Best Practices in Pre-analytical Phase: The Backbone of Reliable Laboratory Results

Presented By:

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Diagnosis is largely **DEPENDENT** upon integrity of **LABORATORY** data

More than **60-80%** of the most **IMPORTANT DECISIONS** on **ADMISSION**, **DISCHARGE** and **MEDICATION** are based on **LABORATORY TEST RESULTS.**

Laboratory Testing which commonly called the Total Testing Process. TTP is a highly Multifarious Process.

TOTAL TESTING PROCESS

Pre-Analytical Phase

Patient Requisition.1

Order the Test.2

Specimen Collection.3

Transportation.4

Processing.5

Analytical Phase

Testing

Post-Analytical Phase

1.**Testing result Transmission**

2. **Interpretation**

3.**Follow-up**

4.**Retesting**

Pre-Analytical Phase

- **About (60 to70) %** of errors are in **Pre-Analytical Phase.**

Most **CRUCIAL** and **HARDEST** to **REGULATE** and **MONITOR** because of the **INVOLVEMENT** of **TOO** many **PROFESSONALS** such as Physicians, Specialists of laboratory, Nurses, Laboratory technologists and Phlebotomists.

- **The pre analytical phase** is the phase where the laboratory has no direct control on the process.

- The pre analytical errors refer to all of the inappropriate performances before the specimens are measured by analyzers.

- **Errors in this phase-**

-are often caused by human error

-lack of knowledge or time pressure.

Rationale for Physicians Role in Preanalytical Errors

The laboratory requisition form is the major communication link between the clinician and the clinical laboratory.

Inaccurate or incomplete requisitions are source of error and can affect the quality of laboratory testing.

When a clinician decides to order a laboratory test, a requisition form is completed in writing or electronically and submitted with the specimen to the laboratory

After following a series of steps, the laboratory result being communicated back to the requisitioning doctor.

GREEN LIFE Medical College Hospital

Histopathology

Name of patient: Mrs. Dipika Rani Sarkar **Age :30years**

Sex: F **Bed No: 1415**

Send by: Prof.Dr. Bidhan C Das

Histopathology:

Diagnosis	: Chronic calculous cholecystitis.
Name of Operation	: Laparoscopic cholecystectomy
Name of specimen	: Jar containing gall bladder
Advice	: Histopathology

Signature

Patient requisition

Scenario:

A busy physician suspected that a patient might have iron deficiency anemia and he wrote on a requisition paper "Iron Panel“, but the handwriting was unclear, appearing almost like "Ion Panel." The Asst. account officer of OPD interpreted this as an "Electrolyte Panel“. As a result wrong test was ordered and performed.

Consequence:
The patient will be needed to reschedule, causing delayed in care and increased healthcare costs.

Order of Tests-

Case Scenario: The "Misleading" Lipid Profile

A 55-year-old male, visited the medicine outdoor with a history of hypertension. The physician, suspected dyslipidemia and decided to order a “Fasting Lipid Profile”.

Due to his busyness, he ordered the test electronically as a lipid profile and also failed to instruct the patient verbally to fast for 10–12 hours. The Asst. account officer of OPD interpreted this as "Routine Lipid Profile”. As a result wrong test was ordered.

Patient Action:

The patient had appointment with the phlebotomist at 9:30 AM and consumed mutton curry, Paratha and tea with sugar at 7:00 AM, assuming it would not affect the results.

Consequences of this Error

1.Lipemic Sample
2.Inaccurate Triglycerides
3.Falsely Elevated LDL ,low HDL
4.Result misinterpretation/Cancellation

Incorrect Timing:

Incorrect timing can lead to improper treatment, unnecessary follow-up tests, and misinterpretation of disease status.

Examples of Collecting Samples at the Wrong Time:

Post-Procedural Sampling:

Diurnal Hormone Variation

Collecting a morning sample (cortisol test, ACTH) in the afternoon.

Ovulation Testing:

TESTS AFFECTED by **DIURNAL VARIATION, POSTURE** and **STRESS**

Pre-Analytical Phase

TEST NAME	MORNING	AFTERNOON	EVENING	NIGHT	STRESS	SUPINE
CORTISOL	↑			↓	↑	
ADRENOCORTICOPIC HORMONE				↓	↑	
PLASMA RENIN ACTIVITY				↓		↑
ALDOSTERONE				↓		
INSULIN				↓		
GROWTH HORMONE		↑	↑			
ACID PHOSPHATASE		↑	↑			
THYROXINE	↑			↑	↑	
PROLACTIN	↑					
IRON						
CALCIUM						↓

Common Preanalytical Errors (urine sample)

- **Inappropriate Sample Type/Timing:** Using a random, heavily diluted afternoon urine sample instead of an early morning sample can lead to inaccurate results.

