SHOT, TACO & Complications of Transfusion

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NHSBT / SHOT

What is SHOT?

- Serious Hazards of Transfusion (Est 1996)
- 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

Haemovigilance in the UK

MHRA

Medicines & Healthcare Products Regulatory Agency

- Competent Authority for the BSQR 2005
  - - QMS in blood establishments and hospital blood banks.
- Competent Authority for the Medicines Act 1968
- Competent Authority for the Medical Devices Regulations 2008
- **STATUTORY** reporting

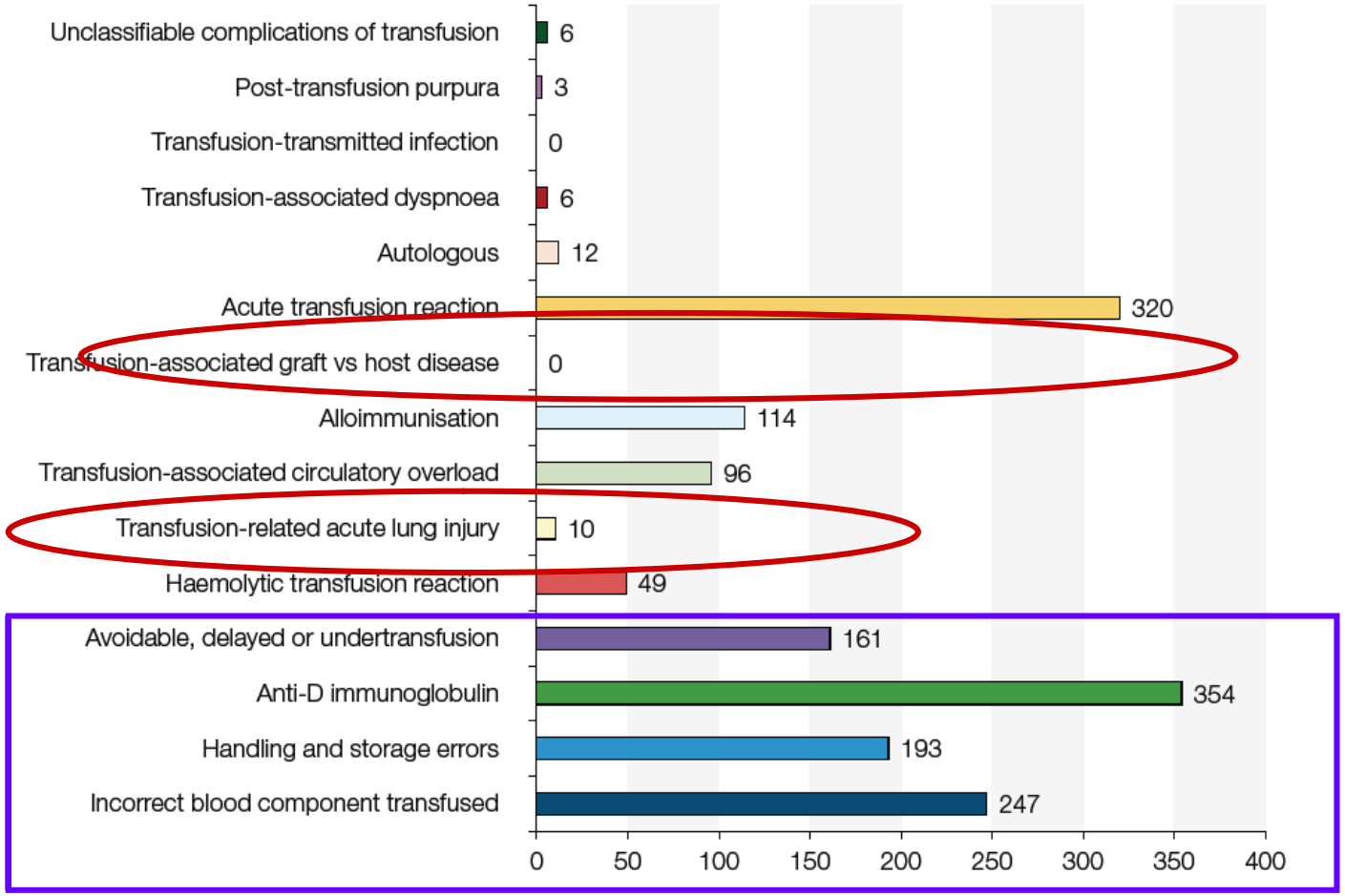
SHOT

Serious Hazards of Transfusion

- Confidential enquiry
- Serious adverse reactions/events AND near misses all of which occur in BOTH a laboratory and CLINICAL environment.
- **PROFESSIONALLY MANDATED** reporting

Reports analysed 2013 n=1571

*excluding near miss and right blood, right patient



SHOT headlines 2013

- Participation includes 99.5% of NHS Trusts and Health Boards across the UK
- 2751 submitted reports were analysed
- 9 ABO incompatible red cell transfusions
- 22 deaths where the transfusion was causal or contributory
- 143 reports associated with major morbidity

Mortality/Morbidity data 2013

- Acute transfusion reactions
  - leading cause of major morbidity (*76 reports - 33 anaphylaxis, 22 severe febrile, 5 hypotensive, 6 mixed*)
