|  |  |  |  |
| --- | --- | --- | --- |
|  | **Crossmatch Protocols**  BB. Protocol.1037.7 | **Dept:**  | 324311 |
| **Dept Name** | Blood Bank |
| **Effective Date:** | <7/2009 |
| **Revised Date:** |  |
| **Name & Title**: CLIA Laboratory Medical Director | **Contact:** | Julie Simmons/ Christina Warren |
| **Signature:** | G. Pomper | **Date:** | **9/17/2019** |

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1. **General Protocol Statement:**
2. **Purpose:** The crossmatch must detect ABO incompatibility either serologically or electronically. The crossmatch shall include an antiglobulin test in the presence of a current or historical clinically significant antibody to detect clinically significant antibodies to red cell antigens.
3. **Responsible Department/Scope:**

1. Protocol owner/Implementer: Julie H. Simmons/Christina S. Warren
2. Protocol prepared by: Mary Rose Jones
3. Who performs protocol: Department staff/management

1. **Definitions:**

SCC: Soft Computer Consultants, Blood Bank computer system

AHG: Anti human globulin

XM IS: Immediate spin Crossmatch

IS: Immediate Spin

XME: Crossmatch Electronic: Computer checks for ABO compatibility

 XM: Crossmatch

 AHG XM: Anti human globulin crossmatch

* PEG: Crossmatch testing media
* Gel: Crossmatch testing media
* LISS: Crossmatch testing media
* SP: Crossmatch testing media

 FULL XM: IS crossmatch AND antiglobulin crossmatch

* For gel testing, immediate spin + IgG phase.
* For PEG testing, immediate spin + 37C check for hemolysis + IgG phase
* For LISS testing, immediate spin + 37C + IgG phases
* For Saline testing, immediate spin + 37C + IgG phases
* For SP testing, immediate spin + IgG phase

DAT: Direct Antiglobulin Test

 IgG: Immunoglobulin G: Potentially clinically significant antibodies

 IgM: Immunoglobulin M

 MTP: Massive Transfusion Protocol

CLINICALLY SIGNIFICANT allo antibodies: Frequently associated with Hemolytic Disease of the

 Fetus and newborn, with hemolytic transfusion reaction or with notably decreased

 survival of transfused red cells.

Antibodies reactive at either 37C or in the antiglobulin (AHG) phase are more likely to be clinically significant. These typically require both an immediate spin crossmatch and an antiglobulin crossmatch even when antibody is no longer detected. The crossmatch units should be antigen negative as indicated above even when antibody is no longer detected. If commercial antisera is not available and antibody is reacting, then full crossmatch is required.

CLINICALLY INSIGNIFICANT allo antibodies: NOT associated with Hemolytic Disease of the Fetus and Newborn, with hemolytic transfusion reactions or with notably decreased survival of transfused red cells. These antibodies are typically reactive at Room Temperature or below and may be naturally occurring. These typically require an immediate spin crossmatch only. The crossmatch units are usually NOT screened for antigens.

1. **Sections: NA**
2. **Protocol: Crossmatch Protocols**

**1.0 The serologic crossmatch is used in the detection of blood group antibodies to antigens on donor red**

 **blood cells by combining patient serum/plasma with donor red cells to allow antigen-antibody**

 **interaction.**

 **2.0 Crossmatch procedures are performed on packed red blood cells, granulocyte pheresis and platelet**

 **pheresis which contain more than 2mL of red cells.**

1. **ABO incompatibility is tested serologically with the immediate spin crossmatch (XM IS) or electronically (XME) using the computer.**
2. **Immediate spin crossmatch is required for patients with an ABO discrepancy that results in an interpretation of “No Group” except neonates up to 4 months.**

