

16.

Transfusion-Associated Circulatory Overload (TACO)

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Definition

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

DATA SUMMARY							
Total number of cases: 71*							
Implicated components				Mortality/morbidity			
Red cells		58		Deaths due to transfusion	0		
FFP		3		Deaths <i>probably/likely</i> due to transfusion	0		
Platelets		2		Deaths <i>possibly</i> due to transfusion	2		
Multiple components		8		Major morbidity	24		
Gender		Age		Emergency vs. routine and core hours vs. out of core hours		Where transfusion took place	
Male	26	≥ 18 years	66	Emergency	26	A&E	1
Female	44	16 years to <18 years	1	Routine	41	Theatre	7
Not known	0	1 year to <16 years	1	Not known	4	ITU/NNU/HDU/Recovery	11
		>28 days to <1 year	1			Wards	45
		Birth to ≤28 days	1	In core hours	34	Community	2
		Not known	0	Out of core hours	36	Outpatient/day unit	4
				Not known	1	Not known	1

*There were 71 cases in 70 patients

A total of 49 questionnaires on TACO were received; 3 were transferred in from the transfusion-associated dyspnoea (TAD) category, 11 from acute transfusion reaction (ATR) (2 reports of which were in one patient), 5 from transfusion-related acute lung injury (TRALI), 1 from right blood right patient (RBRP), 1 from inappropriate, unnecessary or under/delayed (I&U) and 1 from previously uncategorised complication of transfusion (PUCT), resulting in a total of 71 cases which are analysed in this chapter. In addition, 1 patient is described in the I&U chapter (Chapter 9, Case 1).

Definition

Cases were assessed by the reviewer for probability of a diagnosis of TACO based on the International Society of Blood Transfusion (ISBT) definition¹⁵, also available on the SHOT website (www.shotuk.org).

Patients

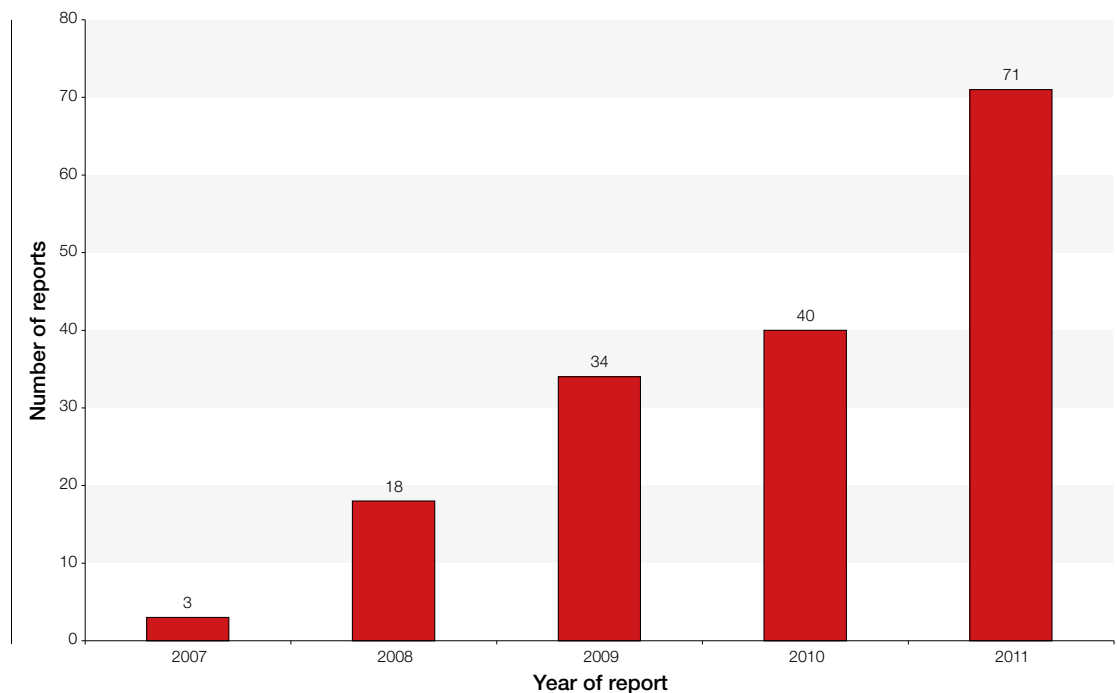
There were 26 males and 44 females. The age range was 15 days – 92 years, with 41/70 patients (58.6%) ≥70 years and 14/70 (20%) <50 years. There were 4 patients under 18 years (1 was a 17 year old male (2 reports), 1 was 7 years, 1 was 1 year; and 1, 15 days).