- Delayed transfusions
  - 5 deaths (*1 certain, 4 possible*) & 7 major morbidities (*3 cardiac arrests*)
- Transfusion-associated circulatory overload (TACO)
  - 12 deaths (5 probable, 7 possible)

47.9% of TACO cases had serious outcomes

Blood Safety v Transfusion Safety

Transfusion transmitted infections	Risk of infected donation entering blood supply
HBV	1 in 1.3 million
HCV	1 in 28.6 million
HIV	1 in 7.1 million

SHOT REPORTS	Risk per component issued
Total risk of death	1 in 125,000
Total risk of major morbidity	1 in 19,157
Risk of ABO incompatible red cells	1 in 263,157
Risk of wrong component	1 in 48,309
Risk of specific requirements not met	1 in 14,514

Procedural Errors

- **WCT** – Wrong Component Transfused
  - Component given to wrong patient
  - Given wrong component (platelets instead of red cells)
  - Incompatible units given
- **HSE** – Handling & Storage Errors
  - Gave blood out of temperature control
  - Transfused for too long (>5 hours)
- **ADU**
  - Avoidable transfusion / avoidable use of O Neg
  - Delay in transfusion causing harm to the patient
  - Undertransfusion causing harm to the patient
- **RBRP** - Right Blood Right Patient
  - Component is correct for the patient, but ID or labelling errors

