

## 14. Transfusion-Associated Circulatory Overload (TACO)

### 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

<i>Total number of cases</i>		<b>34</b>	<i>Implicated components</i>		<i>Mortality/morbidity</i>		
			RBC only (OA, PR, WB)	<b>22</b>	Deaths due to transfusion	<b>0</b>	
			Platelets only	<b>1</b>	Deaths in which reaction was implicated	<b>4</b>	
			FFP only (MB-FFP)	<b>1</b>	Major morbidity	<b>9</b>	
			RBC + platelets	<b>5</b>			
			RBC + FFP (untreated)	<b>3</b>			
			RBC + FFP + platelets	<b>1</b>			
			RBC + FFP + platelets + cryo	<b>1</b>			
<i>Gender</i>		<i>Age</i>		<i>Emergency vs. routine and core hours vs. out of core hours</i>		<i>Where transfusion took place</i>	
Male	<b>11</b>	18 years+	<b>34</b>	Emergency	<b>6</b>	ED	<b>0</b>
Female	<b>23</b>	16 years+ to 18 years		Routine	<b>6</b>	Theatre	<b>1</b>
Unknown	<b>0</b>	1 year+ to 16 years		Not known	<b>22</b>	ITU/NNU/HDU/Recovery	<b>3</b>
		28 days+ to 1 year		In core hours	<b>17</b>	Wards	<b>16</b>
		Birth to 28 days		Out of core hours	<b>17</b>	Community	<b>0</b>
		Unknown		Not known/applicable	<b>0</b>	Other*	<b>4</b>
		Total	<b>34</b>			Not known	<b>10</b>

\* Emergency Assessment Unit/Clinical Decision Unit

Twenty questionnaires on TACO were received; 9 were transferred in from the ATR section and 5 from the TRALI section, resulting in a total of 34 cases which are reported in this chapter.

### Definition

Cases were assessed by the reviewer for probability of a diagnosis of TACO based on the International Society of Blood Transfusion (ISBT) definition.<sup>14</sup> Five of 34 cases were assessed to be highly likely, 14 probable and 15 possible.

### Patients

There were 11 men and 23 women. The median age was 72.5 (range 27 to 89) years, with 20 patients (58.8%) 70 years or over and 5 patients under 50 years. There were no patients under 18 years.

Table 42

## Cases classified according to diagnostic criteria, probability of TACO and imputability

NS: not stated by reporter

NR: not recorded in the clinical records

Case no.	Age Sex	Acute respiratory distress	Tachycardia	Increased BP	Acute or worsening pulmonary oedema	Evidence of positive fluid balance	Probability of TACO	Imputability
1*	F89+	Yes	NS	NS	Yes	NS	Possible	1
2	F59	Yes	Yes	Yes	Yes	NR	Highly likely	3
3	F75	Yes	Yes	Yes	NS	Yes	Probable	2
4	F61	Yes	Yes	Yes	NS	NR	Possible	1
5**	F62++	Yes	NS	NS	Yes	Yes	Probable	2
6*	F84	Yes	NS	NS	Yes	NS	Probable	2
7**	F29	Yes	NS	NS	Yes	Yes	Probable	1
8**	F68	Yes	Yes	Yes	NS	No	Possible	1
9	M67	Yes	No	No	Yes	NS	Possible	1
10	M74	Yes	Yes	Yes	NS	NR	Possible	1
11	F83	Yes	NR	NR	NR	Yes	Possible^^^	1
12*	M86	Yes	Yes	Yes	NS	NS	Possible	1
13	F86	Yes	No	Yes	Yes	NS	Probable	2
14	F71+++	Yes	Yes	Yes	Yes	NR	Possible^^	1
15*	M84	Yes	NS	NS	NS	NS	Possible	1
16*	F83	NS	Yes	NS	NS	NS	Possible	1
17	M78	Yes	Yes	No	Probably	Yes	Probable	2
18*	M88	Yes	NS	No	Yes	NS	Probable	2
19	F68	Yes	Yes	Yes	No	Yes	Probable	2
20	M32	Yes	Yes	No	No	NR	Possible	1
21	F30	Yes	No	No	Yes	Yes	Probable	2
22	M64	Yes	Yes	Yes	Yes	Yes	Highly likely	3
23	F85^	Yes	NS	Yes	Probably	NS	Possible	1
24*	M75	Yes	Yes	Yes	Yes	NS	Highly likely	3
25	F65	Yes	No	Yes	Probably	Yes	Probable^^^	2
26	F27	Yes	Yes	Yes	Yes	NR	Highly likely	3
27	F87	Yes	NS	No	Yes	NR	Probable^^	2
28	F69	Yes	NS	No	Yes	Yes	Probable	2
29*	M88	Yes	Yes	Yes	Yes	NS	Probable	2
30	F40	Yes	NR	NR	Yes	Yes	Probable	2
31	F84	Yes	NS	Yes	Probably	NR	Possible	1
32*	F76	Yes	Yes	Yes	NS	NS	Possible	1
33**	M61	Yes	No	No	Yes	Yes	Possible^^	1
34**	F70	Yes	Yes	Yes	Yes	No	Highly likely	3

