Pulmonary complications
TACO recognition and risks

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Medical Director
Serious Hazards of Transfusion
Overview

3091 total reports

Errors 87.0%

- Near miss: 1283
- RBRP: 227
- All errors: 1178 (74.5%)

1581 incidents

- Pathological reactions: 385 (24.4%)
- Others (CS & UCT): 18 (1.1%)

96 pulmonary complications (24.9%)

Debbi Poles
Data analyst
All incidents reported in 2016 n=3091

- **NM: Near miss**
  - 227

- **RBRP: Right blood right patient**
  - 1283

- **Errors**
  - 1178

- **Possibly preventable**
  - 121

- **Unpredictable**
  - 282

- **Errors**
  - 1178
Deaths and major morbidity 2016
Major morbidity for incidents reported in 2016

<table>
<thead>
<tr>
<th>Condition</th>
<th>Number of Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATR</td>
<td>76</td>
</tr>
<tr>
<td>TACO</td>
<td>18</td>
</tr>
<tr>
<td>IBCT</td>
<td>8</td>
</tr>
<tr>
<td>HTR</td>
<td>7</td>
</tr>
<tr>
<td>TAD</td>
<td>6</td>
</tr>
<tr>
<td>CS</td>
<td>2</td>
</tr>
<tr>
<td>Anti-D</td>
<td>2</td>
</tr>
<tr>
<td>UCT</td>
<td>1</td>
</tr>
<tr>
<td>Delays</td>
<td>1</td>
</tr>
<tr>
<td>TTI</td>
<td>1</td>
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</tbody>
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ATR: acute allergic/febrile reactions; IBCT: incorrect blood component transfused; HTR: haemolytic transfusion reaction; CS: cell salvage; UCT: uncategorised complications of transfusion; TTI: transfusion-transmitted infection
Bad news: 26 patients died where transfusion was implicated

(Granulocyte transfusion)

Preventable deaths n=16/26 (61.5%)

6/16 (37.5%)
Transfusion-related deaths 2010 to 2016
n=115

Delays 21.7% of deaths

Pulmonary complications 53.1%

TTI 1
TA-GvHD 1
UCT 7
PTP 1
HTR 8
ATR 5
Anti-D 1
Avoidable 3
Delay 25
ABO-incompatible 2

Pulmonary complications 61

53 TACO
3 TAD
5 TRALI
The changing pattern of respiratory complications

Year of report

Number of reports

- TRALI
- TACO
- TAD
Number of suspected TRALI cases and deaths at least possibly related to TRALI using revised criteria

Tom Latham

![Bar chart showing the number of suspected TRALI cases and deaths from 2003 to 2016.](chart.png)
TACO data 2014-2016 n=265

74% are over 60 years of age

Remaining TACO cases
Major morbidity
Death

Number of reports

0-10 11-20 21-30 31-40 41-50 51-60 61-70 71-80 81-90 91+

Age
What clinical features suggest a patient is reacting adversely to a transfusion?

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Signs</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Fever, chills, rigors</td>
<td>• Change in temperature</td>
</tr>
<tr>
<td>• Dyspnoea, stridor</td>
<td>• Hypoxia</td>
</tr>
<tr>
<td>• Itch, rash, swelling of lips</td>
<td>• Change in BP, pulse</td>
</tr>
<tr>
<td>• Shock, collapse</td>
<td>• Raised venous pressure, pulmonary signs</td>
</tr>
<tr>
<td>• Nausea, general malaise</td>
<td>• Reduced urine output, change in urine colour</td>
</tr>
<tr>
<td>• Pain</td>
<td>• Change in conscious level</td>
</tr>
<tr>
<td>• Feeling of impending doom</td>
<td></td>
</tr>
</tbody>
</table>

Monitoring should include respiratory rate within 60 mins pre and at 15 mins. Consider oxygen saturation monitoring in those at risk of TACO.
Previous definition of TACO

TACO includes any 4 of the following that occur within 6 hours of transfusion

• Acute respiratory distress
• Tachycardia
• Increased blood pressure
• Acute or worsening pulmonary oedema
• Evidence of positive fluid balance
International discussion about TACO and TRALI

• Many problems
• Areas of overlap
• Can TRALI include ALI without antibodies?
• Do we understand the physiology?
Updated TACO definition

• Patients classified with a TACO (surveillance diagnosis) should have
  – acute or worsening respiratory compromise during or up to 12 hours after transfusion (SHOT accept cases up to 24 hours after transfusion)
  – and should exhibit two or more of the criteria shown on the next slides:
• Evidence of acute or worsening pulmonary oedema based on:
  – clinical physical examination
  – and/or radiographic chest imaging
  – and/or other non-invasive assessment of cardiac function e.g. echocardiogram

• Evidence for cardiovascular system changes not explained by the patient’s underlying medical condition, including
  – development of tachycardia, hypertension, jugular venous distension, enlarged cardiac silhouette and/or peripheral oedema
• **Evidence of fluid overload** including any of the following:
  – a positive fluid balance;
  – response to diuretic therapy combined with clinical improvement;
  – change in the patient’s weight in the peri-transfusion period
Transfusion-associated dyspnoea