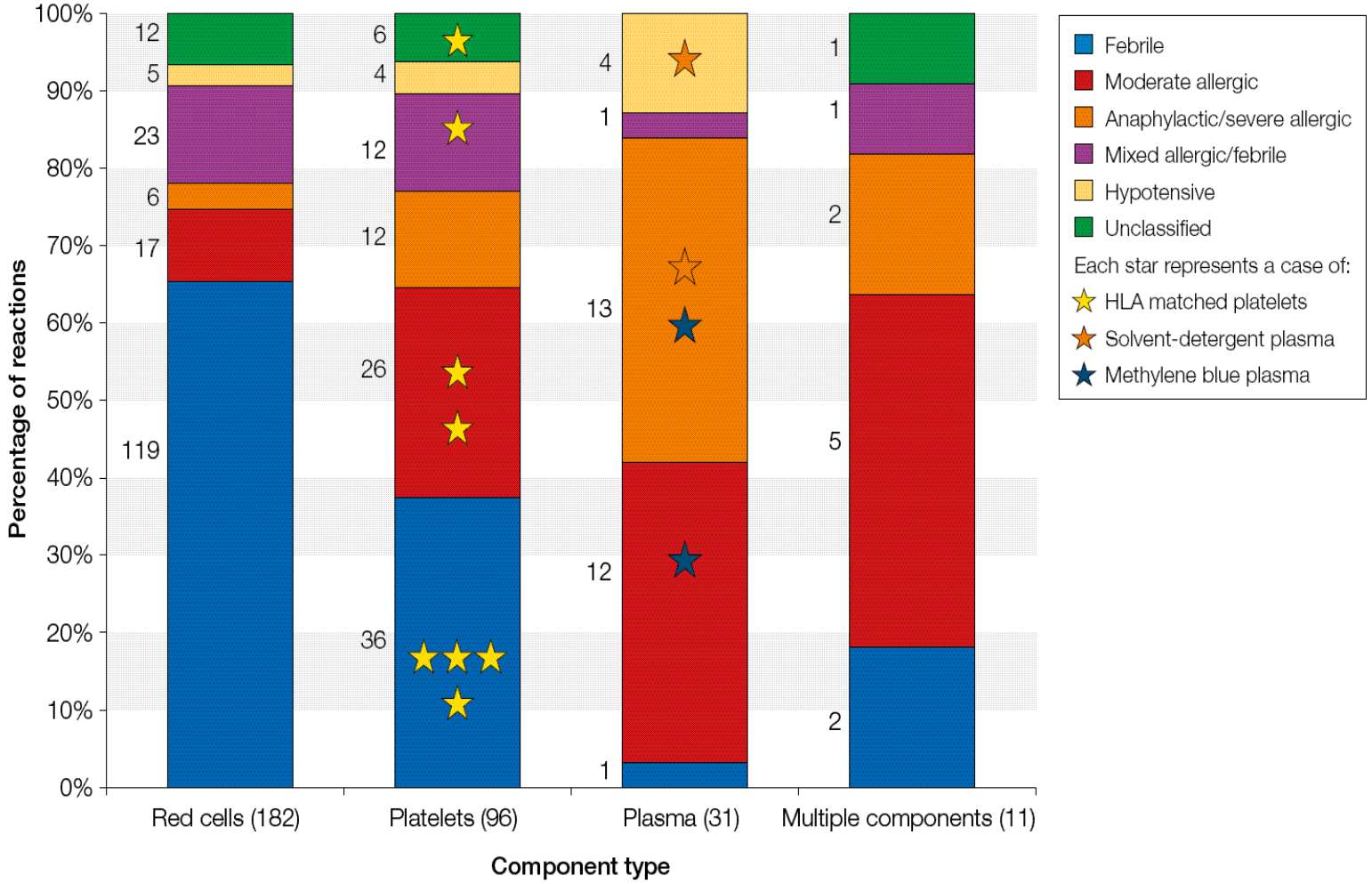
Avoidable transfusion

- 75 yr old man visited at home by GP for unilateral swelling of the leg (Hb 124 g/L three weeks before)
- GP takes sample into syringe and walks 10 mins back to surgery to decant into sample tube
- Hb 76 g/L, so patient (no symptoms of anaemia) admitted overnight as an emergency by on call GP
- Repeat Hb and crossmatch sample at 0640, result available at 0700, Hb 114 g/L
- Transfusion started at 0955 without results review and stopped at 1120 (after 100 mL)

Physiological Reactions

- Transfusion reactions may have many overlapping symptoms and signs with varying severity
- Fever, chills, rigor, myalgia, nausea, urticaria, itching, swelling, respiratory symptoms.....etc.
- Advise patients to report any adverse events and seek advice if they feel unwell

ATR – reaction by component type 2013



Breathlessness and transfusion

- Transfusion-associated circulatory overload – common and under-diagnosed
- Transfusion-related lung injury – uncommon
- Transfusion-associated dyspnoea – those that don’t fit either of the above
- Other: infection, myocardial infarct

What is TACO? - ISBT definition

"When excess transfusion component volume overwhelms the patient's cardiovascular system resulting in pulmonary oedema"

Definitions vary, but TACO includes any 4 of the following that occur within 6 hours of transfusion:

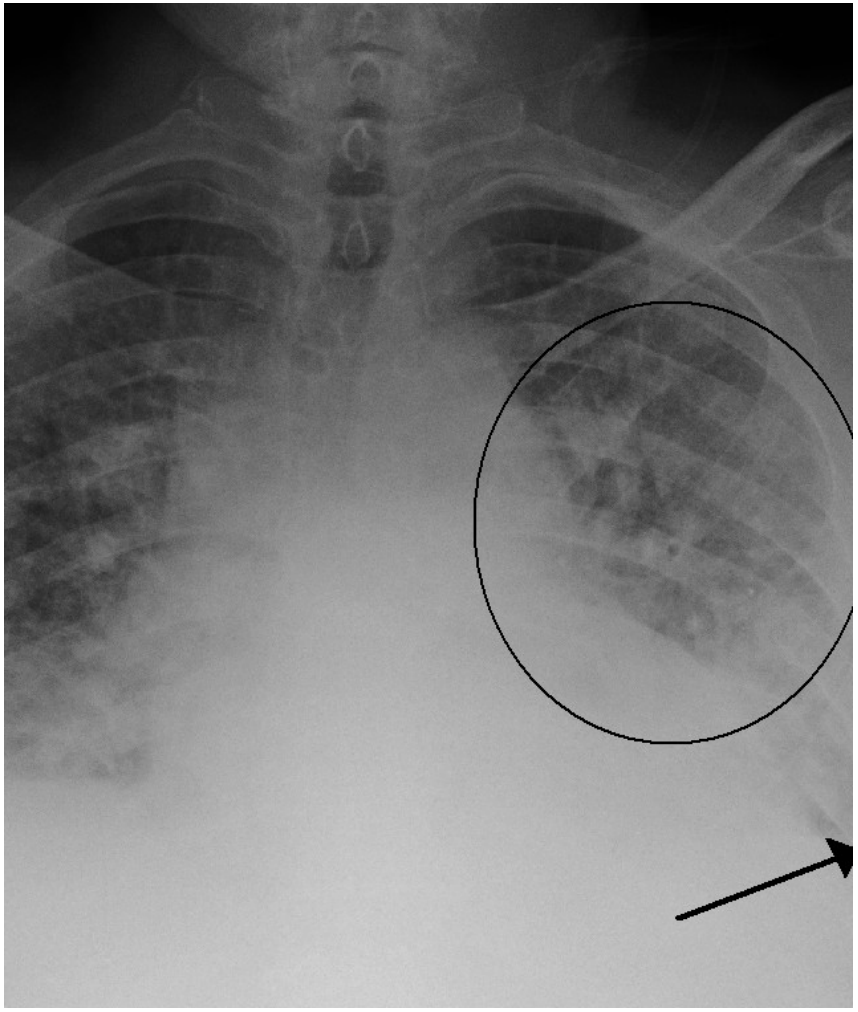
- Acute respiratory distress
- Tachycardia
- Increased blood pressure
- Acute or worsening pulmonary oedema
- Evidence of positive fluid balance

TACO Definition / Mechanism

- Hydrostatic pulmonary oedema due to transfusion
  - Too much blood

    +/- other fluid
  - Transfused too rapidly

15.3% of cases reported to SHOT occur 6 to 24 h post transfusion (2008-2011)



