Annual SHOT Report
2017
Eight Types Team Dynamics – Key Skills or Attributes

- Determination
- Monitoring
- Performance
- Discipline

- Results focus
- Decisive
- Assertive

- Planning
- Organisation
- Time Management

- Listens
- Loyal
- Team Approach

- Flexible & Helps Others,
  Shares ideas

- Drive
- Enthusiasm
- Positive Thinking

- Persuasive
- Creative
- People Skills
Total components issued: 200,191
Number of reports: 330
Reports per 10,000 component issued: 16.5

Total components issued: 57,072
Number of reports: 133
Reports per 10,000 component issued: 23.3

Total components issued: 2,029,453
Number of reports: 3307
Reports per 10,000 component issued: 16.3

Total components issued: 113,017
Number of reports: 189
Reports per 10,000 component issued: 16.7
Donor incidents
Serious adverse events in donation 2017
(No events reported from Northern Ireland)

- **Arm pain >12/12 post donation**
  - NHSBT: 16
  - SNBTS: 1
  - WBS: 1

- **Fracture**
  - NHSBT: 13
  - SNBTS: 2

- **Hospital admission within 24 hours of donation**
  - NHSBT: 12
  - SNBTS: 1

- **Acute coronary syndrome**
  - NHSBT: 2

- **Donor death <7/7 of donation**
  - NHSBT: 1

- **Road traffic accident <24 hours of donation**
  - NHSBT: 1

- **Other**
  - NHSBT: 1

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NHSBT=National Health Service Blood & Transplant; SNBTS=Scottish National Blood Transfusion Service; WBS=Welsh Blood Service;
Trend in whole blood and apheresis donations in the UK 2015 to 2017

- 2015: 1,935,957 whole blood donations, 190,851 apheresis donations
- 2016: 1,901,491 whole blood donations, 103,159 apheresis donations
- 2017: 1,820,847 whole blood donations, 92,803 apheresis donations
3230 total reports

Errors 85.5%

Near miss 1359
RBRP 200
All errors

1671 incidents

Error reports 1201 (71.8%)

Pathological reactions 442 (26.5%)
Others (CS & UCT) 28 (1.7%)

RBRP = right blood right patient; CS = cell salvage; UCT = unclassifiable complications of transfusion
Nine steps: a team?
We need to work better together.

1. Request
2. Sample
3. Sample Receipt
4. Testing
5. Component Selection
6. Labelling
7. Collection
8. Prescription
9. Administration

Critical points where positive patient identification is essential.

Critical points in the Laboratory.
Transfusion process is very complex

<table>
<thead>
<tr>
<th>Step</th>
<th>Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 REQUEST</td>
<td>Midwife</td>
</tr>
<tr>
<td>2* SAMPLE</td>
<td>Phlebotomist</td>
</tr>
<tr>
<td>3 SAMPLE RECEIPT</td>
<td>Lab Admin</td>
</tr>
<tr>
<td>4 TESTING</td>
<td>Trainee</td>
</tr>
<tr>
<td>5 COMPONENT SELECTION</td>
<td>Scientist</td>
</tr>
<tr>
<td>6 LABELLING</td>
<td>Med Lab Asst</td>
</tr>
<tr>
<td>7 COLLECTION</td>
<td>Porter</td>
</tr>
<tr>
<td>8 PRESCRIPTION</td>
<td>Doctor</td>
</tr>
<tr>
<td>9* ADMINISTRATION</td>
<td>Nurse</td>
</tr>
</tbody>
</table>

* Critical points where positive patient identification is essential
Errors account for the majority of SHOT reports in 2017: 2760/3230

- Possibly preventable: 137 (4.2%)
- Not preventable: 333 (10.3%)
- Errors: 2760 (85.5%)
Cumulative data for all SHOT categories 1996 to 2017
n=19815

- UCT: Unclassifiable complications of transfusion
- PTP: Post-transfusion purpura
- TTI: Transfusion-transmitted infection
- CS: Cell salvage
- FAHR: Febrile, allergic and hypotensive reactions
- TAD: Transfusion-associated dyspnoea
- TRALI: Transfusion-related acute lung injury
- TACO: Transfusion-associated circulatory overload
- TAGvHD: Transfusion-associated graft-vs-host disease
- Allo: Alloimmunisation
- HTR: Haemolytic transfusion reactions
- ADU: Over or undertransfusion and PCC
- ADU: Delayed transfusion
- ADU: Avoidable transfusion
- HSE: Handling and storage errors
- Anti-D: Anti-D immunoglobulin errors
- IBCT: Incorrect blood component transfused

