Transfusion Associated Circulatory Overload: Where are we now?

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NHSBT and UHB
Overview

• What is TACO?
• NCA results
• Recent data
• Moving forward
Case 1

- 81 year old man, recent diagnosis MDS-EB2
- PMH COPD, AF, T2DM, hypertension
- Allergy to darbepoietin
- Hb 78g/L, dyspnoeic, tired
  - Second transfusion on haematology day unit
  - 2 units of red cells each over 2h
- Became hypertensive, tachycardic, hypoxic
- CXR shows pulmonary oedema
- Admitted through ED and treated with GTN infusion and furosemide
Surveillance criteria
(ISBT 2019, SHOT 2018)

- Onset during or up to 12 hours after transfusion (SHOT up to 24 hours)
- \( \geq 1 \) required criterion AND \( \geq 3 \) criteria i.e. A and/or B, and total of at least 3 of A to E

- Required criteria
  - A. Acute or worsening respiratory compromise
  - B. Evidence of acute or worsening pulmonary oedema (clinically or radiologically)

- Additional criteria
  - C. Cardiovascular system changes (htn, tachycardia, hypertension, pulm oedema)
  - D. Fluid overload (+ve fluid balance; clinical improvement following diuresis)
  - E. Positive biomarker (e.g. BNP or NT-pro BNP)
Mortality

Major morbidity: 36 cases
Leading cause of transfusion-related mortality and major morbidity
**TACO Checklist**

**Red cell transfusion for non-bleeding patients**

1. Does the patient have a diagnosis of 'heart failure' congestive cardiac failure (CCF), severe aortic stenosis, or moderate to severe left ventricular dysfunction?
2. Is the patient on a regular diuretic?
3. Does the patient have severe anaemia?

**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

**Figure 17b.1: Updated TACO pre-transfusion checklist**
When does 282ml = a litre?
Pathophysiology of TACO

• Hydrostatic and oncotic pressures balanced in health

The glyocalyx

• Protects endothelial cells
  – Keeps inflammatory cells away
  – Role in coagulation
• Reduced surface area in illness (e.g. trauma)
• Damage or reduction in glyocalyx → increased permeability to fluid AND protein
• Damage can be due to
  – Physical pressure e.g. mechanotransduction
  – Illness/inflammation
TACO may not be as straightforward as we thought

- 30% patients with TACO will have fever
- TACO may have reduced (by 50% in US) with leucocyte reduction
- Susceptibility may be independent of fluid-handling ability
  - Trauma coagulopathy
  - Chronic disease
- Alveolar fluid is exudate NOT transudate
- Blurred lines with TRALI
- Importance of reporting TACO, TRALI and TAD
Audit standards

Assessing risk of TACO

1. The indication for transfusion is documented in the notes
   - JPAC, BCSH
2. All patients are risk assessed for TACO and this is documented in the notes
   - SHOT, BCSH

Pre-emptive measures to mitigate against TACO

3. Restrictive red cell transfusions are used
   - NICE
4. Use single unit red cell transfusions for patients who do not have active bleeding
   - NICE, BCSH
5. Perform an assessment of the patient after each unit to assess need for further transfusion
   - NICE, BCSH

Diagnosis and treatment of TACO

6. If risk factors are present steps should taken to reduce the risk
   - SHOT, BCSH
7. Monitor the patient before, during and after the transfusion
   - NICE, BCSH
8. TACO should be suspected when there is respiratory distress with features of fluid overload
   - SHOT
9. Patients developing features of TACO are treated with a trial of diuretics, morphine or nitrates
   - SHOT, BCSH

Reporting

10. All patients with TACO are reported to SHOT
    - SHOT, NICE
Spring 2017; red cell transfusions in the over 60s

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<th>Outpatients</th>
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<tr>
<td>Wye Valley NHS Trust</td>
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- 157/171 (92%) sites contributed data
Standard 1: Document the indication for transfusion in the notes

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<thead>
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<td>National</td>
<td>1799 (74%)</td>
<td>1502 (71%)</td>
</tr>
<tr>
<td>Regional</td>
<td>209/251 (83%)</td>
<td>157/217 (72%)</td>
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</table>

Standard 2: Risk assess all patients for TACO and document this in the notes

2a: Benefits & risks of transfusion – Inpatients

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<th></th>
<th>Inpatients</th>
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<tbody>
<tr>
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<td>502 (20.5%)</td>
</tr>
<tr>
<td>Regional</td>
<td>99/251 (39%)</td>
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</table>
Inpatients

Assessing risk of TACO

89% 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)

Risk Factors:
1. Age >50 years
2. CCF, LVF, AS
3. CKD
4. Liver dysfunction
5. Peripheral oedema
6. Concomitant IV fluids
7. Pulmonary oedema
8. Undiagnosed respiratory symptoms
9. Use of diuretics
10. Weight <50kg
Prescribing