1. **The IS procedure (IS XM) or electronic crossmatch (XME) is used in compatibility testing of all transfusion recipients who lack clinically significant blood group antibodies AND have no history of clinically significant antibodies.**
	1. Crossmatch performed by automation is not currently validated or authorized for immediate spin crossmatch.
	2. The electronic crossmatch (XME) has been validated on site for electronic (computer )crossmatch (XME) to ensure only ABO-compatible whole blood or red cells are selected for transfusion.
	3. Criteria for electronic crossmatch validation includes the below:
	4. Electronic computer crossmatch must be used with a validated electronic crossmatch program.(Cannot use during downtime)
	5. Two (2) determinations of the patient’s ABO/Rh on file with no discrepancies and they must match.
	6. Returning patients can use a previously resulted blood type to qualify IF testing occurred after February 11, 2006 in Sunquest. If testing occurred prior to this date, repeat of ABO/Rh must occur.
	7. For new patients (no previous record), the ABO/Rh blood type may come from the same specimen that is repeated by a different tech (ABO recheck).
	8. The antibody screen must be resulted as NEGATIVE.
	9. The patient has NO clinically significant antibodies in the ABID field or history of clinically significant antibodies.
	10. ABO recheck on sample with add-on is NOT required.
	11. ABO recheck must be completed on each unit of blood and ABO compatible with patient.
	12. Patient blood specimen must NOT be expired.
2. **The crossmatch should include the antiglobulin tests IF clinically significant antibodies were detected in current screening tests OR previous detection of such antibodies (historical record).**

6.1 The completion of the crossmatch (XM)through the antiglobulin (AHG) phase of testing permits

 detection of incompatibilities caused by antibodies that sensitize cells at 37˚C.

 6.2 Antiglobulin crossmatch (AHG XM)can be completed using the following methods:

 Solid Phase, Gel, LISS, PEG, or Saline. PEG is the routine antiglobulin crossmatch (AHG XM)

 method.

6.3 Immediate spin crossmatch (XM IS) testing is required in addition to the antiglobulin crossmatch

 (AHG XM)to detect ABO incompatibility and is referred to as a FULL crossmatch (Full XM).

* 1. When the patient has had clinically significant antibodies identified currently or in the past, blood lacking the relevant antigens should be selected for transfusion.

 *Refer to Attachment 1: Screening and Crossmatch Requirements for Patients with Antibodies*

1. **The blood specimen must be drawn and labeled according to the protocols of the Blood Bank.**

*Refer to Front Desk: Specimen Labeling Requirements*

1. **Patient cell suspension or plasma aliquot tube should be labeled as below.**
* Large barcode accession label OR
* Small accession label with complete last name OR
* Patient’s full last name from main blood specimen and MRN #
* Date/Time of Collection
* Initials of Tech aliquoting
* BBID on plasma aliquots
1. **Plasma/red cells must not be poured back into main blood specimen tube.**
2. **Hemolyzed blood specimen**
	1. Refer to FD: Specimen Labeling Requirements and BBID Numbers
3. **Interpretation of the Crossmatch**

11.1

|  |  |
| --- | --- |
| **INTERPRETATION** | **DO** |
| **INCOMPATIBLE** | Hemolysis or agglutination in any phase of testing (IS, 37C, AHG) may indicate the presence of a serologically incompatible crossmatch. |
| Further investigation is required:1. Immediately check for ABO incompatibility.
2. Refer to antibody identification procedures.
3. Incompatible crossmatches with a negative antibody screen may be due to:
	* + - The transfusion of out of group platelets, transfusion with group O red cell is required as long as the patient is demonstrating anti-A or anti-B.
			- A low frequency antibody.
			- The donor unit has a positive DAT (unit with a positive DAT must be returned to the supplier for credit).
 |
| **COMPATIBLE** | Absence of agglutination and hemolysis in all phases of testing (IS, 37C, AHG) is a negative test result and indicates a serologically compatible crossmatch. |
| **INVALID** | If the IgG-sensitized control cells added to confirm the activity of the polyspecific or anti-IgG reagents show only weak agglutination (<2+) or none, the tube test is invalid and must be repeated. |
| **VALID** | After the addition of IgG-sensitized control cells to an AHG negative tube test, the presence of agglutination indicates that the AHG reagent added was capable of reacting and that the negative antiglobulin test is valid.  |