- **24-Hour Sample Confusion:** Misinterpreting a 24-hour collection requirement with a random spot sample.

Sample Collection:

Proper patient identification, selecting appropriate collection tubes, and maintaining proper blood-to-additive ratios.

- **Sample Collection Responsibility:**

- **Scenario:** A nurse used a small-gauge needle to draw blood for a comprehensive metabolic panel (CMP) test. The blood was drawn too quickly, or the vacuum tube was shaken vigorously. As a result haemolysis occurred.
- **Impact:** The serum appeared pink/red. Intracellular components were released, resulting in falsely elevated potassium and AST.

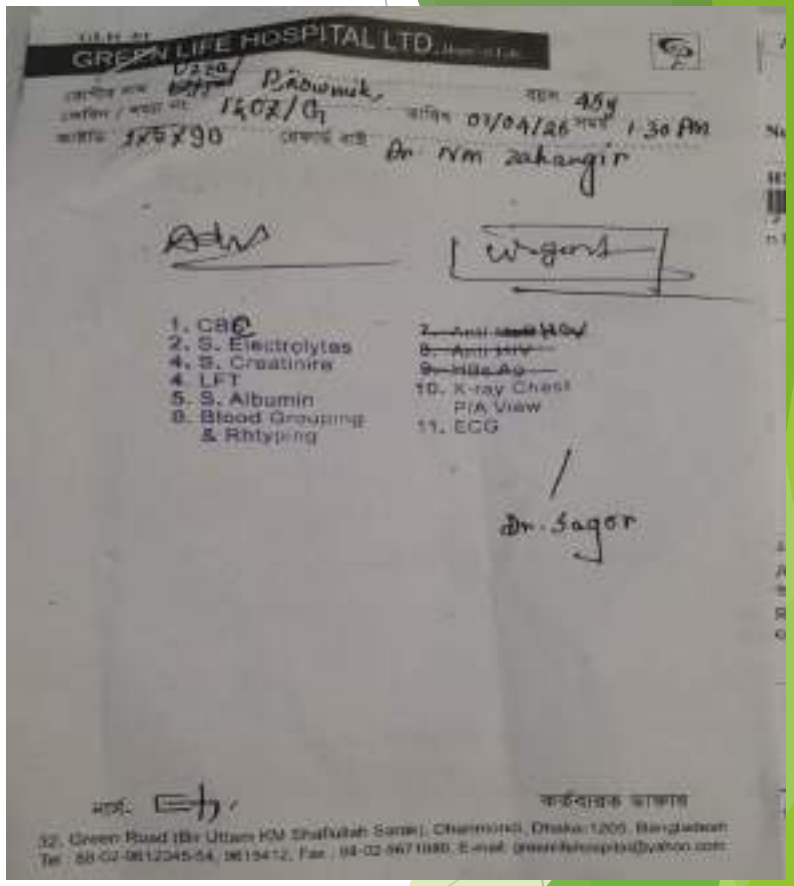
- **Correction:**

Use a larger gauge needle, avoid vigorous mixing, and ensure alcohol on the skin is dried before needle insertion.

MisMatch of Information (Requisition vs. Sample)

- **Scenario:**

A phlebotomist labels a sample with the patient's full name but fails to include patient's age/medical record number (MRN)/ writes the incorrect date of collection.

