

Respiratory Failure after Blood Transfusion: Case Report

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Abstract

Blood transfusion is a common and life-saving medical procedure. However, it can sometimes lead to adverse outcomes for patients. This report details the case of a 39-year-old woman with cerebral palsy who developed acute respiratory failure after a blood transfusion. Transfusion-Associated Circulatory Overload (TACO) and Transfusion-Related Acute Lung Injury (TRALI) are the main causes of transfusion-related deaths, and currently, no specific treatments are available for these conditions.

Keywords

TRALI, TACO, Blood Transfusion, Case Report

1. Introduction

Blood transfusion is a crucial life-saving treatment, but it can also cause significant side effects. To avoid unnecessary transfusions, many studies have been conducted to examine patient survival, length of stay in intensive care, and side effect profiles. These studies provide detailed guidance on when blood products should be used and when they are not necessary. Today, based on these findings, it is recommended to administer blood products only when necessary, which can enhance patient survival, decrease the risk of side effects, and promote more efficient resource use [1].

Transfusion-associated circulatory overload (TACO) and transfusion-related acute lung injury (TRALI) are syndromes characterized by acute respiratory distress that occurs within hours or days after a blood transfusion.

The UK reported TACO (along with transfusion delays) as the leading cause of transfusion-related deaths in 2020, responsible for 30 out of 39 deaths (76.9%) [2]. Accordingly, in 2019, the Food and Drug Administration (FDA) identified TACO

(along with TRALI) as the most common cause of transfusion-related deaths at 27% [3].

TACO and TRALI remain the leading causes of transfusion-related deaths. We present a case of a potential TACO patient, a 39-year-old woman with cerebral palsy, who developed pulmonary edema after blood transfusion.

2. Case Presentation

A 39-year-old female patient with a diagnosis of cerebral palsy was brought to the emergency department by her relatives due to irregular breathing and decreased consciousness compared to her baseline. She was not on any regular medication. The patient was normotensive, with a pulse rate of 120 beats/min, a respiratory rate of 35 breaths/minute, and an oxygen saturation of 93% with a reservoir mask. Physical examination revealed significant pallor, +2 pretibial edema in both legs, and rales in the left basal lung sounds. The patient's Glasgow Coma Scale score was 8.

Laboratory results:

Hb: 1.6 g/dl RBC: $1.2 \times 10^{12}/L$ MCV: 54 RDW: 22.5

WBC: $20 \times 10^9/L$ Neutrophil: $20 \times 10^3/ml$

LDH: 189 U/L CRP: 21.9 mg/L Albumin: 31 g/L

Total bilirubin: 0.3 mg/dl Direct bilirubin: 0.12 mg/dl

Blood gas:

PH: 7.219 HCO₃: 12.5 mEq/L Lactate: 13 mmol/L

Base (ecf): -13.7

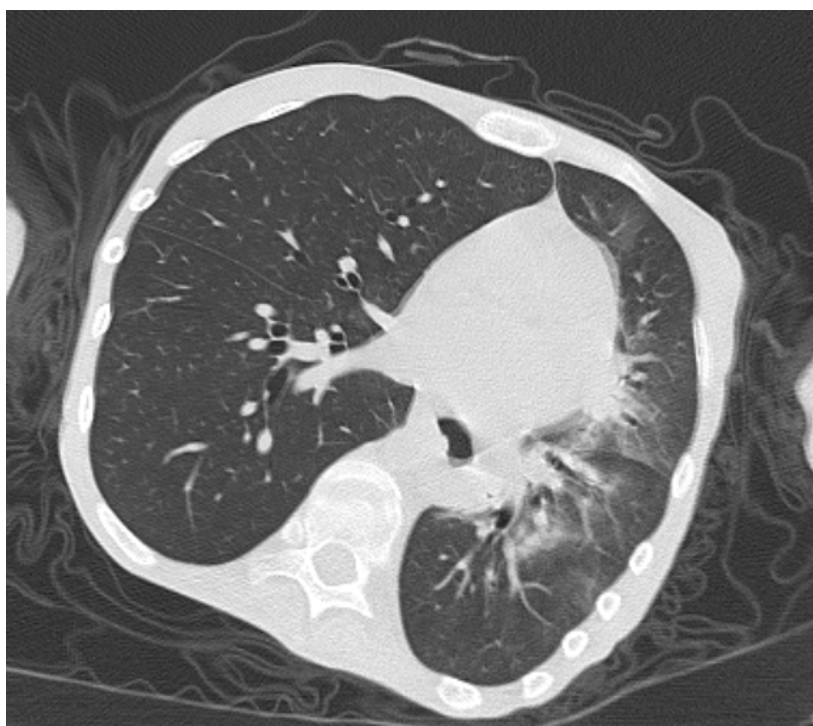


Figure 1. Thoracic CT scan at E.R. Admission.