11.2 In the presence of **WARM AND COLD AUTOANTIBODIES, the crossmatch reaction is**

 **reported based on NEAT (unmodified) plasma and donor red cell reactions.**

1. Adsorptions (with plasma and/or eluate) are routinely performed to determine if any underlying alloantibodies are demonstrating in either plasma or eluate.
* Units will be tested with both adsorbed plasma and/or eluate and are expected to be compatible if no alloantibodies are detected. These reactions are recorded on the antibody workup forms or blood bank order requisition but not reported to Epic.
* Emergency release is required.
1. Prewarming technique may be used in the presence of strong cold autoantibodies to determine if any underlying alloantibodies are demonstrating in the plasma.
* Units will be tested by prewarm technique with plasma and are expected to be compatible if no alloantibodies are detected. These reactions are recorded on the antibody workup forms or blood bank order requisition but not reported in Epic.
* Emergency release is required.
* Cold adsorption may be needed if reactions occur at immediate spin.

**12.0 SELECTION OF UNITS FOR CROSSMATCHING**

 12.1 Whenever possible, patients should receive ABO-identical blood components.

12.2 Rh positive blood components should routinely be selected for D-positive recipients.

12.3 D-negative patients should receive red cell-containing components that are D-negative to avoid

 immunization to the D antigen.

*Refer to Protocol: Selection of Blood and Blood Components.*

*Refer to Attachment 1: Screening and Crossmatch Requirements for Patients with Antibodies.*

# 13.0 CLINICALLY INSIGNIFICANT ANTIBODIES THAT ARE NO LONGER DETECTABLE

 13.1 Clinically insignificant antibodies that are no longer demonstrating in the patient’s plasma may be

 removed from the antibody section of SCC.

 *A Refer to Attachment 1: Screening and Crossmatch Requirements for Patients with Antibodies*

 *Sections II & III* for a list of antibodies that may be removed.

 B .For cold or warm autos that are no longer showing, add the Special Message ‘PWC’

 (Previous WARM or COLD auto antibody) to the patient’s patient caution window.

13.2 Clinically insignificant antibodies that are no longer detectable do NOT disqualify a patient for a

 delayed crossmatch sample.

 a. The clinically insignificant antibody will be removed from SCC.

 **14.0 CROSSMATCHING FOR MASSIVE TRANSFUSION OR TRAUMAS**

14.1 Massive Transfusion is defined as infusion, within a defined period, of a volume of blood approximating the recipient’s total blood volume.

14.2 Following massive transfusion, the pretransfusion sample no longer represents the blood currently in

 the patient’s circulation and has limited benefits.

14.3 Crossmatch testing (electronic or immediate spin crossmatch or AHG crossmatch) is not necessary

 when blood is being issued emergently with an emergency release form prior to the completion of

 the antibody screen and crossmatch.

14.4 Patient testing (antibody screen and/or crossmatch) is completed for units once the patient is stable

 providing a sample is available in the Blood Bank.

1. If NO clinically significant antibody currently detected (negative antibody screen) OR historical clinically insignificant antibody, then the crossmatch can be completed as either electronic (XME) or immediate spin (XM IS).
2. If antibody screen IS POSITIVE OR historical clinically significant antibody, then a Full Crossmatch is required (Full XM).

 *Refer to Protocol: Emergency Blood Protocols, Section IV. Massive Transfusion Guidelines*

 14.5 When no sample is received (patient expires or is transported to another facility by

 AirCare), then the test ‘Prepare non-irradiated red cell” is ordered in WakeOne.

* + 1. Units are ‘Emergency Issued’ in the computer in SCC.
		2. Crossmatch testing is cancelled.