Table 16.1
TACO case
probability

TACO case probability (ISBT criteria)*	Number of cases
Highly likely	16
Probable	14
Possible	41
TOTAL	71

* Cases where TACO was observed between 6 hours and 24 hours are also included

Figure 16.1
Number of cases of
TACO reported to
SHOT each year



One further case of TACO this year is described in the I&U chapter (Case 1, Chapter 9).

Deaths n=2

TACO was possibly contributory to death (imputability 1), in two patients, both aged 72 years.

In addition, there was 1 fatal TACO case (imputability 3), described in the I&U chapter (Case 1, Chapter 9).

There were a further 4 deaths, where the reporter considered that the transfusion was possibly contributory to the reaction but unrelated to the death.

Major morbidity n=24

Twenty-four patients developed major morbidity; of these, 23 required intensive care or high dependency admission and/or ventilation, and 1 was admitted to the renal unit for emergency dialysis.

The remainder (n=45) experienced minor morbidity; of these, the majority were managed with oxygen and diuretic therapy.

Clinical details and transfused fluids in TACO cases

Thirty-two of the 70 patients (45.7%) were reported to have 1 or more concomitant medical conditions that increase the risk of TACO: cardiac failure, renal impairment, hypoalbuminaemia and fluid overload.

Complete details on fluid balance were supplied by the reporter in 10/71 (14.1%) of cases.

The median time between the transfusion and the onset of symptoms, where information was available, was 0-2 hours in 49.3% (35/71), 2-6 hours in 30.9% (22/71), and between 6-24 hours in 11.3% (8/71) of cases.

Case 1**TACO in an elderly patient with severe chronic iron deficiency anaemia**

An 82 year old woman was admitted to hospital with chronic iron deficiency anaemia, Hb 4.5 g/dL. Four units of red cells were transfused, each over 2.5 hours. Following this she developed acute shortness of breath, her oxygen saturation dropped to 54% associated with pulmonary oedema. She had a tachycardia with a pulse rate of 110 bpm, and was hypertensive, blood pressure (BP) 200/99, with a subsequent fall in her BP the following day to 50/20. She was stated to be fluid overloaded. She required intubation and ventilation for 2 days in the intensive therapy unit (ITU). Her treatment post-transfusion included furosemide and noradrenaline. She made a full recovery.

Although this case was reported to have occurred within 12-24 hours of the transfusion (i.e. outside the standard definition), it was in other respects a typical and highly likely case of TACO.

Learning points

- The elderly are at high risk of transfusion-associated circulatory overload (TACO). Younger individuals are also at risk, particularly those with one or more concomitant risk factors for TACO: cardiac failure, renal impairment, hypoalbuminaemia and fluid overload. Pre-transfusion clinical assessment will identify patients at increased risk of TACO in whom measures can be taken to reduce the risk of developing this complication.
- Chronic iron deficiency anaemia should be identified before the Hb falls to critical levels and corrected with iron therapy, and the underlying cause established and treated.
- Cases of TACO are observed up to 24 hours after completion of transfusion. All patients having a blood transfusion should be monitored accordingly as advised in the British Committee for Standards in Haematology (BCSH) guidelines on blood administration¹⁴.

