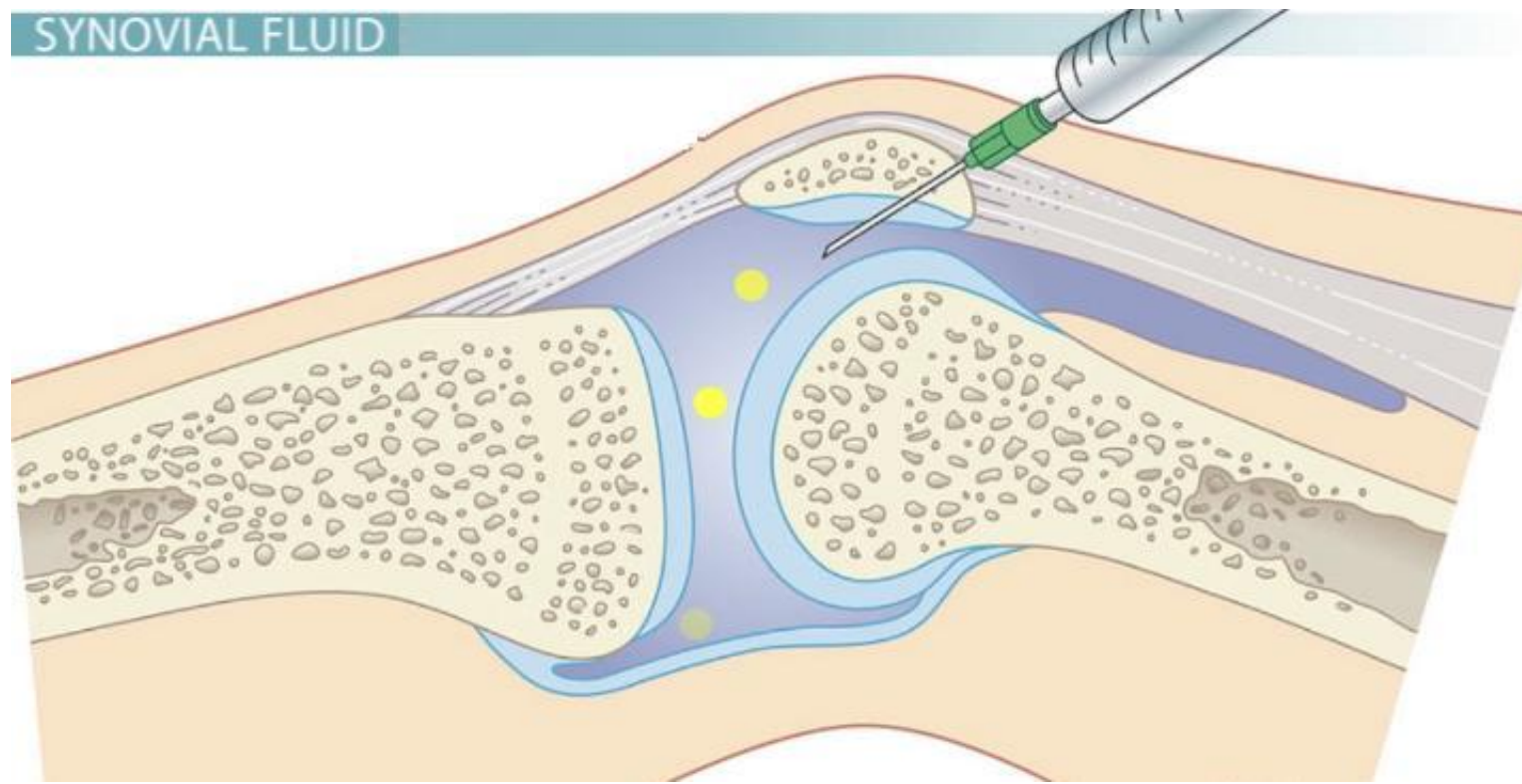


**Pericardial effusion** is an accumulation of fluid in the pericardium, the sac that holds your heart.

When it happens quickly or involves a large amount of fluid, the excess fluid can take up too much space in the pericardium, compressing your heart and causing a life-threatening condition known as cardiac tamponade



# Specimen Collection Synovial Fluid



# Synovial Fluid

The amount of fluid depends on the size of the joint and effusion.  
**3 to 5 mL** sample is ideal for laboratory analysis.



