e-Learn LAB — Transfusion Medicine

Based on IQMH Centre for Proficiency Testing Survey TMED-1907-ED

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Focus of this Presentation

This is a transfusion medicine case study. You will be presented with patient information and laboratory data and asked a series of questions for self-learning.
The case details and discussion were provided by the 2019 IQMH Transfusion Medicine Scientific Committee, and the IQMH Consultant Technologist.
Patient Information

• A 59-year-old man is admitted post motor vehicle collision (MVC), with an open fracture requiring emergent operative repair.
• In the emergency room his hemoglobin is 78 g/L, platelet count is $42 \times 10^9$/L and there is ongoing bleeding.
• A group and screen is sent to the transfusion medicine laboratory to prepare for anticipated blood transfusion.
• The medical history from the patient is not yet available and he has no prior testing at this hospital.
The results of ABO/Rh and antibody detection testing are shown below:

### ABO/Rh Typing

<table>
<thead>
<tr>
<th></th>
<th>Forward</th>
<th>Reverse</th>
<th>Rh Antisera</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anti-A</td>
<td>Anti-B</td>
<td>A₁ Cells</td>
<td>B Cells</td>
<td>−D</td>
</tr>
<tr>
<td>MF (3+)</td>
<td>MF (Weak)</td>
<td>1+</td>
<td>0</td>
<td>3+</td>
</tr>
<tr>
<td>MF (3+)</td>
<td>MF (Weak)</td>
<td></td>
<td></td>
<td>0</td>
</tr>
</tbody>
</table>

### Antibody Screening

<table>
<thead>
<tr>
<th>Cell</th>
<th>Rh</th>
<th>Rhesus</th>
<th>Kell</th>
<th>Duffy</th>
<th>Kidd</th>
<th>Lewis</th>
<th>P</th>
<th>MNSs</th>
<th>Lu</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<td></td>
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</tr>
</tbody>
</table>

CAT = Column Agglutination
What process(es) should be followed in order to further investigate the discrepant serologic finding?

a) Request a second sample for repeat testing  
b) Request additional past medical history  
c) Repeat testing using tube method if not used for initial sample  
d) Refer out for further testing  
e) All of the above are reasonable approaches
Answer

e) Each of the options listed are reasonable approaches to investigate a new patient with an ABO discrepancy.
• ABO genotyping and/or flow cytometry through a reference laboratory may ultimately be required to resolve a discrepancy and determine the ABO group.
• In most cases, obtaining a clinical history is key to determining the cause of an ABO discrepancy.
Which of the following can explain these results?

a) Recent transfusion  
b) Twin chimerism  
c) Cold reacting auto-antibodies  
d) Bone marrow transplant
• In this case, recent transfusion is less likely because, in the case of a group A patient receiving group O blood, group A reagent cells should not react, and group B reagent cells should.
• In a group AB patient receiving group O blood, neither group A nor group B reagent cells should react.
• In both cases, this would not explain the variable forward results.
Discussion

• Patients who have a twin can develop chimerisms that manifest as mixed field results and ABO discrepancies.¹
• Cold reacting autoantibodies are possible.²
A stem cell transplant (also called a hematopoietic cell transplant/HPC) patient who received an ABO incompatible transplant should be considered. Patients can take time (in excess of 100 days in some cases) to transition from their native state to that of the stem cell donor and discrepancies can occur during the transition. The table on the next slide summarizes the types of ABO incompatibility in stem cell transplantation.
Types of Incompatibility in Stem Cell Transplantation

<table>
<thead>
<tr>
<th>Type</th>
<th>Recipient</th>
<th>Donor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major</td>
<td>O</td>
<td>A, B, AB</td>
</tr>
<tr>
<td></td>
<td>A</td>
<td>AB</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>AB</td>
</tr>
<tr>
<td>Minor</td>
<td>A</td>
<td>O</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>O</td>
</tr>
<tr>
<td></td>
<td>AB</td>
<td>O, A, B</td>
</tr>
<tr>
<td>Bidirectional</td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>A</td>
</tr>
</tbody>
</table>

Minor
- Donor serum carries antibodies to recipient RBC antigens
- Donor B lymphocytes produce anti-recipient isoagglutinins

Major
- Recipient serum carries antibodies directed at donor RBC antigens
- Presence of preformed anti-donor isoagglutinins produced by recipient immune system
Discussion

• Conversion to donor stem cell red cell ABO group occurs over time and can be inhibited by persistence of isohemagglutinins secreted by recipient plasma cells.
Additional Patient Information

