ANNUAL SHOT REPORT 2016

BMS Education Day - Transfusion reactions

Hema Mistry: SHOT Laboratory Incidents Specialist
SHOT recommendations

- Some recommendations have been repeated many times
  - almost 50% recommendations are repeats
- Many have been actioned:
  - SHOT contributed to at least 18 different British Society for Haematology (BSH) guidelines
  - Changes to Blood Service practices: reduced TRALI & bacterial infection
  - Transfusion training and competency assessments
  - Widespread appointment of transfusion practitioners
  - Patient blood management
Haemovigilance definition

Blood is a living transplant

Collection, transport, processing and testing
Delivery to the patient

Is the donor safe?

Is the process safe?

Is a transfusion the most appropriate treatment?

Recipient characteristics

Donor characteristics
What is reportable

- Incorrect blood component transfused (IBCT)
  - WCT/SRNM
- Avoidable, delayed or under transfusion (ADU)
- Handling & Storage (HSE)
- ‘Near-miss’ events (NM)
- Right blood right patient (RBRP)
- Anti-D Ig
Clinical reactions

- Transfusion-associated circulatory overload (TACO)
- Transfusion-related acute lung injury (TRALI)
- Transfusion-associated dyspnoea (TAD)
- Acute transfusion reactions - allergic/febrile (ATR)
- Haemolytic transfusion reactions (HTR)
Transfusion-transmitted infections including bacterial contamination (TTI)

Cell salvage incidents

Post-transfusion purpura (PTP)

Transfusion-associated graft-versus-host-disease (TA-GVHD)

New or unclassifiable complication of transfusion (UCT) includes necrotising enterocolitis (NEC) and prothrombin complex concentrate (PCC) errors
Adverse clinical events & reactions when & how...

When...

- **Immediate** and life-threatening: ABO incompatibility; anaphylaxis
- **Hours**: pulmonary complications, bacterial infections, transfusion reactions
- **Days**: Delayed haemolytic reactions
- **Late** (months or years): viral infections; iron overload
What clinical features suggest a patient is reacting adversely to a transfusion?

**Symptoms**
- Fever, chills, rigors
- Dyspnoea, stridor
- Itch, rash, swelling of lips
- Shock, collapse
- Nausea, general malaise
- Pain
- Feeling of impending doom

**Signs**
- Change in temperature
- Hypoxia
- Change in BP, pulse
- Raised venous pressure, pulmonary signs
- Reduced urine output, change in urine colour
- Change in conscious level
What to do at the bedside...

- Stop the transfusion, maintain IV access with saline
- Check the bag and patient ID
- Rapid medical assessment
- Inform the transfusion laboratory
- Take samples and return blood bag to laboratory
- Renal function
  - Monitor fluid balance (input and output)
  - Collect first and subsequent urine samples

*BSH Guideline on the investigation and management of acute transfusion reactions (2012)*
Acute transfusion reactions

What do you know about acute transfusion reactions?

- Acute transfusion reactions can be serological, but usually are not
- They are mostly unexplained, unpredictable, pathological reactions

### Acute Transfusion Reactions (ATR)
- SHOT ATR cases in 2016 n=253 – many reactions
- Seldom serological
- Reaction to any component
- Non-haemolytic reactions:
  - Anaphylaxis
  - Allergic
  - Febrile
  - Hypotension

### Haemolytic Transfusion Reactions (HTR)
- SHOT HTR cases in 2016 n=35 (acute n=17 – not many)
- Often serological
- Reaction to red cells
- Patient has haemolysis
  - can be acute (AHTR)
  - or delayed (DHTR)
  - haemolysis usually within 14 days
Acute Haemolytic Tx Reaction

• Dramatic & severe: this type most likely to be fatal

  Haemolysis: red cells destroyed in patient’s circulation

• Major complications: DIC & renal failure, irreversible shock, death!