Needle is inserted into the joint, and fluid is withdrawn

***Specimens should not be rejected because of small volumes***

since even a drop may provide definitive diagnosis in crystalline joint disease and only small volumes are needed for cell count and differential.

# Synovial Fluid

<u>Test</u>	<u>Anticoagulant</u>	<u>Volume (mL)</u>	<u>Comments</u>
Cell count, differential, crystals, inclusions	Heparin, EDTA	3-5	Can be done on a few drops of fluid. Mix thoroughly.
Glucose	Fluoride or none	3-5	8-hr. fast preferred
Protein	None		
CH50	None		Freeze if not tested immediately.
C3, C4	None or EDTA		Requires 1 mL
Culture	SPS, none, or anticoagulant without bactericidal or bacteriostatic effect	3-5	Sterile tube required

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\* Requirements may change with advances in technology.

# Specimen Handling and Transport

- Specimens should be transported to the laboratory promptly.
- Cellular degeneration of CSF can begin within one hour of collection, so cell counts should be completed as soon as possible.
  - Delay in transfer of specimens result in :  
cell lysis, cellular degradation, and bacterial growth
- CSF specimens should be transported at ambient temperature

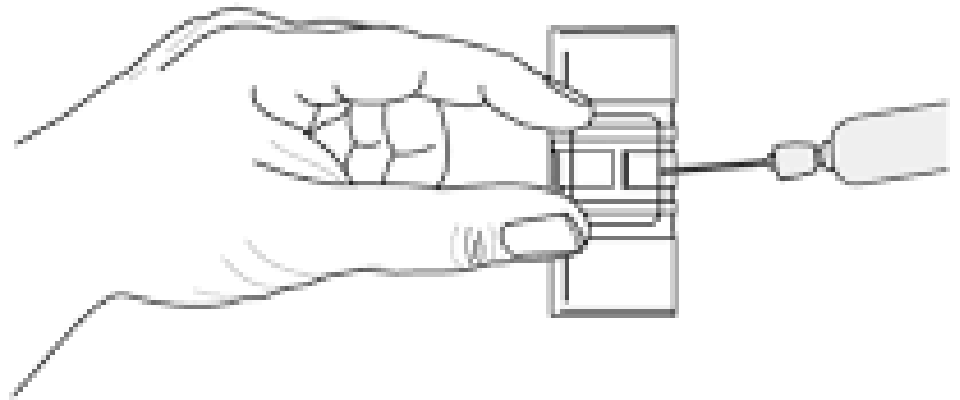
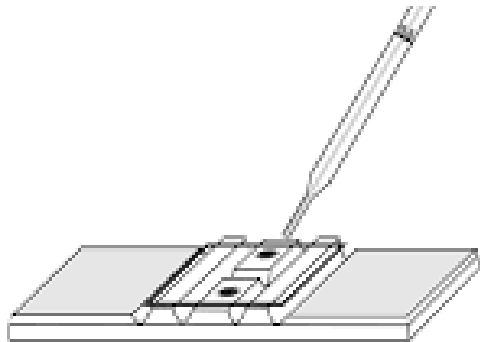
# Serous Fluids Handling and Transport

- Serous & Synovial Fluids, transported to the testing site at ambient temperature.
- Serous fluids for the cytology laboratory should be sent as soon as possible.

If storage is necessary, the specimen should be refrigerated at 4 °C **without a fixative.**

- Serous fluids have a **high protein content**, cellular detail with Papanicolaou (PAP), H & E, or other stains will be adequately preserved with refrigeration for several days.

# Quantitative Assessment Manual Counting, Procedure



# Quantitative Assessment Manual Counting, Procedure

- Mix the specimen well by rotation on an automated mixer: maximum of 2 to 5 min.(excessive rocking may damage cells)

Or

hand mix by inverting the tube 10 to 15 times.

