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Chemistry Procedure for Hemolysis, Icterus and Lipemia -Troy

Document Type: Procedure

I. PURPOSE AND OBJECTIVE:

This procedure will assist technologists in dealing with specimens that show evidence of hemolysis, icterus or lipemia. The Architect c16000 chemistry system is currently used for determination of hemolysis (H), lipemia (L) and icterus(I) by spectrophotometery.

II. PROCEDURE:

A. Hemolysis
Hemolysis may affect chemistry measurements in the following way:

1. Interfere with photometric measurements.
2. Cause release of analytes from red cells, resulting in an increase in serum levels e.g. K+, AST, LD.
3. Dilute serum analytes that are present in low concentrations in the red cell, e.g. ionized calcium, Na+.
4. Hemolysis Index less than 500:
    a. When the Hemolysis Index (H) is between 50 mg/dL and 500 mg/dL, Instrument Manager (IM) automatically sends a comment regarding the effect of hemolysis on the analytes listed below.
    b. The comment appears in the comment line of the result field in the Laboratory Information System (LIS).
    c. Not all analytes are affected by hemolysis (up to 500 mg/dL) – results for

these analytes will be reported without comments.

Table 1

Analyte	Hemolysis (mg/ dL Hgb)	Comment- effect of hemolysis on test result
Ammonia	Cancel at 50	
Iron	Cancel at 100	
Iron	50	Variable
LDH	H index = or > 50	Increased
Potassium	H index = or > 50	Increased
Protein, Total	H index = or > 50	Increased
Direct Bilirubin	H index = or > 50	Decreased
Lactic Acid	H index = or > 100-199	Increased
AST	H index = or > 100	Increased
Magnesium	H index = or > 100	Increased
Phosphorus	H index = or > 100	Increased
Lactic Acid	Cancel at 200	
Acetaminophen	Cancel at 200	
Amylase	H index = or > 250	Decreased
CK	H index = or > 250	Increased
T. Bilirubin	H index ≥ 500	Decreased
Salicylate	Cancel at 600	
Phenytoin	Cancel at 800	
Valproic Acid	Cancel at 1000	
Digoxin	Cancel at 1000	
Vancomycin	Cancel at 1150	

FLUIDS Cancel all fluid tests and request a redraw at Hemolysis index 500 and above unless listed below.	
Fluid Test	Hemolysis Value
Albumin	DO NOT CANCEL
Cholesterol	DO NOT CANCEL
Creatinine	DO NOT CANCEL
Glucose	DO NOT CANCEL
Trigycerides	DO NOT CANCEL
Urea Nitrogen	DO NOT CANCEL

Lactic Acid , CSF	Cancel at 200
Amylase	Cancel at 800
Biliribin	Cancel at 1000

B. Hemolysis Index Less than 1000
    1. A single order for either glucose or creatinine can be reported up to an H index of 1000, even if the hemolysis is due to in-vitro hemolysis.
    2. In the case of a CRITICAL value for glucose and/or creatinine ordered as part of a panel, call the physician and ask if they want the result. If the physician requests the result:
        a. In SPECIMEN UPDATE Add on the individual test requested to the specimen.
        b. Cancel the panel test.
        c. Resend the result from IM to Beaker using the Send to HOSH function.
    3. A single order for ETOH can be reported up to an H index of 800, even if the hemolysis is due to in-vivo hemolysis.

C. Hemolysis > 500 Due to In-Vitro Hemolysis
When IM determines that the H > 500, all the results will hold in IM and an Error Code will populate in IM that indicates: "Sample is hemolyzed, Please Request Redraw." Cancel tests in the LIS and reject the results in IM.

D. NICU Samples(any age) or neonates (less than 4 weeks old).
    1. Report results as though in-vivo hemolysis has been confirmed (see table 2).
    2. Any or all results listed in the table "Reportable tests for in-vivo hemolysis" can be resulted.

E. Troponin samples may be resulted with hemolysis > 500.

F. In-Vivo Hemolysis Assessment:
    1. In-vivo hemolysis may be due to patient pathophysiology or some type of cardiopulmonary device or a procedure that is damaging the patient's red cells.
    2. When Hemolysis is originating in-vivo, redrawing the specimen does not improve the quality of the sample.
    3. Interferences or result abnormalities may vary according to whether the hemolysis has occurred in-vitro or in-vivo.
    4. In many hemolyzed samples, it is not possible to determine the type of hemolysis either by visual inspection or from chemistry test results.
    5. To assess in-vivo hemolysis:
        a. If a specimen is hemolyzed, request a re-draw.
        b. If the second specimen is hemolyzed with a hemolysis index(H) > 500mg/

dL is received on a patient, the possibility of in-vivo hemolysis should be considered.

c. A third sample from Emergency Center with an H > 500 mg/dL in-vivo hemolysis should be considered.

d. Contact the nurse caring for the patient to determine:

i. Was the sample obtained from a venipuncture or a line?

ii. Does the patient have a left ventricular assist device (LVAD e.g. Impella device) or are they being treated by extrocorporeal membrane oxygenation (ECMO) or continuous renal replacement therapy (CCRT).