*Refer to FD: Specimen Receipt*

# 15.0 CROSSMATCHING FOR NEONATES

15.1 Go to Protocol: Selection of blood and Blood Components. Sections: VII. Neonatal Blood/Blood

 Component Selection and VIII. Neonatal Exchange

# 16.0 CROSSMATCHING FOR BONE MARROW TRANSPLANT

16.1 Go to Protocol: Transplant Testing Protocols. Section II. Bone Marrow Transplant Testing.

16.2 Go to Special: BMT

**17.0 ELUATE CROSSMATCHES**

17.1 The eluate may be used for crossmatching in the presence of an unidentified or unidentifiable

 antibody.

17.2 Modification of the eluate through absorption may result in a compatible crossmatch.

17.3 Eluate results are recorded on Antibody Summary workup forms or on the blood bank order requisition.

 but not reported in Epic.

17.4 Incompatible eluate crossmatch requires Emergency Release.

17.5 Eluate testing may identify an antibody that is not detectable in plasma testing. This antibody must be

 considered a true antibody and must be honored and antigen negative blood provided.

**18.0 GROUP AB PATIENTS** that have received multiple out of group red cell transfusions and meet the criteria for No Group:

18.1 Keep transfusing Group A red cells.

18.2 Management should be informed and at management’s discretion the ABORh may be interpreted as AB, with “Massive Trans Group A, [initials]” in comment field. Once the AB interpretation has been entered another ABOCK can be performed to avoid supervisor override at issue of group A red cells.

 **19.0 Delayed Crossmatch Blood Specimens**

19.1 Blood specimens collected within 30 days of surgery with a negative antibody screen & no

 ABO discrepancies qualify and are considered in dated on date of surgery. The new

 expiration date of specimen is 3 days from date of surgery.

 19.2 Blood specimens that qualify but are lost or damaged in blood bank can be still have

 electronic crossmatch on day of surgery providing that the T&S was completed within 24

 hours of collection, antibody screen is negative, no ABO discrepancies, and no historic

 antibodies.

* 1. SCC action code to document another blood specimen using same BBID# should be drawn and logged into SCC **(Pending**). The specimen does not need to be tested at this time. The specimen is available if there is a reported adverse reaction.

 19.3 Blood specimens that are drawn within 30 days of surgery and have a positive antibody

 screen (disqualified) need another blood specimen collected on day of surgery.

**3. Review/Revised/implemented:**

All protocols must be reviewed according to the Document Change Protocol.

All new protocols that have major revisions must be signed by the CLIA Director.

All reviewed protocols with minor revisions can be signed by the designated section Medical Director.

**4. Related Protocols:**

Crossmatch Procedures, BB.R.1007

Daily Reagent Quality Control Procedure, BB.QC.1006

Blood and Blood Products: Storage, Transport, Return and Reissue, BB.FD.1010

ABID Protocols, BB.PROCOTOL.1031; Section III. Providing Low Prevalence Antigen Negative Units

Adsorption and Prewarmed Technique, BB.SPECIALS.1009

Transplant Testing Protocols, BB.PROTOCOL.1030; Section II. Bone Marrow Transplant Testing.

BM/HPC Procedures and Protocols, BB. SPECIALS.1005; BMT.ALLO.1015

Selection of blood and Blood Components, BB.PROTOCOL.1022; Sections: VII. Neonatal Blood/Blood Component Selection and VIII. Neonatal Exchange

Emergency Blood Protocols, BB.PROTOCOL.1041

**5. References**:

 Technical Manual, revised periodically

Standards for Blood Bank and Transfusion Service. AABB, revised periodically.

