

## TRAINING UPDATE

**Lab Location:** SGAH and WAH      **Date Implemented:** 3.19.2013  
**Department:** Blood Bank      **Due Date:** 3.27.13

### DESCRIPTION OF PROCEDURE REVISION

<b>Name of procedure:</b>
Fetal Bleed Screening
<b>Description of change(s):</b>
<ul style="list-style-type: none"><li>• Beginning March 27, 2013 we will report the number of vials of RhIG to be given as part of the fetal bleed screen.</li><li>• This is added to the fetal cell screen test as the “NRV” or “RhIG vials to give” field.</li><li>• If the fetal screen result is <b>negative</b>, report the NRV field as <b>1</b></li><li>• If the fetal screen result is <b>positive</b>, report the NRV field with the comment, “;<b>RKBT</b>” which will expand to a comment of “Reflexed to KBT for quantification of fetal bleed.”</li></ul>

Technical SOP

<b>Title</b>	<b>Fetal Bleed Screening</b>	
<b>Prepared by</b>	Stephanie Codina	Date: 11/14/2012
<b>Owner</b>	Stephanie Codina	Date: 11/14/2012

<b>Laboratory Approval</b>		<b>Local Effective Date:</b>
<b>Print Name</b>	<b>Signature</b>	<b>Date</b>
<i>Refer to the electronic signature page for approval and approval dates.</i>		

<b>Review</b>		
<b>Print Name</b>	<b>Signature</b>	<b>Date</b>

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**1. TEST INFORMATION**

<b>Assay</b>	<b>Method/Instrument</b>	<b>Local Code</b>
Fetal Bleed Screening	Manual	FSCR, RHOG

<b>Synonyms/Abbreviations</b>
FetalScreen, RhIG Evaluation

<b>Department</b>
Blood Bank

## 2. ANALYTICAL PRINCIPLE

A red blood cell suspension from a D-negative mother is incubated with reagent containing anti-D and then washed to remove unbound antibody. A weak suspension of D-positive red blood cells is added. The red blood cell mixture is centrifuged and examined microscopically for mixed-field agglutination. Since any minor population of D-positive red cells will have become coated with anti-D during the incubation phase, the D-positive indicator cells added after washing form rosettes around the individual cells of the minor population, leading to larger and readily detected agglutinates. In most cases the fetomaternal hemorrhage is not sufficient to cause a positive test, but in those cases where a significant volume of fetal blood has entered the maternal circulation, the test provides an indication that a quantitative test is required to determine whether the bleed was sufficient to warrant a larger dose of RhIG to the mother.

## 3. SPECIMEN REQUIREMENTS

### 3.1 Patient Preparation

Component	Special Notations
<b>Specimen Collection and/or Timing</b>	Maternal specimen collected after delivery of all products of conception. It is best to wait approximately 1 hour after delivery to allow fetal cells to mix with maternal circulation if present.
<b>Other</b>	Testing is not required if patient is less than 20 weeks gestation.

### 3.2 Specimen Type & Handling

Criteria	
<b>Labeling</b>	Patient identification must be confirmed. Refer to procedure 'Sample Specifications for Blood Bank Testing' for details.
<b>Type</b> -Preferred -Other Acceptable	Plasma (EDTA) None
<b>Collection Container</b>	Lavender top tube
<b>Volume</b> - Optimum - Minimum	3ml 2ml
<b>Transport Container and Temperature</b>	Same as above, at room temperature
<b>Stability &amp; Storage Requirements</b>	Room Temperature: N/A, testing performed ASAP
	Refrigerated: 2 days
	Frozen: Unacceptable
<b>Timing Considerations</b>	Testing performed ASAP to permit administration of RhIG within 72 hours of delivery.

Criteria	
<b>Unacceptable Specimens &amp; Actions to Take</b>	Frozen, Incomplete or incorrect labeling – refer to procedure ‘Sample Specifications for Blood Bank Testing’ for details.
<b>Compromising Physical Characteristics</b>	Do not use grossly hemolyzed samples for testing. Bacterial contamination may cause false positive results.
<b>Other Considerations</b>	None

#### 4. REAGENTS

Refer to the Material Safety Data Sheet (MSDS) supplied with the reagents for complete safety hazards. Refer to the section in this procedure covering “SAFETY” for additional information.

