

18b Transfusion-Associated Circulatory Overload (TACO) n=149

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Definition:

TACO is defined as acute or worsening respiratory compromise and/or acute or worsening pulmonary oedema during or up to 12 hours[†] of transfusion, with additional features including cardiovascular system changes not explained by the patient's underlying medical condition; evidence of fluid overload and a relevant biomarker[‡].

[†]SHOT accepts cases up to 24 hours

[‡]see Table 18b.2 for details of required and additional criteria for a surveillance diagnosis

Key SHOT message

- Patients who develop respiratory distress during or up to 24 hours following transfusion where transfusion is suspected to be the cause must be reported to SHOT. The transfusion-associated circulatory overload (TACO) definition criteria can be used as guidance, but this should not be restrictive. The SHOT Working Expert Group can transfer cases between categories

Abbreviations used in this chapter

Hb Haemoglobin

TACO Transfusion-associated circulatory overload

NT pro-BNP N-terminal-pro B-type natriuretic peptide

Recommendations

- A formal pre-transfusion risk assessment for transfusion-associated circulatory overload (TACO) should be undertaken whenever possible for all patients receiving blood transfusion (especially if older than 50 years or weighing less than 50kg) and mitigating actions taken, as TACO is the most commonly reported cause of transfusion-related mortality and major morbidity

Action: All staff authorising transfusions

- A structured incident review should be undertaken for every case of TACO. This will ensure optimal organisational and individual patient safety measures are in place to protect patients from TACO as far as possible (see recommended resources)

Action: Trust/Health Board governance and clinical risk departments, all staff investigating transfusion incidents

- Weight-adjusted red cell dosing should be used to guide the appropriate volume required for all non-bleeding adult patients. Ideally tools which also highlight inappropriate transfusion should be used (Grey et al. 2018, NCA 2017)

Action: All staff authorising transfusions

The TACO pre-transfusion assessment infographic has been re-drafted as a checklist (Figure 18b.1) that can be incorporated as part of the transfusion care pathway in healthcare.

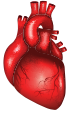


TACO Checklist		Patient Risk Assessment		YES	NO	If Risks Identified		YES	NO
	Does the patient have any of the following: diagnosis of 'heart failure', congestive cardiac failure (CCF), severe aortic stenosis, or moderate to severe left ventricular dysfunction?					Review the need for transfusion (do the benefits outweigh the risks)?			
	Is the patient on a regular diuretic?					Can the transfusion be safely deferred until the issue is investigated, treated or resolved?			
	Does the patient have severe anaemia?					If Proceeding with Transfusion: Assign Actions		TICK	
	Is the patient known to have pulmonary oedema?					Body weight dosing for red cells			
	Does the patient have respiratory symptoms of undiagnosed cause?					Transfuse a single unit (red cells) and review symptoms			
	Is the fluid balance clinically significantly positive?					Measure fluid balance			
	Is the patient receiving intravenous fluids (or received them in the previous 24 hours)?					Prophylactic diuretic prescribed			
	Is there any peripheral oedema?					Monitor vital signs closely, including oxygen saturation			
	Does the patient have hypoalbuminaemia?					Name (PRINT):			
	Does the patient have significant renal impairment?					Role:			
						Date:		Time (24hr):	
						Signature:			

Figure 18b.1: TACO pre-transfusion checklist

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.

TACO=transfusion-associated circulatory overload

Introduction

The 2020 reporting year has recorded the highest number of TACO cases ever reported to SHOT. COVID-19 has complicated the assessment of some cases and the overall increase in number of reports received has been affected by patients on convalescent plasma trials. The increasing number of cases where preventive actions include the TACO pre-transfusion checklist being incorporated into documents and processes, including electronic systems and training programmes, is a welcome and positive change in practice. It is critically important that all TACO cases are used as a learning opportunity to prevent or mitigate TACO in other patients. A new recommendation for this year is the use of the TACO investigation and preventive action guidance tool, to ensure a structured and comprehensive review of cases to support effective preventive actions (see recommendations and recommended resources sections).

Deaths n=18

TACO resulted in the death of a patient in 18 reported cases. Although the imputability level was 1 (possibly related to transfusion) in most cases, this is a significant increase in the number of cases of TACO where patients died, and the transfusion was judged to be contributory. This may reflect the severity of underlying illness and in particular those with COVID-19 as such patients were unfortunately more likely to die.

