Laboratory Investigation of Transfusion Reactions

Sharon Lowry, MT(ASCP)SBB
University of Michigan Hospitals
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## Acute Reaction

<table>
<thead>
<tr>
<th></th>
<th>Step</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Stop transfusion; keep line open - saline</td>
</tr>
<tr>
<td>2</td>
<td>Contact physician for instructions</td>
</tr>
<tr>
<td>3</td>
<td>Perform clerical check of patient and blood</td>
</tr>
<tr>
<td>4</td>
<td>Notify blood bank</td>
</tr>
<tr>
<td>5</td>
<td>Return blood unit, IV solution and tubing</td>
</tr>
<tr>
<td>6</td>
<td>Collect post-transfusion sample <strong>STAT</strong></td>
</tr>
<tr>
<td>7</td>
<td>Complete transfusion reaction form</td>
</tr>
</tbody>
</table>
Standard Investigation

- Clerical Check
- Visual Check
- Post ABO
- Post DAT
Why Do a Clerical Check?

- Detect labeling errors
- Detect patient identification errors
- Treat patient for ABO incompatibilities
- Prevent companion errors with another patient or another blood unit
Clerical Check - Bedside

At the bedside compare

- Patient identification
- Labels on blood unit
Clerical Check – Blood Bank

Compare post-transfusion sample/record

- Pre-transfusion sample
- Pre-transfusion test results
- Blood unit labels
  - Inspect blood unit for color change
  - Confirm IV fluid is saline
Why Do a Visual Check?

Hemolysis in patient plasma may be a sign of an acute hemolytic reaction

- Antibodies bind antigens on transfused RBCs
- Complement system is activated
- RBCs are destroyed
- Free hemoglobin is released into the plasma

Destruction of 5mL of red cells may be visible
Visual Check for Hemolysis

- Observe **pink** or **red** color in plasma of post-transfusion sample

- Compare with pre-transfusion sample plasma
Visual Check Problems

Hemolysis observed in plasma may be

- Myoglobinemia in trauma
- Hemolysis in the donor unit
- Underlying condition: AIHA, G6PD
- Traumatic draw

Collect second sample if hemolysis present
## Why Repeat the ABO?

<table>
<thead>
<tr>
<th>Sample</th>
<th>Wrong label</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Wrong patient</td>
</tr>
<tr>
<td>Lab</td>
<td>Double sample labels</td>
</tr>
<tr>
<td></td>
<td>Specimen mix up</td>
</tr>
<tr>
<td></td>
<td>Switched blood tags</td>
</tr>
<tr>
<td>Recipient ID</td>
<td>Wrong patient</td>
</tr>
<tr>
<td></td>
<td>Wrong unit</td>
</tr>
</tbody>
</table>

*Repeat Rh for additional verification*
Post ABO Result

- Compare to pre-transfusion ABO
- Repeat pre-transfusion ABO if different
- Explain mixed field agglutination
<table>
<thead>
<tr>
<th></th>
<th>-A</th>
<th>-B</th>
<th>-D</th>
<th>a</th>
<th>b</th>
<th>ABO/Rh</th>
<th>I</th>
<th>II</th>
<th>ABSC Intrp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre</td>
<td>4</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>4</td>
<td>A Pos</td>
<td>0</td>
<td>0</td>
<td>Neg</td>
</tr>
<tr>
<td>Post</td>
<td>MF</td>
<td>0</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>?</td>
<td>0</td>
<td>0</td>
<td>Neg</td>
</tr>
</tbody>
</table>
**WBITs**

**Wrong Blood In Tube**

- Discovered by transfusion reaction or subsequent sample
- Not discovered if companion sample is same blood type
- Missed during pre-transfusion testing when patient has no historical record
Does the facility have a plan to implement a system to reduce the risk of mistransfusion for non-emergent red cell transfusions?
NOTE: ...among the risk reduction options are:

- Documenting the ABO group of the intended recipient on a second sample collected at a separate phlebotomy

- Utilizing a mechanical barrier system or an electronic identification verification system that ensures that the patient from whom the pretransfusion specimen was collected is the same patient who is about to be transfused.
NOTE continued:

The use of a second manual banding system, while acceptable, is probably not as effective as the above two options.
Never Events

Never should have happened

- Incompatible blood transfusions are preventable
- Medicare and other insurers will stop paying for added costs of treatment
- Patients cannot be charged for error costs
Why Do a DAT?