\* Transferred from ATR section

\*\* Transferred from TRALI section

^ hypertensive on admission

^^ onset 6–12 hours after transfusion

^^^ onset 12–24 hours after transfusion

\* chest pain and raised troponin t

\*\* pneumocystis pneumonia on bronchoscopy

\*\*\* new lateral wall changes on ECG, ST down, T down

## Mortality *n* = 4

There were 4 deaths (4/34; 12%) where the transfusion reaction was thought by the reporter to be probably (Case 28 and Case 34) or possibly (Case 7 and Case 33) contributory. Two further patients died, but in both, the deaths were thought by the reporter to be unrelated to the transfusion (Case 10 and Case 16).

### Case 28

#### **Patient with myeloma, cardiac failure and renal impairment develops probable TACO**

A 69-year-old woman on chemotherapy for myeloma was pancytopenic, with Hb 9.9 g/dL and platelets  $7 \times 10^9/L$ . She had a history of angina, atrial fibrillation, type 2 diabetes, asthma and COPD. She had cardiac failure on admission and her fluid input was 912 mL with anuria. After 1 pool of platelets and  $1\frac{3}{4}$  RBC units she developed acute respiratory distress with hypoxia, hypercapnia and worsening pulmonary oedema. The BP was 140/90 and pulse not stated. She required ITU admission and received respiratory support with  $O_2$  and CPAP. She received diuretic therapy with no diuretic response. Her condition deteriorated and she died.

### Case 34

#### **Single RBC unit transfusion to patient with hypoalbuminaemia results in TACO**

A woman had rheumatoid arthritis with pulmonary fibrosis and hypoalbuminaemia, and had an Hb of 7.4 g/dL. She was transfused 1 RBC unit over 4+ hours. At 4 hours she developed acute severe dyspnoea and persistent hypoxia ( $pO_2$  6.93 kPa) which was unresponsive to high flow  $O_2$  and CPAP. The pulse was 133 bpm and BP 150/90. Furosemide and antibiotic therapy were also administered. Her condition deteriorated and she died.

### Case 7

#### **Patient with complex medical problems on ITU complicated by TACO**

A 29-year-old woman had sepsis due to necrotising fasciitis, DIC with bleeding and hypoalbuminaemia. She had been in ITU and ventilated long term prior to transfusion of > 2000 mL of blood components over approximately 3 hours. Fluid balance was 1716 mL positive. An hour after the last component, her  $pO_2$  dropped to 88%, requiring manual mask ventilation with  $O_2$ , and further respiratory support. Within 6 hours of transfusion her PEEP requirement and CVP increased. A CXR showed bilateral pulmonary infiltrates. She was given IV furosemide 50 mg resulting in a diuresis of 2280 mL in 4 hours. She improved initially but deteriorated and died 5 days later. Six of 8 blood culture bottles grew Gram-positive staphylococci.