##### 4.1 Reagent Summary

Reagents / Kits	Supplier & Catalog Number
FMH RapidScreen	Immucor 7893 or equivalent
pHix Buffer Solution	Immucor 5070 or equivalent
Isotonic Saline, Certified blood bank saline	Fisher 23535435 or equivalent

##### 4.2 Reagent Preparation and Storage

**NOTES:** Date and initial all reagents upon opening. Each container must be labeled with (1) substance name, (2) lot number, (3) date of preparation, (4) expiration date, (5) initials of tech, (6) any special storage instructions; check for visible signs of degradation.

Refer to the Material Safety Data Sheet (MSDS) for a complete description of hazards. If a specific hazard is present, it will be noted in this procedure when the hazard is first encountered in a procedural step.

Assay Kit - FMH RapidScreen	
<b>Reagent a</b>	Anti-D, monoclonal, IgM, GAMA401
<b>Reagent b</b>	Indicator Cells
<b>Reagent c</b>	Positive Control
<b>Reagent d</b>	Negative Control
<b>Storage</b>	1-10°C
<b>Stability</b>	Stable until manufacturer’s expiration date.
<b>Preparation</b>	Gently resuspend cell suspensions before using.

Reagent	pHix Buffer Solution
<b>Preparation and Storage/Stability</b>	Add 1 bottle (200 ml.) pHix to one cube of isotonic saline (20L). Store at ambient temperature (18-30°C) for a maximum of 30 days. pH of buffered saline should be 6.5 – 7.5 as tested with a pH strip. Record lot#, expiration date and pH on Phix Log.

**5. CALIBRATORS/STANDARDS**

N/A

**6. QUALITY CONTROL****6.1 Controls Used**

Positive and Negative Controls supplied with kit.

**6.2 Control Preparation and Storage**

Refer to section 4.2.

**6.3 Frequency**

Both controls are run in parallel with each batch of tests (or with each test if performed singly).

**6.4 Tolerance Limits**

Expected results:

Positive control must have 5 or more agglutinants per five low-power fields

Negative control must have 4 or fewer agglutinants per five low-power fields

For the patient test result to be considered valid, the result of the negative control cell run at the same time must be negative and the result obtained with the positive control cells run at the same time must be positive. The test is invalid if either control yields unacceptable results and testing must be repeated. Do not report results and notify and supervisor if controls fail a second time.

**6.5 Review Patient Data**

Review patient results for unusual patterns, trends or distributions in patient results, such as an unusually high percentage of abnormal results, or unusually high percentage of non-reactive, or indeterminate, or reactive results. Computer aided tools should be used when available.

**6.6 Documentation**

Results are recorded on appropriate worksheet.

**6.7 Quality Assurance Program**

Participation in CAP proficiency testing

**7. EQUIPMENT and SUPPLIES**

**7.1 Assay Platform**

N/A

**7.2 Equipment**

- Timer
- Centrifuge
- Microscope

**7.2 Supplies**

- Test tubes, 12 x 75 mm
- Disposable pipettes
- Microscope slides
- Phosphate Buffered Saline, 0.9%, pH 6.5 – 7.5

**8. PROCEDURE**

**NOTE:** For all procedures involving specimens, buttoned lab coats, gloves, and face protection are required minimum personal protective equipment. Report all accidents to your supervisor.

The package insert for a new lot of kits must be reviewed for any changes before the kit is used. A current Package Insert is included in the appropriate notebook/file. The components of each kit should be used together.