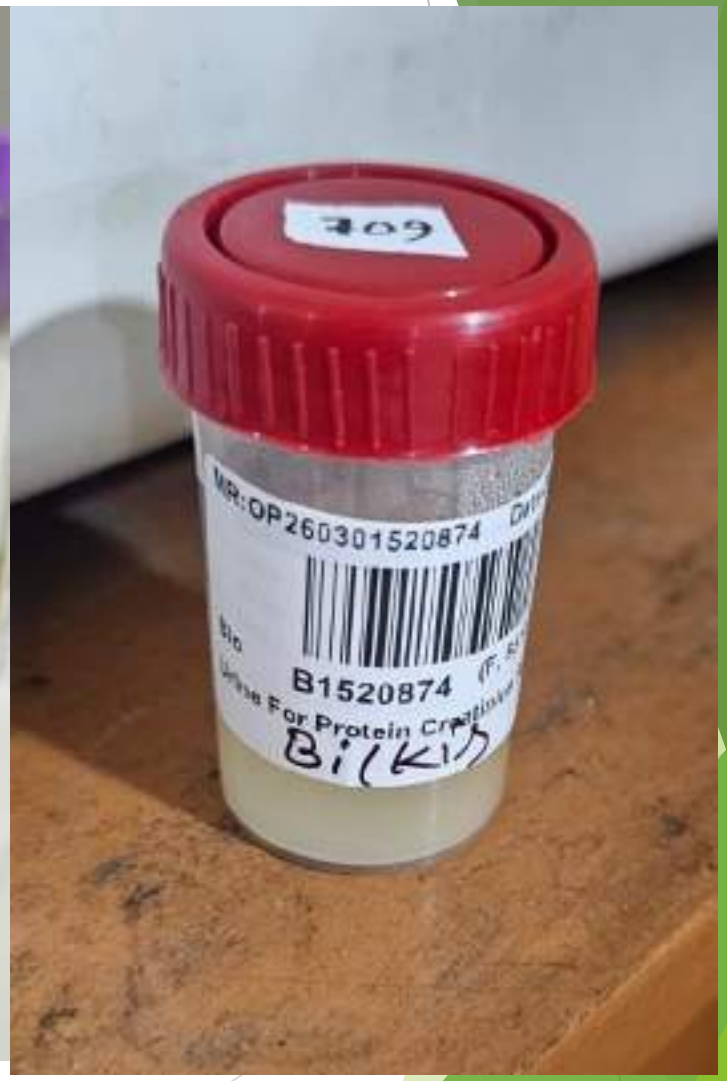


- **Consequence:**

Laboratory staff detected the mismatch with the information and he discarded the sample, causing delay in patient care and requiring a re-draw.

