Emergency and Massive Transfusion: What’s Taking So #%^&*!! Long?

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Blood Bank, UKMC
Conventional wisdom: Emergency and massive transfusion situations are inherently unpredictable. Some aspects are predictable.

Yikes! Call the Blood Bank!
Why can’t you just send the blood?
Objectives

- Limitations and risks of emergency issue blood products.
- Weighing risks and benefits.
- Inner workings of the Blood Bank.
- The art of getting compatible blood quickly.
- Being proactive.
Relax.

The following 2 cases are totally fictitious. But they could happen.
Scenario #1

The system works as intended.
Another Day at the Office ED

A young man is brought by ambulance to the ED in shock with a GSW to the chest. Forewarned by the EMS, the ED registers the patient as Beta Male before he arrives. His identity, medical history, and blood type are not immediately known.

He needs blood now!
Springing Into Action

- Because he needs blood transfusion immediately, the Trauma Alert Red protocol is initiated.
- He receives 4 units of emergency issue O positive PRBCs en route to the OR. (He’s male.)
- A properly labelled specimen is sent to the blood bank.
We’re never on TV (unless we screw up)

- The Blood Bank quickly types his blood as A negative. Antibody screen is negative.
- Type specific blood products can now be provided (even though we still don’t even know his identity.)
Result

- The bleeding is controlled.
- The patient recovers, is discharged, and is lost to follow-up.
- The hospital eats the bill, but we saved a life, so we feel good.
Lessons Learned

• The system worked as intended.
• An Rh(-) male patient received Rh+ blood, and is at risk of forming anti-D antibody about 3 months later.
• This would pose little problem for a male, except for future emergency transfusion.
• There is usually no point in switching Rh negative patients to Rh(-) products after initial Rh+ RBC tx.
Scenario #2

The system has the hiccups that day.
Not Again!

- An unidentified female unrestrained driver in a MVA is brought by helicopter to the ED on a hectic day.
- She appears to be about 20 weeks pregnant, has evidence of hemoperitoneum and is hypotensive. Fetal heart tones are audible.
- She is registered as Gamma Female several minutes after she arrives.

She needs blood too!
• The Trauma Alert protocol is initiated.
• 4 units of uncrossmatched O negative units are sent to the ED and transfused as she is readied for surgery.
• A blood specimen is sent to the blood bank in a plastic bag containing the labels of two different patients. Neither is attached to the specimen tube.

The Blood Bank can’t use that specimen! FDA **REQUIRES** properly labelled specimens.
We’ve had better days.

- Late registration and the wait to receive a properly labelled specimen delay the type and screen in the blood bank.
- Wouldn’t you know it? Her antibody screen is positive!
- She needs more blood. **Now.**
Meanwhile, back in the OR...

- Emergency laparotomy reveals liver and spleen lacerations with hemoperitoneum. The gravid uterus is intact.
- The patient receives 10 more units of O negative PRBC plus FFP and platelets over several hours of surgery via the Massive Transfusion Protocol.
- Bleeding is finally controlled.

We’re OK, right?
She got all O negative products.
Not so fast.....
Belated results from the Blood Bank:
• Blood type A+.
• The alloantibody is anti-c.
• c is one of the Rh antigens.
• Most Rh negative donor blood contains c antigen.

You mean most of those units were incompatible?!
Yep...

- This patient is now at risk for an immune hemolytic transfusion reaction.
- She got a lot of antigen positive blood, so it could be a doozy.
- She should be observed for fever, hemolysis and hyperbilirubinemia.
- She will probably need further transfusion with compatible blood.
- We could even consider exchange transfusion.
What about the baby?

- Also, if her baby has c antigen on its RBCs, the chance of HDFN (already a risk in this case) could be greatly increased.
- The pregnancy should be closely monitored and intrauterine transfusion considered.
Lessons Learned

- The system worked, with a few glitches.
- The mother’s and baby’s lives were saved.
- Their other problems may be manageable.
- New antibody identification takes \( \sim 1 \text{ hr.} \)
- 1 out 5 random units are c-antigen negative. Add 30-60 minutes even if we elected to skip the full crossmatch for the emergency.
- Timely receipt of a valid specimen could have reduced the amount of incompatible blood transfused.
Conclusions

• Emergency issue blood saves lives, but has possible adverse consequences.

• “Universal donor” blood does not cover all possible situations.

• When time does not permit type and crossmatch, alloantibodies and occasional hemolytic transfusion reactions must be expected.

• In many acute trauma cases, these consequences may be manageable and forgivable.

