

## Specimen Rejection

Why Does This Sample Need Recollected?

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## Objectives

- Discuss common preanalytical causes for rejection of blood and non-blood samples
- Identify patient factors that may lead to specimen rejection and recollection
- Discuss how the patient may be affected when testing is delayed or rejected

## When Are Specimen's Rejected?

- Mean rejection rate of 1% or less of heme and chem specimens \*
  - Higher rejection for Inpatient and ED
  - Majority are preventable
- 6% result in inappropriate treatment outcomes

\*2014 CAP QProbe

## Something's Not Right...



- Who identifies the error?
- Are rejections tracked as part of CQI?
  - Where does the specimen originate from?
  - Who performed the collection?
  - Which tests are mainly affected?

## Something's Not Right...



- Examine the sample visually
  - Labeling
  - Tube type
  - Appearance
- Review how the sample was collected


## Something's Not Right...

- Is the specimen acceptable with respect to the test ordered based on the transport conditions
  - Temperature of sample upon receipt
  - Length of time between sample collection and receipt

What pre-analytical factors affect specimen rejection?

### Labeling Errors


- Requisition mismatch
- Missing identification information/incomplete labeling
- Missing label/unlabeled
- Mislabeled
  - WBIT – wrong blood in tube



Preventable with training!

### Improper Collection

- Wrong collection container
  - Sterile vs non sterile
  - Tube/anticoagulant/order of draw
- Improper ratio of anticoagulant to sample
  - Short draw or overfill
- Wrong specimen type
  - Plasma vs serum



Preventable with training!

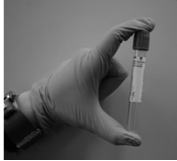
### Insufficient Volume

- QNS to perform the necessary testing
  - Pediatric, neonatal and elderly collections
  - Multiple tests per tube
  - Blood cultures

Preventable with proper training!

### Clotted Samples

- EDTA most susceptible due to inadequate or delayed mixing of the sample after draw
  - Microtubes and the pediatric patient



Preventable with proper training!

### Timing of Collection

- Therapeutic drug monitoring
  - Peak/Trough collections
- Cardiac troponin values
- Blood cultures
- Biorhythms
  - Cortisol

Preventable with proper training!

## Handling Error

- Delay in centrifugation
  - Glucose, potassium
- Delay in delivery of microbiology samples
  - Overgrowth of normal flora
- Protected from light
  - Bilirubin

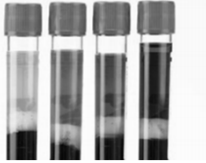
## Handling Error

- Frozen vs not frozen
  - Serum or plasma vs whole blood
- Delivered on ice/subjected to heat
  - Ammonia, lactate, renin
  - Microbiology specimens

Preventable through following established protocol

## Hemolysis

- Cell membrane of erythrocyte ruptures
- Hb and cellular components released
  - Visible when free plasma Hb is  $>3\text{mg}\%$



## Preanalytical Causes of Hemolysis

- Collection method
  - Needle gauge
  - Collection method
  - Specimen transfer device
  - Vigorous shaking



## Pre Analytical Causes of Hemolysis

- Collecting personnel
- Centrifugation
- Pneumatic tube jarring

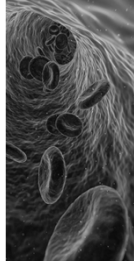
Preventable through following established protocol!

## Affects of Hemolysis

- Spectral interference in test methodology
- Release of intracellular material to cause a false increase in analytes
  - Enzyme release to interfere with methodology
  - Dilutional effect

## Affects of Hemolysis

- Increase in analyte value
  - K<sup>+</sup>, LD, TP, Alb, Ca<sup>2+</sup>, Mg<sup>2+</sup>, ALP, CK, AST, Phos
- Decreased values with hemolysis
  - TNI, Haptoglobin, Bilirubin,
- Varied results
  - Hb, RBC, MCHC, Plt



## Other Causes for Rejection

- Broken tubes
- Needles still attached to syringes
- No requisition
  - Missing information such as physician name, phone, diagnosis

## What About Rejecting Non-Blood Samples?

## Anaerobic Cultures

- Collected inappropriately
  - Inappropriate site of collection
    - NP, Sputum, Urine, Stool, Vaginal/Cervical
- Time delay
  - Decreases viability of organism

## Urine Samples

- Incorrect collection container
- Leaking container
- QNS
- Inappropriate storage
  - Store at RT 48 hrs for stabilized CCM
  - Store at RT 24 hrs for stabilized culture tubes



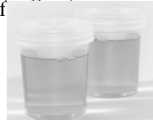
## Urine Samples

- Incorrect collection time
  - First morning collection
- Improper collection
  - 24 hour collection
    - Incorrect preservation
  - Non-sterile