- **Correction:**

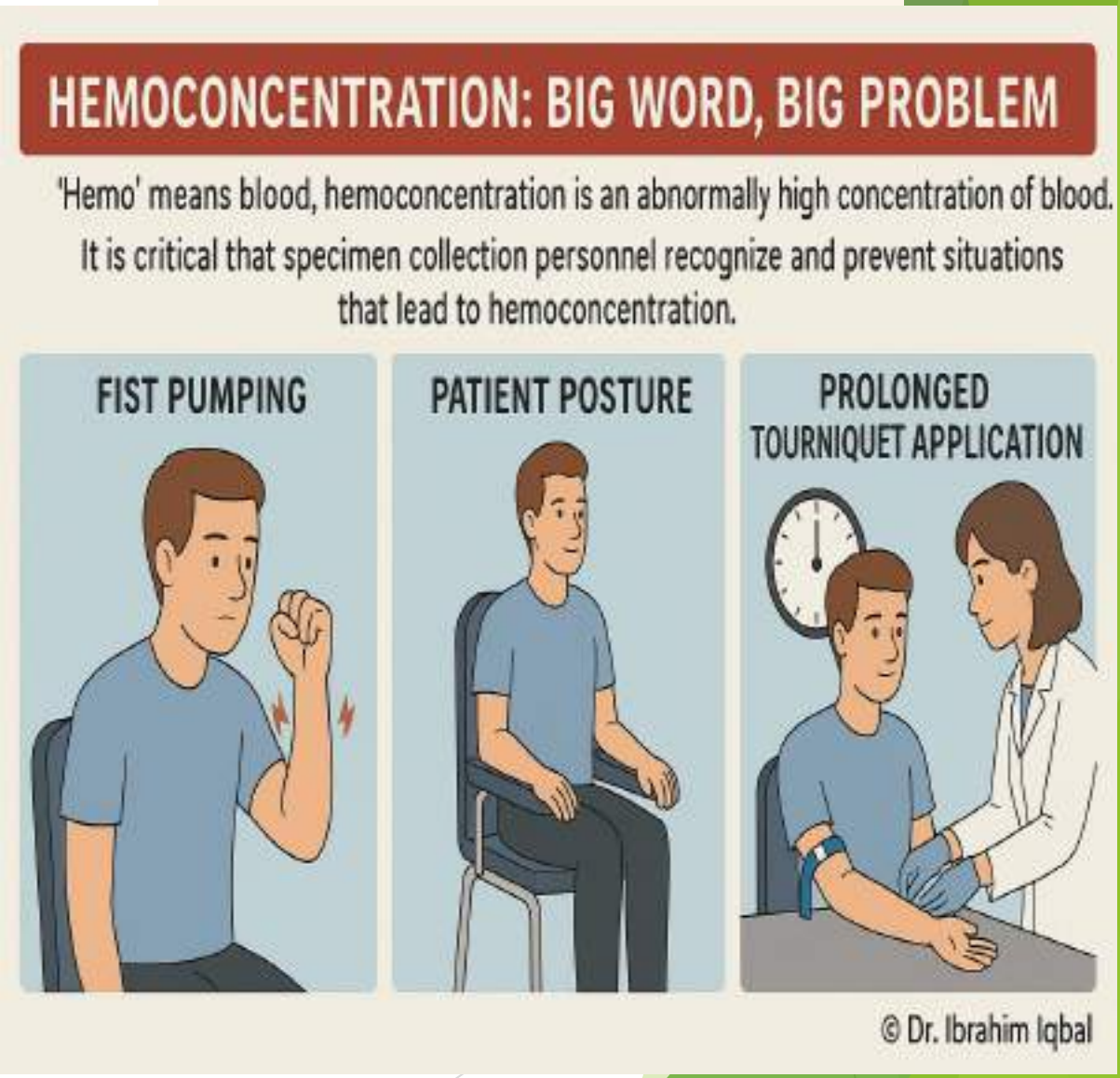
- Training
- Bar-code



Prolonged Tourniquet Time (Hemoconcentration) -

Scenario: A phlebotomist had difficulty locating a vein and left the tourniquet on for more than 3 minutes, requested the patient to make a fist repeatedly.

Correction: Keep tourniquet on for less than 1 minute.



- **Sample Contamination:**

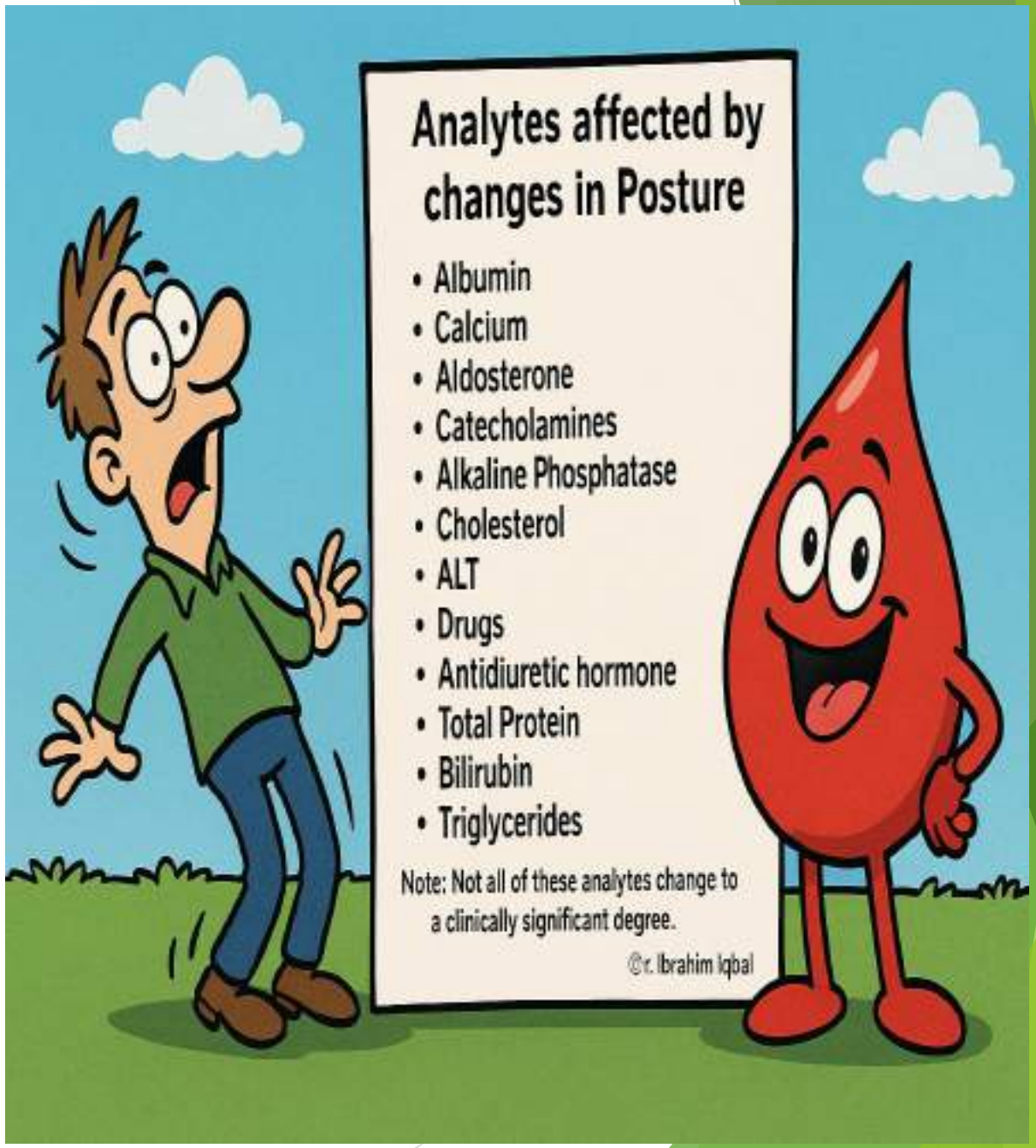
  Improper clean-catch technique can introduce external proteins, invalidating the PCR/ACR.