**6. Attachments**:

 Attachment 1: Screening and Crossmatch Requirements for Patients with Antibodies

 Attachment 2: Causes of Positive Pretransfusion Tests

**7. Revised/Reviewed Dates and Signatures:**

 See Archived Document Change Control

**Attachment 1: SCREENING AND CROSSMATCH REQUIREMENTS FOR PATIENTS WITH ANTIBODIES**

**I. Clinically Significant Antibodies:** All antigen positive cells reactive or demonstrating dosage (reactive with all

 homozygous cells) or hemolyzing or always considered clinically significant.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Clinically Significant-***.* | **Reactive in any media.** | **Full Crossmatch** | **Antigen Negative Units**  | **XM Interp**(with Neat Plasma and/or Eluate)  | **Comments** |
| 1 | Rh, Kell, Kidd, Duffy, Ss, M | YES | YES | YES | Compatible |  |
| 2 | Cw, V, VS, Jsa, Kpa, Goa ,Dia, Cob, Dob | YES | YES | YES | Compatible | *Refer to Protocol: ABID Protocols-Providing Low Prevalence Antigen Negative Units* |
| 3 | U, N, P1 | YES | YES | YES | Compatible |  |
| 4 | In vitro hemolytic Lewis, H, Vel | YES | YES | YES | Compatible |  |
| 5 | Non hemolytic Lewis | YES | YES | NO | Compatible |  |
| 6 | Lutheran (a, b, variants) | YES | YES | YES | Compatible |  |
| 7 | HLA (Bg), HTLA (Ch, Rg, Csa, Yka, Kna, McCa, JMH), Sda | YES | YES | NO | Compatible |  |
| 8 | UNIDENTIFIED | YES | YES | \*NO | Compatible | \*Consult managementEmergency release |
| 9 | OTHER ANTIBODIES not listed | YES | YES | \*YES | Compatible | \*Consult managementEmergency release |
| 10 | Dib, Yta, Coa, Doa | YES | YES | YES | Compatible |  |
| 11 | Ytb, Xga, Sc1, Sc2 | YES | YES | NO | Compatible |  |
| 12 | Positive DAT | NA | YES | NO | Compatible | *Antigen negative if clinically significant antibody identified in eluate.* |
| 13 | Cold auto (thermal amplitude positive) | YES | YES | NO | IncompatibleCompatible | If incompatible, Emergency Release |
| 14 | Warm auto with specificity (child or infant (< 17 years old)) | YES | YES | YESSee footnote | CompatibleIncompatible | If incompatible, Emergency ReleaseConsult management |
| 15 | Warm auto with specificity (adult (≥17 years old)) | YES | YES | NOSee footnote | CompatibleIncompatible | Emergency ReleaseSee footnote |
|  | MASSIVE TRANFUSION PROTOCOL/TRAUMA | YES | YES | Emergency Release. *Patient’s physician must be notified of the availability and time factor involved to provide antigen negative units and will make the decision.* *Document.*  |

**FOOTNOTE:**

**15. Warm Auto with specificity > 17 years old:**

 **When RH variants are identified, provide the best choice of blood based on the guidelines of anti-e variant below:**

 African American patients with anti-e specificity may be auto or allo if they are e positive on their cells.

 RBC genotype will conclusively direct us if autoantibody or e variant.

 For Children, consult Medical Director.

 For Adults, if patient E positive, you can provide e positive or e negative blood.

 If patient E negative, provide **e positive E negative blood**. A blood unit that is e negative but E positive may

 sensitize patient to make anti- E in addition to the anti- e.

**II. Clinically Insignificant Antibodies:** NOT showing dosage (not reacting with just homozygous cells) or NOT reacting with all antigen positive cells and NOT showing hemolysis

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Clinically Insignificant****Antibodies:**  | **Reactive in any media** | **Full XM** | **Antigen Negative****Units** | **XM Interp** | **Comments** |
| DARA | YES | YES | Kell neg\* | Compatible | \* If patient Kell neg |
| Non hemolytic Lewis | YES | YES | NO | Compatible |  |
| N, P1 (allo/auto) | YES | YES | NO | Compatible |  |
| A1  *(transfusing A2 units)* | YES | YES | YES | Compatible | A2 units |
| A1 *(transfusion O units)* | YES | NO | YES | Compatible |  O units – IS crossmatch |
| Cold auto (I, IH) undetermined | YES | YES | NO | Compatible |  |
| ROULEAUX | YES | YES | NO | Compatible | Refer to Saline Replacement  |

**Footnote for Section II:**

*\* When antibody is no longer demonstrating in solid phase or Gel 40 minutes, then antibody may be removed*

 *from the “antigens/antibody” field in the computer system so that an electronic crossmatch can be*

