In The name of God

The 7th International & 12th national congress on Quality Improvement in Clinical Laboratory

ABO Discrepancy

By:

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James Blundell: Pioneer of human-to human blood transfusion (1818)
Although blood transfusion is increasingly safe, it remains hazardous in many respects, and its history is replete with severe and sometimes fatal complications that are both infectious and noninfectious in origin.

Most common causes of transfusion related deaths include:
- Improper specimen identification
- Improper patient identification
- Antibody identification error
- Cross match procedure error.
The most common causes of transfusion related hazards are the result of **Human Error**
Blood transfusion is like *marriage*; it should not be entered upon lightly, unadvisedly or wantonly or more often than is absolutely necessary.”

Dr. Robert Beal
What is Acceptable Risk?
ABO Blood group typing: is the most important test in assuring a safe blood transfusion.
### ABO blood Group System:

<table>
<thead>
<tr>
<th>Blood Group</th>
<th>Antigens on RBCs</th>
<th>Antibodies in Serum</th>
<th>Genotypes</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>A</td>
<td>Anti-B</td>
<td>AA or AO</td>
</tr>
<tr>
<td>B</td>
<td>B</td>
<td>Anti-A</td>
<td>BB or BO</td>
</tr>
<tr>
<td>AB</td>
<td>A and B</td>
<td>Neither</td>
<td>AB</td>
</tr>
<tr>
<td>O</td>
<td>Neither</td>
<td>Anti-A and anti-B</td>
<td>OO</td>
</tr>
<tr>
<td></td>
<td>Type A</td>
<td>Type B</td>
<td></td>
</tr>
<tr>
<td>----------------------</td>
<td>--------</td>
<td>--------</td>
<td></td>
</tr>
<tr>
<td><strong>Antigens on red blood cells</strong></td>
<td><img src="image1" alt="Type A Antigens" /></td>
<td><img src="image2" alt="Type B Antigens" /></td>
<td></td>
</tr>
<tr>
<td><strong>Antibodies in plasma</strong></td>
<td><img src="image3" alt="Type A Antibodies" /></td>
<td><img src="image4" alt="Type B Antibodies" /></td>
<td></td>
</tr>
<tr>
<td><strong>Agglutination reaction</strong></td>
<td><img src="image5" alt="Type A Agglutination" /></td>
<td><img src="image6" alt="Type B Agglutination" /></td>
<td></td>
</tr>
</tbody>
</table>
Blood Typing

Type A

Type B

Type AB

Anti-B

Anti-A
The forward and reverse ABO grouping reaction patterns

<table>
<thead>
<tr>
<th></th>
<th>Anti-A</th>
<th>Anti-B</th>
<th>Anti-AB</th>
<th>A cells</th>
<th>B cells</th>
<th>O cells</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
<td></td>
<td></td>
<td>[Image]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
<td></td>
<td></td>
<td>[Image]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AB</td>
<td></td>
<td></td>
<td></td>
<td>[Image]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>O</td>
<td></td>
<td></td>
<td></td>
<td>[Image]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
ABO Discrepancies:

• ABO discrepancies happen when there is no match in results between forward and reverse grouping (Cell type and Back type).

• Since production of ABO antigens is genetically controlled, they are less vulnerable to problems than does the production of ABO antibodies.

Therefore we see more problems in Reverse grouping.
Conditions of Discrepancies:

1. Strength of reaction
   - Weak or missing
   - ABO forward and reverse reactions are typically strong: 3+ to 4+
2. Additional reactions
3. Abnormal reactions

The discrepancy may arise because of Technical and Non-technical errors;

which are usually technical in nature.
Popular Technical Errors

1. Poorly labeled specimen or test tubes
2. Cell suspension is too heavy or too light
3. Wrong specimen put in Patient’s labeled test tubes
4. Is hemolysis really a Positive reaction?
5. Wrong results recorded on patient form
6. Didn’t follow manufacturer’s instructions
7. Poor centrifugation: over or under!
8. Contaminated reagents
9. Dirty tubes or glassware
10. Failure to add serum or reagents
11. Use of incorrect reagents or samples

Other than technical factors, there are four types of ABO discrepancies.
Group I Discrepancies

• These discrepancies are due to:
  ✓ weak reaction or missing antibodies.

• These kind of discrepancies are the most common.