Step	Action
1	<p>Verify the history of both the mother and the infant.</p> <ul style="list-style-type: none"> <li>A. The mother must have a current T&amp;S to ensure she is Rh-negative and does not have anti-D. Request a T&amp;S order if she does not have a current specimen on file.</li> <li>B. The mother must be Rh-negative.</li> <li>C. The infant must be Rh-positive.</li> <li>D. False negative results may occur if the infant is weak D positive.</li> <li>E. False positive results may occur if the mother is weak D positive.</li> <li>F. If the blood type of the fetus is unknown or Rh-negative, the results of this test may not be valid and a Kleihauer-Betke should be recommended.</li> </ul> <p><b>Note:</b>                      SGAH - The physician or patient care area will order the fetal cell screen testing.                      WAH - The blood bank will order fetal cell screen or Kleihauer-Betke testing on any Rh-negative or weak D negative mother that delivers an Rh-positive or weak D positive infant.</p>
2	<p>Label 4 test tubes:</p> <ul style="list-style-type: none"> <li>1. Label 2 tubes with the patient identifiers (one tube is for the cell suspension and one tube is for testing). At a minimum, the tubes should be labeled with the patient's first and last initial or the first 3 letters of the patient's last name.</li> <li>2. Label 1 tube "POS" for the positive control.</li> <li>3. Label 1 tube "NEG" for the negative control.</li> </ul>
3	<p>Prepare a 2-4 % suspension of the maternal red blood cells in PBS in one of the tubes labeled with the patient identifiers. Ensure the patient sample is well mixed prior to making the cell suspension. Refer to procedure, "Preparing a 2-4% Cell Suspension for Testing."</p>
4	<p>Place 1 drop of the test cells in each tube.</p> <ul style="list-style-type: none"> <li>A. Place 1 drop of the patient cell suspension in the tube labeled with the patient identifiers.</li> <li>B. Place 1 drop of "positive control" in the tube labeled "POS."</li> <li>C. Place 1 drop of "negative control" in the tube labeled "NEG."</li> </ul>
5	<p>Add 1 drop of "Anti-D Reagent" to each of the 3 tubes and gently mix. Be sure to use the "Anti-D Reagent" that is supplied with the kit.</p>
6	<p>Incubate the tubes for 5 minutes (<math>\pm</math> 1 minute) at room temperature (18-30°C).</p>



Step	Action
7	Wash the tubes a minimum of 4 times in PBS and decant the last wash completely. Refer to procedure, "Manual Wash Technique."
8	Add 1 drop of "Indicator Cells" to each tube and mix well by gently shaking the tube.
9	Serofuge for the AHG time listed on the serofuge.
10	<p>Resuspend the cell button completely and examine microscopically for mixed-field agglutination.</p> <p>A. A minimum of 5 microscopic fields must be looked at.</p> <p>B. Use 100x magnification.</p> <p><b>Note:</b> Microscopic examination can be carried out either in the tube or on a microscope slide. If clumps are seen in the tube, the contents should be transferred to a microscope slide so that the number of clumps per low-powered field can be evaluated.</p>
11	Immediately record results of patient and controls on the appropriate worksheet. Enter the patient results in the LIS.
12	<p>If the fetal cell screen is positive</p> <p>A. Notify the patient care area and tell them additional vials of RhIG may be indicated.</p> <p>B. Document the phone call in "Blood Order Processing."</p> <p>C. Order a Kleihauer-Betke test. Refer to appendix A.</p> <p>D. Note: Perform weak D testing on the mother if the fetal cell screen is strong positive and the Kleihauer-Betke is negative.</p> <p>a. No further investigation is needed if the mother is weak D positive.</p> <p>b. Notify a supervisor or group lead if the weak D test on the mother is negative.</p>

## 9. CALCULATIONS

N/A

**10. REPORTING RESULTS AND REPEAT CRITERIA****10.1 Interpretation of Results and Repeat Criteria**

1. Negative = Four or fewer clumps of agglutinated red blood cells observed in five low-power fields. A negative test indicates that a fetal bleed less than 30 mL of whole blood has occurred and 1 vial of RhIG will provide the appropriate prophylaxis.

Positive = Five or more clumps of agglutinated red blood cells observed in five low-power fields ( $\geq 5$  clumps / 5 LPFs). A positive test indicates that a fetal bleed greater than 30 mL of whole blood has occurred and additional RhIG is needed. Reflex a Kleihauer-Betke test to quantitate the fetal bleed volume and determine the appropriate dose of RhIG.

2. A positive and negative control is run with each batch of patient specimens tested. The positive control must be positive and the negative control must be negative for the test results to be valid. The test must be repeated if either control does not yield expected results. Notify a supervisor if problems persist.