Transfusion reactions which may not be preventable
Possibly or probably preventable by improved practice and monitoring

Adverse incidents due to mistakes
Summary data for 2017 all categories ranked by number

n=3230: no change in the pattern

42.1%
The bedside check is vital in preventing transfusion error. Staff should be vigilant in checking identification details of the component against those of the patient. Every hospital should have a policy for formally checking the identity of the patient against the blood component label at the bedside. Nursing observations during transfusion also show wide variation. National guidelines for the administration and monitoring of transfusion are being developed by the British Committee for Standards in Haematology (BCSH) on behalf of the British Society for Haematology (BSH).
Errors in Transfusion Medicine

Dorothy Stainsby, FRCP, FRCPath

National Blood Service, Holland Drive, Barrack Road, Newcastle upon Tyne NE2 4NQ, UK

Analysis of incorrect blood component transfused:
Multiple errors
70% clinical area
Failure of bedside check

Serious Hazards of Transfusion:
A Decade of Hemovigilance in the UK

Dorothy Stainsby, Hilary Jones, Deborah Asher, Claire Atterbury, Aysha Boncinelli, Lisa Brant, Catherine E. Chapman, Katy Davison, Rebecca Gerrard, Alexandra Gray, Susan Knowles, Elizabeth M. Love, Clare Milkins, D. Brian L. McClelland, Derek R. Norfolk, Kate Soldan, Clare Taylor, John Revill, Lorna M. Williamson, and Hannah Cohen, on behalf of the SHOT Steering Group

Transfusion Medicine Reviews, Vol 20, No 4 (October), 2006; pp 273-282

So nothing new..
Key recommendation last year

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.

This is a rule, endorsed by the Chief Medical Officer

It is not a guideline

The bedside check **will not detect a wrong blood in tube at sampling**
2016 key recommendation 1

A checklist must be used at the patient's side as a final administration check prior to transfusion as standard of care

January 2018: 160 responses from a total of 222 organisations (72%)

- Fully implemented: 91
- Implementation in progress: 41
- Not yet implemented but planning to implement: 24
- No plans to implement: 4

Jayne Addison
2016 key recommendation 1
Whatever bedside system is currently in place (including electronic systems) it should be assessed and include a validation step where someone has to sign to say that all steps have been followed.

- **No plans to implement**
  ‘We expect that by signing the "administered by" column on the script the staff member is signing that they have done all the checks’

- **Plans in progress to include a validation step**

- **Validation step included**
  - 102

- **No plans to implement**
  - 43
What else did we learn in 2017?
Error rate varies with department
Deaths related to transfusion in 2017 n=21

HTR=haemolytic transfusion reaction; TAD=transfusion-associated dyspnoea; TACO=transfusion-associated circulatory overload
Transfusion-related deaths 2010 to 2017 n=136

HTR=Haemolytic transfusion reactions; TACO=Transfusion-associated circulatory overload; TRALI=Transfusion-related acute lung injury; TAD=Transfusion-associated dyspnoea

‘Other’ includes 1 each for transfusion-transmitted infection, post-transfusion purpura, transfusion-associated graft-versus-host disease and anti-D related; there were 5 in the avoidable, over or undertransfusion category and 7 deaths related to other unclassified reactions
Approximate risks of transfusion complications compared with other risks, UK data

- 1 in 100 million
- 1 in 10 million
- 1 in 1 million
- 1 in 100,000
- 1 in 10,000
- 1 in 1,000
- 1 in 100
- 1 in 10

- Risk of febrile allergic/hypotensive reaction
- Risk of pulmonary complications
- Smoking-related deaths
- Death from external injury
- Preventable hospital deaths
- Alcohol-related deaths
- Road deaths

- Transfusion-related deaths (by component issued)
- Death from TACO (2016)
- Transfusion-related death due to error
- Death from transfusion (ISTARE)
- Air traffic accident deaths
- Death from lightning strike
- Drowning