### Case 33

#### **Transfusion of RBC and FFP for massive gastrointestinal haemorrhage resulting in TACO**

This 61-year-old man had a massive gastrointestinal haemorrhage with a decrease in Hb to 5.5 g/dL. He was transfused 6 units RBC and 4 units FFP, but 6–12 hours after completion of the transfusion he developed SOB and his  $pO_2$  fell to 8 kPa, with the CXR consistent with pulmonary oedema. The pulse was 98 bpm and the BP 87/40. He was already receiving  $O_2$ , and as a result of the reaction also required CPAP. He developed ARDS and died.

## Major morbidity *n* = 9

In 9 of the remaining 29 cases (26.5% of the total 34), the reporter stated that the patient was transferred to the ITU as a result of the reaction. Of these, 4 had highly likely, 2 had probable and 3 had possible TACO. Three other patients (Case 3, Case 20 and Case 31) were already in ITU at the time of the reaction.

## Minor morbidity *n* = 19

All 19 patients with highly likely, probable or possible TACO experienced symptoms and/or signs. Eight of these 19 patients were reported to be given oxygen and 2 required CPAP.

## Clinical details and transfused fluids in TACO cases

Table 43 summarises the clinical diagnosis or indication for transfusion in each case, along with the blood components transfused and the rate of transfusion, as well as fluid balance in the 24 hours preceding the reaction. Details of the rate of transfusion were reported in 21/34 cases (62%). Fluid balance was supplied by the reporter in 14/34 cases (41%) and not recorded or not stated in the remainder.

The median time between the transfusion and the onset of symptoms was 0–2 hours in 17/34 cases (50%), 2–6 hours in 12 cases (35%), and > 6 hours in the remainder (15%; 6–12 hours in 3 (1 probable and 2 possible cases) and 12–24 hours in 2 cases (1 probable and 1 possible)).

### Acute haemorrhage cases in which more than one component type was transfused $n = 4$

There were 4 cases of TACO in which RBC plus other blood components/products and additional IV fluids were administered for acute major haemorrhage (Case 7, Case 9, Case 21 and Case 3). Two of the 4 patients (Cases 7 and 21) were  $\leq 30$  years old and the other 2 were 67 and 61 years respectively.

#### Case 21

##### *Young woman develops TACO after transfusion for massive obstetric haemorrhage*

A 30-year-old woman had an emergency CS for pre-eclampsia with an estimated blood loss of 3000 mL associated with DIC. She received 1500 mL colloid, 3500 mL crystalloid, 9 units (2546 mL) RBC and 4 units of FFP (1127 mL). In the 24 hours prior to the reaction she was in positive fluid balance of 1813 mL. She developed dyspnoea, hypoxia and hypercapnia associated with pulmonary oedema. Her pulse was 82 bpm and BP 109/82.  $O_2$  was administered and she was transferred to ITU for ventilation. She was given diuretic therapy resulting in a 'good diuresis' and, after a second dose of diuretic, clinical improvement was evident.