- **Lacking of instruction during 24 hrs urine sample collection**

Standing vs. Lying-

Hematology Components: Hemoglobin, hematocrit, and RBC counts show "meaningful" increases (about 5–10%), a phenomenon known as postural pseudoanemia.

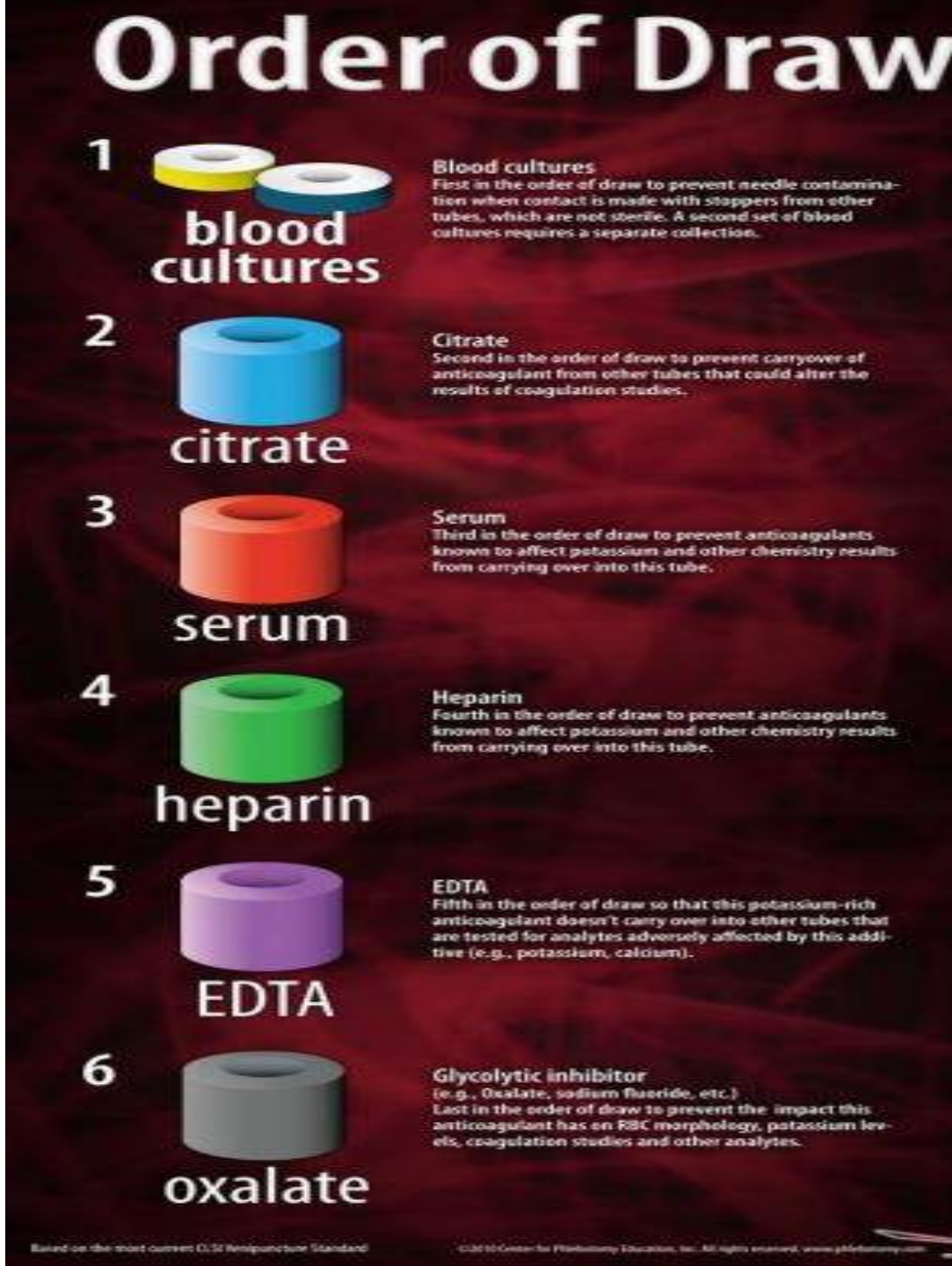
WBCs and Platelets: Leukocyte (WBC), neutrophil, lymphocyte, and platelet counts can increase.