Major morbidity n=25

There were fewer cases resulting in major morbidity than in the previous reporting year but again this may reflect the severity of underlying illness in some patients, in that they were possibly more likely to die than they were to survive following major morbidity. TACO remains the leading cause of transfusion-related combined mortality and major morbidity.

Table 18b.1:
Demographic
overview of cases

Demographic	Number of reports
Deaths (imputability 3)	0
Deaths (imputability 2)	2
Deaths (imputability 1)	16
Major morbidity outcome	25
Age [†]	Range: 9 days to 97 years Median: 73 years
Top 3 medical specialties [†]	Haematology, acute medicine, general medicine
Bleeding patients (indication code R1 or 'massive bleeding' indicated [†])	24
Non-bleeding patients (other indication codes or not stated)	125

[†] where data was provided

TACO is more commonly reported in the elderly, non-bleeding patients but is seen across all age groups and is consistent with the data from previous years. There were 2 cases in the under-18 age group both of which were neonates. Haematology and adult medical specialties are again the most common specialties where TACO is reported, and this should be considered when delivering TACO education and mitigation plans.

Analysis of cases

Analysis by definition criteria

Cases reported in 2020 were assessed using the surveillance criteria in Table 18b.2. It should be noted that the criteria are for the purposes of reporting and surveillance. They do not constitute a clinical diagnosis for the purpose of real-time interventions for the medical management of a patient presenting with respiratory compromise during or following transfusion. However, the surveillance criteria should promote recognition of TACO.

Figure 18b.2 shows the number of accepted TACO cases versus the number of TACO surveillance criteria met. One accepted case only met two TACO surveillance criteria but was otherwise a clinically compelling scenario. A patient with a positive fluid balance developed respiratory distress and increased oxygen requirement during transfusion, which improved following treatment with a diuretic. A chest X-ray was not performed and therefore the presence of pulmonary oedema could not be confirmed, and there were no cardiovascular changes reported. There was a slightly increased number of patients meeting all five criteria due to a slight increase in NT pro-BNP testing, which is a useful indicator of left atrial hypertension in patients with circulatory overload.

Table 18b.2:
TACO surveillance
definition (adapted
from Wiersum-
Osselton et al.
2019)

Patients classified with TACO (surveillance diagnosis) should exhibit at least one required criterion* with onset during or up to 12 hours after transfusion (SHOT continues to accept cases up to 24 hours), and a total of 3 or more criteria i.e. *A and/or B, and total of at least 3 (A to E)

* Required criteria (A and/or B)

- A.** Acute or worsening respiratory compromise and/or
- B.** 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

Additional criteria

- C.** 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
- D.** Evidence of fluid overload including any of the following: a positive fluid balance; clinical improvement following diuresis
- E.** Supportive result of a relevant biomarker, e.g. an increase of B-type natriuretic peptide levels (BNP) or N-terminal-pro brain natriuretic peptide (NT-pro BNP) to greater than 1.5 times the pre-transfusion value