HCV, HIV, HBV

Sources of data: Many of these are found online in the UK office for national statistics. Red outline indicates SHOT data, blue outline indicates data from other sources. ISTARE is the International Haemovigilance Network database for the surveillance of adverse reactions and events in donor and recipients. Viral transmissions denote risk of infection, not deaths. HCV=hepatitis C virus; HIV=human immunodeficiency virus; HBV=hepatitis B virus. A full list of sources is available in supplementary information on the SHOT website www.shot.uk.org.
Transfusion-associated graft-v-host disease

- Total patients who have missed irradiated components since 1999 is 1397
- Estimated risks for red cell units exceeding
  - >5x10^6 leucocytes/unit is 1:1000
  - >1x10^6 leucocytes/unit is 1:200
- 30-35 million components transfused
- One patient with a history of Hodgkin lymphoma had received 486 non-irradiated components

IUT=intruterine transfusion.
Key SHOT messages

Do not assume, verify: At each step in the transfusion process, do not assume that no errors have been made in previous steps; verify each step, particularly patient identification.

Human factors: Failure of communication, distractions, interruptions, wrong assumptions, poor handovers and overriding alerts in the laboratory information systems are all important contributory factors.
Key SHOT messages

Do not assume, verify: At each step in the transfusion process, do not assume that no errors have been made in previous steps; verify each step, particularly patient identification.

Human factors: Failure of communication, distractions, interruptions, wrong assumptions, poor handovers and overriding alerts in the laboratory information systems are all important contributory factors.

What went wrong? Thorough root cause analyses are essential and must identify attributable system-related and human factors so that appropriate actions can be instituted.

Is your staffing adequate? Inadequate staffing, lack of training and poor supervision are all likely to be associated with an increased risk of error.
Teamwork

• Team accountability reinforces the message that safety is not an individual responsibility

Guy Hirst, former BA pilot SHOT symposium 2014
Key SHOT messages

Do not delay: Emergency transfusion saves lives. Do not let the patient bleed to death or die from anaemia.

Guidelines or rules? Guidelines must not be translated into inflexible rules which may put patients at risk. Proportionate application of knowledge and experience may lead to a different course of action in individual circumstances. However, the final bedside check is a rule and must be completed in full.

TACO alert: Patients who develop respiratory distress during or up to 24 hours after transfusion where transfusion is suspected to be the cause must be reported to SHOT. The national comparative audit of TACO in 2017 demonstrated that risk factors are being missed.

It is the clinician’s responsibility to know the patient’s specific transfusion requirements.
Laboratory incidents
Out-of-date LIMS and a manual interpretation error leads to two different blood groups being reported on a patient’s record

• A new patient was grouped on two separate occasions

• Manual interpretation of the results was performed by the BMS

• The first result recorded was interpreted as A D-positive and the second result was interpreted as B D-positive

• Group O compatible red cells were issued, and one unit was transfused before the error was noted by a second BMS

• The laboratory used an out-of-date LIMS which added complication to authorising results and allowed two different blood groups to be reported on the same patient
Non-irradiated platelet units issued to a <10-year-old patient despite a warning flag, 3 errors (1)

• A BMS issued two bags of platelets for a patient who required irradiated cellular components

• This specific patient requirement was recorded on the LIMS. BMS 2 was covering for a break during a night shift, and receipted the platelets on arrival from the Blood Service

• When BMS 1 returned from their break, they received a handover message that the platelets had been placed on the agitator but required irradiation

• This message was taken verbally but not written down

• It is usual practice at this hospital for all platelets to be irradiated on arrival from the Blood Service and then placed on the agitator, however in this instance that did not happen
Non-irradiated platelet units issued to a <10-year-old patient despite a warning flag, 3 errors (2)

- The shift ended and day staff arrived
- BMS 3 issued the platelets assuming they had been irradiated
- A message flagged up that they had not been irradiated but was overridden
- At administration BloodTrack® was used but it did not pick up the need for irradiated platelets, and it was not picked up by the registered nurse administering them and so the patient received the transfusion
- The error was noticed during the bedside check for the second unit
- The unit was returned to the laboratory and an incident form completed
Laboratory errors (n=409) showing at which stage the error occurred and the outcome

