**1.0 Purpose**

1.1 To identify serological incompatibility between donor red blood cells and recipient serum/plasma/ plasma.

1.2 To prevent the transfusion of incompatible red blood cells.

1.3 To differentiate between apheresis units Container number in order to make the correct selection of blood product when performing a crossmatch.

**2.0 Scope**

2.1 This procedure provides the mechanism for donor/patient red cell crossmatching.

 2.1.1 Routine Crossmatches are performed at Immediate Spin

 2.1.2 Extended Crossmatches are carried out thru IgG phase.

**3.0 Specimen**

3.1 Clotted specimen or anticoagulated sample

3.1.1 Donor samples are retrieved through the integral tube segment.

3.1.2 Patient samples must be labeled as directed by the **Specimen Requirements and Labeling** procedure.

3.2 Centrifuge patient samples to allow for separation of cellular elements from the serum/plasma/plasma and fibrin clot before testing.

3.3 Patient specimens can be used for crossmatch up to 3 days from the collection date unless directed otherwise directed by the Supervisor/Medical Director. Document physician’s approval in the comments of Patient Product Inquiry.

**4.0 Equipment**

4.1 Isotonic saline

4.2 12x75mm test tubes and tube rack

4.3 Transfer pipettes

4.4 37ºC incubator

4.5 serofuge

4.6 cell washer

4.7 Antibody Enhancement Reagent

4.8 Anti-IgG

4.9 Coombs Control Cells

4.10  **Blood Bank Transfusion Record Tag** (Attachment 1)

**5.0 Quality Control**

5.1 Reagents are quality control tested each day of use.

5.2 Negative results are tested with Coombs Control Cells to verify the negative reactivity of Anti-IgG.

**6.0 Procedure**

6.1 Verify patient information.

6.1.1 Compare and confirm a match of all patient information on the sample tube, the Blood Bank product Requisition slip and computer record.

 6.1.1.1 If patient verification fails, do not crossmatch.

* + 1. Search Blood Bank records for previous test records, and any comments applicable to the patient.
		2. If the patient record indicates that special products are required (i.e. irradiated or Hgb S negative), provide appropriately tested products for transfusion. See 6.2.2.

6.2 Select appropriate unit(s) for crossmatch.

* + 1. Select ABO and Rh identical donor units from the storage location (if available)

6.2.1.1 If ABO identical units are not available, choose the appropriate ABO compatible units according to the following chart:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Patient Type** | **1st Choice** | **2nd Choice** | **3rd Choice** | **4th Choice** |
| **O** | O | No other choices are appropriate |
| **A** | A | O | No other choices are appropriate |
| **B** | B | O | No other choices are appropriate |
| **AB** | AB | A | B | O |

**NOTE:** If an Apheresis PRBC is selected for crossmatching and there are multiple blood products to choose from when the “Select Blood Product” box opens. Select the appropriate unit by doing the following:

* Look at the actual unit that was selected from the refrigerator. Labeled on the bottom left hand corner of the product look to see whether it is **Container 1** or **Container 2.**
* Expand the product description screen to expose the container number that matches the unit selected from the refrigerator and compare the product code.
* Scroll over to the volume (this should be specific to the unit volume).
* **Please note:** Sometimes the volume maybe the same for both units. So the product E code is the sole identifier for the unit/container number.
* Scan the product code (**E code)** on the unit that was selected from the Refrigerator and the correct unit will automatically be selected in cerner. **NOTE\*** The container number of the unit being crossmatched **MUST** be the same container number selected in Cerner.

6.2.2 Select units conforming to any applicable comments in the patient record

* + - 1. Antigen negative units (corresponding to the antibody identified in the patient) should be provided. Refer to the **Special Antigen Typing** procedure for further direction.

 **NOTE: For patients who have a history or are demonstrating Lewis antibodies, antigen negative units are not required (Extended crossmatch is performed).**

* + - 1. CMV-safe/ Pre-storage leukoreduced) blood is provided for all patients including renal, liver and pancreas transplant requests.
			2. Irradiated blood is essential for patients at risk of transfusion associated GVHD (Graft vs. Host Disease), including fetuses receiving intrauterine transfusion, select immunocompetent or immunocompromised recipients, recipients who are undergoing marrow transplantation, recipients of platelets selected for HLA or platelet compatibility, and recipients of donor units from blood relatives.
				1. If the patient record indicates that the recipient requires irradiated cellular products, select irradiated for compatibility testing.
				2. If irradiated products are not available in inventory, order appropriate products from the Red Cross. The Red Cross performs all irradiation on products transfused.
				3. Note: All neonatal cellular transfusion products must be irradiated.
			3. Patients with Sickle Cell Disease need Hemoglobin S negative blood (HBS neg). Enter HBS-neg in Transfusion requirements.
				1. If the patient record indicates that the recipient requires Hgb S negative products, select HBS neg for compatibility testing. If this patient record indicates no transfusion history within the last three months, antigen type the patient for E, K, C. Provide units negative for E,K,C antigens, in addition to HgB S. Enter antigen typing results in Cerner.
				2. If HBS negative products are not available in inventory, have Hematology test units as necessary to provide for patient needs.
				3. All neonatal RBC transfusion products must be HBS negative.
				4. Call ARC reference lab for previous phenotyping on new sickle cell patients. Previous ARC results will be honored and entered in cerner.
			4. All autologous units must have an immediate spin crossmatch test performed before the unit can be issued for transfusion and the patient must have a current type and screen result as well as two valid types on file.