• As physicians, we are often ultimately responsible for things that are “not our job”.
Scenario #3

This was an actual elective surgery case.
Brief Details

- Middle aged female w/ spinal metastases.
- Poor prognosis, intolerable pain.
- Palliative surgery planned.
- Large blood loss anticipated.
- Known (to Blood Bank) to be B negative with anti-D antibody.
- Blood Bank learned details of her condition after surgery was in progress.
Brief Details

- Large blood loss as expected.
- Anesthesia alerted Blood Bank re: expected further massive needs.
- B neg and O neg PRBC inventory that day was strained at UKMC.
- We weighed the relative risks of emergency switch to Rh+ blood in spite of the antibody.
- Risk of DHTRx vs. the risk to the community of depleting our O neg supply.
Fortunately, Kentucky Blood Center was able to round up enough B negative units to get us through that case without having to switch to Rh+ or use up all our O neg.

We were scrambling.
Was this unavoidable?

• A day or two’s notice would have let us prepare.

• We routinely assess our supplies on several hours’ notice prior to liver transplants, and communicate with those surgeons if supplies may be inadequate or delayed.
Trauma and unexpected emergencies are one thing...

Much other high blood loss surgery could be anticipated. A few examples:

- Enlarging AAAs
- RP
- Hip and knee replacement
- Difficult C sections and pelvic surgery
- Solid organ transplant
- Cardiovascular surgery
We’re here to help

If high blood loss surgery is anticipated:

• Check the type and screen ahead of time.
• Recognize rare types and antibodies.
• Give the Blood Bank some notice.
What is a “blood type”?

ABO:

- Polysaccharide chains on RBCs
- Types represent different terminal sugars in the chain: A, B, AB, or O.
- Transferase enzymes genetically determined.
- Antibodies to A and B are naturally occurring and expected.
What is a “blood type”?

ABO Antibodies:

- Type A has anti-B; can’t receive type B RBCs.
- Type B has anti-A; can’t receive type A RBCs.
- Type AB has neither anti-A nor anti-B; can receive any ABO type RBCs.
- Type O has both anti-A and anti-B; must receive type O RBCs only.
- Type O is “universal RBC donor”.
- Type AB is “universal plasma donor”.
Rh type

- Major Rh antigen is D.
- D+ = “Rh+”; indicates presence of at least one gene for the red cell membrane protein RHD.
- Rh(-) means no D antigen present.
- D is the most immunogenic RBC antigen.
- Commonly involved in severe cases of HDFN.
- Other Rh antigens may be relevant if antibodies to them are present.
- Alloantibodies are not expected, but are frequent if hx of transfusion or pregnancy.
What is a “rare blood type”?

- ABO type is most important.
- Rh type most relevant for childbearing age females.
- Other antigen phenotypes important in the presence of RBC alloantibodies due to previous transfusion or pregnancy.

"He has a pretty rare bloodgroup."
What is a rare blood type?

**ABO/Rh frequency**

<table>
<thead>
<tr>
<th>Type</th>
<th>Frequency</th>
<th>Rarity</th>
</tr>
</thead>
<tbody>
<tr>
<td>O Pos</td>
<td>37.4% (1 in 3)</td>
<td>1 in 3</td>
</tr>
<tr>
<td>A Pos</td>
<td>35.7% (1 in 3)</td>
<td>1 in 3</td>
</tr>
<tr>
<td>B Pos</td>
<td>8.5% (1 in 12)</td>
<td>1 in 12</td>
</tr>
<tr>
<td>AB Pos</td>
<td>3.4% (1 in 29)</td>
<td>1 in 29</td>
</tr>
<tr>
<td>O Neg</td>
<td>6.6% (1 in 15)</td>
<td>1 in 15</td>
</tr>
<tr>
<td>A Neg</td>
<td>6.3% (1 in 16)</td>
<td>1 in 16</td>
</tr>
<tr>
<td>B Neg</td>
<td>1.5% (1 in 67)</td>
<td>1 in 67</td>
</tr>
<tr>
<td>AB Neg</td>
<td>0.6% (1 in 167)</td>
<td>1 in 167</td>
</tr>
</tbody>
</table>

Compatible units can be even rarer if other common antigens must be avoided due to presence of alloantibodies.
What is a rare blood type?

**Rh frequency**

<table>
<thead>
<tr>
<th>Patients:</th>
<th>Donors:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rh+ (1 or 2 copies of D antigen): &gt;85%</td>
<td>Rh+: 85%</td>
</tr>
<tr>
<td>Rh(-): (no D antigen) ~&lt;15%</td>
<td>Rh(-): 15%</td>
</tr>
</tbody>
</table>

Other Rh antigens including C, c, E, e, and many others occur at varying frequencies.

Many other important types of RBC antigens exist.
What is a rare blood type?