- Sample receipt and registration: 7 WCT, 18 SRNM, 18 HSE, 6 RBRP, 2 Avoidable, 24 Anti-D Ig
- Testing: 10 WCT, 63 SRNM, 8 Avoidable, 9 HSE, 19 RBRP
- Component selection: 24 WCT, 21 SRNM, 8 Avoidable
- Component labelling: 72 WCT, 58 SRNM, 12 HSE, 6 RBRP
- Collection: 3 WCT, 2 SRNM
- Miscellaneous: 3 WCT, 5 SRNM

WCT = wrong component transfused; SRNM = specific requirements not met; HSE = handling and storage errors; RBRP = right blood right patient; Ig = immunoglobulin
Incorrect blood components transfused
Incorrect blood component transfused n=307 (100%)

Clinical: 149 (48.5%)
Laboratory: 158 (51.5%)

Wrong component transfused n=82
Clinical: 35 (42.7%)
Laboratory: 47 (57.3%)

Specific requirements not met n=225
Clinical: 114 (50.7%)
Laboratory: 111 (49.3%)
A patient with sickle cell disease received an incorrectly phenotyped component following an error from the Blood Service

- A unit of red cells was requested from the Blood Service for a patient with sickle cell disease

- The Blood Service crossmatched the unit but it was not matched for Rh and K. The red cell units should be sickle-negative (HbS-), matched for both Rh and K, and <10-days old

- The receiving transfusion laboratory failed to identify this omission and made the unit available for the patient

- The patient subsequently developed anti-C: should have received red cells negative for the antigens C, E and S that were also HbS-negative as recommended by the Blood Service expert laboratory report
ABO-incompatible transfusions compared to near miss 2016 and 2017

4 ABO-incompatible red cell transfusions

606 ABO-incompatible near miss events
Reduction in ABO-incompatible red cell transfusions that resulted in serious outcomes in 2 decades of reporting

Note that 66% of ABO-incompatible red cell transfusions are not associated with serious harm and are not shown here.

![Bar chart showing reduction in ABO-incompatible red cell transfusions](chart.png)
Transfusion of ABO-incompatible components 2017

(Unintentional)

**FFP n=4**

- Patient group A+ Donor group O+
  - Sample receipt and registration
  - Case 10.8

- Patient group A+ Donor group O+
  - Testing

- Patient group B+ Donor group O+
  - Component selection
  - Case 10.5

- Patient group A+ Donor group O+
  - Component selection

**Platelets n=2**

- Patient group B+ Donor group A-
  - WBIT
  - Case 10.3

- Patient group A Donor group O
  - Component selection
  - Case 10.4

- Patient group O+ Donor group A+
  - Administration
  - Case 10.2

**Red cells n=1**

*WBIT=wrong blood in tube*
Failure to complete the administration check at the bedside correctly leads to an ABO-incompatible red cell transfusion

- Two units of red cells were issued for Patient 1
- A healthcare assistant collected the correct unit and took this to the correct ward and handed it to the nurse looking after Patient 1
- Two nurses then checked the component against the prescription in the clinical utility room and not next to the patient
- The nurse who was to administer the blood then went to the wrong side room and administered the blood (donation group A D-positive) to Patient 2 (group O D-positive)
- Within 5-10 minutes the patient complained of lumbar pain, a general feeling of being unwell, a hot sensation on his back, and had developed tachycardia
- Transfusion was stopped and the clinical team informed
- The patient stabilised and recovered with minimal medical intervention
Duplicate samples lead to unintentional ABO-incompatible platelet transfusion because of a wrong blood in tube error

- A male patient post chemotherapy for a brain tumour was admitted via the emergency department with a fever but no obvious focus for infection
- Two samples were obtained from the patient in the medical admissions unit and received in the transfusion laboratory from the same person but different times documented, both grouped as A D-negative
- Platelets were issued based on these two results
- Seven weeks later a new request form and sample were received for this patient, which grouped as B D-positive
- Due to the discrepancy in the group history a full blood count sample taken 3 days earlier was tested which grouped as B D-positive
- The duplicate samples from the original admission were from a different patient, i.e. WBIT, and led to the issue and subsequent transfusion of incompatible platelets; group A D-negative to a group B D-positive patient
- The patient had no adverse outcome
A patient whose blood group was B was transfused with group O FFP resulting from poor communication during handover