6.3 Label Tubes:

* + 1. Label one test tube with the donor number (for each unit to be crossmatched) to make a 3-5% cell suspension.

6.3.2 Label one test tube with the ~~unique patient identifier~~ last 4 numbers of the patient’s accession number and the donor unit to perform the immediate spin crossmatch.

6.4 Enter the donor number(s) in the computer.

6.5 Perform **Immediate Spin** phase crossmatch.

6.5.1 Remove the segment from the tube, cut it and add one (1) drop of red cells to the appropriately labeled tube.

6.5.2 Wash the donor cells at least once with isotonic saline. Resuspend the cells to a 3-5% suspension.

6.5.3 Add two (2) drops of patient serum/plasma to each labeled crossmatch tube.

6.5.4 Add one drop of the appropriate donor cell suspension to the applicable crossmatch tube. Gently mix the tube contents.

6.5.5 Centrifuge the tubes at 3500 rpm for the time indicated on the serofuge for saline phase testing.

6.5.6 Observe the supernatant for evidence of hemolysis.

6.5.7 Gently resuspend the cell button. Observe for agglutination.

6.5.8 Grade and record reactions and interpretations of these reactions immediately in the LIS system.

6.5.9 Proceed with the extended phase of the crossmatch if the patient has a positive antibody screen, or has a history of an atypical antibody (ies).

 6.6 Perform **Extended Phase** crossmatch using PEG- **EMCP**

* + 1. Place 2 drops serum/plasma to be tested in a properly labeled test tube.
		2. Add 1 drop of 3-5% donor cells suspension to each tube.
		3. Centrifuge the tubes at 3500 rpm for the time indicated on the serofuge for

 Saline phase testing (Immediate spin).

 6.6.4 Add 2 drops of PeG and mix well.

 6.6.5 Incubate for 10-15 minutes at 37°. (Incubation may be extended to 30 minutes if desired)

* + 1. After incubation, remove the tubes from the incubator and examine for hemolysis.

 **6.6.7 DO NOT CENTRIFUGE TUBES. Note any hemolysis after 37**° **incubation.**

**PeG cause cells to aggregate; therefore, the tubes cannot be read at this stage for direct agglutination.**

* + 1. After examination for hemolysis proceed directly to washing phase.
		2. Wash cells at least 3 times with isotonic saline.
		3. Decant the last wash completely.

 6.6.10 Add 2 drops Anti-Human Globulin to the tube.

 6.9 Mix well and centrifuge at the appropriate time/speed.

6.10 Gently resuspend the cell button. With the aid of the agglutination viewer, **macroscopically** examine each tube for agglutination.

 6.10.1 There is no microscopic reading with PeG.

 6.11 Add Coombs Control Cells to all negative tubes. A positive reaction is expected. Negative reactions invalidate the test and must be repeated.

6.7 Perform **Extended Phase** crossmatch using LISS-**EMC-EP [Elkins Park Hospital]**

6.7.1 After completion of the Immediate Spin phase, add two (2) drops of LISS/ImmuAdd to each crossmatch tube (following the saline phase). Gently mix the tube contents.

6.7.2 Incubate the tubes at 37ºC for 10-15 minutes.

6.7.3 After the incubation period, remove the tubes and centrifuge at 3500 rpm for the time indicated on the serofuge for 37ºC incubation phase.

6.7.4 Observe the supernatant for evidence of hemolysis.

6.6.5 Gently resuspend the cell button. Observe for agglutination.

6.7.6 Grade and record reactions and interpretations of these reactions immediately in the LIS system.

6.7.7 Wash the tube 3-4 times with isotonic saline.

6.7.8 Add two (2) drops of Anti-IgG to each dry cell button.

6.7.9 Mix the tube contents and centrifuge at 3500 rpm for the time indicated on the serofuge for AHG phase testing.

6.7.10 Observe the supernatant for evidence of hemolysis.

6.7.11 Gently resuspend the cell button. Observe for agglutination.

6.7.12 Grade and record reactions and interpretations of these reactions immediately in the LIS system.

6.7.13 Add one (1) drop of Coombs Control Cells to each tube yielding a negative reaction in the AHG phase.

6.7.14 Mix the tube contents and centrifuge at 3500 rpm for the time indicated on the serofuge for AHG phase testing.

* + - 1. Agglutination is expected. No agglutination in this phase

 invalidates the test. **Repeat all crossmatch steps for invalid tests**.