**Table 43**

#### Diagnosis/Indication for transfusion, components/products transfused and fluid balance

NS: not stated by reporter

NR: not recorded in the clinical records

Case no.	Age Sex	Diagnosis/Indication for transfusion	RBC Units	FFP mL	Other	Rate of transfusion	Fluid Balance 24 hrs mL	Concomitant medical conditions that increase risk of TACO
1*	F89*	Ca vulva, Hb 8.1	2	-	-	NS	NS	NS
2	F59	microcytic anaemia, IHD, COPD Hb 4.8	2	-	-	1 unit/2 hrs	NR	NS
3	F75	Post-op Hb 6.0	1	-	-	1 unit/4 hrs	+3242	Hypoalbuminaemia and fluid overload
4	F61	AML, Hb 7.6, plts 22	~2	-	Plts 1 pool	Total: 8 hrs	NR	-
5**	F62	AML, thrombocytopenia	1	-	Plts 1 pool	RBC: 1 unit/2 hr Plts: 30 mins	+3119	NS
6*	F84	PR bleeding	~2	-	-	'too fast'	NR	Cardiac failure
7**	F29	IVDU, sepsis, DIC, bleeding	2	1200	Plts 1 pool Cryo 2 pools	Total: ~3 hrs	+1716	Hypoalbuminaemia and fluid overload
8**	F68	NHL, chemo, t'penia, pneumonia, progressive pulm. disease, rec. pulm. oedema	-	-	Plts 1 pool	NS	-1460^ (8040 in 9500 out)	Hypoalbuminaemia
9	M67	Bleeding DU Hb 15 dropped to 7	7+	600		Total: ~15 hrs	NS	NS

10	M74	MDS, bleeding varices/ ulcers, Hb 8.2	1+	-	-	NS	NR	Cardiac failure, renal impairment
11	F83	CLL, AIHA, Hb 4.7	4	-	-	1 unit/ ~3-4 hrs	+2374	Fluid overload
12*	M86	TKR, falling Hb post-op	2	-	-	2 <sup>nd</sup> unit ~ 1.5 hr	NS	NS
13	F86	?Myeloma, Hb 6.6	3	-	-	1 unit /2 hrs	NR	Cardiac failure
14	F71	Post-op TKR, Hb 8, symptomatic	1+	-	-	1 unit/3 hrs	NR	NS
15*	M84	MDS, COPD	2	-	Plts 1 pool	NS	NS	NS
16*	F83	Ca, GI bleed, septic	2+	-	-	NS	NS	NS
17	M78	chest infection, Hb 8.3	1	-	-	1 unit/3 hrs	+900	Renal impairment, fluid overload
18*	M88	Acute on CRF, anaemia	$\frac{2}{3}$ unit	-	-	NS	NS	Renal impairment
19	F68	Bleeding DU, Hb 11 dropped to 8	5	-	-	Total: 90 min	+6710	Hypoalbuminaemia renal impairment, fluid overload
20	M32	GI bleed secondary to NSAID, Hb 5.5	5	-	-	Total: 3 hrs	NR	NS
21	F30	Massive obst. haemorrh	9	1127	-	Total: rapid	+1813	Fluid overload
22	M64	CRF, anaemia Hb 6.4	4	-	-	1 unit/3 hrs	+1933	Renal impairment
23	F85	ARF, type II resp failure, Hb 7.7	1	-	-	1 unit/4 hrs	+13^^	Renal impairment
24*	M75	ET + anaemia	1	-	-	NS	NS	Cardiac failure
25	F65	TTP	-	2636 MB-FPP	-	15-30 min/ unit	+3787	Fluid overload
26	F27	Crohn's post hemicolectomy, Hb 8.6	2	-	-	-	NR In 3000	Hypoalbuminaemia
27	F87	MDS, Hb 5.8	4	-	Plts 1 pool	1 unit RBC/4 hrs	NR	Cardiac failure, fluid overload
28	F70	Myeloma, chemo, Hb 9.9, plts 7	1 $\frac{3}{4}$	-	Plts 1 pool	1 unit RBC/3 hrs	+912 Out 0	Cardiac failure, fluid overload
29*	M88	Post-op cardiac surgery	< 1	-	-	NS	NS	NS
30	F40	ALL, MOF, HL insertion	2	-	Plts 2 pools	30 mins	In 5250 ↓ urine output	Renal impairment, fluid overload
31	F84	Anaemia ?cause, Hb 5.6	2	-	-	1 unit/4 hrs	NR	Cardiac failure, renal impairment
32*	F76	Bleeding ?Ca bowel	3	-	-	NS	NS	NS
33**	M61	GI bleed Hb 5.5, ARDS	6	1200	-	NS	+488^	NS
34**	F70	RA, pulm. fibrosis, periph. oedema, Hb 7.4	1	-	-	> 4 hrs	-3569^	Hypoalbuminaemia