- A patient received multiple transfusions of red cells, FFP and platelets for recurring gastrointestinal bleeding in the presence of liver disease
- The patient had been grouped as O due to the presence of donor red cells in the test samples (the patient’s actual blood group was B)
- Several messages had been handwritten on a single sticky note by a junior member of laboratory staff undergoing transfusion training
- During handover these messages were misinterpreted and in addition, no formal request form for FFP had been received from the clinical area
- Unused, pre-thawed group O FFP prepared for an earlier patient was issued knowingly against national guidelines as the BMS thought that concessionary release had been approved
- The LIMS allowed major ABO mismatches for plasma components although it did display a warning flag that was overridden
- The patient was transfused the incompatible FFP (no adverse outcome)
Key recommendation 1

- Training in ABO and D blood group principles is essential for all laboratory and clinical staff with any responsibility for the transfusion process. This should form part of the competency assessments.

Action: Hospital Chief Executives and Medical Directors, National Blood Transfusion Committee, Hospital Transfusion Teams

Key recommendation 2

- All available information technology (IT) systems to support transfusion practice should be considered and these systems implemented to their full functionality. Electronic blood management systems should be considered in all clinical settings where transfusion takes place. This is no longer an innovative approach to safe transfusion practice, it is the standard that all should aim for.

Action: Hospital Chief Executives, Hospital Risk Managers and Hospital Transfusion Teams
Nine steps in the transfusion process

1. Request
2. Sample Taking
3. Sample Receipt
4. Testing
5. Component Selection
6. Component Labelling
7. Component Collection
8. Prescription
9. Administration

Critical points where positive patient identification is essential

Critical points in the laboratory

Note: Once a decision to transfuse is made, the authorisation or prescription may be written at variable times during this sequence, but must be checked during the final stage.
Point in the process where the first mistake occurred leading to wrong component transfusion (WCT) or specific requirements not met (SRNM)

Laboratory steps

- Sample receipt
  - WCT: 7
  - SRNM: 18
- Testing
  - WCT: 10
  - SRNM: 63
- Component selection
  - WCT: 24
  - SRNM: 21
- Component labelling
  - WCT: 1
  - SRNM: 0
- Collection
  - WCT: 26
- Prescription
  - WCT: 2
  - SRNM: 0
- Administration
  - WCT: 5
  - SRNM: 1
- Miscellaneous
  - WCT: 5
  - SRNM: 10
Clinical errors leading to specific requirements not being met n=114

HEV=hepatitis E virus; CMV=cytomegalovirus
Laboratory errors resulting in wrong component transfused n=47

- ABO-incompatible platelets: 1
- ABO non-identical: 2
- Wrong patient: 1
- Wrong component: 11
  - Sample receipt and registration: 3
  - Testing: 6
  - Component selection: 2
  - Collection: 1
- ABO-incompatible FFP: 2
- D-mismatch: 6
  - Sample receipt and registration: 2
  - Testing: 4
  - Component selection: 1
- Wrong ABO/D to HSCT patient: 5
  - Sample receipt and registration: 1
  - Testing: 4
  - Component selection: 1

FFP=fresh frozen plasma; HSCT=haemopoietic stem cell transplant
Laboratory errors leading to specific requirements not being met \( n=111 \)

- Blood warmer
- Washed platelets
- K-negative
- HEV-screened
- Incorrect phenotype
- Methylene-blue treated
- Irradiated
- HLA-matched
- CMV-screened
- Apheresis platelets
- Sampling errors

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

HEV = hepatitis E virus; HLA = human leucocyte antigen; CMV = cytomegalovirus
Most ‘near miss’ incorrect blood component transfused were wrong blood in tube errors

- Request errors: 2
- Laboratory errors: 59
- Collection: 18
- Administration: 31
- Wrong blood in tube (WBIT): 789

87.8% WBIT
Comparison of near miss and actual wrong blood in tube errors leading to incorrect blood components transfused

![Bar chart showing comparison of near miss and actual wrong blood in tube (WBiT) errors leading to incorrect blood component transfusion (IBCT) over the years from 2010 to 2017. The chart indicates a steady increase in near miss WBIT errors, with a peak in 2017 at 789 cases. The number of WBIT leading to IBCT remains relatively low, with a peak of 3 in 2011 and 2015.]
Point in the process where a wrong blood in tube incident was detected

This is why the group-check sample is so important
Delayed transfusion reports by year 2010-2017