• Does not fit criteria for TRALI or TACO
• Often very unwell with complicating pathology
• Patients with severe sepsis may be at increased risk perhaps triggered by increased levels of biological response modifiers, particularly with platelets
• **Make sure every transfusion is indicated**
Cases
Multiple positive features on the TACO checklist where TACO could probably have been prevented

- An elderly patient weighing 51kg with pre-existing congestive cardiac failure (CCF) (ejection fraction 30%) and aortic stenosis received regular transfusions due to non-Hodgkin lymphoma
- She was admitted with worsening dyspnoea and epigastric/chest pain
- Two hours into the transfusion of a red cell unit she developed tachypnoea
- The chest X-ray was suggestive of some infective consolidation but also pulmonary oedema/progressive heart failure compared to the previous image
- She improved after diuretic treatment
- The post-transfusion Hb was 98g/L
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’

**What would you do next?**

• 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
How should iron deficiency be managed?

• 82 yr old woman with chronic iron deficiency, Hb 45 g/L

**What else would you like to know? How will you manage this patient?**

• 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
An elderly woman with leukaemia and sepsis

- A 79-year-old woman with acute myeloid leukaemia and neutropenic sepsis developed breathlessness and decreased oxygen saturation after transfusion of a unit of apheresis platelets

- Her respiratory rate increased from 20 to 36, her pulse rate from 56 to 101 and her blood pressure from 130/78 to 180/100

- She was known to have pre-existing pulmonary fibrosis with angina and cardiac failure

- Investigations gave no support for TRALI and she was not fluid overloaded
A cardiac patient developed respiratory symptoms during transfusion (1)

• A 72-year-old man was transfused two units of red cells for a low Hb on CCU (under care of cardiology)
• He had a history of ischaemic heart disease with three stents and a previous myocardial infarction, and was now generally unwell with diarrhoea
• He had renal impairment and some evidence of heart failure. Changes to respiratory function and increased oxygen requirement were noted
• A CXR showed early pulmonary oedema
(continued)
A cardiac patient developed respiratory symptoms during transfusion (2)

- 4 hours after the transfusion was completed $pO_2$ fell to 6.9 kPa (normal >10.5kPa)
- His oxygen requirement increased from 40% via facemask to 60% and then to 15L via facemask.
- He was given 40mg IV furosemide x 3 and passed 1580mL urine
- TRALI was considered as a possible cause for the patient’s ongoing symptoms following discharge from critical care
- The TRALI expert panel concluded that the respiratory failure was more likely to be explained by the presence of heart failure, sepsis and TACO but there were not sufficient criteria for this latter diagnosis
Key recommendation 2
use a TACO checklist as standard of care.

This has been revised from 2015
Sharran Grey

TACO Checklist

Red cell transfusion for non-bleeding patients

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?

Is the patient known to have pulmonary oedema?

Does the patient have respiratory symptoms of undiagnosed cause?

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?

If 'yes' to any of these questions

1. Review the need for transfusion (do the benefits outweigh the risks)?

2. Can the transfusion be safely deferred until the issue can be investigated, treated or resolved?

3. Consider body weight dosing for red 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.
The next few slides are not to be copied or tweeted as they contain unpublished data
National TACO Audit

• Patients >60 yrs of age; 157 sites
• 2461 inpatients, 2119 outpatients
• Mean age 78 yrs
• 90% inpatients had an additional risk factor for TACO but <1% were documented by their own medical teams as at risk
• TACO is under recognised
Assessing risk of TACO

90% of inpatients had at least one additional risk factor for TACO, apart from age.

3 most common risk factors:
- Hypoalbuminaemia: 52% (1283/2461)
- Concomitant IV fluids: 39% (949/2461)
- Positive fluid balance: 35% (286/808)
Only **2%** (21/985) of inpatients who had at least one additional risk factor documented by auditor had risk of TACO documented in notes.

Only **61%** (1513/2461) of inpatients were weighed within a week prior to transfusion.

**10%** (151/1513) of those weighed, weighed less than 50kg.
National comparative audit

Key Recommendations

Pre-transfusion

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

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

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.
Key SHOT message

• TACO must be suspected when there is respiratory distress with other signs including
  – pulmonary oedema
  – unanticipated CV system changes
  – evidence of fluid overload (including improvement after diuretic, morphine or nitrate treatment), during or up to 24h after transfusion

• Many patients do not have CXR or fluid balance recorded

• International review of diagnostic criteria
Pulmonary complications

• Please report pulmonary complications even if you are not sure in what category or what the cause is
• Report with as much detail as possible
• SHOT experts can move the cases around
• TACO is not necessarily caused by error, it may be an inevitable consequence of a necessary transfusion
Reactions to platelets

- 25% of women, and at least 10% of multitransfused male patients have HLA antibodies
- No evidence that reactions are reduced with HLA-matched platelets
- Washed platelets do reduce reactions
- IV hydrocortisone takes 8 hours to act
- Little evidence for antihistamine but if washed platelets do not work, worth trying
- Appropriate use underpins everything we do
Additional Information

Following documents available on website [www.shotuk.org](http://www.shotuk.org)

- Annual SHOT reports
- Annual SHOT summaries
- Teaching slide set
- SHOT cases
- SHOT reporting definitions
- SHOT Bites

The administration of blood components, BSH guidelines
Robinson et al. Transfusion Medicine Nov 2017
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