\* transferred from ATR section

\*\* transferred from TRALI section

^ over preceding 48 hours

^^ over preceding 12 hours

## Cases in which RBC transfusion was implicated *n* = 32

In 32/34 cases (94%) red blood cells (RBC) were given. RBC were transfused for anaemia associated with acute haemorrhage (or probable acute haemorrhage in 14/32 cases (4 noted above)), and in the absence of acute haemorrhage in 18/32 (median age of these 18 patients 77.5 years (range 59 to 89)). Twelve of these 18 cases and 21 of the total 34 cases (information not stated in 12) had concomitant medical conditions that increase the risk of TACO (cardiac failure, renal impairment, hypoalbuminaemia or fluid overload). The onset of symptoms occurred after transfusion of  $\leq 1$  unit in 8 cases,  $\leq 2$  units in 13 cases and  $\leq 3$  units in 3 cases.

Details are given above in Table 43 and in selected cases below.

### Case 11

#### **Possible TACO occurring after 12–24 hours in an elderly patient with fluid overload**

*An elderly woman had CLL associated with AIHA with Hb 4.7 g/dL. Twelve to 24 hours after completion of a 4 unit RBC transfusion she developed sudden SOB and was noted to be in positive fluid balance (+2374). Staff did not record observations so the reporter was unable to establish if there were other symptoms.*

### Case 4

#### **Possible TACO without any concomitant condition that could increase the risk**

*A 61-year-old woman with AML on chemotherapy received an RBC transfusion for anaemia (Hb 7.6 g/dL) and thrombocytopenia (platelets  $22 \times 10^9/L$ ) in the absence of bleeding. During the second RBC unit she became increasingly SOB and tachycardic (pulse 110 bpm) with wheezing. BP was not raised. CXR showed a whiteout at mid-level down. Fluid balance was not recorded in the preceding 24 hours.  $O_2$  was administered and CPAP following transfer to ITU. Steroid and diuretic therapy were given, but responses not documented.*

## Cases in which FFP was transfused *n* = 6

There were 6 cases in which transfusion of FFP was implicated in TACO, of which 4 occurred in the presence of acute haemorrhage (Case 7, Case 9, Case 21 and Case 33). Of the remaining 2 cases, in 1 FFP was given to cover a Hickman line insertion in a patient with ALL and multi-organ failure although details regarding coagulopathy were not given. The other case is described below.

### Case 25

#### **Repeated large volume MB-FFP without plasma exchange for presumed TTP results in probable TACO**

*A 65-year-old woman diagnosed to have acute thrombotic thrombocytopenic purpura (TTP) was treated with 12 units of MB-FFP (2636 mL). Each unit was infused over 15–30 minutes and the infusions were repeated for 3 days. The patient did not receive plasma exchange. After 3 days the physiotherapists noticed she was SOB and wheezy. She was also hypertensive, BP 170/95 with pulse 92 bpm, and in positive fluid balance, +3787 mL, in the 24 hours prior to the reaction. She was given furosemide 80 mg and her symptoms improved.*

## Cases in which platelets were transfused *n* = 8

There were 8 cases in which platelets were transfused, of which 1 occurred in the presence of acute haemorrhage; in 6 cases RBC were also transfused and in 1 case platelets only were transfused.