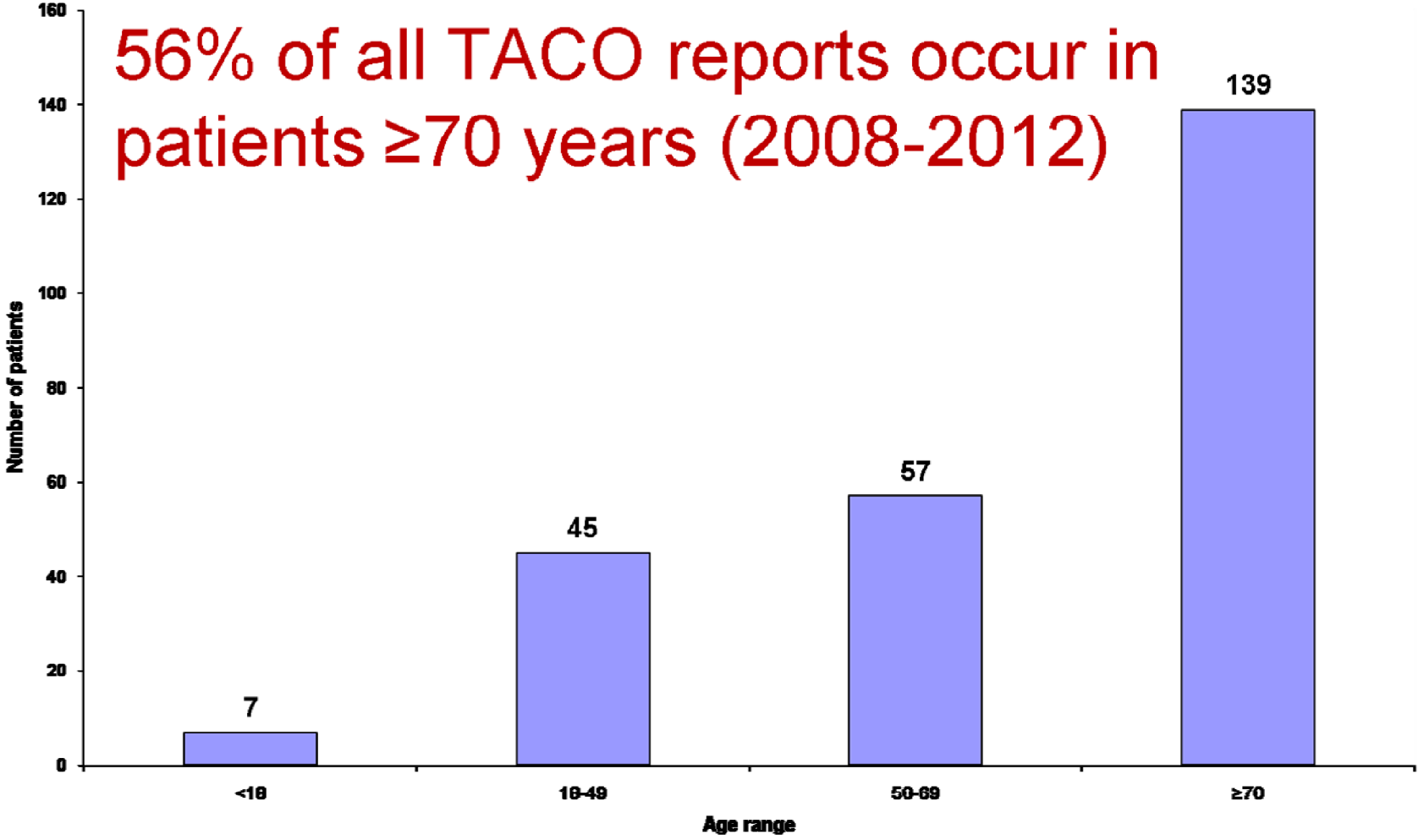
Features of TACO vs TRALI

	TRALI	TACO
Type of component	Usually plasma or platelets	Any
BP	Often reduced	Often raised
Temperature	Often raised	Normal
Echo	Normal	Abnormal
Diuretics	Worsen	Improve
Fluid loading	Improves	Worsens

HDU admission in patient at increased risk of TACO after transfusion as a day case

- A 78 year old female with myeloma, weight 56 kg, was transfused 3 units of red cells as a day case despite being at increased risk of developing 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, but 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 an ST segment elevation myocardial infarction (STEMI).

