Beaumont

Beaumont Laboratory
Clinical Pathology
Royal Oak

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Related Documents:

Automated Chemistry Policy for the Determination of Hemolysis, Lipemia and Icterus

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Purpose

This policy describes how technologists should deal with serum or plasma samples that show evidence of hemolysis, lipemia or icterus. Hemolysis is the destruction of red blood cells with the liberation of hemoglobin and other red cell contents. Lipemia is defined as "Fat in the blood" and is caused by an increase in triglycerides. Icteric or icterus, refers to pigmentation of the tissues, membranes, and secretions with bile pigments, measured as bilirubin in the serum. The Abbott Architect chemistry system is currently used for determination of hemolysis (H), lipemia (L), and icterus (I) by spectrophotometry.

Hemolysis

Hemolysis may affect chemistry measurements in the following way:

- interfere with photometric measurements
- cause release of analytes from red cells, resulting in an increase in serum levels, e.g. K+, AST, LD
- dilute serum analytes that are present in low concentrations in the red cell, e.g, ionized calcium, Na+

CORE Lab protocol

Unless it has been established that the patient has in-vivo hemolysis:

- **Cancel all samples with a measured hemolysis index >500 mg/dL**
- **Hemolyzed samples (>500 H) must be canceled in LIS prior to release from Instrument Manager.**

When the H index is between 50 mg/dL and 500 mg/dL IM automatically sends a comment regarding the effect of hemolysis on the analytes listed below. The comment appears in the comment line of the result field. Not all analytes are affected by hemolysis up to 500 mg/dL; results for these analytes will be reported without a comment.

Analyte	Hemolysis (mg/dL Hgb)
Albumin	H index = or > 100*
AST	H index = or > 100*
CK	H index = or > 50*
GGT	H index = or > 250*
Iron	H index = or > 250*
K	H index = or > 100*
LD	H index = or > 50*
Phosphorus	H index = or > 100*
Uric Acid	H index = or > 100*
EXCEPTIONS: **1) Cancel PLAC activity when H index = or > 50** **2) Single order glucose may be reported up to H < = 1000** **3) Tox: Cancel Acetaminophen when *visual* H index = or > 200**	

***** IM comment generated when H value is flagged for specific tests:
"Sample is hemolyzed. Result may be falsely increased."

STAT Lab Protocol

STAT Lab instruments also measure hemolysis with the Abbott Architect chemistry system.

Unless it has been established that the patient has in-vivo hemolysis**:**

- **Cancel all samples with hemolysis >500 mg/dL.** Exceptions (Glucose, BUN, Creatinine, and EtOH) are noted in the In-vitro Hemolysis Interference Table – Stat Lab.
- **Cancel all Ammonias with hemolysis >50 mg/dL.**
- **When the H index is between 50 and 500 mg/dL** certain tests (K, T Bili, AST, LD, CK, Phos, Uric acid) must be reported with a specific comment. Comments are listed in the table below. All other chemistry tests can be reported without a comment.

Interference Table-Stat Laboratory

Analyte	Hemolysis	Action
Glu (single order)	50 - 500 mg/dL	No comment
T Bili	501 – 1000 mg/dL	Report with comment @2HMT
BUN (single order)	50 – 500 mg/dL	No comment
LD	501 – 1000 mg/dL	Report with comment @2HMT
Creatinine	EC samples > 500 mg/dL	Cancel panels and reorder as single test. Report with comment @2HMT
ETOH	Test regardless of hemolysis	When H index >500 mg/dL report with comment @2HMT
Ammonia	**CANCEL at >50 mg/dL hemolysis**	

* 2HMT – Sample is markedly hemolyzed.

SOFT Lab Comments Defined

Code	Expanded Report Comment
@CH10	Sample is hemolyzed. Potassium may be falsely increased.
@CH21	Sample is hemolyzed. T Bili may be falsely increased.
@CH13	Sample is hemolyzed. AST may be falsely increased.
@CH14	Sample is hemolyzed. LD may be falsely increased.
@CH15	Sample is hemolyzed. CK may be falsely increased.
@CH38	Sample is hemolyzed. Phos may be falsely increased.
@CH37	Sample is hemolyzed. Uric Acid may be falsely increased.
@CH31	Sample appears lipemic. Lactic Acid may be falsely increased.
@CH32	Sample appears lipemic. Magnesium may be falsely increased.
@CH04	Sample pre-treated to minimize the effects of lipemia.
@CH27	Sample appears Icteric. Uric Acid may be variably affected.
@CH28	Sample appears Icteric. Lactic Acid may be variably affected.
@CH22	Sample appears Icteric. Creatinine may be falsely decreased.
@2HMT	Sample markedly hemolyzed.