Wrong ORDER OF DRAW

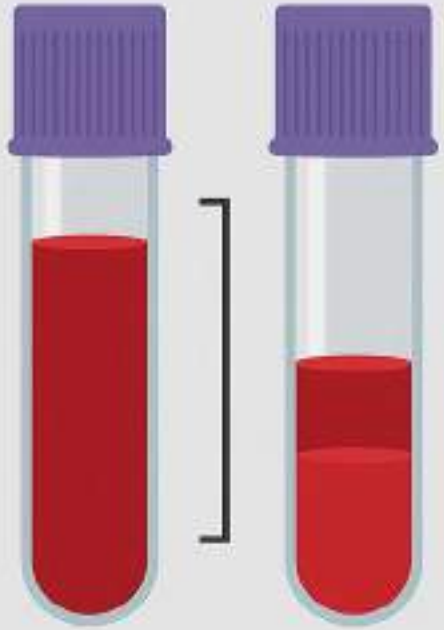
Scenario: An EDTA tube (lavender) was filled before a serum tube (red/gold).

Impact: EDTA carries over into the serum tube, chelating calcium. This results in falsely low calcium and magnesium, and falsely high potassium (if the EDTA is potassium-based).



WHAT`S WRONG

Under filling tubes with additives alter the balance between blood and additives and tinker the chemistry



Blood : Additive
9 : 1

- Disruption of the sample-to-additive ratio interferes with clinical testing and the interference can be variable from patient to patient

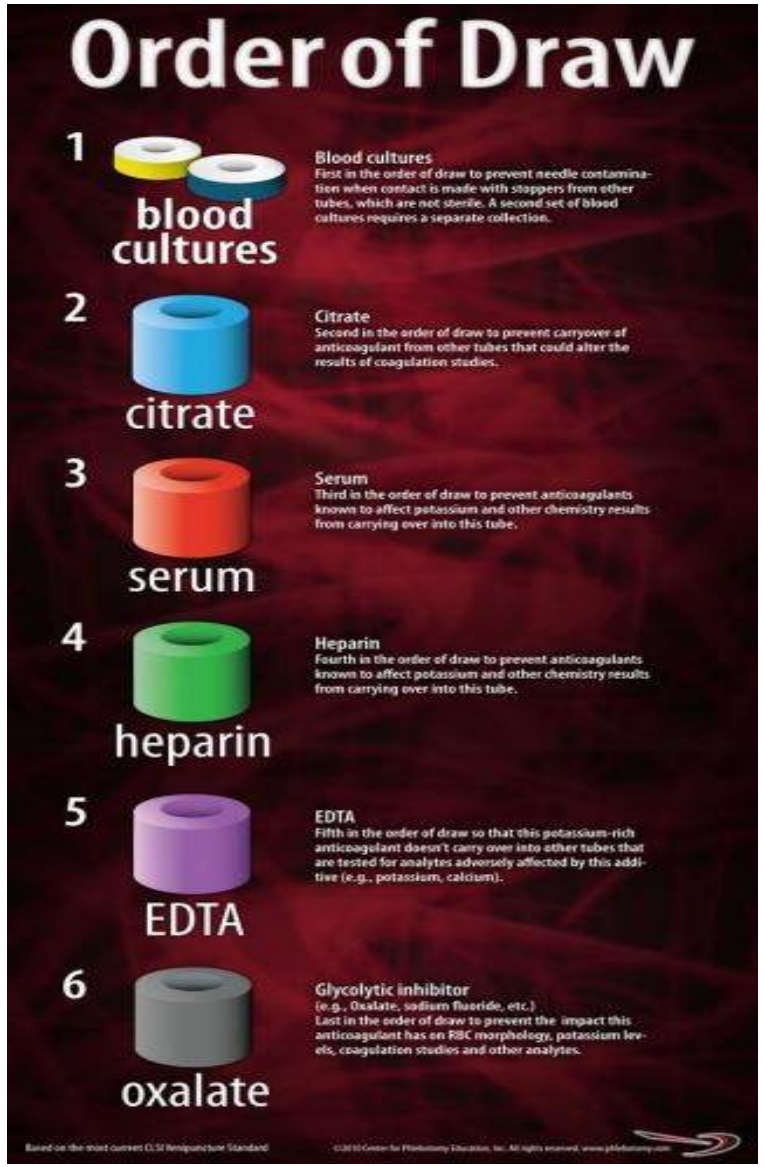
PROPER TUBE FILL VOLUME

COMPLETELY FILLED WITHIN 90% OF STATED VOLUME

IMPROPER ADDITIVE TO BLOOD RATIO MAY RESULT

- Micro-clots formation
- Clotted specimens
- Platelet clumping which can possibly affect test results.
- The excess additive in a short drawn tube can cause potential interference in immunoassays.