56% of all TACO reports occur in patients ≥70 years (2008-2012)



Risk factors for TACO

1. Age ≥70
2. Cardiac failure
3. Renal impairment
4. Hypoalbuminaemia
5. Fluid overload
6. Low body weight
7. Children also at risk

2,3,4,5 present
in 53% (86/162*) of cases 2008-2011

2 reports 2011 related to 1 patient

Number of RBC units implicated in TACO

Number of RBC units transfused in the absence of suspected acute haemorrhage 2008-2011

In 86/93 cases (*i.e. where data available*)

- ≤3 units RBC 15 (17.4%)
- ≤ 2 units RBC 49 (57%)
- ≤1 unit RBC 22 (25.6%)

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 106g/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

Over-transfusion leading to polycythaemia and a cerebral infarct

- Elderly patient of low body weight (29 kg) admitted with an initial Hb of 70 g/L
- Three units of red cells were prescribed and the post-transfusion Hb was 170 g/L, confirmed with repeat sampling the following day
- She sustained a cerebral infarct 48 hours following the transfusion, which resulted in long-term morbidity

Life-threatening 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

Massive over-transfusion of 1-year-old child

- *A 10Kg child with a gastrostomy inserted a few days previously was brought into A&E, pale but alert, following an episode of vomiting blood - Hb was 98 g/L*
- *He was (wrongly) diagnosed as having an acute arterial bleed, and the major haemorrhage protocol was activated*
- *Red cells were incorrectly prescribed in adult units rather than mL/kg and he was given a total of 4 units (1122 mL), the first 3 given over one hour*
- *He was taken to theatre, found to have no evidence of fresh bleeding in his stomach, and a Hb of 270 g/L*
- *Attempted venesection was difficult and only removed 40 mL blood. He required transfer to a paediatric intensive care unit and made a full recovery*

Prospective observational study

Li et al, Transfusion 2011; 51: 338-43

- Prospective observational study in an ICU
  - 6% of 901 transfused patients developed TACO
- Compared with matched controls TACO cases had:
  - more positive fluid balance (1.4 L vs. 0.8 L)
  - larger amount of **plasma** (0.4 L vs. 0.07)
  - faster rate of transfusion (225 mL/hr vs. 168 mL/hr
- Compared with random controls TACO cases:
  - left ventricular dysfunction increased risk of TACO 8.23x
  - **plasma** ordered for reversal of anticoagulant increased TACO risk x4.31

How can we reduce the risks of TACO ?

- No verbal orders for transfusion
- Mandatory pre-transfusion risk assessment and volume assessment
  - Age>70, LV dysfunction, renal failure, positive fluid balance, current dose of diuretics, acute myocardial infarction, plasma
- Slow the rate of transfusion – at risk transfusion should be run at 1-2 mL/minute
- Pre-emptive furosemide *before* the transfusion
- 1 unit of RBC at a time (non-bleeding)
- 'Critical' nursing supervision

How can we reduce the risk of TACO?

- Appropriate use
- Raise awareness
- Monitor patients for 24 hours post-transfusion
- Labs avoid transmitting results that they know or suspect to be inaccurate, but instead request a second sample
- In the absence of massive haemorrhage, check the patient clinically and Hb after every 2 RBC units
- Application of the empirical paediatric formula for low body weight individuals? *Br J Haematol 2001;124:433*

Supplement to BCSH guidelines on blood administration (2009)

Key Recommendation

Don’t give two without review: Transfusion-associated circulatory overload (TACO) is a significant hazard, particularly when elderly or other patients at risk receive several units of blood without review and a check Hb level

***advice inspired by a campaign devised by NHSBT’s**

Patient Blood Management team

Additional Information

Documents available on website to help with reporting:
www.shotuk.org

- SHOT reporting definitions
- SHOT reporting toolkit
- Clinical Lessons
- Laboratory Lessons
- SHOT reports
- SHOT summaries
- Supplemental data

Useful References on TACO:

Popovsky MA, et al. *Immunohematology.* 1996;12(2):87-89.
Robillard P, et al. *Transfusion* 2008; 48 suppl: 204A, 212A
Li G, et al. *Transfusion* 2009; 49: 13-20
Popovsky MA, et al. *Transfusion* 1985; 25: 469

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  .....for slide content

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