Acute haemorrhage cases in which more than one component was transfused n=5

There were 5 cases of acute haemorrhage where more than 1 blood component was transfused. Red cells and fresh frozen plasma (FFP) were transfused in 2 cases of ruptured ectopic pregnancy; together with platelets in 1 case of massive obstetric haemorrhage; and in a fourth case, for massive haemorrhage following liver transplantation, when cryoprecipitate and platelets were also transfused. In the fifth case, FFP and cryoprecipitate were given for a second case of obstetric haemorrhage, detailed below.

Case 2**An unusual case of TACO - after cryoprecipitate and FFP for congenital hypodysfibrinogenaemia**

A 36-year old woman with congenital hypodysfibrinogenaemia underwent emergency caesarean section because of failure to progress. The pre-operative fibrinogen was 1.4 g/dL. During the operation, she bled 1100mL; 295mL of this blood was salvaged, and returned to her. She was also given 2L of crystalloid, then 2 units of FFP (~500mL) and finally ~200mL of cryoprecipitate (1 adult dose). In recovery, she became hypoxic, pO₂ 84, and her blood pressure increased to 185/105. A chest X-ray showed bilateral pulmonary infiltrates. An echocardiogram showed normal cardiac function. She was then transferred to the ITU. She was noted to be oedematous and the central venous pressure (CVP) (post-furosemide) was 9cm H₂O.

This degree of fluid overload would not have been expected to have precipitated TACO in a fit 36 year old, however, it occurred in the presence of probable pre-eclampsia which is associated with pulmonary oedema. Her symptoms did not respond quickly to 100mg of furosemide, and she required ventilatory support for several days afterwards.

Learning point

- Individuals with congenital bleeding disorders undergoing procedures should be managed in a Haemophilia Centre⁶².

Cases in which red cell transfusion was implicated n=58

Red cells were implicated in 58 cases and transfused in a further 7 cases where multiple components were transfused. In 48 cases red cells were transfused in the absence of suspected acute haemorrhage. In 46 of these 48 cases (i.e. in patients >18 years) TACO occurred after ≥ 3 units in 12 cases, after ≤ 2 units in 23, and after ≤ 1 unit in 11. In 71.7% (33/46) of these cases, patients were ≥ 70 years of age. The median duration of transfusion/RBC unit where red cells were transfused in the absence of suspected acute haemorrhage (in 33/46 cases where details were given) was 2.5 (range 1-6) hours. One patient developed possible TACO following red cell transfusion for obstetric haemorrhage.

Learning point

- Transfusion-associated circulatory overload (TACO) can occur after relatively small volumes of red cells, even 1 unit or less, particularly in patients at increased risk of developing TACO.

Cases in which FFP was transfused n=10 (some had multiple components)

There were 10 cases where FFP was transfused. Five are detailed above. In the remainder, 4 patients were given FFP to correct coagulopathy and 1 patient on warfarin was given FFP pre-procedure to correct a high International Normalised Ratio (INR).

Learning point

- Fresh frozen plasma (FFP) should not be used for warfarin reversal. The British Committee for Standards in Haematology (BCSH) guidelines have, since 1990, recommended that prothrombin complex concentrate (PCC) is the treatment of choice for warfarin reversal when this is indicated¹⁹.

Cases in which platelets were transfused n=6 (some had multiple components)

There were 6 cases where platelets were transfused, 2 pooled and 4 apheresis. Three platelet transfusions were given to patients with massive blood loss and 3 prophylactically: 1 in a patient with liver disease who had a platelet count of $< 20 \times 10^9/L$ with additional risk factors for bleeding; 1 prior to an invasive procedure in a patient with pancytopenia; and 1 in a patient with post-transplant thrombocytopenia.

COMMENTARY

TACO remains an important cause of serious morbidity. This year TACO was implicated in 2 deaths (both imputability 1) and 24 cases of major morbidity, with these serious outcomes together comprising 36.6% (26/71) of cases analysed in the TACO chapter.