- 2010: 2
- 2011: 12
- 2012: 21
- 2013: 34
- 2014: 50
- 2015: 94
- 2016: 101
- 2017: 95
Delayed transfusions 2017: urgency and location

Urgency of delayed transfusions n=95

- Urgent or emergency: 56
- Routine: 23
- Unknown: 16

Location of emergency and urgent transfusions n=56

- Theatres and ITU: 28
- Ward: 11
- ED/MAU: 11
- Obstetrics: 4
- Unknown: 2

ED=emergency department; MAU=medical admissions unit; ITU=intensive therapy unit (all types)
Potential hold-up points in the transfusion pathway

1. Recognition of bleeding
   - Haemorrhage call

2. Communication between clinical area and laboratory
   - Laboratory – grouping, antibody screen, prepares and issues components
   - Components received and transfused – poor venous access

3. Blood samples to laboratory
   - Logistics: Porter availability, Distance

4. Transport of components to patient
   - Logistics: Porter availability, Distance
Anti-D immunoglobulin and sensitisation
Anti-D immunoglobulin errors in 2017 n=426

- Omission or late administration of anti-D Ig: 327
- Wrong dose of anti-D Ig given: 23
- Anti-D Ig given to a woman with immune anti-D: 23
- Anti-D Ig given to the mother of a D-negative infant: 16
- Anti-D Ig given to a D-positive woman: 14
- Anti-D Ig given to the wrong woman: 12
- Anti-D Ig handling and storage errors: 7
- Unnecessary administration of anti-D Ig: 2
- Right product right patient: 2
Location of anti-D immunoglobulin errors n=426

- Hospital: 330 (77.4%)
- Community: 80 (18.8%)
- Other: 11 (2.6%)
- Multiple: 5 (1.2%)
Staff group responsible for primary error by category

- Unnecessary administration of anti-D Ig
- Right product right patient
- Anti-D Ig handling and storage errors
- Wrong dose of anti-D Ig given
- Anti-D Ig given to wrong woman
- Anti-D Ig given to mother of a D-negative infant
- Anti-D Ig given to a woman with immune anti-D
- Anti-D Ig given to a D-positive woman
- Omission/late administration of anti-D Ig

Total:
- Nurse/midwife: 240
- Laboratory: 16
- Doctor: 38
- Other/unknown: 33

284 total events.
Number of reports of anti-D immunisation in pregnancy

Addition of online reporting form in 2017

Jane Keidan

Emerging questions for anti-D Ig:
- Do obese women need higher doses?
- Are extra doses needed for pregnancies that go beyond term?
Serious adverse reactions

Note change in name of category from acute transfusion reactions (ATR) to febrile and allergic or hypotensive reactions (FAHR)

Acute transfusion reactions are any that occur in the first 24 hours, and are not confined to FAHR
Pulmonary complications
Reports of pulmonary complications by year 2010-2017

TRALI=transfusion-related acute lung injury; TACO=transfusion-associated circulatory overload; TAD=transfusion-associated dyspnoea
Number of suspected TRALI cases and deaths at least possibly related to TRALI by year of report

TRALI = transfusion-related acute lung injury
TACO risk assessment remains a Key Recommendation

<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></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></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>
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<tr>
<td></td>
<td>Does the patient have significant renal impairment?</td>
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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.
Acute or worsening respiratory compromise during or up to 12 hours after transfusion and should exhibit two or more of the criteria below:

1. Evidence of acute or worsening pulmonary oedema based on:
   1. clinical physical examination, and/or
   2. radiographic chest imaging and/or other non-invasive assessment of cardiac function

2. Evidence for cardiovascular system changes not explained by the patient’s underlying medical condition, including tachycardia, hypertension, jugular venous distension, enlarged cardiac silhouette and/or peripheral oedema

3. Evidence of fluid overload including any of the following: a positive fluid balance; response to diuretic therapy combined with clinical improvement; and change in the patient’s weight in the peri-transfusion period

4. Elevation in B type natriuretic peptide (NP) levels (e.g., BNP or NT-pro BNP) to greater than 1.5 times the pre-transfusion value. A normal post-transfusion NP level is not consistent with a diagnosis of TACO; serial testing in the peri-transfusion period may be helpful in identifying TACO.
Recommendation

• A formal pre-transfusion risk assessment for transfusion-associated circulatory overload (TACO) should be undertaken whenever possible, as TACO is the most commonly reported cause of transfusion-related mortality and major morbidity

Action: All staff authorising transfusion

National Comparative Audit TACO (2017)

20.5% (502/2449) inpatients had a TACO risk assessment performed

• Include a formal pre-transfusion risk assessment for TACO in hospital transfusion policies. The example given in the 2016 SHOT report (SHOT, 2017) is reproduced in Appendix A.