• Antibodies
  – cause rapid activation of Complement
    • to membrane
  – Most likely to be ABO blood group system

• Incidence: 0.00001 %
Delayed Haemolytic Tx Reaction

- Approximately between ___ days post transfusion
- Denoted by ↓↓ & ↑↑
  - Serum / plasma pinkish
  - Patient becomes jaundiced and / or anaemic
  - Occasionally fever; rarely renal failure & death
- Extravascular clearance of red blood cells
- Antibodies
  - Reactive at 37°C by IAT
  - Usual suspect: Kidd antibodies
- Incidence: 0.00001 %
Delayed ‘Sero logical’ Tx Reaction

Clinically benign

• Haemolysis is not detectable

• Serum/Plasma ‘usual’ colour

• Evidence of newly formed antibodies in plasma and/or eluted*

• Only detected when patient has a repeat work-up

• Antibodies – active at 37°C by IAT

• Incidence - ???
Laboratory Investigation

Check paper work
Samples
Elution
Donor cells

BAG, BAND, BLOOD!
Summary

In investigating a suspected transfusion reaction

- You are trying to rule out / detect
  - ABO incompatibility first
  - Reduced red cell survival (ab active @ 37°C)
  - Screening / XM failure
    - dosage
    - antigen deterioration
    - poor technique
    - user error

- ALWAYS REMEMBER THE PATIENT’S SYMPTOMS

- Senior scientific staff & the consultant haematologist should review case(s) & decide on further action(s)
  - Further investigations
  - Referral
  - Reporting to SHOT/SABRE
• Elderly man with myelodysplastic syndrome, comorbidities (COPD)
• Back and abdominal pain after 160mL red cells, transfused to outpatient and died within 12 h
• WRa positive unit (1 in 1000): patient had anti-WRa
• Recognised cause of HTR and HDFN
• 10 cases SHOT 2012-2015, none 2008-2011
• Increasing use of EI: 36% in 2008, 61% in 2016
Laboratory signs

Laboratory indications of DHTR

- HB↓
- New antibody in plasma and/or eluate
- Billirubin↑
- DAT positive
- LDH↑
Fever, chills and rigors during or soon after transfusion: possible causes

- Febrile non-haemolytic transfusion reaction
- Acute haemolytic reaction
- Bacterial contamination
- Underlying condition
Case 1

• A patient with myelodysplasia has a 2 unit red cell transfusion as a day case

• History of complex red cell antibodies

• With the second unit, she complains of feeling unwell, with mild nausea and chills

• Her temperature rises from 37.8 to 39°C, BP and pulse both increase

• The transfusion is stopped and symptoms and signs improve within 30 minutes
What is this most likely to be?

A. A haemolytic transfusion reaction due to complex red cell antibodies

B. A haemolytic reaction due to incorrect component transfused

C. A febrile transfusion reaction

D. Bacterial contamination of the unit
Case 2

• Patient with haematuria being transfused with platelets

• 20 minutes into transfusion:
  – 2.2°C rise in temperature, vomiting, tachycardia, chest pain
  – Hypoxia

• Rigors prevented BP measurement

• Urine positive for haemoglobin but patient has haematuria
Which investigations would you do?

A. Blood cultures of the patient, send the platelet unit for culture
B. Repeat group and antibody screen the patient
C. All the above
D. None of the above
Culturing the platelet unit:

A. Perform culture in hospital lab, refer to blood service if positive result

B. Contact nearest blood service to discuss next steps

With a severe febrile reaction such as this, the most important step is to contact the blood service.
Pooled & apheresis platelets

Pooled platelets suspended in additive solution

Reactions as a % of units issued

Year of report

2014

2015

2016

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### All incidents reported in 2016 (n=3091)