## Urine for Drug Screening

- Failure to follow protocol regarding COC and documentation of collection
- Insufficient volume
- Adulterated sample
  - Overall appearance
  - Sample temperature within 4 minutes of collection
  - pH between 4.5-8.0
  - Specific gravity <1.002 or >1.020
  - Creatinine >20mg/dL



## Respiratory Cultures

- Timing of collection
  - Prior to the start of antibiotics
- Inappropriate swab
- Inappropriate collection
  - Normal flora contamination on collection
- Timing of testing
  - Delay in processing, expired media

## Sputum



- Inadequate sample
  - May not be representative of the lower respiratory tract = oropharyngeal contamination
  - Contamination of the container by the patient
    - >10 SEC per low power field
    - <25 WBC per low power field
    - >10 SEC and <25 WBC per low power field
- Delay in transport or testing
- Inappropriate storage

## Stool

- Inappropriate specimen
  - Solid stool vs liquid stool
  - Inadequate volume
  - Presence of urine
  - Presence of barium, antacids, antibiotics
- Storage or transport issues
  - Leaking containers
  - Overgrowth of normal flora
  - Drying of sample
  - Extremes in temperature



But...It's Not My Fault...

## Patient Factors Affecting Recollection

- Patient non compliance
  - Fasting
  - Adhering to collection instructions

## In-vivo Hemolysis

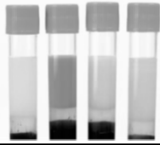
- Transfusion reactions
  - ABO incompatibility, delayed reactions
- Hemorrhagic conditions
  - DIC, SS, HUS, TTP
- AIHA

## Lipemia

- Caused by increased concentration of triglycerides
- Seen as cloudiness or turbidity, milky discoloration of serum or plasma
- Causes analytical interference
  - Spectral
  - Immunometric
  - Potentiometric

## Lipemia

- Can be prevented by patient fasting or delayed sampling based on timing of the meal
- May be corrected by ultracentrifugation



## Icteric Samples

- High levels of bilirubin in excess of 1.5 mg/dL
- Patients have conditions which cause increased bilirubin such as biliary obstruction or viral hepatitis
- Can cause spectral interference with some analyte measurements
  - Cholesterol, triglyceride, lipase, total protein, GGT

## So, How Often Are Specimens Rejected?

## Sample Rejection Data

- 453,171 samples, with 27,067 rejected
- Inpatient 28%
- ED 41%
  - Pediatric 10%
  - Adult 31%

Biochemia Medica 2015

## Sample Rejection Data

- 2.5% chemistry tests
- 3.2% CBCs
- 9.8% ABGs
- 13.3% Coagulation samples
- 12.8% TDM
- 3.5% Cardiac markers
- 12% Hormone tests

Biochemia Medica 2015

## Sample Rejection Data

- Stat lab rejections
  - 46.4% Chemistry hemolyzed
  - 43.2% Hematology clotted
  - 6.4% Lost samples
  - 2.9% Inadequate sample to coag ratio
  - 0.7% Pt ID
  - 0.3% Wrong tubes
  - 0.1% Missing requisitions

Biochemia Medica 2015

## Sample Rejection Data

- Chemistry rejections
  - 28% fibrin clots
  - 9% QNS
- Coag, ABG, CBC
  - Clotted 35%
  - QNS 13%

Biochemia Medica 2015

## Sample Rejection Data

- CAP Q Probe (2014) study of 78 facilities
- Over 2 million samples
  - 4794 rejections
    - 92% due to inappropriate/inadequate sample
    - 8% improper labeling
  - 88% were recollected
    - 11% were not recollected (abandoned)

## Non-blood Sample Rejection Data

- Six month study, 2000 samples
- Reviewed sputum, urine, stool, body fluids and blood cultures
  - 5.3% microbiology samples were rejected
    - 8% body fluids
    - 6.8% urine
    - 5.3% stool
    - 3.3% sputum



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## Effects on Patient Care

- Inconvenience to the patient
- Iatrogenic blood loss
- Questionable quality of results
- Delay in diagnosis
- Delay in treatment
  - Leads to new sample request
  - Cancellation of current request
- Adverse patient outcomes



## To Reject or Accept?

- All specimens must meet the requirements before being accepted for testing
- CLSI C56-A *Hemolysis, Icterus, and Lipemia/Turbidity Indices as Indicator of Interference in Clinical Laboratory Analysis*
  - Provide a quantitative estimation of the degree of hemolysis, lipemia, and icterus based on the manufacturer recommendations
  - Provide a visual assessment using a color chart

## In Summary

- Clearly define rejection criteria in the workplace
- Identify under what circumstances new specimens will be collected
  - Define when a new sample is to be requested
  - Identify what is not acceptable
- Institute quality indicators/performance indicators for
  - Misidentification, specimen collection, transport issues
  - Monitor error rate and types
  - Perform root cause analysis to identify cause of error

## In Summary

- Education, training and competency must be provided
- Educate staff on best practices in sample collection

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