• The patient reports to the trauma team that six weeks ago, he underwent a stem cell transplant from his brother.
• He achieved engraftment by day 30 and was discharged.
• He was visiting his brother who lives near the presenting hospital when he was involved in a motor vehicle collision.
• The patient has received numerous prior transfusions of red blood cells (RBCs) and platelets over the past year, most recently four weeks ago.
• He recalls the doctors mentioning something about incompatibility with his brother’s blood.
Question 3

What ABO group will you issue if the team requests urgent RBCs?

a) Group O
b) Group A
c) Group B
d) Group AB
That’s Correct

a) Group O

Continue e-Learn module
That’s Not Correct

Try Again
What ABO group will you issue if the team requests urgent plasma?

a) **Group O**
b) **Group A**
c) **Group B**
d) **Group AB**
d) Group AB

Continue e-Learn module
That’s Not Correct

Try Again
Question 5

What RhD type will you issue if the team requests urgent RBCs?

a) RhD positive
b) RhD negative
That’s Correct

The patient described above should receive RhD positive RBCs

Continue e-Learn module
That’s Not Correct

Try Again
Question 6

Red blood cell units prepared for this patient should be irradiated

a) Yes
b) No
That's Correct

a) Yes
Continue e-Learn module
That’s Not Correct

Try Again
discussion

• He requires irradiated RBCs and platelets because of risk of transfusion-associated graft versus host disease (Ta-GVHD) that is a rare, but often fatal complication that occurs when donor lymphocytes from a transfused blood component cause an immune-mediated reaction against recipient tissues.⁴
Question 7

Red blood cell units prepared for this patient should be CMV negative

a) True
b) False
That’s Correct

B) False

Continue e-Learn module
That's Not Correct

Try Again
Discussion

• He does not require CMV negative blood because universal leukoreduction is considered equivalent to CMV safe blood in Canada.\textsuperscript{5}
Discussion

• The hospital where the transplant took place will be able to provide a history of transfusion, the stem cell transplant history and serological history.
• They will also be able to provide guidance on selecting the most appropriate units.
• The table on the next slide summarizes blood product support for patients who have undergone an ABO-incompatible stem cell transplant.
### Table 2: Transfusion Support Recommendations for ABO-Incompatible HPC Transplantation

<table>
<thead>
<tr>
<th>ABO Major Mismatch</th>
<th>Donor</th>
<th>Red Blood Cells</th>
<th>Platelets &amp; Plasma</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recipient</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>O</td>
<td>A</td>
<td>O</td>
<td>A or AB</td>
</tr>
<tr>
<td>O</td>
<td>B</td>
<td>O</td>
<td>B or AB</td>
</tr>
<tr>
<td>O</td>
<td>AB</td>
<td>O</td>
<td>AB</td>
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<tr>
<td>A</td>
<td>AB</td>
<td>A or O</td>
<td>AB</td>
</tr>
<tr>
<td>B</td>
<td>AB</td>
<td>B or O</td>
<td>AB</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ABO Minor Mismatch</th>
<th>Donor</th>
<th>Red Blood Cells</th>
<th>Platelets &amp; Plasma</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recipient</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>O</td>
<td>O</td>
<td>A or AB</td>
</tr>
<tr>
<td>B</td>
<td>O</td>
<td>O</td>
<td>B or AB</td>
</tr>
<tr>
<td>AB</td>
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<td>AB</td>
<td>A</td>
<td>A or O</td>
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</tr>
<tr>
<td>AB</td>
<td>B</td>
<td>B or O</td>
<td>AB</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>ABO Major/Minor Mismatch</th>
<th>Donor</th>
<th>Red Blood Cells</th>
<th>Platelets &amp; Plasma</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recipient</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>B</td>
<td>O</td>
<td>AB</td>
</tr>
<tr>
<td>B</td>
<td>A</td>
<td>O</td>
<td>AB</td>
</tr>
</tbody>
</table>
• Transfuse group O red blood cells until criteria for changing blood group are met.

• It is recommended to transfuse group AB platelets and plasma until criteria for changing blood group are met. However, it is acceptable to cross the ABO barrier with platelet transfusion if the ideal component is not available and transfusion is required urgently.

• Irradiated blood products are required as per NAC guidelines.
Discussion

• Patients can be supported with blood group O blood if there is ongoing discrepancy.
• In a patient with an ABO discrepancy and a negative antibody screen, an immediate spin crossmatch is both appropriate and sufficient.
• A positive DAT on its own does not disqualify the patient from an immediate spin crossmatch.
Discussion

• The following are some of the recommendations that can be found in the Recommendations for Use of Irradiated Blood Components in Canada: A NAC and CCNMT Collaborative Initiative\(^6\) that are pertinent to the case described above.