Detect incompatibility

- Patient antibodies coating donor RBCs
- Undetected antibodies
- Donor antibodies coat patient RBC antigens
Key DAT Points

- 2-5% cell suspension
- Wash EDTA cells thoroughly
- Polyspecific, IgG, Complement AHG
- Saline control
- Centrifugation
- Grade/record agglutination immediately
- Incubate complement, if directed
- IgG and Complement check cells
- If post DAT positive, perform pre DAT
DAT Best Practice

No delays start to finish!

- Fresh cell suspension prevents IgG disassociation
- Immediate centrifuging/reading prevents weakened agglutination
Post DAT Problems

- Positive before transfusion
- Invalid due to spontaneous agglutination
- Negative if transfused red cells are destroyed
- Negative with low levels of attached globulins
Positive Standard Investigation

- Blood Bank
- Hematology
- Urinalysis
- Chemistry
Urinalysis

- Red or dark urine is observed
- Visual check shows hemolysis
- Additional test for intravascular hemolysis
Urinalysis Results

If blood is detected, exam microscopically

- Hemoglobinuria = RBC absent (Hemolysis)
- Hematuria = RBC present (R/O hemolysis)

- Compare to pretransfusion results
- Consider immunological and non-immunological causes
Further Testing: Blood Bank

- Post-transfusion DAT positive:
  - Eluate (transfused <2 weeks ago)
  - Include ABO cells if indicated
- Antibody screen pre and post
- AHG crossmatch pre and post
- Antibody studies
- Antibody enhancement studies
Acute Reaction Antibodies

ABO
Kidd
K
Fya
Rh
Others
### Explanation?

<table>
<thead>
<tr>
<th></th>
<th>ABO /Rh</th>
<th>DAT</th>
<th>ABSC</th>
<th>XM</th>
<th>ABID</th>
<th>Eluate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre</td>
<td>O POS</td>
<td>NEG</td>
<td>NEG</td>
<td>XMCNEG</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post</td>
<td>O POS</td>
<td>POS</td>
<td>NEG</td>
<td>AHGPOS</td>
<td>NEG</td>
<td>ABID NEG</td>
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Other Lab Testing

- LDH increased
- Bilirubin increased (5-7 hours)
- Haptoglobin decreased
- CBC, platelet count
- Coagulation studies for DIC
- BUN, creatinine, urine output
Investigations of Other Reactions

- Sepsis
- TRALI
- Anaphylactic
- Delayed
Sepsis

Brown/purple/frothiness/bubbles observed in unit
Gram’s stain and culture blood unit and patient

Problems:
Little or no blood left in bag
Contamination during sample collection

- Gram negative organisms (Yersinia enterocolitica)
- Coagulase- negative Staphylococcus
- Others
TRALI

Test pre-transfusion and post-transfusion samples

- BNP may not increase
- CBC may show decreased WBCs

Suspected TRALI

- Report to blood center
- Test patient for HLA and granulocyte antibodies/antigens
- Test donor for HLA and granulocyte antibodies
Anaphylactic

- Test patient for IgA deficiency
- Track as special needs patient
- Special order IgA deficient products
- Washed RBCs and platelets may be given
Delayed Reactions

- Positive antibody screen
- New antibody identified
- Anamnestic or primary response
- Autocontrol/DAT may be + or -
Delayed Reaction Testing

- Antibody identification studies
- Eluate if DAT+ and transfused < 2 weeks ago
- Antigen type pre-transfusion sample and donor segments
- Bilirubin may increase at 5 days
- CBC may show decreased Hgb
- Urinalysis may show hemoglobinuria
## Explanation?

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<th>DAT</th>
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<th>Eluate ABID</th>
<th>Ag Type</th>
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<td>AB POS</td>
<td>NEG</td>
<td>1+</td>
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<td></td>
<td>E- Fya-</td>
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<tr>
<td>Post</td>
<td>AB POS</td>
<td>POS</td>
<td>2+</td>
<td>E</td>
<td>FYA</td>
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Note: The table format is used to present the data in an organized manner.
Abbreviated Investigation

Simple allergic
- Few hives early in transfusion
- Clerical check
- Visual check
- Omit repeat ABO and DAT
Reporting

- FDA: Fatalities, BPDR for manufacturing errors
- Supplier: Bacterially contaminated units, TRALI
- Physician: Hemolysis, bacterial contamination, TRALI, delayed, serious reactions
- Medical Record: All investigation reports, delayed reaction reports
Questions?