<table>
<thead>
<tr>
<th>Incident Type</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>NM: Near miss</td>
<td>0</td>
</tr>
<tr>
<td>RBRP: Right blood right patient</td>
<td>227</td>
</tr>
<tr>
<td>UCT: Unclassifiable complications of transfusion</td>
<td>9</td>
</tr>
<tr>
<td>PTP: Post-transfusion purpura</td>
<td>0</td>
</tr>
<tr>
<td>TTI: Transfusion-transmitted infection</td>
<td>1</td>
</tr>
<tr>
<td>CS: Cell salvage</td>
<td>0</td>
</tr>
<tr>
<td>ATR: Acute transfusion reaction</td>
<td>253</td>
</tr>
<tr>
<td>TAD: Transfusion-associated dysphoria</td>
<td>10</td>
</tr>
<tr>
<td>TRALI: Transfusion-related acute lung injury</td>
<td>0</td>
</tr>
<tr>
<td>TACO: Transfusion-associated circulatory overload</td>
<td>86</td>
</tr>
<tr>
<td>TA-GvHD: Transfusion-associated graft vs host disease</td>
<td>0</td>
</tr>
<tr>
<td>HTR: Haemolytic transfusion reaction</td>
<td>35</td>
</tr>
<tr>
<td>ADO: Over of under transfusion and FCS</td>
<td>731</td>
</tr>
<tr>
<td>ADU: Delayed transfusion</td>
<td>101</td>
</tr>
<tr>
<td>ADU: Avoidable transfusion</td>
<td>114</td>
</tr>
<tr>
<td>HSE: Handling and storage errors</td>
<td>192</td>
</tr>
<tr>
<td>Anti-D: Anti-D immunoglobulin errors</td>
<td>0</td>
</tr>
<tr>
<td>IBCT: Incorrect blood component transfused</td>
<td>331</td>
</tr>
</tbody>
</table>

**Unpredictable**
- NM: Near miss
- RBRP: Right blood right patient
- UCT: Unclassifiable complications of transfusion

**Possibly preventable**
- TAD: Transfusion-associated dysphoria
- TACO: Transfusion-associated circulatory overload
- ADO: Over of under transfusion and FCS
- ADU: Delayed transfusion
- ADU: Avoidable transfusion
- HSE: Handling and storage errors
- IBCT: Incorrect blood component transfused

**Errors**
- NM: Near miss
Deaths & Major morbidity

Bad news: 26 patients died where transfusion was implicated

Major morbidity n=122

Preventable deaths n=16/26 (61.5%)
Fatal TACO as a result of transfusion following spurious result

- 96 year old woman admitted with a GI bleed
- FBC sample sent to the laboratory underfilled and gave Hb result of 50 g/L
- Result telephoned to ward and authorised in the computer with a text comment “sample underfilled, result subject to error”
- No repeat sample was sent but a 6 unit crossmatch was ordered
- Three units were transfused and the post-transfusion Hb was 200 g/L
- Patient developed TACO and an emergency venesection was requested but she died the following day
Over-transfusion due to lack of monitoring of response to transfusion

- Elderly patient admitted to the Medical Admissions Unit with haematemesis and initial Hb 106 g/L
- No details provided of her observations or the findings on endoscopy but she had further episodes of vomiting blood
- Five units of red cells were transfused before a repeat Hb was performed which was 204 g/L
- The patient was recognised to have circulatory overload and died shortly afterwards
Wrong component transfused

Mother: anti-D and anti-C detected at 17 weeks gestation
Advised close follow-up with titres
Monitored in tertiary centre

Given the WRONG BLOOD
O D-pos (incompatible with maternal antibodies), should be O D-neg

Baby: induced delivery at 36 weeks in local centre: hyperbilirubinaemia, Group O D-pos
NICU staff were not aware of this baby prior to delivery; not discussed in obstetric high risk meeting

Policies not followed:
Day 3: Verbal requests for urgent blood for exchange
2 BMS did not look at maternal results so provided wrong group

The baby required repeat exchange transfusion with O D-negative on day 8
What went wrong….