 *performed. Otherwise, Immediate Spin crossmatch should be performed.*

**III. Clinically Insignificant Antibodies: NOT detectable**.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Clinically Insignificant****Antibodies:**  | **No longer detected** | **IS or****XME\*** | **AHG XM** | **Antigen Negative****Units** | **XM Interpretation** | **Comments** |
| Non hemolytic Lewis | YES | YES | NA | NO | Compatible | \*Notify managementRemove from PCW |
| N, P1 (allo/auto) | YES | YES | NA | NO | Compatible | \*Notify managementRemove from PCW |
| HLA (Bg), HTLA (Ch, Rg, Csa, Yka, Kna, McCa, JMH), Sda | YES | YES | NA | NO | Compatible | \*Notify managementRemove from PCW |
| A1 | YES | YES | NA | NO | Compatible | \*Notify managementRemove from PCW |
| Cold auto (I, IH) undetermined | YES | YES | NA | NO | Compatible | \*Notify managementRemove from PCW\*\*\* see footnote |
| History of Eluate negative or Panel negative **\*\*** | NA | YES | NA | NO | Compatible | \*Notify managementRemove from PCW |
| DARA | YES | YES | NA | NO | Compatible | \*Notify managementRemove from PCW |

**Footnotes:**

*\* When antibody is no longer demonstrating in solid phase or Gel 40 minutes, then antibody may be removed*

 *from the “antigens/antibody” field in the computer system so that an electronic crossmatch can be*

 *performed. Otherwise, Immediate Spin crossmatch should be performed.*

*\*\*The technologist should look at the current reactions and take that into consideration. If any questions about potential antibody, then crossmatch (serologic) should be done. Most eluate negatives are associated with cold autoantibodies or drugs.*

# \*\*\*When cold autoantibody is no longer demonstrating in solid phase or PEG 30 minutes and DAT is negative, then antibody may be removed from the PCW.

# Add SCC special message, PWC (Previous WARM or COLD auto ab)

# Attachment 2: CAUSES OF POSITIVE PRETRANSFUSION TESTS

# 1.0 Negative Antibody Screen, Incompatible Immediate-Spin Crossmatch

Donor red cells are ABO-incompatible.

Donor red cells are polyagglutinable.

Anti-A1 in the serum of an A2 or A2B individual.

Other alloantibodies reactive at room temperature (e.g., anti-M)

Rouleaux formation

Cold autoantibodies (e.g., anti-I)

Passively acquired anti-A or anti-B.

# 2.0 Negative Antibody Screen, Incompatible Antiglobulin Crossmatch

 a. Donor red cells have a positive DAT

 b. Antibody reacts only with cells having strong expression of a particular antigen (e.g., dosage) or

 variation in antigen strength (e.g., P1)]

 c. Antibody reacts with a low-incidence antigen.

 d. Passively acquire anti-A or anti-B.

#  Positive Antibody Screen, Compatible Crossmatches

 a. Auto-anti-H (-IH) or anti-LebH and nongroup O units are selected.

 b. Antibodies dependent on reagent cell diluent.

 c. Antibodies demonstrating dosage and donor red cells are from heterozygotes (ie, expressing a

 single dose of antigen).

 d. Donor unit is lacking corresponding antigen.

# Positive Antibody Screen, Incompatible Crossmatches, Negative Auto Control

1. Alloantibody (ies).

# Positive Antibody Screen, Incompatible Crossmatches, Positive Auto Control, Negative Direct Antiglobulin Test

1. Antibody to ingredient in enhancement media or enhancement dependent autoantibody
2. Rouleaux formation

#  Positive Antibody Screen, Incompatible Crossmatches, Positive Auto Control, Positive DAT

* 1. Alloantibody causing either a delayed serologic or hemolytic transfusion reaction
	2. Passively acquired autoantibody (e.g. intravenous immune globulin).
	3. Cold- or warm -reactive autoantibody

Reference: Table 15-6 AABB Technical Manual, revised periodically.