Considerations when in-vivo hemolysis is suspected:

In-vivo sample hemolysis may be due to patient pathophysiology or some type of cardio-pulmonary device that is damaging the patient's red cells. When in-vitro hemolysis has occurred, a careful redraw may provide an acceptable sample for testing. However, when hemolysis is originating in-vivo, redrawing the specimen does not improve the quality of the sample. Interferences or result abnormalities may vary according to whether the hemolysis has occurred in-vitro or in-vivo. In many hemolyzed samples it is not possible to determine the type of hemolysis either by visual inspection or from chemistry test results.

In-vivo hemolysis assessment

Because the incidence of in-vitro versus in-vivo hemolysis varies with patient location, the following information should be obtained to help determine whether in-vivo hemolysis is likely:

Technologist responsibility:

3rd Hemolyzed sample from *Emergency Center*
Once a **3rd hemolyzed sample** with hemolysis >500mg/dL is received on a given patient, the possibility of in-vivo hemolysis should be considered.

2nd Hemolyzed sample from an *In-patient*
Once a **2nd hemolyzed sample with a hemolysis index >500 mg/dL** is received on a given patient, the possibility of in-vivo hemolysis should be considered.

Patient Name:_____ **MRN:**_____

Specimen ID(s):_____

Was the sample obtained from a venipuncture or from a line (central, arterial)?	Venipuncture / Line
Does the patient have a left ventricular assist device (LVAD – e.g. Impella device) or are they being treated by ECMO (extracorporeal membrane oxygenation) or CRRT (continuous renal replacement therapy)?	YES / NO

Name/ID of Care Provider contacted:_____

Technologist:_____ **Date:**_____

Based on the information obtained above, the technologist will make the best judgment as to which type of hemolysis has occurred. If the most likely explanation is in-vivo hemolysis, test results can be reported out as indicated in the "Reportable Tests for in-vivo Hemolysis" table (page 5 of this procedure). If the H-index is very high (e.g. > 500) and the potassium is within the reference range or just slightly increased, hemolysis is most likely to be occurring in-vivo. If the potassium is > 10 mmol/L, hemolysis is likely to be in-vitro. A potassium result of > 10 mmol/L has been deemed by Beaumont clinical staff to be incompatible with life. Samples obtained by venipuncture are more likely to result in in-vitro hemolysis, however, line draws can occasionally cause this problem.

After obtaining the relevant information (see above):

- Write the patient's name and MRN on the board in both Core Lab and Stat Lab
- Complete the patient information form and return to a supervisor
- If the technologist is unable to determine that in-vivo hemolysis has occurred:
    - Release results according to the **Reportable Tests for In-Vivo Hemolysis** table
    - Contact a Pathologist or Technical Director (Mon-Fri); Page Resident on-call after hours and on weekends.

Reporting results when in-vivo hemolysis has been confirmed or is strongly suspected:

Manufacturer's specifications for hemolysis interference on the Laboratory's chemistry analyzers usually do not extend to the levels encountered in significant in-vivo hemolysis. However, in cases of in-vivo hemolysis, the Laboratory will report out at least some chemistry test results for patient care purposes. Acceptability was based on CAP evaluation criteria.

The following tests will be reported when **marked in-vivo hemolysis has been identified:**

Reportable Tests for In-Vivo Hemolysis	
Chemistry Analyzer	**Radiometer ABL 825**
Sodium	Sodium
Potassium	Potassium
Chloride	Chloride
CO2	CO2
Glucose	Glucose
BUN	Ionized calcium
Creatinine	pH
Calcium	PCO2
T.Bilirubin	PO2
Magnesium	
Phosphorus	
TIBC	
LD	
Haptoglobin	

Core Laboratory: Instrument Manager automatic comment ("*Sample is hemolyzed. Please Request Redraw.*") will auto-populate in LIS and **must be changed to @CHVT** ("*Sample is markedly hemolyzed. Suggest clinical correlation to assess whether due to in-vitro or in-vivo hemolysis*")

- For analytes that cannot be reported, type "." in the LIS result field, and attach the following comment to the first analyte reported: @CHVO ("*Unable to report all results.*")

Stat Laboratory: The following comment must be added to all reported results: @CHVT ("*Sample is markedly hemolyzed. Suggest clinical correlation to assess whether due to in-vitro or in-vivo hemolysis.*")

- For analytes that cannot be reported, type "." in the LIS result field, and attach the following comment to the first analyte reported: @CHVO ("*Unable to report all results.*")

Toxicology Protocol:
Cancel all Acetaminophen samples with a hemolysis index >200 mg/dL.