• We recommend the use of a checklist highlighting the following risk factors
  ✓ Age >50 years
  ✓ Congestive cardiac failure, left ventricular failure or aortic stenosis
  ✓ Chronic kidney disease
  ✓ Liver dysfunction
  ✓ Peripheral oedema
  ✓ Prescription of concomitant IV fluids
  ✓ Pulmonary oedema
  ✓ Undiagnosed respiratory symptoms
  ✓ Use of regular diuretics
  ✓ Weight <50kg
Recommendation

- Use weight-adjusted red cell dosing to guide the appropriate number of units required for all non-bleeding adult patients, ideally using tools which also highlight inappropriate transfusion (Grey et al. 2018)

Action: All staff authorising transfusion

National Comparative Audit TACO (2017)

- Weigh all patients prior to transfusion (or record an estimated weight if the clinical situation does not allow an accurate weight to be measured). We recommend all patients are weighed no later than 7 days prior to the transfusion.

- In patients at risk of TACO
  - Monitor fluid balance
  - Prescribe one unit at a time and consider prescribing according to body weight
  - Transfuse at a slower rate
  - Consider use of a prophylactic diuretic
  - Monitor the observations closely, including oxygen saturations
  - Review the patient following each unit
Febrile and allergic reactions: targeted treatment

**Key SHOT messages**

- For febrile reactions alone, give paracetamol.
- For allergic reactions give an antihistamine as first line; give adrenaline if anaphylaxis is suspected. The effect of steroids is delayed by several hours, will have no immediate effect, and should only be used to prevent a late recurrence. The use of steroids may further immunosuppress already immunocompromised patients and increase the risk of side effects such as infection.

<table>
<thead>
<tr>
<th>Reaction</th>
<th>Treatment</th>
<th>Prevention of recurrent reactions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Febrile</td>
<td>Paracetamol</td>
<td>Paracetamol 60 minutes before anticipated time of reaction</td>
</tr>
</tbody>
</table>
| Allergic   | Antihistamine (steroid should not be used routinely) | If previous reaction with apheresis platelets try pooled platelets in PAS  
If reactions continue, give pre-transfusion antihistamine  
If reactions continue, consider washed platelets/red cells; for fresh frozen plasma (FFP) try a pooled component e.g. solvent-detergent treated plasma |
|            | If anaphylaxis, adrenaline is essential        |                                                                                                  |
Percentage of reactions to apheresis and pooled platelets 2014 to 2017

Febrile reactions are more common with pooled platelets

Allergic reactions have decreased since pooled platelets were suspended in platelet additive solution
Outcome of reports of suspected transfusion-transmitted infection

114 reports for investigation

106 suspected bacterial incidents investigated

- 89 concluded post transfusion reactions with no evidence of bacteria on investigation
- 9 concluded NOT bacterial TTI
- 7 concluded indeterminate bacterial incidents**

8 suspected viral incidents reported and investigated

- 1 concluded POSSIBLE bacterial TTI

- 5 concluded NOT viral TTI (2 CMV, 3 HCV)
- 1 concluded PROBABLE viral TTI (1 HEV)
- 2 concluded viral TTI (1 HAV, 1 HEV)
Antibodies implicated in delayed haemolytic transfusion reactions 2013-2017

- **Jk$$^a$$**: 32 cases
- **Mixture incl Jk$$^a$$ or Jk$$^b$$**: 10 cases
- **C**: 9 cases
- **Mixture**: 8 cases
- **Jk$$^b$$**: 8 cases
- **Fy$$^a$$**: 5 cases
- **E**: 5 cases
- **M**: 4 cases
- **C**: 3 cases
- **S**: 2 cases
- **Fy$$^b$$**: 2 cases
- **U**: 1 case
- **A**: 1 case
- **S**: 1 case
Cumulative data for sickle cell disease 2010-2017 n=193