• Day 3 – clinician alerted laboratory, BMS did not review maternal details and issued O+ red cells

• All requests were by telephone, handover not effective and no follow up request form received by laboratory

• On several occasions BMS did not check mothers blood group and antibody results and issued 2 O+ red cells without crossmatching against the mother’s sample

• Multiple other human factors contributed

• Kleihauer test was inappropriate due to the mothers antibody status and laboratory staff should not have issued anti-D Ig
ABO-incompatible red cell transfusions (n=3)

Patient group O+  
Donor group A+  
Wrong blood in tube  
Major morbidity  
Case 10.3

Patient group O+  
Donor group A+  
Wrong blood in tube  
Case 10.4

Patient group B+  
Donor group A+  
Collection & administration  
Major morbidity  
Case 10.5
Near miss IBCT-WCT cases n=881

- WBIT: 88.0%
- Clinical errors: 76.6%

Point in the process where a wrong blood in tube incident was detected

Poor practice
- Patient not identified: 238
- Sample not labelled: 339
- Sample not labelled by person taking blood: 13
- Sample not labelled at bedside: 7
- Prelabelled bottle: 32
- Other: 31

Overall source of near miss errors
- Laboratory errors: 300
- Clinical errors: 983

Testing 84.5%
reduction in ABO-incompatible transfusions

Good news.
be like a pilot – **use a bedside checklist** as standard of care. It will prevent administration errors and is the final opportunity to detect errors made earlier.

No amount of experience or years of practice will remove the risk of misidentification if you are interrupted or distracted.

The bedside check will not detect a wrong blood in tube incident.

(idea courtesy of Joy Murphy)
Key recommendation 2

<table>
<thead>
<tr>
<th>TACO Checklist</th>
<th>Red cell transfusion for non-bleeding patients</th>
<th>If ‘yes’ to any of these questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart</td>
<td>Does the patient have a diagnosis of ‘heart failure’ congestive cardiac failure (CCF), severe aortic stenosis, or moderate to severe left ventricular dysfunction?</td>
<td>• Review the need for transfusion (do the benefits outweigh the risks)?</td>
</tr>
<tr>
<td></td>
<td>Is the patient on a regular diuretic?</td>
<td>• Can the transfusion be safely deferred until the issue can be investigated, treated or resolved?</td>
</tr>
<tr>
<td>Lungs</td>
<td>Is the patient known to have pulmonary oedema?</td>
<td>• Consider body weight dosing for red cells (especially if low body weight)</td>
</tr>
<tr>
<td></td>
<td>Does the patient have respiratory symptoms of undiagnosed cause?</td>
<td>• Transfuse one unit (red cells) and review symptoms of anaemia</td>
</tr>
<tr>
<td></td>
<td>Is the fluid balance clinically significantly positive?</td>
<td>• Measure the fluid balance</td>
</tr>
<tr>
<td></td>
<td>Is the patient on concomitant fluids (or has been in the past 24 hours)?</td>
<td>• Consider giving a prophylactic diuretic</td>
</tr>
<tr>
<td></td>
<td>Is there any peripheral oedema?</td>
<td>• Monitor the vital signs closely, including oxygen saturation</td>
</tr>
<tr>
<td></td>
<td>Does the patient have hypoalbuminaemia?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Does the patient have significant renal impairment?</td>
<td></td>
</tr>
</tbody>
</table>

Due to the differences in adult and neonatal physiology, babies may have a different risk for TACO. Calculate the dose by weight and observe the notes above.
Recurring laboratory errors

- Failure to heed and maintain accurate patient history
- Not following procedures
- IT errors: Failure to heed warning flags
- Multiple errors
- Errors associated with IT communication and teamwork
- Distracted: Interrupted Poor knowledge and skills
• Similar errors noted across 3 exercises
  – A process of exclusion not followed where antibodies were masked
  – Antibodies excluded with inappropriate cells
  – Making positive identification with only one example of an antigen positive cell
Learning Points

Claire Whitham

• Every antibody investigation should include a systematic process for exclusion and positive identification of antibody specificities

• All reactions should be accounted for before a conclusion is reached

• Errors in antibody identification cannot be detected at the bedside
Wrong compatible component transfused: n=170

- Sampling errors: 2
- Wrong ABO/D to HSCT patient: 5
- D-mismatch: 5
- ABO non-identical: 2
- ABO-identical: 1
- Wrong component: 1
- ABO-incompatible FFP: 1
- Serological crossmatch incompatible: 1