6. Based on the information obtained, the technologist will make their best judgement as to which type of hemolysis has occurred. Contact the pathologist on-call if necessary.
7. 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
    a. 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.
    b. If the potassium is > 10 mmol/L, hemolysis is likely to be in-vitro.
8. After obtaining relevant information:
    a. Complete the patient information form and attach to the communication log.
    b. If the technologist/pathologis is unable to determine whether in-vivo hemolysisi has occurred, release results according to the "Reportable Tests for In-vivo Hemolysis" table.
9. Reporting results:
    a. Laboratory can report some values for patient care purposes.
    b. Acceptability is based on a combination of in-house studies and information from Abbott and College of American Pathologists (CAP).
    c. The following tests will be reported when marked in-vivo hemolysis has been identified:

Table 2- Reportable Tests for In-vivo Hemolysis

Radiometer ABL 825
Sodium
Potassium
Chloride
pO2

Glucose	
Ionized Calcium	
pH	
pCO2	
ABBOTT Test	Comment
Sodium	
Potassium	INCREASED
Chloride	
CO2	
Glucose	
BUN	
Creatinine	
Calcium	
T. Bilirubin	DECREASED
Magnesium	INCREASED
Phosphorus	INCREASED
Transferrin	
LD	
Albumin	
C-Reactive Protein (CRP)	
Ferritin	

d. @@ IM comment generated when H > 500: "Sample is hemolyzed. Result may be falsely decreased".

e. When IM determines that the H index is > 500 all results will hold in IM and an error code will populate in IM that reads: " Sample is hemolyzed. Please request redraw."

f. For analytes that will be reported (see table) the proper comment must be added to the comment field in IM. **.CHVT (**Sample is markedly hemolyzed, suggest clinical correlation to assess whether due to in-vitro or in-vivo hemolysis).

g. For all analytes that cannot be reported, reject the analytes in IM. Release results from IM and add the comment **.CHVO** (Unable to report all results) to the comment section for each analyte.

h. For all anlaytes that are affected by hemolysis, but the laboratory has deemed the result to be acceptable, a comment will automatically added in IM and will populate in the LIS.

G. Lipemia

1. Lipemic Index (L)≥ 200:
    a. All patient samples will be Airfuged **(except samples for Lipid testing**).
    b. Beckman Airfuge is an air-driven ultra centrifuge that clears blood samples of chylomicrons that impair the accuracy of spectropotometric analyses.
    c. Re-test patient using the Airfuged sample.
2. Lipemic Index between 50 < 200.
    a. IM automatically sends a comment regarding the effect of lipemia on the analytes listed below.
    b. The comment appears in the comment line of the result field in the LIS.
    c. Not all analytes are affected by Lipemia up to 200, results for those analytes will be repored without a comment.

Table 3

Analyte	**Icterus Index**	**IM Comments or Action**
Magnesium	L index > 50	Decreased
Ammonia	L index = 100-199	Result may be compromised
Calcium	L index > 125	Decreased
Urea	L index > 125	Decreased
All EXCEPT Lipid Panel	L index > or = 200	Airfuge Sample: Report with comment **.CH04**

Add the comment **.CH04** (Sample pre-treated to minimize the effects of lipemia) to all samples that are airfuged.

    d. Ammonia- Immediately centrifuge to separate plasma from cells. On visual recognition of lipemia or lipemia index ≥ to 100, remove a plasma aliquot and airfuge. Continue with approved dilutions as necessary to reduce interference (whether or not sample was airfuged). Add comment from table above and comment indicating the sample was airfuged if appropriate.

H. Icterus

1. When icteric index(I) is greater than 2.5:
    a. IM automatically sends a comment regarding the effect of icterus on the analytes listed below.
    b. The comment appears in the comment line of the result field in the LIS.

I. Not all analytes are affected by icterus; results for these analytes will be reported without a comment.

Table 4

Analyte	Icterus Index	IM Comments or Action
Iron	I index > 2.5	Result may be compromised
Total Protein	I index > 10	Decreased
Ammonia	I index > 20 or Absorbance Error	Program auto-dilution 1:1.85. If needed, manually dilute x2 and program with dilution to resolve.
Phosphorus	I index > 25	Increased
Creatinine	I index > 30	Decreased

Table 5

CODE	Expanded Report Comment
.CH10	Sample is hemolyzed. Potassium 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. Phosphorus may be falsely increased.
.CH04	Sample pre-treated to minimize the effects of Lipemia.
.CH22	Sample appears Icteric. Creatinine may be falsely decreased.
.2HTMT	Sample markedly hemolyzed.
.CHVO	Unable to report all results.
.CHVT	Sample is markedly hemolyzed. Suggest clinical correlation to assess whether due to in-vitro or in-vivo hemolysis.

III. REFERENCES:

College of American Pathologists Interfering Substances Survey 2015.
Abbott individual analyte Instructions For Use.

Attachments

in-vivo hemolysis form

Approval Signatures

Step Description	Approver	Date
	Vaishali Pansare: Chief, Pathology	2/21/2023
Policy and Forms Steering Committee (as needed)	Kristin Russell: Supv, Laboratory	2/14/2023
Policy and Forms Steering Committee (as needed)	Gail Juleff: Project Mgr Policy	2/8/2023
	Kristin Russell: Supv, Laboratory	2/8/2023