Pulmonary complications in the Elderly

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What does SHOT do?

- Serious Hazards of Transfusion
- Collect data on serious adverse reactions and events related to transfusion
- Data reviewed by transfusion experts to produce Annual SHOT Report
- Participation is professionally mandated
 - a requirement of quality, inspection and accreditation organisations
- Small core team based in Manchester





RBRP=right blood right patient; CS=cell salvage; UCT=unclassifiable complications of transfusion



Errors account for the majority of SHOT reports in 2017: 2760/3230



Cumulative data for all SHOT categories 1996 to 2017 n=19815



Pars Serious Hazards of Transfusion SHOT

Summary data for 2017 all categories ranked by number n=3230: no change in the pattern





Definitions



Acute transfusion reactions

- Adverse symptoms occurring within 24 hours of transfusion
 - Febrile, allergic, hypotensive reactions
 - Acute haemolytic reactions
 - Bacterial infection
 - **Pulmonary complications** usually within 6 hours
 - TACO
 - TRALI
 - TAD



Transfusion-related acute lung injury

- Acute dysphoea with hypoxia and bilateral pulmonary infiltrates during or within 6 hours of transfusion in the absence of circulatory overload or other likely causes, or in the presence of HLA or HNA antibodies cognate with the recipient
- Currently international discussion and likely change in definition 2019



Transfusion-associated dyspnoea

- TAD is characterised by respiratory distress within 24h of transfusion that does not meet the criteria for TRALI or TACO or allergic reaction.
- Respiratory distress is not adequately explained by the patient's underlying condition



Transfusion-associated circulatory overload

Any 4 of the following within 6 hours of transfusion

- Acute respiratory distress
- Tachycardia
- Increased blood pressure
- Acute or worsening pulmonary oedema
- Evidence of positive fluid balance

ISBT 2011 – undergoing revision



2017 Draft TACO Surveillance Criteria

Acute or worsening respiratory compromise during or up to 12 hours after transfusion and should exhibit <u>two or more</u> 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 pretransfusion value. A normal post-transfusion NP level is not consistent with a diagnosis of TACO; serial testing in the peritransfusion period may be helpful in identifying TACO.









Essential/additional criteria Number present



SERIOUS HAZARDS OF TRANSFUSION

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 data 2014-2016 n=265





Age range: TACO vs other Serious Adverse Reactions (SAR) in 2017





Case examples



Equivocal TRALI

- A woman in her 60s on prolonged ventilation following oesophageal surgery complicated by a perforated oesophagus and splenic rupture was also recovering from postoperative sepsis
- She developed increased oxygen requirements and deterioration in the CXR following transfusion of two units of red cells. There was pre-existing pulmonary oedema on a CXR prior to the transfusion, but this was worse after transfusion and a CT scan showed patchy ground-glass shadowing within the lung fields in keeping with acute respiratory distress syndrome (ARDS)
- Investigation showed that both red cell donors had HLA class 1-specific antibodies, in particular to HLA-A2. The patient also had the cognate HLA-A2 antigen
- 'Equivocal TRALI' it is practically impossible to assign causation retrospectively in the presence of pre-existing lung injury, infection and fluid overload but the presence of cognate antibodies in both donors raises the possibility of TRALI as a causative or contributory factor



Probable TRALI

- A female teenager developed acute respiratory deterioration, hypoxia and bilateral patchy air space shadowing 4 hours after transfusion of red cells. The transfusion was given for anaemia 2 days after a liver transplant. She had a positive fluid balance and impaired renal and cardiac function although these had not caused functional compromise. She required ventilation but made a complete recovery
- The red cell donor had HNA-1a antibodies which were cognate with the recipient
- The case was classified as 'probable TRALI' in view of the positive serology and the treating clinician's impression that fluid overload was unlikely, however the patient also had coexisting risk factors for fluid overload which therefore cannot be ruled out



TACO: What should have happened?

- 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



TACO: Over-transfusion due to lack of monitoring of response to transfusion

- Elderly patient admitted to the MAU 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



TACO: inappropriate management of iron deficiency

- 82 yr old woman with chronic iron deficiency, Hb 45 g/L
- Transfused 4 units, each over 2.5h
- Developed TACO with tachycardia, hypertension, short of breath etc.
- Intubation, ventilation 2d
- Full recovery



Day case transfusion – what are the risks?

• A 78 year old woman with myeloma, wt 56 kg, was transfused 3 units of red cells as a day case

What are risk factors for TACO?

- Renal impairment, hypoalbuminaemia, age ≥70 years, low bodyweight
- She developed fluid overload and pulmonary oedema with hypertension and hypoxia before the end of the third unit. She initially responded to diuretic and was sent home by a junior doctor

Comments?