Lipemia

Core Lab

It is the policy of the Automated Chemistry Core Lab to "Airfuge" all patient samples, (except samples for lipid testing) with a lipemic index ≥ 200 mg/dL. The Beckman Airfuge is an air-driven ultracentrifuge that makes it possible to clear blood samples of chylomicrons (lipid particles between 80-500nm in diameter) that impair the accuracy of spectrophotometric analyses. Once the low-density chylomicrons are removed from the sample, the sample can be processed without the interference of lipids.

Analyte	Lipemia	Centralink Comment/Operator Action
All **EXCEPT** Lipid panel	≥ 200 mg/dL	*Airfuge sample;* *Report with comment @CH04*

STAT Lab

It is the policy of the Automated Chemistry Stat Lab to "Airfuge" all patient samples, (except samples for lipid testing) with a lipemic index ≥ 200 mg/dL. The Beckman Airfuge is an air-driven ultracentrifuge that makes it possible to clear blood samples of chylomicrons (lipid particles between 80-500nm in diameter) that impair the accuracy of spectrophotometric analyses. Comments are generated automatically from Instrument Manager.

Icterus

Core Lab

When an icteric index is obtained on the chemistry analyzer, Instrument Manager will send a comment to the LIS documenting icterus as a potential interference in the comment field of the affected analytes. The appropriate interference comment follows:

Analyte	Icterus	Instrument Manager Comment
Triglyceride	>6 mg/dL	*IM adds comment*
Creatinine	>15 mg/dL	*IM adds comment*

STAT Lab

When an icteric index is obtained on the chemistry analyzer, Instrument Manager will send a comment to the LIS documenting icterus as a potential interference in the comment field of the affected analytes. The appropriate interference comment follows:

Analyte	Icterus	Automatic Instrument Manager Comments or Action
Uric Acid	10 mg/dL	*Decreased*
Ammonia	20 mg/dL or Absorbance error	*Action: Program Auto Dilution 1:1.85. Manually dilute x2 and program with dilution if needed to resolve*
Creatinine	30 mg/dL	*Decreased*

References

CAP 2015 Interfering Substances Survey (IFS)

Authorized Reviewers

Section Medical or Technical Director

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Document Control
Location of Master: Master electronic file stored on the Beaumont Laboratory server under S:/Document Control Library/CH/LOP/Masters
Master printed document stored in AutoChem General Policy and Procedure Manual-Core Lab
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Number of circulating Controlled Copies: 1
Location of circulating Controlled Copies: AutoChem General Policy and Procedure Manual-Stat Lab
Document History

Signature		**Revision #**		**Related Document Reviewed/ Updated**
Prepared by: Ann Oddi	6/8/04			
Approved by: Valerie Peterson MT, ASCP(SC)	06/8/04			
Reviewed by: (Signature)	**Date**	**Revision #**	**Modification**	**Related Document Reviewed/ Updated**
Valerie Peterson MT(ASCP) SC	10/1/07	r00	Into Document format	
REK	12/17/07	r01	Changed to Advia 2400 & DxC 800	
Raymond Karcher	12/4/08			
Raymond Karcher	12/4/09			
Dr, V. Kumar	8/28/10	r02	Included age of pediatric, added tables, added Total Bili and Glucose (Cartridge method). Included specimen can be analyzed on hemolyzed specimen only using the Glucose Modular method.	
Vivek Kumar, PhD	12/06/2010			
Vivek Kumar, PhD	09/08/2011	r03	SOFT revisions	
E. Sykes, MD	02/16/2012			
E Sykes, MD	02/14/2014			
Revised by: Amber M Macumber, MLS(ASCP)^{cm} Robin Carey-Ballough MT(ASCP) Stephanie Barden, MLS(ASCP)^{cm} Approved: Elizabeth Sykes, MD	11/17/2016	r04	Combine LHI to one policy. Update to automatic comments from Centralink. Update hemolysis procedure to include acceptable analytes for hemolysis; change cancellation to H index >500.Combine in vivo hemolysis procedure. Removed Lipemia comment when level is 245	
Revised by: Robin Carey-Ballough MT(ASCP) Approved: Kenneth Simkowski, PhD	01/25/2017 01/27/2017	r05	Remove BHBT cancellation at any level, add CRRT to in-vivo	
Revised by: Dina Mansour MLS(ASCP)^{cm} Approved: Kenneth Simkowski, PhD	03/21/2017 03/29/17	r06	Added Toxicology Protocol under Hemolysis policy.	
Revised by: Robin Carey-Ballough MT(ASCP) Approved: Elizabeth Sykes, MD	08/22/2017	r07	Change “see comment” instruction to “.” to satisfy compliance. Expand SOFT codes to define report comments.	

Peter Millward, MD	09/17/2018		New medical director	
Peter Millward, MD	11/19/2018			
Kelly Walewski C(ASCP)cm	11/07/2019	**R08**	Removed instrument specific information	