- HTR: 74 cases (35.8%)
- SRNM: 69 cases (38.3%)
- FAHR: 28 cases (14.5%)
- ADU: 11 cases (5.7%)
- IBCT: 7 cases (3.6%)
- TACS: 2 cases (1.0%)
- TAD: 1 case (0.5%)
- TTI: 1 case (0.5%)

FAHR=febrile, allergic or hypotensive reactions; ADU=avoidable, delayed or under or overtransfusion; IBCT=incorrect blood component transfused; SRNM=specific requirements not met; TACO=transfusion-associated circulatory overload; TAD=transfusion-associated dyspnoea; HTR=haemolytic transfusion reactions; TTI=transfusion-transmitted infection
Paediatrics

Key SHOT messages

- Over and undertransfusion, largely due to mistakes in prescribing on a weight-basis, was a significant problem, with 13/19 (68.4%) of overtransfusion cases in paediatrics; this reflects the complexity of paediatric prescribing.

- In 6 cases adult emergency O D-negative units were given to neonates, an area for hospital focus in developing strategies to help staff correctly identify the age-specific emergency units.

- Most handling and storage errors (HSE) resulted from technical administration problems (12/16), including using incorrect pump settings; vigilance is required in the paediatric setting where pumps are so often used.

- There were 2 confirmed paediatric reports of transfusion-related acute lung injury (TRALI) and 1 of transfusion-associated circulatory overload (TACO); it is important for these pulmonary complications to be considered in neonates and paediatrics as in older patients.
Identify your neonatal emergency group O D-negative units

With permission from Rachel Moss
Summary of paediatric reports by category and age 2017

- Incorrect blood component transfused (IBCT): 41
  - ≤28 days: 15
  - >28 days to <1 year: 8
  - 1 to <16 years: 14
  - 16 to <18 years: 4

- Avoidable, delayed or undertransfusion (ADU): 31
  - ≤28 days: 11
  - >28 days to <1 year: 6
  - 1 to <16 years: 14
  - 16 to <18 years: 2

- Febrile, allergic and hypotensive reactions (FAHR): 36
  - ≤28 days: 2
  - >28 days to <1 year: 29
  - 1 to <16 years: 4
  - 16 to <18 years: 1

- Anti-D immunoglobulin errors (Anti-D Ig): 7

- Handling and storage errors (HSE): 16
  - ≤28 days: 2
  - >28 days to <1 year: 5
  - 1 to <16 years: 7
  - 16 to <18 years: 2

- Haemolytic transfusion reactions (HTR): 1

- Transfusion-related acute lung injury (TRALI): 2

- Transfusion-associated circulatory overload (TACO): 1

- Transfusion-associated dyspnoea (TAD): 1

- Unclassifiable complications of transfusion (UCT): 3
  - ≤28 days: 1
  - >28 days to <1 year: 2
  - 1 to <16 years: 3
  - 16 to <18 years: 1
Recommendation

- Clinical staff who prescribe blood for paediatric patients should not do so unless they have been given training in weight-based prescribing of blood components. Additional resources that can support best practice include the ‘Bookmarks’ and ‘Blood Component App’ with key information from the British Society for Haematology (BSH) paediatric transfusion guidelines (New et al, 2016; see SHOT website https://www.shotuk.org/resources/current-resources/)

Action: Hospital Transfusion Teams, Hospital Paediatricians, Royal College of Paediatrics and Child Health
EU reports for 2017 (MHRA)

Human errors are responsible for most reports

The inspectors have picked up poor practice and will increase inspections in 2018 with short notice
Serious adverse event reports to MHRA 2017

- Apheresis collection: 1
- Storage/HSE: 1
- Distribution/HSE: 8
- Testing of donations: 12
- Processing: 16
- Other: 26
- Whole blood collection: 41 (3)
SABRE reports, human error 2017

Do it right first time, each step

- Inadequate supervision: 9
- Lapsed/no training: 25
- Incorrect procedure: 40
- Inadequate training: 46
- Inadequate QMS—staffing and workload: 80
- Ineffective training: 119
- Inadequate process: 211
- Procedural steps omitted/wrong procedure performed: 237
- Procedure performed incorrectly: 291

QMS=quality management system
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