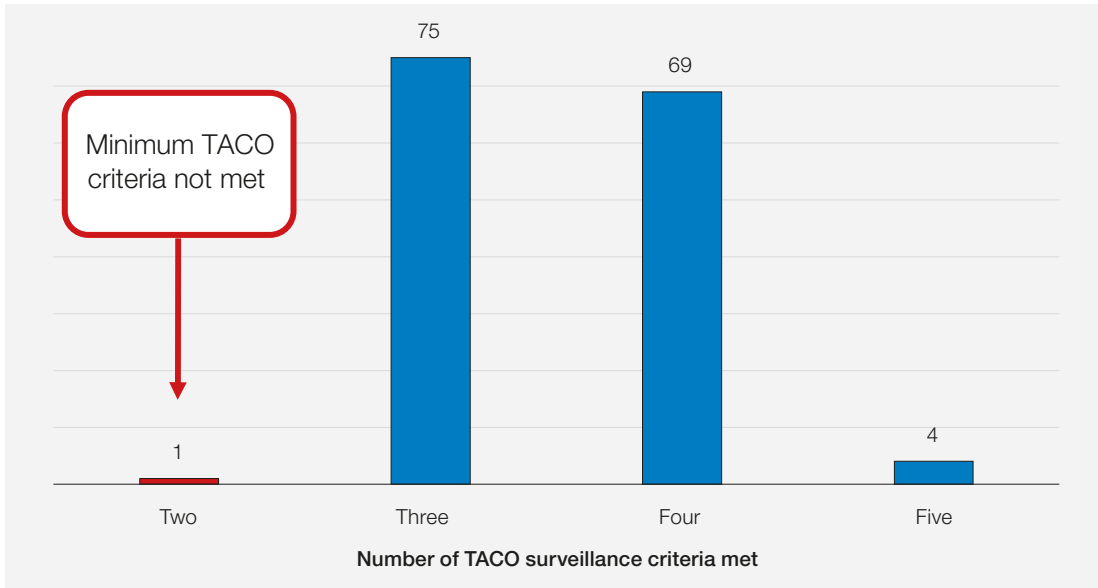


Figure 18b.2: Number of TACO surveillance criteria versus number of accepted TACO cases

Use of the TACO checklist

The TACO risk assessment recommendation was introduced in 2016 in the 2015 Annual SHOT Report (Bolton-Maggs et al. 2016). A question regarding the use of the TACO risk assessment and mitigating actions was added to the SHOT reporting questionnaire for the 2019 reporting year. An overview is shown in Figure 18b.3.

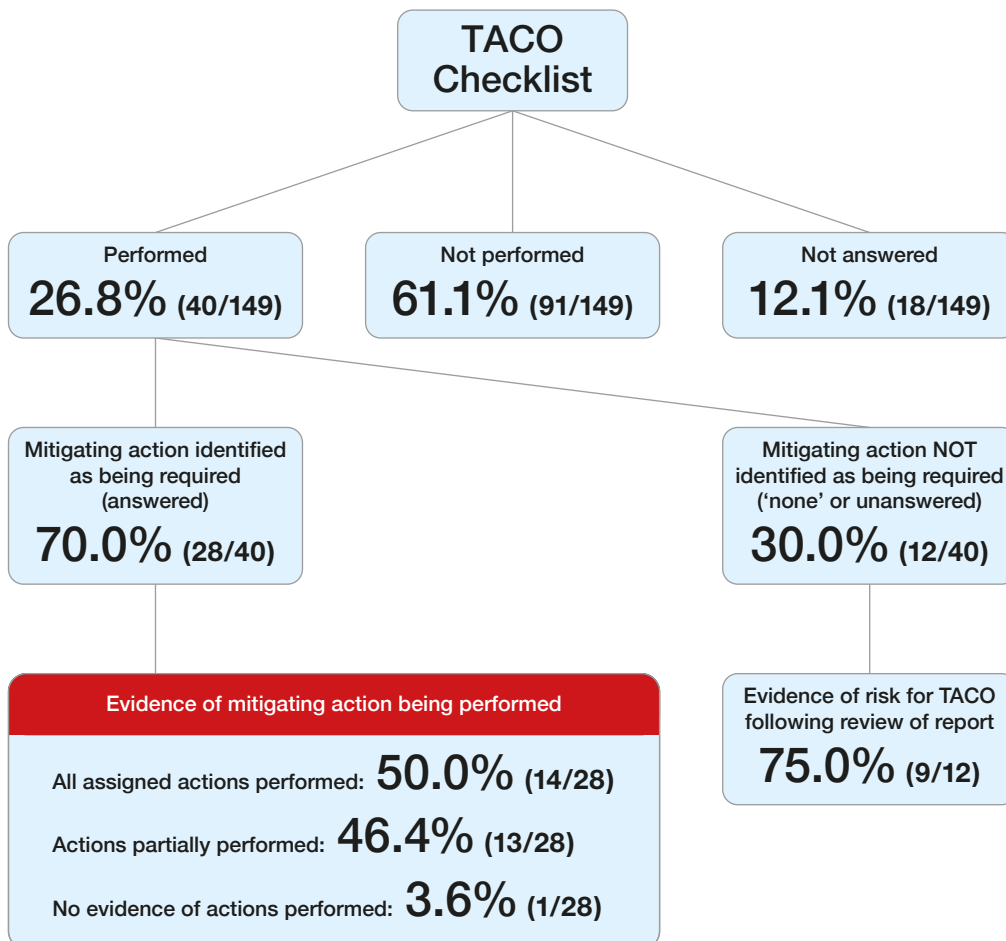


Figure 18b.3: Use of the checklist to identify patients at risk of TACO and implementation of mitigations