There was 1 further death related to TACO (imputability 3) described in the I&U chapter (Chapter 9).

Whilst the number of cases of TACO has increased from 40 in 2010 to 71 in 2011, TACO probably remains under-reported.

Elderly patients are particularly at risk of TACO with almost 60% of patients reported in 2011 ≥ 70 years. Younger individuals are also at risk of TACO particularly when there are 1 or more concomitant risk factors that increase the likelihood of TACO: cardiac failure, renal impairment, hypoalbuminaemia and fluid overload. Low body weight is also a risk for TACO and SHOT is now systematically collecting information on this.

It remains of concern that complete details on fluid balance were documented in only 10/71 (14.1%) of cases; and 9/57 (15.8%) of cases reported as TACO or transferred from the TAD or TRALI chapters where the questionnaires requested details of fluid balance.

Whilst the '4 hour rule' for the duration of transfusion prevails^{14 63}, this is based on data relating to the 'lag phase' before bacteria begin to proliferate rather than clinical evidence. A recent systematic review concluded that available data make it difficult to draw significant conclusions, and that robust studies using multiple combinations of blood, anticoagulant, and additive solutions with defined temperatures

and times of exposure are required⁴⁷. BCSH guidance on the clinical assessment of patients pre-transfusion and measures to reduce the risk of TACO, including the rate of transfusion in patients at high risk of TACO is awaited.

Notably, a small proportion of TACO cases (11.3%) continue to be observed between 6 and 24 hours emphasising the importance of vigilance to identify these cases so that affected patients can receive appropriate management.

In one case, FFP was given for warfarin reversal prior to a procedure. PCC is the product of choice for warfarin reversal and FFP¹⁹ should not be used for this indication.

Five patients including Case 1, four of these aged ≥ 70 years, were given red cell transfusions for chronic iron deficiency anaemia. This has also been noted in the I&U chapter (Chapter 9). Chronic iron deficiency anaemia should be corrected with iron therapy and the underlying cause, almost always blood loss, established and treated.

One patient received FFP and cryoprecipitate for bleeding associated with congenital hypodysfibrinogenaemia. Patients with congenital bleeding disorders should be managed within a Haemophilia Centre⁶².

Three further cases of TACO in patients with obstetric haemorrhage were reported this year, bringing these to a total of 10 cases reported since 2008, and highlighting that this complication does occur in these young individuals who are often regarded to be 'immune' to TACO. Contributory factors are difficulties in estimating actual blood loss, particularly because of the changing blood volume and circulatory capacity.

Of the 71 TACO cases analysed, 49 (69%) were reported as TACO, with the remainder transferred from several other categories. Data on these transferred TACO cases is inevitably incomplete due to the differences in the individual questionnaires. The new SHOT pulmonary questionnaire prompts collection of relevant information in all cases reported where respiratory distress is prominent. This will provide a common dataset, which will enable accurate categorization of pulmonary complications of transfusion.

Recommendations

- All measures must be taken to reduce the risk of transfusion-associated circulatory overload (TACO). These include pre-transfusion clinical assessment to identify patients at increased risk of TACO, in whom particular consideration should be given to the appropriateness of transfusion, the rate of transfusion and diuretic cover. Careful attention to fluid balance is essential and must be documented.

Action: Transfusion practitioners, Hospital Transfusion Teams (HTTs), Hospital Transfusion Committees (HTCs)

- Prothrombin complex concentrate should be used for warfarin reversal in accordance with national guidelines¹⁹, and should be immediately available in all Trusts/Hospitals/Health Boards.

Action: HTTs, Hospital Transfusion Laboratory Managers

- Blood transfusion is not an appropriate treatment for iron deficiency and puts patients, particularly the elderly, at risk of TACO. Iron deficiency should be diagnosed and appropriately corrected with iron supplements, and the underlying cause established and treated.

Action: General Practitioners, hospital doctors, Medical Schools, HTTs

For active recommendations from previous years and an update on their progress, please refer to the SHOT website