Number of reports

- Sample receipt and registration
- Testing
- Component selection
- Component labelling
- Miscellaneous

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Selection error leads to transfusion of incompatible FFP

- 83 year old male, blood group A, required 3 units of FFP
- 3 units of group O FFP were issued and 1 unit was transfused
- Post transfusion Hb fell from 80g/l to 72g/l, bilirubin was 19µmol/L and DAT was negative
- BMS was following the SOP for platelets rather than FFP during a busy period of the day
- There was no warning flag within the LIMS to prevent ABO-incompatible plasma components

Component selection
Component labelling
Administration
**Laboratory**: In an emergency, or if the group was unclear, the safe group of FFP to give is group AB or group A (as group AB is often in short supply), but not group O. Group O FFP should be reserved for patients confirmed to be group O and is not suitable for use in the emergency setting where the blood group is unknown.

**Clinical staff**: Should have sufficient knowledge to identify if there is an ABO-incompatible component that has been issued by the laboratory during the pre-administration checks, and not assume that this is only the responsibility of the laboratory.

Change management and validation protocols must challenge the new system or equipment to ensure it is fit for purpose.
Critical points in the transfusion process

1 REQUEST

2* SAMPLE

3 SAMPLE RECEIPT

4 TESTING

5 COMPONENT SELECTION

6 LABELLING

7 COLLECTION

8 PRESCRIPTION

9* ADMINISTRATION

Critical points: Positive patient identification essential

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7.21. The compatibility tag

7.21.1. The labelling of blood components is a critical step, and all relevant information must be identified at this stage.

7.21.2. If the practitioner is unsure that the blood component issued is correct, e.g. an unexplained difference between blood groups in the donor and recipient or whether specific requirements have been met, the transfusion laboratory must be contacted and verification must be sought before starting the transfusion.

- vii. Patient ABO and D group;
- viii. Donation number;
- ix. Component type;
- x. Donor ABO and D group.
"The BMS was sick and should not have been at work, but there was no one else available to cover the night shift so they came in. Staffing levels are critically low and there is no give in the system to allow for sickness. All band 6 staff are locums, because the pay is better..."
• Collaboration of IBMS, SHOT, BBTS, NEQAS & RCPath formed in 2006
• Targeted with a 50% reduction of laboratory errors by 2012
• Identified problems with :- IT, Staff levels, Knowledge & skills
• 3 laboratory surveys 2011, 2013, 2015
  - 2014 UKTLC standards available
UKTLC 2017 Survey

Laboratory Errors

- Increasing workload
- Loss of “body of knowledge” as experienced staff leave
- Vacant posts unfilled for long periods
- Poor quality of applicants
- Increase use of BT unqualified, multidisciplinary & locum staff
- No staff available for training and keeping competencies up to date
- Educational events not well attended – further loss of knowledge
- Reduction in funding for training & development

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General comments

Quality of service is suffering due to increased numbers of very inexperienced staff and the inability to recruit anyone with BT experience.

As the technical transfusion lead I struggle to keep up with workload within my core 37.5 hours, and regularly work additional hours.

Rotation of staff due to shift systems means less continuity.

Lack of resource and support leads me to feel stressed and under considerable pressure regularly, and the only aspect that keeps me in this profession is my personal interest in the subject.

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Key SHOT Messages 2016

Laboratories should always have adequate staffing at the appropriate grade to support those that require training.

Appropriate use and management of Laboratory Information Management Systems (LIMS) are essential for patient safety.

Gap analysis should be performed against national transfusion guidelines and SOPs amended to correct deficiencies.
Conclusion

The standard of transfusion knowledge and education within laboratories is becoming a prevalent source of error.

Anecdotal evidence that there is a national shortage of qualified BMS staff applying for vacant positions and vacancies being filled with less qualified staff.

It is everyone's responsibility to ensure they complete their part of the process fully with care.
Acknowledgements

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