Rh frequency

Patients:
Rh+ (1 or 2 copies of D antigen): >85%
Rh(-): (no D antigen) ~15%

Donors:
Rh+: 85%
Rh(-): 15%

The donor population is overwhelmingly Caucasian. The hospital patient population is more diverse. Racial differences in antigen frequencies may create availability issues.
What about patients who need “very rare blood”?

- Rare units are kept in frozen inventories at blood centers.
- Thawing and reconstitution take hours.
- Very rare units may have to come from distant blood centers; can take days.
- Don’t rely on the frozen inventory for acute emergencies.
What is "incompatible blood"?

- ABO incompatibility: e.g., A into O, A into B, etc. Usually due to clerical error. Acute intravascular hemolytic transfusion reactions may be fatal.

- In presence of most alloantibodies, transfusion with antigen positive RBCs → delayed extravascular HTRxN. May be severe, but slower hemolysis, jaundice, possibly fever.
- Weigh risks of "incompatible blood" vs life-threatening anemia.

- "Delivery of a perfectly crossmatched unit to a dead patient is not a therapeutic triumph."
Other take-home points

- KBC is an excellent resource, not a miracle worker.
- KBC has access to blood products previously distributed to area hospitals.
- KBC is 20-30 minutes away in good weather and light traffic.
- Some “area hospitals” are hours away.
- Blood product shortages occur in summer, around holidays and periods of bad weather if donors don’t come in.
Other take-home points

Send adequate samples ($\geq 10$ mL) early.

- Complex work-ups can be delayed if the Blood Bank has to wait for more sample.

<4 mo. - 2 purple bullets (500 uL, total 1.0 mL)
4 mo. - 6y. 3 mL blood in 6 mL pink top Vacutainer
6 y.- full pink top Vacutainer (6 mL)
Other take-home points

Ensure the Blood Bank has a CURRENT SAMPLE! These expire every 3 days. The OR may assume “the floor” has seen to this and vice versa. Don’t assume anything!
Other take-home points

Registering pt from OR:

• Occasionally necessary (eg, AAA by helicopter).
• The ED registers patients all the time; the OR doesn’t.
• Be aware.
Other take-home points

Ensure we’re all talking about the same patient (e.g., multiple trauma situations).

- “I’m here to pick up the blood for OR 6.”
- “Which patient is that?”
- “I don’t know. I’m filling in at the front desk. We’re slammed, so they sent me.”

At least half of mistransfusions occur when the right unit goes to the wrong patient!
Errors occur in chaotic situations.

- ER
- OR
- ICU

Think twice, act once, (including paperwork).

Yikes!
**DOWN TIME ISSUE/RETURN SECTION**

<table>
<thead>
<tr>
<th>Inspection OK, issued by:</th>
<th>Received by:</th>
<th>Date:</th>
<th>Time:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Product returned and □ is □ is not satisfactory for reissue.</th>
<th>Reissue Inspection OK, issued by:</th>
<th>Date:</th>
<th>Time:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Tech:</th>
<th>Date:</th>
<th>Time:</th>
</tr>
</thead>
</table>

<table>
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<tr>
<th>TRANSFUSION RECORD</th>
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</table>

I have verified that:
1) There is written consent for transfusion.
2) The recipient's name and MR# on this form, the unit label, and the recipient's ID bracelet are the same.
3) The Unit/Pool/Lot# on the blood bag and this form are the same.

Signature of Transfusionist: ____________________________

I have verified 2 & 3: Signature of Verifier: ____________________________

<table>
<thead>
<tr>
<th>DO NOT STORE BLOOD ON FLOOR, PRODUCT SHOULD BE STARTED OR RETURNED TO BLOOD BANK WITHIN 30 MINUTES.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>DATE OF TRANSFUSION</th>
<th>TIME STARTED</th>
<th>AMOUNT GIVEN</th>
<th>TIME COMPLETED</th>
<th>BLOOD WARMER USED</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>REACTION NOTED:</th>
<th>□ NO</th>
<th>□ YES</th>
</tr>
</thead>
</table>

If yes, immediately do the following:
1) Stop transfusion
2) Notify physician
3) Notify Blood Bank
4) Complete Transfusion Reaction Section of the Blood Bank Requisition
5) See Nursing policy NI08-02, Care of the Patient Receiving Blood and Blood Products.

**EMERGENCY RELEASE SECTION**

This section to be completed (ONLY) for emergency release transfusions

I accept responsibility for and release the Blood Bank Medical Director and personnel of the responsibility for any adverse reaction resulting from this transfusion which may have been prevented by routine compatibility testing.

Signature of Requesting Physician: ____________________________

Signature and Title: ______________________

Person accepting for Dr.: ______________________
Blood Bank Phone
323-5401
Thank you for your attention.