**10.2 Rounding**

N/A

**10.3 Units of Measure**

N/A

**10.4 Clinically Reportable Range (CRR)**

N/A

**10.5 Repeat Criteria and Resulting**

N/A

**11. EXPECTED VALUES****11.1 Reference Ranges**

None established

**11.2 Critical Values**

None established

### 11.3 Priority 3 Limit(s)

None established

## 12. CLINICAL SIGNIFICANCE

Rh<sub>0</sub> (D) Immune Globulin (RhIG) is used to prevent isoimmunization in the Rh negative individual exposed to Rh positive blood as a result of a fetomaternal hemorrhage. A full dose (300 µg) is sufficient to counteract the immunizing effects of 15mL of D-positive red cells; this corresponds to approximately 30 mL of fetal whole blood. The fetal bleed test is a screen to detect a feto-maternal hemorrhage of an amount greater than that covered by a standard dose of RhIG.

## 13. PROCEDURE NOTES

- **FDA Status:** Approved/cleared
  - **Validated Test Modifications:** None
1. The test must be performed on the blood of an Rh-negative mother who delivered an Rh-positive infant.
    - a. If the infant is weak D positive, false-negative results may occur.
    - b. If the mother is weak D positive, false-positive results may occur.
    - c. If the mother is Rh-positive or weak D positive, false-positive results will occur.
    - d. If the infant is Rh-negative, false negative results will occur.
  2. In cases of ABO incompatibility between mother and child, the mother's natural ABO antibodies may destroy any fetal cells in the maternal blood specimen before testing is performed. This is true for any method of detecting fetal cells in the maternal blood.
  3. Failure to carry out the washing stages of the test procedure properly may give rise to a false-positive test result due to agglutination of the indicator cells by free anti-D remaining in the test system.
  4. A false-positive test result may occur if the maternal red blood cells have a positive direct antiglobulin test due to an autoantibody capable of reacting with the indicator cells.
  5. A positive test result does not of itself provide evidence that an increased dose of RhIG is required to protect the mother from producing anti-D, but merely indicates that a larger-than-normal feto-maternal hemorrhage may have occurred. A quantitative procedure is required to determine the volume of feto-maternal hemorrhage.
  6. The reactivity of the red blood cells may tend to diminish over the dating period.

## 14. LIMITATIONS OF METHOD

**14.1 Analytical Measurement Range (AMR)**

N/A

**14.2 Precision**

N/A

**14.3 Interfering Substances**

Contaminated reagents, improper incubation time, temperature, centrifugation, examination for agglutination, and deviation from the procedure may give rise to false test results.

**14.4 Clinical Sensitivity/Specificity/Predictive Values**

N/A

**15. SAFETY**

You, the employee, have direct responsibility to avoid injury and illness at work. Nearly all harmful exposures to infectious substances and chemicals, and other injuries, can be avoided with effective training and consistent safe work practices.

Become familiar with the Environmental, Health and Safety (EHS) Manual to learn requirements on working safely and protecting the environment from harm. Although lab work typically focuses on the hazards of working with specimens and chemicals, we must also control other important hazards.

- Slips, trips, and falls cause many serious injuries. Please ensure that spills are cleaned quickly (to avoid slippery floors) and that you can see and avoid obstacles in your path.
- Ergonomic injuries result from performing tasks with too much repetition, force, or awkward position. Ergonomic injuries include strains and back injuries. Learn about ergonomic hazards and how to prevent this type of injury.
- Scratches, lacerations, and needlesticks can result in serious health consequences. Attempt to find ways to eliminate your risk when working with sharp materials.
- Warnings of other specific hazards are noted in this procedure. Please comply with the requirements to reduce your risk of injury."

**Report all accidents and injuries to your supervisor or the Environmental, Health and Safety Coordinator.**

**16. RELATED DOCUMENTS**SOP: Rh<sub>0</sub> (D) Immune Globulin

SOP: Sample Specifications for Blood Bank Testing

SOP: Preparing a 2-4% Cell Suspension for Testing

SOP: Manual Wash Technique

Current package insert, Fetal Bleed Screening Test

**17. REFERENCES**

1. Roback, J.D., Combs, M.R., Grossman, B.J., Hillyer, C.D. 2008. Technical Manual of the AABB, 16th ed. AABB Publishing, Bethesda, Maryland.
2. Standards for Blood Banks and Transfusion Services, 2012. AABB, 28th ed. AABB Publishing, Bethesda, Maryland
3. FMH RapidScreen Manufacturer’s Instructions, Insert code 3047-1, Revised 3/12. ImmucorGamma: Norcross, GA.