• The reason: Depressed Ab production or cannot produce the ABO Ab.
  ✓ New born infants, elderly patients.
  ✓ Patients with lymphoma.
  ✓ Patients using immunosuppressive drugs.
  ✓ Patients with immunodeficiency disease.

• Resolving discrepancies
  ✓ Eliminate all technical errors
  ✓ Enhancing the reaction in reverse grouping; Incubate the patient’s serum with reagent cells at RT for 15 mins.
Group II Discrepancies

• These discrepancies are due to:
  ✓ weak reaction or missing antigens.

• These kind of discrepancies are the least one.

• The reason: Depressed Ab production or cannot produce the ABO Ab.
  ✓ Some ABO subgroups.
  ✓ patients with leukemia and hodgkin’s disease.

• Resolving discrepancies
  ✓ Eliminate all technical errors
  ✓ wash the patient’s cells with saline.
Group III Discrepancies

• These discrepancies are due to:
  ✓ Protein or plasma abnormalities.

• The reason: Elevated levels of globulin (Rouleaux formation).
  ✓ Certain diseases such as multiple myeloma.

• Resolving discrepancies:
  ✓ Eliminate all technical errors
  ✓ wash the patient’s cells with saline or adding a drop of saline to the tube.
  ✓ Cord blood must be washed 6-8 times in forward grouping only.
Group IV Discrepancies

• These discrepancies are due to:
  ✓ Miscellaneous problems such as Poly agglutination.
Examples
<table>
<thead>
<tr>
<th>Anti~A</th>
<th>Anti~B</th>
<th>A₁~Cells</th>
<th>B~Cells</th>
</tr>
</thead>
<tbody>
<tr>
<td>3+</td>
<td>0</td>
<td>0</td>
<td>1+</td>
</tr>
</tbody>
</table>

**Problem:** Reverse grouping – weakened patient antibody

**Causes:** Age related, immunosuppressed, immunocompromised

**Resolution:** Incubate in RT for 15-30 minutes and re-spin. Check Patient history.
### Anti-A Anti-B A$_1$-Cells B-Cells

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>3+</td>
<td>1+</td>
<td>0</td>
<td>4+</td>
</tr>
</tbody>
</table>

**Problem:** 1+ Reaction with Anti-B. Appears to have additional antigens.

**Causes:** Acquired ‘B’ antigen.

**Resolution:** Patient history – bowel obstruction, carcinoma of the bowel. (E. coli de-acetylation of the Group A antigen.)
<table>
<thead>
<tr>
<th>Anti-A</th>
<th>Anti-B</th>
<th>A₁-Cells</th>
<th>B-Cells</th>
</tr>
</thead>
<tbody>
<tr>
<td>2+</td>
<td>0</td>
<td>1+</td>
<td>4+</td>
</tr>
</tbody>
</table>

**Problem:** Weak forward anti-A and 1+ reaction with A1 Cells.

**Causes:**
2) Unexpected cold reacting antibody to antigen on reagent A1 cells.

**Resolution:**
1) Test patient cells with anti-A1 lectin and with patient serum test A2 cells.
2) Antibody screen should demonstrate unexpected cold reacting antibody.
Problem: Reverse grouping – Patient with missing antibody

Possible discrepancy: Missing Ab (group I discrepancy)
<table>
<thead>
<tr>
<th>Anti-A</th>
<th>Anti-B</th>
<th>A₁-Cells</th>
<th>B-Cells</th>
</tr>
</thead>
<tbody>
<tr>
<td>1+</td>
<td>0</td>
<td>0</td>
<td>4+</td>
</tr>
</tbody>
</table>

**Problem:** Forward grouping – Patient with weakened Ag

- **Possible discrepancy:** Missing Ag (group II discrepancy)
When an ABO Discrepancy is encountered:

1. Results must be recorded, but interpretation of the ABO group must be delayed until the discrepancy is resolved...by you!
2. Begin follow up by getting an accurate patient history – age, medications, diagnosis, etc.
3. Repeat testing to rule out technical errors such as mislabeling, adding reagents, wrong patient sample, etc.

Awareness about the said classification of ABO discrepancies and methods to undertake them to achieve an truthful result are the essential need especially in the management of disorders that necessitate transfusions.
Concluding Remark

- Blood transfusion has reached levels of safety that could not have been imagined a decade ago;
- Though the relative calm could be perturbed again by adverse effect of transfusion due to misinterpretation of ABO typing

So, Dr Beal,

we have a good but not perfect marriage,

we anticipate and hope that continued counseling will further improve the relationship.