### Case 5

#### **Co-existent ARDS and TACO initially reported as TRALI**

*A 62-year-old patient with AML became acutely SOB and collapsed after receiving a unit of RBC over 2 hours and a pool of platelets over 30 mins. She had put on 4 kg in weight over the previous few days and had positive fluid balance of 3119 mL in the 24 hours preceding the transfusion. She responded well to furosemide 40 mg on the day of the episode and on each of the next 2 days. She developed a fever after the collapse and was restarted on tazocin and vancomycin, which had been stopped 3 days earlier following positive cultures (CNS on blood and Staph. aureus on hand swab). This case, initially reported as TRALI, appears to be a highly likely case of TACO; however, based on the ISBT criteria, it was classified as a 'probable' case. It illustrates that TACO may co-exist with other conditions, in this case ARDS.*

## Procedural review

In 88% (30/34) cases, the reaction was reported to the HTC; 16 of these had been reviewed by the HTC at the time of reporting to SHOT. Two cases were reported to the hospital transfusion laboratory only. Three hospitals also reported the reactions to their clinical risk committee/team with a further 4 hospitals reporting the reactions to other forms of risk review group, including the following: Patient Safety Team, Serious Incident Review Group, the Governance Department and the Senior Nurse meeting. In 2 cases there was no form of clinical risk review documented.

### Learning points

- TACO is potentially avoidable in many cases. Doctors should consider whether transfusion is appropriate and also take note of concomitant medical conditions that increase the risk. The use of diuretic cover for blood transfusion is likely to reduce the risk of TACO and should also be considered.
- Nurses should monitor the patient's clinical condition during and after the transfusion as TACO may occur during or up to 24 hours after transfusion. This was a main SHOT recommendation last year and has been highlighted in new BCSH guidelines on blood administration.<sup>19</sup> It is also important to monitor the rate of transfusion and fluid balance as these factors influence the risk of a patient developing TACO.

## COMMENTARY

- TACO has caused the most cases of transfusion-related major morbidity and mortality in any category in this year's report. There were 4 deaths (approximately 12%) where the transfusion was probably (Case 28 and Case 34) or possibly (Case 7 and Case 10) contributory; 9 patients (31%) required ITU admission and a further 2 patients required CPAP. TACO appears to be common in critically ill patients on ITU where it may be difficult to avoid.<sup>40</sup> Cases of greater relevance to SHOT are those where TACO is potentially avoidable.
- In this second year of TACO as a separate SHOT category, there were 34 cases compared with 18 in 2008, i.e. an 89% increase. Nine of 20 patients, where the case was initially reported as TACO, had haematological disorders, which probably reflects awareness of TACO among haematologists. However, TACO probably remains under-reported.
- TACO is associated with the transfusion of relatively modest volumes of RBC, particularly in the elderly. In the 18 (of 32) patients in whom RBC were transfused in the absence of haemorrhage (median age 77.5 years), the onset of symptoms occurred after transfusion of  $\leq 1$  unit in 8 cases and  $\leq 2$  units in 13 cases. Twelve of these 18 cases and 21 of the total 34 cases were known to have concomitant medical conditions that increase the risk of TACO (cardiac failure, renal impairment, hypoalbuminaemia or fluid overload).
- Approximately 60% of TACO cases occurred in patients  $> 70$  years and 15% occurred in patients  $< 50$  years. The incidence of TACO in the UK paediatric hospital population remains unknown.
- The classification of cases according to diagnostic criteria is critically dependent upon the information provided, and distinctions between TACO, TRALI and TAD may not always be clear-cut. Some cases which appeared to be TACO did not fulfil ISBT diagnostic criteria and, particularly in critically ill patients, TACO may co-exist with other conditions (Case 5) which may modify classical diagnostic features of TACO. Five cases of TACO (2 probable and 3 possible) occurred after 6 hours, therefore the 6 hour cut-off for diagnosis of TACO merits reconsideration (see Key Messages and Main Recommendations, page 21).
- In 1 case (Case 25) large volumes of MB-FFP were infused to treat an adult with presumed TTP. The mainstay of the treatment of TTP is plasma exchange with FFP replacement. Prior to its institution mortality rates were in excess of 90% and have now fallen to  $\sim 20\%$ . Plasma exchange is associated with a significantly higher survival rate than is plasma infusion.<sup>41,42</sup> Furthermore, MB-FFP appears to be less effective than FFP for plasma

exchange in patients with TTP.<sup>43</sup> In January 2006 the DH recommended SD-FFP for plasma exchange in adult patients with TTP.<sup>39</sup> The diagnosis of TTP should be confirmed by measurement of ADAMTS13 activity and antibody levels (a disintegrin and metalloproteinase with a thrombospondin type 1 motif, member 13; also known as von Willebrand factor-cleaving protease); a UK MRC registry (Haemostasis Research Unit, University College, London) provides a service for these assays. New BCSH guidelines on TTP are in preparation.<sup>44</sup>