**18. REVISION HISTORY**

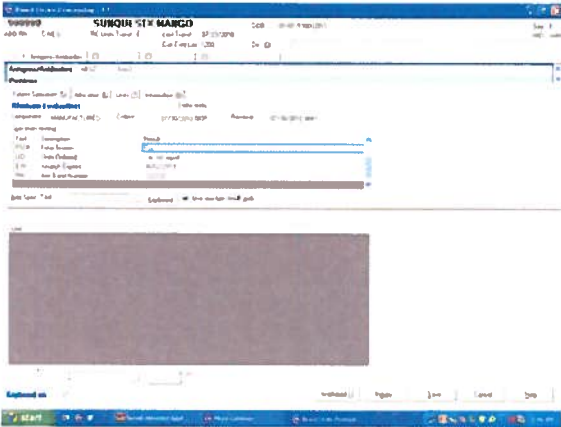
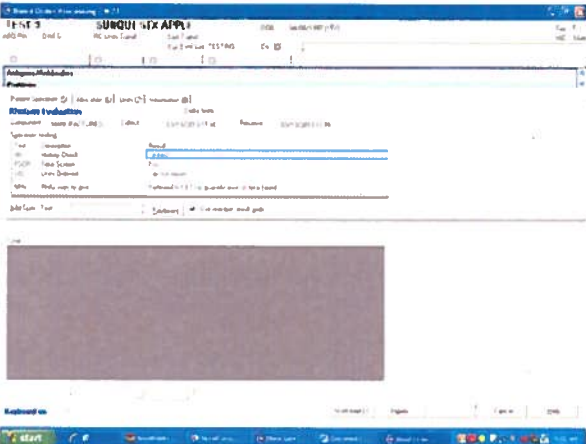
Version	Date	Section	Reason	Reviser	Approval
			Supersedes SOP WAH.BB49.002, SGAH.BB51.002		
000	3.18.2013	19	App A—Updated LIS resulting to include NRV field. App C—Added additional lines (larger bleed dosing) to RhIG dosing chart	SCodina	NCacciabeve

**19. ADDENDA**

- A. Entering RHOG Results in the LIS
- B. Ordering a Kleihauer-Betke Test
- C. Determining RhIG Dosage