- She was unable to lie flat all night because of shortness of breath
- She was readmitted, to the HDU, within 24 hours with pulmonary oedema and myocardial infarction



TAD? (Transfer from TRALI)

- A woman in her 60s received a blood transfusion without complications following coronary artery bypass surgery and observations were stable during transfusion. She had diabetes and known ischaemic heart disease.
- She developed rigors (but no measurable increase in temperature) after blood transfusion with a tachycardia of 199/min, BP 175/77 and decreased oxygen saturation.
- The CXR showed bilateral alveolar infiltration, and she was readmitted to intensive care shivering and shaking uncontrollably. IV fluid and antibiotics were started.
- This was thought to be TRALI because of acute hypoxia and bilateral infiltrates seen on CXR after one unit of blood with normal echo and no suggestion of fluid overload. A Blood Centre was informed but no TRALI investigations were suggested.



TAD

- A woman in her 90s received regular red cell transfusions for myeloproliferative disease
- She had community-acquired pneumonia with acute kidney injury. She was already very frail, and was drowsy on admission with Hb 59g/L
- The RR was 25-26/min, O2 sats 94-95% on 2L of oxygen. BP 110/60mmHg and tachycardia 100-105/min
- At the end of the second unit the respiratory rate increased to 30/min with a fall in O2 sat to 76% but no significant change in BP or pulse
- She was reviewed by the doctor who reported peripheral oedema and raised JVP
- Furosemide treatment did not give any benefit. She died the following day and transfusion was considered as a possible contributing factor.



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



Recommendation 2016 and 2017

- A formal pre-transfusion risk assessment for transfusion-associated circulatory overload (TACO) should be performed whenever possible as TACO is the most commonly reported cause of death and major morbidity
- Use weight-adjusted red cell dosing to guide the appropriate number of units required for all nonbleeding adult patients



TACO risk assessment remains a Key Recommendation

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

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.



TACO Audit March & April 2017





9%

of inpatients were transferred between teams between the decision to transfuse and completion of transfusion, which may increase the risk of TACO.



Assessing risk of TACO



89%

(2195/2461)

of inpatients had at least one additional risk factor for TACO, apart from age

| | | Hypoalbuminaemia | 52% | (1283/2461) |
|---|--------------------------|------------------------|-----|-------------|
| 3 | most common risk factors | Concomitant IV fluids | 39% | (949/2461) |
| | | Positive fluid balance | 35% | (286/808) |

http://hospital.blood.co.uk/audits/national-comparative-audit/medical-audits/2017-transfusion-associated-circulatory-overload-audit/



Only **11%** of inpatients who had at least one additional risk factor documented by auditor had risk of TACO documented in notes (21/189)





of inpatients were weighed within a week prior to transfusion

of inpatients weighed, weighed less than 50kg

Only **23%** (490/2119)

(151/1513)

of outpatients were weighed within a week prior to transfusion



of outpatients were seen by the person 'prescribing' the blood in the week before transfusion



Fluid balance prior to transfusion





of inpatients with a fluid balance recorded, were more than 1000ml positive prior to the transfusion



Key Recommendations

Pre-transfusion

Use a formal pre-transfusion risk assessment for TACO e.g. SHOT example



Include risk of TACO in discussion of risks and benefits of transfusion with patient, and document consent clearly in the notes

Weigh all patients prior to transfusion, or record estimated weight if patient cannot be weighed. This needs to be a recent weight, we recommend patients are weighed within 1 week prior to transfusion.

Document the weight on the transfusion prescription form, or electronic prescribing system.

The person authorising the blood must review the patient, we recommend this is within the week prior to transfusion if the patient is an outpatient, or within 24 hours if the patient is an inpatient.

We recommend using a transfusion authorisation checklist that includes: documenting the risks and benefits of transfusion, including TACO; any discussion with the patient; and consent.



Diagnosis and treatment of TACO



Educate transfusion and clinical teams that respiratory distress, hypoxia or raised respiratory rate within 24 hours of transfusion may be a sign of TACO.

Inform patients they should seek medical attention if they experience breathlessness within 24 hours of having a blood transfusion.

Any patient developing respiratory distress during or within 24 hours of transfusion needs prompt clinical assessment and treatment. Including:

- Stopping or slowing the transfusion
- Chest X-ray
- Considering a trial of diuresis
- Early involvement of intensive care or outreach team if patient does not respond

Patients who have had an episode of TACO are at high risk of further events and patients should be highlighted as high risk prior to any future transfusions



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

| Reaction | Treatment | Prevention of recurrent reactions |
|----------|--|---|
| Febrile | Paracetamol | Paracetamol 60 minutes before anticipated time of reaction |
| Allergic | Antihistamine (steroid should not be used routinely) If anaphylaxis, adrenaline is essential | 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 |



The transfusion process is very complex





Additional Information

Following documents available on website

- Teaching slide set
- SHOT cases
- SHOT reporting definitions
- SHOT Bites



Also available: Previous SHOT reports SHOT summaries

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SHOT

www.shotuk.org

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