UNDERFILLING



- **EDTA -** RBC shrink affect Hct ,MCV MCHC
- **CITRATE – MOST SENSITIVE**. <90% fill will yield falsely prolong coagulation result.
- **HEPARIN-** Half filled tube double the heparin concentration (<50%) falsely lower sodium, and GGT concentration
- **CULTURE** – Longer to detect / will not be detected at all.

- **Transport & Storage:**
- Prompt transportation to the lab, ensuring appropriate temperature control (e.g., refrigeration, freezing), and minimizing transport time.

Pre-Analytical Error in Urine Sample

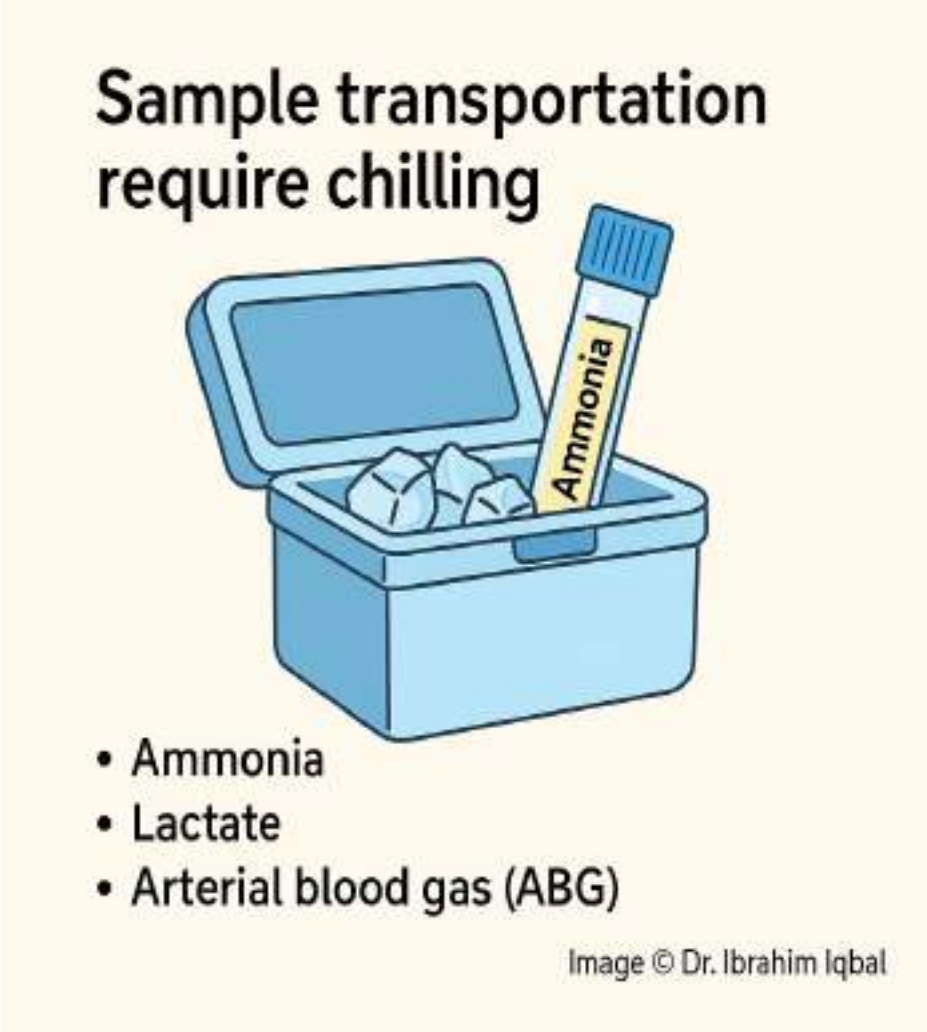
•Case Scenario:

•A patient, instructed to provide a morning urine sample for culture, collected the sample at 8:00 AM in an unsterile container and left it in the washroom corner. The sample was delivered to the lab at 11:30 AM.

•Correction:

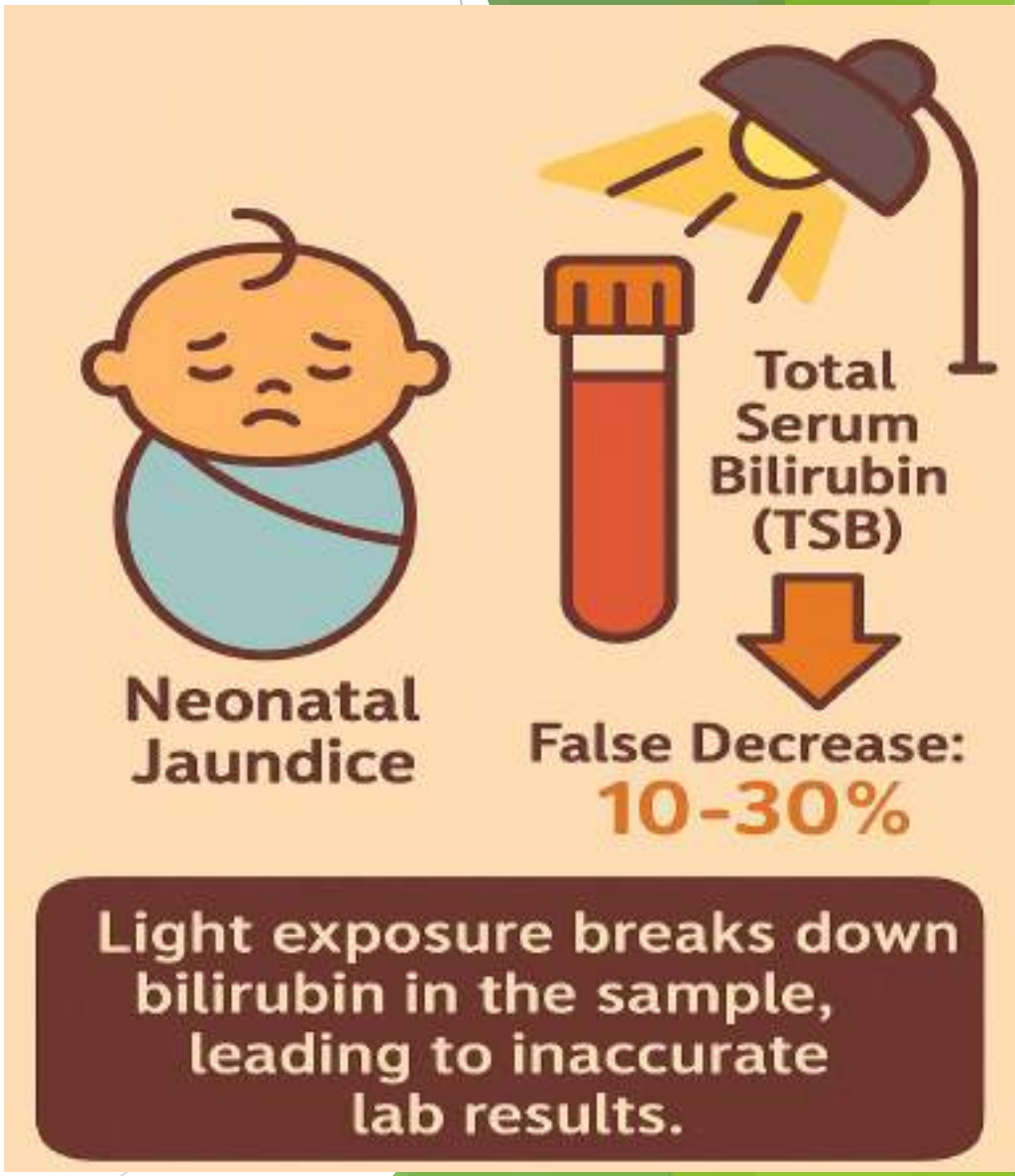
Urine sample should ideally be analyzed within 1–2 hours of collection. If delivery is not possible within 1–2 hours, the sample must be refrigerated at 4°C for up to 24 hours.

Certain Biochemistry analytes will require the tube of blood to be chilled after collection in order to maintain the stability of the analyte.



Tests requiring specimen protection from light during Transport

- Bilirubin
- Porphyrins



Sample Processing:

Sorting, centrifuging, and pipetting samples before analysis.

Discard Criteria of samples:

- **Improper Labeling:** Unlabeled, mislabeled.

- **Contamination/Degradation:** Samples with visible contamination, hemolysis, or those that have exceeded their stability timeframe (e.g., old blood samples).

- **Incorrect Collection:** Using the wrong container, tube type, or lacking necessary preservatives.

•**Damaged/Leaked:** Containers that are broken or have leaked in transit.

•**Improper Storage/Transport:** Samples that were kept at the wrong temperature (e.g., ambient instead of frozen).

•**Insufficient Quantity (QNS):** Not enough sample volume for the required test.

Delayed Centrifugation

- **Scenario:** Blood samples were transported but not separated from RBC within 2 hours of venipuncture.

- **Impact:** The serum/plasma remains in contact with red blood cells, resulting in decreased glucose and increased potassium, LDH, and phosphate.

Take Home Message-

- **Proper Test Selection**
- **Properly Fill-up the Requisition Form**
- **Proper instructions to patients for sampling**
- **Identification, Collection & Ensuring Transportation of the Sample.**

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PEACE
যুদ্ধ নয় যুদ্ধ নয়
তোল আওয়াজ !


এসো হে বৈশাখ


Thank you