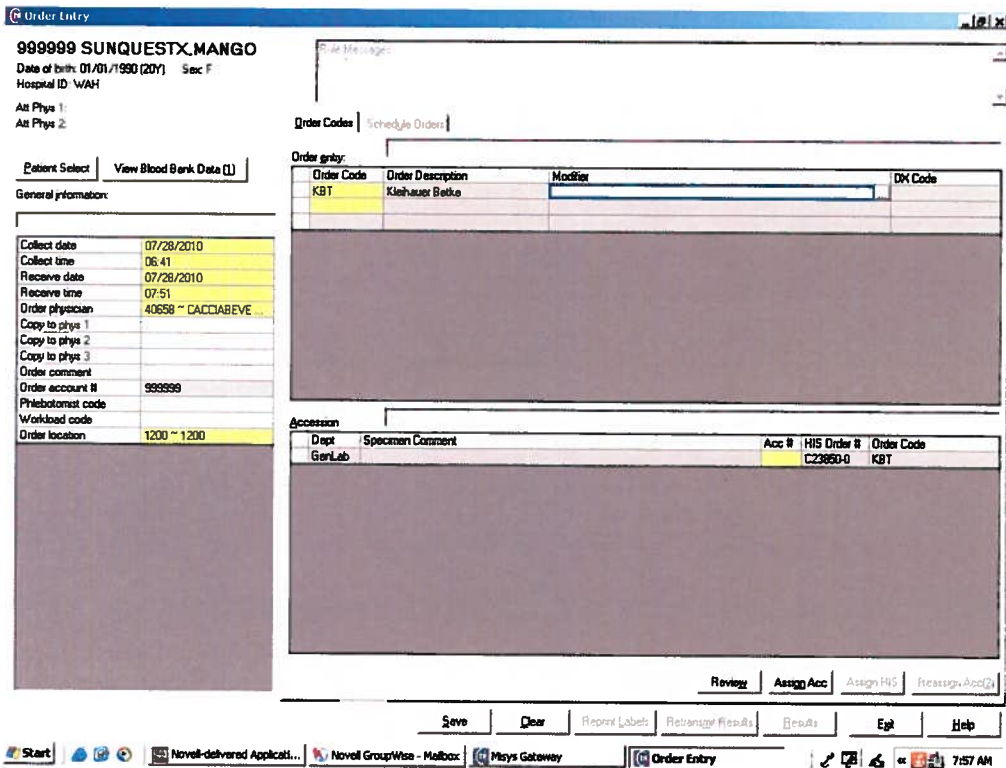
**Appendix A**

**Entering RHOG Results in the LIS**

Step	Action
1	Access SunQuest function “Blood Order Processing.”
2	In the “Lookup by” prompt, click on the dropdown menu and select “Patient ID.”
3	In the “Value” prompt, type the patient’s medical record number and click on the “Search” button.
4	If more than one patient appears, select the correct patient by clicking on the name.
5	Click on the “Search All” button.
6	Click on the “RHOG” specimen.
7	<p>Enter the fetal cell screen result in the “FSCR” entry area.</p> <p>A. Enter “P” for positive.</p> <p>B. Enter “N” for negative.</p> 
8	<p>In the “NRV” field, enter the number of RhIG vials to give.</p> <p>A. If the fetal cell screen result was negative, enter “1” in this field.</p> <p>B. If the fetal cell screen results was positive, enter the mnemonic “;RKBT” which expands to “Reflexed to KBT for quantification of fetal bleed.”</p> 
8	Click on the “Save” button.

**Appendix B**

**Ordering a Kleihauer-Betke Test**

Step	Action
1	Access Sunquest function "Order Entry."
2	At the "Lookup by" prompt, click on the dropdown menu and select "Patient ID."
3	At the "Value" prompt, type in the patient's medical record number and click on the "search" button.
4	If more than one patient exists with that medical record number, both will appear. Select the correct patient by verifying the hospital and date of birth. Click on the "Select" button.
5	Type in the collect date and collect time of the fetal cell screen specimen.
6	Type in the number of the treating physician. If the physician number is unknown, click on the ellipses button (...) and search by provider name.
7	<p>Press the "Tab" button until your cursor is in the "Order Code" box. Type "KBT" for Kleihauer-Betke.</p> 
8	Click on the "Save" button.
9	A label will print for the test.
10	<p>Send or walk the specimen and labels to the SGAH hematology department for testing. The results will be available in Sunquest within 24 hours.</p> <p>Note: If the fetal cell screen is positive and the Kleihauer-Betke test is negative, perform weak D testing on the mother. False positive fetal cell screen results may occur if the mother is weak D positive.</p>

## Appendix C

## Determining RhIG Dosage

## RhIG Dosing Based on Kleihauer-Betke Results

% Fetal Cells	Vials to Inject
<0.3	1
0.3 – 0.8	2
0.9 – 1.4	3
1.5 – 2.0	4
2.1 – 2.6	5
2.7 – 3.2	6
3.3 – 3.8	7
3.9 – 4.4	8
4.5 – 5.0	9
5.1 – 5.6	10
5.7 – 6.2	11
6.3 – 6.8	12
6.9 – 7.4	13
7.5 – 8.0	14
8.1 – 8.6	15

## Calculating the Dose of RhIG Manually (Reference Only)

Step	Action
1	One 300- $\mu$ g vial of RhIG is needed for a bleed of 30 mL of fetal whole blood or 15 mL of red blood cells.
2	To calculate the volume of fetal hemorrhage, use the formula:  $\text{Fetal Hemorrhage mL (whole blood)} = \frac{\text{Number of Fetal Cells Counted} \times 5000 \text{ mL}}{\text{Total Cells Counted}}$ <p>Note: 5000 mL is an estimated maternal blood volume. The actual maternal blood volume can be entered here if known.</p>
3	Calculate the number of RhIG vials needed by dividing the volume of fetal hemorrhage by 30 mL. Always add 1 additional vial of RhIG to account for variation in the Kleihauer-Betke test results. A. If the decimal point is <0.5, round down to the nearest whole number and add 1 extra vial. B. If the decimal point is $\geq$ 0.5, round up to the nearest whole number and add 1 extra vial.