- In 2009, 1 case of TACO was reported following major obstetric haemorrhage; there were 2 in 2008. This is a clinically challenging situation where there are difficulties in estimating actual blood loss, particularly because of the changing blood volume and circulatory capacity: delivery, obligate blood loss, pre-partum increased blood volume and cardiac output, peripartum disconnection of placenta and fetus, and massive constriction of uterus and natural reduction in blood volume. As a result, patients may be over-transfused. There may also be failure to recognise TACO in these young individuals who are often regarded to be 'immune' to TACO. A good quality echocardiogram to assess cardiac function during major obstetric haemorrhage will aid assessment; however, this may be difficult to achieve during the emergency situation.
- A patient with AML and a platelet count of 22 (Case 4) was transfused platelets without any explanation. In this scenario, a threshold platelet count of < 10 for prophylactic platelets is generally accepted. A higher threshold is required for patients with bleeding or severe sepsis.<sup>45</sup>

## RECOMMENDATIONS

### New recommendation

- Patients with TTP should have plasma exchange at presentation (and ideally within 24 hours of presentation),<sup>42</sup> with plasma infusion alone administered prior to transfer to a unit or hospital that can offer plasma exchange and appropriate management.

**Action: Consultant haematologists and SHAs**



## Previous recommendations still relevant

Year first made	Recommendation	Target	Progress
2008	Increased recognition of TACO by clinicians and reporting to SHOT is needed, to raise awareness and increase focus on this important and in many cases potentially avoidable complication of blood transfusion.	<b>HTT</b>	The number of cases of TACO have increased; however, it almost certainly remains under-reported.
2008	Education and training aimed at the recognition and avoidance of TACO is required for doctors across all specialties, and nurses at both national and local levels. Education and training of junior doctors, to ensure appropriate decision making as regards transfusion of blood components/ products and appropriate prescription, remains a key priority.	<b>NBTC</b>	This year's report highlights the need for a national initiative to address these issues.
2008	Doctors should ensure careful clinical assessment of each patient to whom transfusion of components is being considered, to ensure that the proposed transfusion is appropriate. The minimum volume of blood components required should be prescribed to be transfused at an appropriate rate, in accordance with BCSH guidelines on blood administration.	<b>HTT, BCSH</b>	a) The new BCSH guidelines on the administration of blood components have addressed issues related to the rate of transfusion. <sup>19</sup> b) The BCSH guidelines do not address clinical assessment prior to transfusion, which could be addressed in a national initiative led by NBTC (see above recommendation).
2008	If it is necessary to transfuse RBC to a patient with chronic anaemia, the risk of precipitating congestive cardiac failure may be minimised by administering a diuretic. The decision to give a diuretic must be based on clinical assessment of the patient.	<b>HTT, BCSH</b>	As b) above
2008	Nursing staff should record the rate of transfusion and fluid balance in patients receiving blood components and act on signs suggestive of TACO. Transfusions should be administered at times, and in locations, permitting careful observation of patients throughout the transfusion and upon completion. Out-of-hours transfusions should be avoided unless appropriate facilities are available. BCSH guidelines on blood administration in preparation should address these issues.	<b>HTT, BCSH</b>	The new BCSH guidelines on the administration of blood components have addressed these issues, and also advise that patients discharged home after a transfusion should be counselled with systems available to ensure that patients have 24 hour access to clinical advice. <sup>19</sup>