43% of outpatients were seen by the person 'prescribing' the blood in the week before transfusion

9% of inpatients were transferred between teams between the decision to transfuse and completion of transfusion

Only 61% of inpatients were weighed within a week prior to transfusion

10% of inpatients weighed, weighed less than 50kg

Only 23% of outpatients were weighed within a week prior to transfusion
Recommendations: assessing risk

• Include a formal pre-transfusion risk assessment (e.g. SHOT) for TACO in transfusion policies
• Include risk of TACO in consent

• **Weigh all patients** within 7 days prior to transfusion and document on the prescription
  – If the patient cannot be weighed, document **estimated weight**
• The person authorising/prescribing the blood **must review the patient**
  – Within 24h (inpatient) or 7 days (outpatient)
Standard 3: Use restrictive red cell transfusion thresholds

28% inpatients and 20% outpatients with asymptomatic anaemia had pre-transfusion hb ≤70g/L

71% inpatients and 53% outpatients with cardiovascular disease had pre-transfusion hb ≤80g/L
Top clinical areas transfusing above recommended thresholds

Inpatients
1. Gastrointestinal surgery
2. Oncology
3. Orthopaedic surgery

Outpatients
1. Trauma and orthopaedics
2. Obstetrics and gynaecology
3. Haematology
**Standard 4: Use single unit red cell transfusions for patients who do not have active bleeding**

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<td>55/158 (35%)</td>
<td>18/106 (17%)</td>
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<td>0/6 (0%)</td>
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<td>0/1 (0%)</td>
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<tr>
<td>Heart of England NHS Foundation Trust</td>
<td>3/10 (30%)</td>
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<td>2/8 (25%)</td>
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<td>3/7 (43%)</td>
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<td>5/15 (33%)</td>
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<tr>
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<td>1/18 (6%)</td>
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<td>0/8 (0%)</td>
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<td>2/10 (20%)</td>
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<td>3/8 (38%)</td>
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<tr>
<td>Wye Valley NHS Trust</td>
<td>2/17 (12%)</td>
<td>0/9 (0%)</td>
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</table>
Standard 5: Perform a clinical assessment of the patient after each unit

14% inpatients and 11% outpatients had a **clinical review** after the first unit

12% inpatients had a **haemoglobin checked** after the first unit

In the instances where there was a clinical review of following the first unit, subsequent management was altered as a result in **13%**

Over-transfusion to **hb >110g/L** occurred in **5.8%** inpatients
Standard 6: If risk factors are present
- measure fluid balance
- consider prophylactic diuretics

Of inpatients with 1+ additional risk factor:

57% had a **completed fluid balance** in the 24h prior to transfusion

11% received **pre-emptive diuretics** prior to the transfusion

Prescribers were **twice as likely** to have prescribed a pre-emptive diuretic had they seen the patient within a week prior to the transfusion 9.0% vs. 4.2% (p<0.05)
Inpatients with at least 1 additional risk factor who pre-emptive diuretics prescribed

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<tr>
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<td>1/19 (5%)</td>
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<tr>
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<td>1/18 (6%)</td>
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<tr>
<td>The Royal Wolverhampton NHS Trust</td>
<td>4/19 (21%)</td>
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<tr>
<td>Wye Valley NHS Trust</td>
<td>5/18 (28%)</td>
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Recommendations: Pre-emptive measures

• For patients at risk of TACO
  1. Monitor fluid balance
  2. Prescribe one unit at a time and prescribe according to body weight
  3. Transfuse at a slower rate
  4. Consider prophylactic diuretics
  5. Monitor observations, including oxygen saturations

• Review inpatients after every unit to assess
  – Whether further transfusion is required
  – Whether features of TACO are developing
Standard 7: monitor the patient before, during and after the transfusion

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<td>39%</td>
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<tr>
<td>of observations at 15</td>
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<td>minutes</td>
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<tr>
<td>Inpatients: sats done</td>
<td>41%</td>
<td></td>
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<tr>
<td>at 15 minutes</td>
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<td>Outpatients: complete</td>
<td>60%</td>
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<tr>
<td>set of observations</td>
<td></td>
<td></td>
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<tr>
<td>within 15 minutes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outpatients: sats done</td>
<td>68%</td>
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<td>at 15 minutes</td>
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Clinical review after each unit transfused

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<th>Outpatients</th>
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<tbody>
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<td>2/15 (13%)</td>
<td>0/20 (0%)</td>
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Standard 8: Suspect TACO when there is respiratory distress with features of fluid overload

69/2461 (2.8%) patients developed respiratory distress within 24h of transfusion

64% inpatients who developed acute or worsening respiratory distress had a CXR

100% outpatients admitted with worsening respiratory symptoms had a CXR
Standard 9: Treat patients developing features of TACO with a trial of diuretics, morphine or nitrates

51% inpatients who developed acute or worsening respiratory distress and 50% outpatients admitted with acute or worsening respiratory distress with worsening chest x-ray changes had a trial of diuresis
Recommendations: Diagnosis and treatment