• Please note that there are other recommendations in the document, and other indications for irradiated blood products.
Recommendation 1

- For at-risk patients, all red cell, platelet and granulocyte concentrates should be irradiated, except cryopreserved red cells after deglycerolization.
- It is not necessary to irradiate plasma, cryoprecipitate or fractionated plasma products.
Recommendation 2

- Red cell components may be irradiated up to 28 days after collection.
- Irradiated cells must be transfused as soon as possible, but no later than 14 days after irradiation, and in any case, no later than 28 days after collection. (Council of Europe Standards, 17th edition, 2013)
Recommendation 3

• Platelets can be irradiated at any stage during storage and can thereafter be stored up to their normal shelf life after collection.
Recommendation 4

- In the event of emergency transfusion in the absence of on-site irradiation or pre-storage irradiated inventory, pre-storage leukoreduced red cells that have been stored for more than 14 days should be provided to patients with an indication for irradiated blood transfusion.
Recommendation 5

• All recipients of allogeneic hematopoietic stem cell transplantation (HSCT) must receive irradiated blood components from the time of initiation of conditioning chemoradiotherapy. (BCSH 2010, Grade 1 recommendation; level B evidence).
Recommendation 6

- Irradiated blood components should be continued while the patient continues to receive graft-versus-host disease (GVHD) prophylaxis.
- The indication for ongoing transfusion of irradiated blood components should be reviewed at least yearly.
- If chronic GVHD is present or if continued immunosuppressive treatment is required, irradiated blood components should be given indefinitely.
• Recommendation number four is of particular importance in this case.

• The rationale is that there are no reported cases of Ta-GVHD from RBCs stored longer than two weeks.\(^4\)
Additional Patient Information

• The patient returns six months following the MVC for a surgical revision to his injury.
• A pre-operative group and screen is sent to the transfusion laboratory.
• Additional information has been provided from the hospital where the transplant took place: The patient had a related non-myeloablative allogeneic stem cell transplant for high grade myelodysplastic syndrome (MDS).
Transfusion History

Patient group B RhD positive
Antibody screen negative
Donor (brother) group A RhD positive
## Patient Information

<table>
<thead>
<tr>
<th>Timeline</th>
<th>Forward</th>
<th>Reverse</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Anti-A</td>
<td>Anti-B</td>
</tr>
<tr>
<td>Initial baseline data provided from hospital where transplant took place</td>
<td>0</td>
<td>3+</td>
</tr>
<tr>
<td>Day 10 - post transplant</td>
<td>0</td>
<td>1+</td>
</tr>
<tr>
<td>Day 15 - post transplant</td>
<td>0</td>
<td>MF (2+)</td>
</tr>
<tr>
<td>Week 6 - MVC and first sample at current hospital</td>
<td>MF (3+)</td>
<td>MF (Weak)</td>
</tr>
<tr>
<td>Month 7 - post transplant (preoperative sample)</td>
<td>3+</td>
<td>0</td>
</tr>
</tbody>
</table>
Discussion

• This patient has now converted to his donor phenotype.
• His reverse grouping may never demonstrate concordance with his forward grouping as patients will often not develop antibodies to their native ABO status.
• Two independent peripheral blood samples for group and screen testing are required in order to confirm the patient’s new status.
• If two samples are not obtained, group O blood can be used; however, given that this is a pre-operative, non-emergent scenario, a second sample should be obtained so that group specific blood can be provided.
• In this scenario, with a clear clinical history of transplant as the cause for discrepancy, genotyping and chimerism studies to confirm blood group are not necessary.

• The ideal platelet product would be group A; however, it is acceptable to cross the ABO barrier with platelet transfusion, as it is with other patients, if the ideal component is not available and transfusion is required urgently.\(^7\)
Question 8

This patient still requires irradiated blood

a) True
b) False
That’s Correct

The expected answer is “True”

Continue e-Learn module
Discussion

• The decision to stop the requirement for irradiated blood should be made by the transplant team.

• In general, if a patient is off immune-suppression therapy and has a lymphocyte count greater than $1 \times 10^9$/L, consideration can be made to stop.

• In this scenario, in order to make the decision to stop providing irradiated blood, additional information would be required (e.g. patient’s current medications and lymphocyte count).

• There is time to check with the transplant hospital blood bank/transplant team regarding on going need, and there would be time to obtain irradiated blood products in the event that they are required for the surgery.


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