6.7.15 Grade and record all reactions and interpretations immediately in the LIS system.

6.8 Document crossmatch results:

6.8.1 Generate a **Blood Bank Transfusion Record Tag** (Attachment 1)

6.8.1.1 Ensure that the following information is recorded on the **Blood Bank Transfusion Record Tag** (Attachment 1):

6.8.1.1.1 Donor unit number

6.8.1.1.2 Patient and Donor ABO/Rh types

* + - * 1. Interpretation of compatibility testing
		1. Inspect the **Blood Bank Transfusion Record Tag** for accuracy and completion:

6.8.2.1 Before attaching Transfusion Record to unit, ensure the unit number on the FRONT of the product matches the unit number on the Transfusion Record.

* + - 1. Peel the Patient Identification Label (from the Transfusion Record) (Attachment 2) and place on the back of the product. Check the unit number on the Patient Identification Label to ensure it matches the unit number on the rear of the product. (NOTE: if no numbers exist on back of unit, compare the Patient Identification label to the FRONT of the unit)

6.8.3 Place tagged unit in appropriate storage area.

6.8.4 Notify the patient care unit of the availability of product.

6.8.5 Document incompatible crossmatches.

6.8.5.1 Return the unit to inventory.

6.8.5.2 Notify the patient care unit of a delay in obtaining blood for transfusion.

6.8.5.3 Identify the cause of incompatibility.

6.8.5.3.1 Check patient typing.

6.8.5.3.2 Review documentation for accuracy.

6.8.5.3.3 Patient may have an antibody to a low frequency antigen.

6.8.5.3.4 The donor unit may have a positive Direct Antiglobulin test. Perform a DAT on the unit as directed by the applicable procedure. Notify the Supervisor/Lead technologist of a positive DAT unit. Quarantine the unit. The Supervisor/Lead technologist shall determine the disposition of the unit.

6.9 Place the specimen in the appropriate storage location.

**7.0 Interpretation**

7.1 Compatibility is indicated by negative reactions in all phases of the crossmatch steps performed (except the Coombs Control phase).

7.1.1 No evidence of agglutination or hemolysis is detected.

7.2 Agglutination and/or hemolysis indicate a positive reaction which renders the crossmatch Incompatible. **Do not transfuse incompatible crossmatches unless specifically directed to do so by the Section Director**.

**8.0 Reporting Results**

Results are reported as directed by the applicable LIS procedure. Refer to the LIS manual as appropriate.

**9.0 Procedure Notes**

9.1 **The Saline Phase of the crossmatch is sufficient for patients having a negative antibody screen, no history of atypical antibodies or no agglutination at room temperature crossmatch. The extended crossmatch phase (section 6.6) is not required**.

9.2 Patients with a positive antibody screen or with a history of atypical antibodies must be given donor units negative for the corresponding antigen unless directed otherwise by the Supervisor and/or Section Director. An extended crossmatch must be performed on such cases.

9.3 **EMCP- ONLY**: LISS may be used as an alternate enhancement solution in tandem with PEG for investigative purposes.

* + 1. Perform the test as described by the procedural steps. **See Section: 6.7 LISS**

9.4 **EMC-EP ONLY [Elkins park hospital**]: PeG may be used as an enhancement solution in tandem with LISS for investigative purposes.

* + 1. Perform the test as described by the procedural steps. **See Section: 6.6 PEG**
	1. Red cell products must be stored at the appropriate temperature during testing.

 \* **NOTE:** The patient ABO/Rh Check shall be repeated each time the patient’s

 specimen is crossmatched.

* 1. **Document all Medical Coverage approvals in comments of Patient Product Inquiry.**

**10.0 Limitations of Procedure**

Red cells are not issued for transfusion until any discrepancies have been resolved unless otherwise directed by the Supervisor and/or Section Director. Refer any questions/concerns/discrepancies to the Supervisor and/or Section Director.

**11.0 References**

* 1. Roback, John D., ed. Technical Manual, 18th ed. Bethesda, MD: American Association of Blood banks,2014

11.2 Standards for Blood Banks and transfusion Services, 30th ed. Bethesda, MD: American Association of Blood Banks, 2016

**12.0 Records**

Patient crossmatch interpretations are retained for five (5) years, or longer as directed by local, federal or regulatory agency regulations.

**13.0 Attachments/Appendix/Forms/Documents**

13.1 Attachment 1: **Blood Bank Transfusion Record Tag**

13.2 Attachment 2: **Patient Identification Label**

**Approval Signatures:**

|  |  |  |
| --- | --- | --- |
| **Date** | **Printed Name** | **Signature** |
| 4/5/16 | Pettina WaltonBlood Bank Supervisor |  |
| 4/5/16 | Vanessa RawlingsElkins Park Supervisor |  |
| 4/5/16 | Manjula Balasubramanian, MDSection Director, Blood Bank |  |
| 4/5/16 | Nancy A. Young, MD Medical Director |  |

**History Review**

|  |  |  |
| --- | --- | --- |
| **Date Reviewed** | **Reviewed By** | **Revisions** |
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