• Educate on TACO, highlighting that respiratory distress, hypoxia and increased respiratory rate within 24h transfusion may be signs of TACO

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

• For patients developing respiratory distress within 24 hours of transfusion:
  – Stop or slow the transfusion
  – Perform a CXR
  – Consider a trial of diuresis
  – Involve intensive care or outreach team early
Standard 10: Report all patients with TACO to SHOT

27.3% inpatients identified by the treating team as having TACO were reported to SHOT
Clinical evidence of TACO (SHOT 2016 definition)

- Any three of the following clinical features occurring within 24 hours of the transfusion
  - Acute respiratory distress (in the absence of other specific causes)
  - Acute of worsening pulmonary oedema on imaging
  - Evidence of a positive fluid balance
  - Evidence of volume intolerance (response to treatment for circulatory overload or evidence of pulmonary oedema on clinical examination)

9 inpatients (0.37%) met 3 out of 4 criteria, but lots of missing data
### Outpatient outcomes

1.7% **outpatients** were admitted within 24 hours admission

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<td>Admitted immediately from the day unit</td>
<td>71%</td>
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<tr>
<td>Admitted within 24h of transfusion after being discharged from day unit</td>
<td>29%</td>
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<table>
<thead>
<tr>
<th>Location of readmission</th>
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<tbody>
<tr>
<td>Admitted to same hospital</td>
<td>94%</td>
</tr>
<tr>
<td>Admitted to other hospital</td>
<td>6%</td>
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</table>

| Admitted due to worsening respiratory symptoms                                     | 20%   |
| Respiratory symptoms thought to be due to the transfusion                          | 28.6% |
Summary of findings

Despite NICE guidelines, low numbers of patients are being transfused with restrictive thresholds and with single units.

Almost all patients aged >60 have additional risk factors.

Few pre-emptive measures taken – be it with enhanced monitoring or additional treatment.

Many basic assessments not done e.g. weighing patient, fluid balance.

Transfers of care, increasing use of electronic prescribing, weekend OP transfusions mean authorisers may prescribe medication/blood without ever seeing the patient.

Awareness is lacking and although patients may be being treated appropriately, documentation and reporting rates to SHOT are low.
Case study

Woman in her 80s
Under multiple teams; under elderly care when transfused
No documented weight, eGFR 56, low albumin
2 units for ‘no apparent indication’ authorised by consultant (pre transfusion hb 71 g/L)
No risk assessment documented
Each unit prescribed over 4 hours
Fluid balance >1500ml positive in 24h prior to transfusion (concomitant fluids of 2000ml)
No pre-emptive diuretics
No clinical review between units, no observations done
No post transfusion haemoglobin
Developed worsening SOB during transfusion; no imaging undertaken (unsure if diuretic given or response)
Suggested improvements to care...

1. Documentation of the **indication** for transfusion and the **risks and benefit** including as discussed with patient

2. **One unit** transfused at a time

3. **Weight** performed and documented

4. Reduction in concomitant IV fluids to allow for the transfusion volume

5. Consideration of **pre-emptive diuretics**

6. **Observations** performed as a minimum at baseline, 15 minutes and completion of the transfusion

7. Transfusion administered **during working hours**

8. Transfusion over **3 hours** (4 hours not recommended due to cold chain regulations)

9. **Clinical review** following the first unit

10. Clinical review with **CXR and diuretics** at the onset of breathlessness
Example of good practice

A lady in her 70s under elderly care and on a general medical ward was transfused for symptomatic anaemia with a haemoglobin of 74 g/L. She had pre-existing respiratory symptoms and hypoalbuminaemia. She weighed 47 kg. Both the indication for the transfusion and a risk assessment were documented. Fluid balance was documented. One unit was prescribed by a CMT/SHO level doctor. The unit was commenced at 11:45 over 3 hours. She was reviewed following the single unit transfusion. Post transfusion Haemoglobin was 95 g/L.
Transfusion-associated circulatory overload (TACO) is the most commonly reported cause of transfusion-related mortality and major morbidity. 377 reported cases - Deaths = 33, Major morbidity = 108 (2015-2018)

PERFORM a pre-transfusion risk assessment for TACO

TACO Checklist
- Red cell transfusion for non-bleeding patients
  - Does the patient have a diagnosis of ‘heart failure’, congestive cardiac failure, severe aortic stenosis, or moderate to severe left ventricular dysfunction?
  - Is the patient on a regular diuretic?
  - Does the patient have severe anaemia?
  - 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.

Developing respiratory distress during or up to 24 hours after transfusion may be a sign of TACO

STOP or slow the transfusion
PROMPT clinical assessment is required
PERFORM a chest x-ray
CONSIDER a trial of diuretics
CONTACT intensive care early if the patient does not respond to initial measures

1. www.shotuk.org
Thank you