- The exception is **synovial fluid**, which must be mixed for 5 to 10 min due to the **viscosity** of the fluid.
- ✓ If the fluid is in a conical tube, flick the bottom of the conical tube several times
- ✓ The more turbid the sample, the greater the mixing process impacts cell count accuracy

# Specimen Dilutions

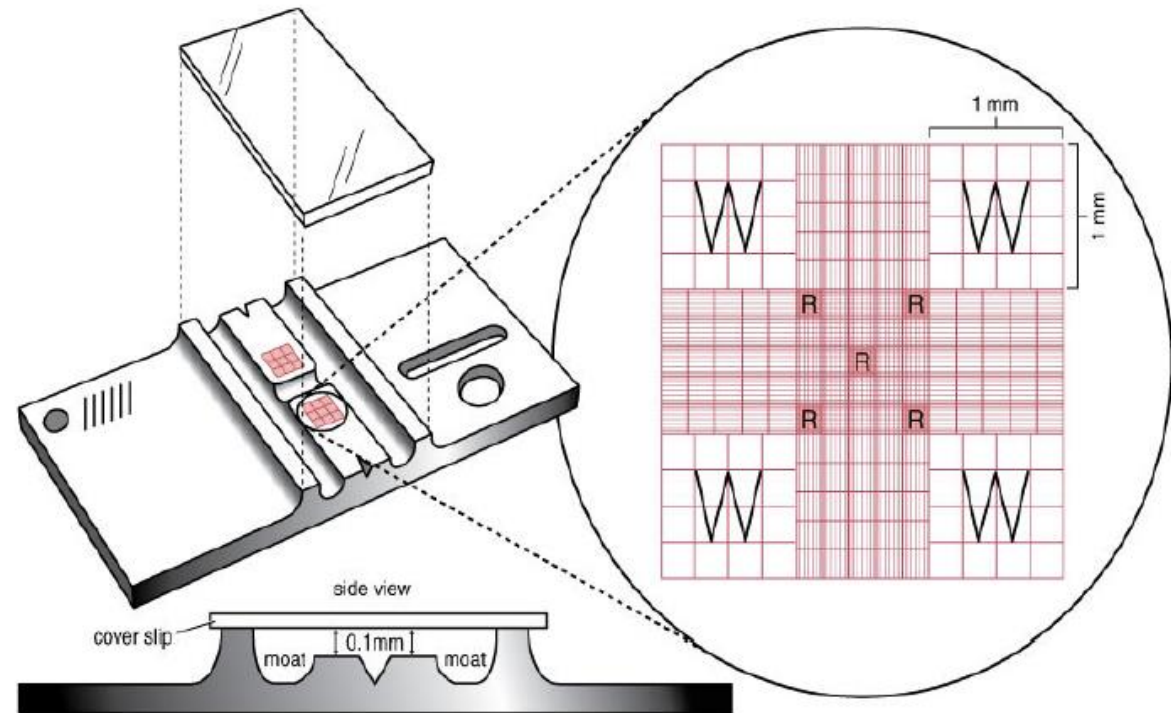
- Different diluents
  - **Isotonic saline**: white and **red cell**
  - **acetic acid or hypotonic saline** may be used to lyse red cells for white cell dilutions.
    - Acetic acid should not be used as a diluent for **synovial fluid** manual nucleated cell counts, since mucin will coagulate.
    - If manual nucleated cell counts are performed on synovial fluid samples, erythrocytes can be lysed, with preservation of nucleated cells, by using **a hypotonic saline solution (0.3%).**



# White and Red Blood Cell Counts

- Nucleated cells may be counted in the **same chamber** as erythrocytes.

All **9** squares if **no** dilution  
All **9** squares for **1:10** dilution  
**4** corner squares for **1:20** dilution  
**Center square** for **1:100** dilution  
**Red cell area** for **1:200** dilution



# White and Red Blood Cell Counts

**Total Cell count** - **leukocyte count** = **Erythrocyte count**