The TACO checklist had only been reported as performed in 40/149 (26.8%) of cases, resulting in missed opportunities to mitigate the risk of TACO. Where it had been performed, 28/40 (70.0%) of those cases were identified as requiring a TACO risk-reduction measure. This was performed in 14/28 (50.0%) of cases, with the majority of the remainder partially performed, or not fully assessable from the data available. A TACO risk-reduction measure was not identified as required in 12/40 (30.0%) of cases, but on review 9/12 (75.0%) of these cases had clear risk factors for TACO, suggesting the checklist had not been accurately performed.

TACO cases with evidence of excessive red cell volume to meet the target Hb

The recommendation for weight-adjusted red cell dosing for non-bleeding patients was introduced in 2018 in the 2017 Annual SHOT Report (Bolton-Maggs et al. 2018). Analysis of the 2019 data showed this was not implemented in practice and was contributing to a significant level of overtransfusion in reported cases of TACO.

In 2020 there were 73 cases where the patient was not bleeding, and body weight and pre-transfusion Hb level was reported. Thirty-four of these cases also had a post-transfusion Hb level reported. In 7/34 (20.6%) of cases their post-transfusion Hb target was exceeded. The number of red cell units transfused was reported in 28 cases. In 12/28 (42.9%) of cases the patient received more than the calculated weight-adjusted dose resulting in 5/12 (41.2%) exceeding their post-transfusion Hb target. This suggests that weight-adjusted red cell dosing is not sufficiently implemented, and this continues to result in excessive red cell transfusion.



Learning points

- Excessive volume of red cell transfusion to meet a target haemoglobin (Hb) level remains a significant factor in cases of transfusion-associated circulatory overload (TACO) in non-bleeding patients. This can be minimised by weight-adjusted red cell dosing, and medical management of anaemia where possible. The red cell calculation shown below helps estimate the volume of red cells required to meet the target haemoglobin (Norfolk 2013)

$$\text{[target Hb (g/L) - pre-transfusion Hb (g/L)]} \times \text{weight (Kg)} \times 0.4\text{mL red cells} \\ = \text{volume of red cells (mL) required to meet target Hb}$$

(The volume of a unit of adult-specification red cells in the UK is 220 - 340mL)

This volume calculation will help inform the number of units to be requested

- A significant number of reported TACO cases do not appear to have had a TACO checklist performed, and/or TACO risk-reduction measures not implemented where risk was identified. This should be embedded into the procedure for the request and authorisation of transfusion
- Every case of TACO is an opportunity to improve practice and reduce risk for other patients. Structured investigation and root-cause analysis allows implementation of effective preventive actions

Conclusion

TACO is in many cases a preventable complication of transfusion but remains the leading cause of transfusion-related mortality and major morbidity. More cases than ever were reported to SHOT in 2020, but cases of TACO continue to be under-recognised and under-reported. Most TACO cases have a recognised risk factor for circulatory overload. Although there are now well-established recommendations and tools to mitigate TACO in patients with risk factors, analysis of the data shows these are not being implemented in clinical practice, and opportunities are being missed to protect patients. It is critically important that every case of TACO is used as an opportunity to improve practice and reduce risks for other patients. Structured investigation and root cause analysis allows implementation of effective preventive actions for the future protection of patients.

Recommended resources

Example of weight-adjusted red cell dosing implemented in clinical practice

www.rcdcalculator.co.uk

TACO investigation and preventive action guidance tool

<https://www.shotuk.org/resources/current-resources/>

TACO checklist: in risk assessment/checklist alternative format for incorporation into clinical documents

<https://www.shotuk.org/resources/current-resources/>

SHOT Bite number 11: respiratory symptoms during transfusion

<https://www.shotuk.org/resources/current-resources/shot-bites/>



References

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Wiersum-Osselton J, Whitaker BL, Grey S, et al. Revised international surveillance case definition of transfusion associated circulatory overload (TACO): a classification agreement validation study. *Lancet Haematol* 2019;**6**(7):e350-e358. doi: 10.1016/S2352-3026(19)30080-8.