Computed tomography of the thorax revealed infectious ground-glass opacities in the lower lobe of the left lung, as shown in **Figure 1**. The patient was admitted to the intensive care unit, and two units of blood were transfused. Following the transfusion, the patient's overall condition improved, and the requirement for oxygen support was eliminated. The patient was transferred to the internal medicine ward the following morning. However, three hours of post-admission, the patient developed shortness of breath, and oxygen saturation decreased to 75%. The patient was urgently transferred back to the intensive care unit and intubated. Thoracic CT angiography was performed.

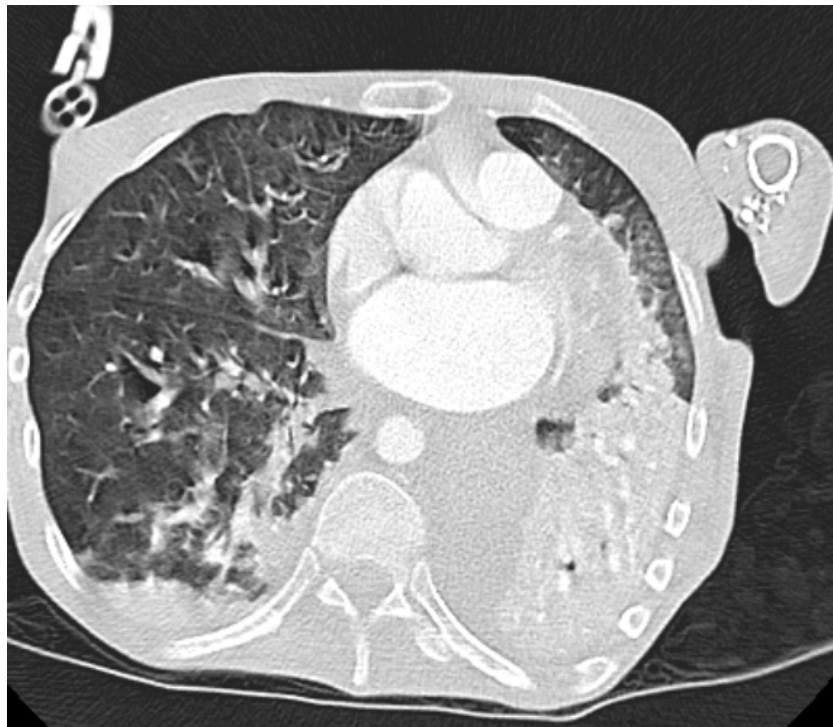


Figure 2. A day later thoracic CT angiography (36 hours after admission).

In thoracic CT angiography, patchy consolidations and ground-glass opacities were predominantly observed in the lower lobes of the lungs, as shown in **Figure 2**. These findings were evaluated in favor of TRALI-TACO, considering the patient's medical history. An attempt was made to extubate the patient; however, she was unable to tolerate it. As her condition did not improve with broad-spectrum antibiotics and diuretic treatment, a tracheostomy was performed, and she continues to live on a home ventilator to this day.

3. Discussion

The pathogenesis of TACO and TRALI is not fully understood. Two main causes have been suggested for both conditions. The first cause involves the patient's underlying preexisting clinical condition (transfusion recipient risk factors), while the second is related to the transfused blood product. Both factors are necessary

for TACO or TRALI to develop. In TACO, the first cause can be explained by poor adjustment to volume overload. A large prospective study of 200 patients with TACO found that high blood pressure, congestive heart failure, cardiomegaly on chest radiography, pretransfusion diuretic use, acute kidney injury, chronic kidney disease, and emergency surgery are risk factors associated with TACO [4].

TACO-TRALI is rare, occurring in about 1% of blood transfusions. Although the most common cause of TACO is excessive blood product transfusion, other risk factors include heart or kidney failure, cancer diagnosis, chronic anemia, previous fluid overload, and rapid blood product administration. To prevent TACO, it is recommended to administer erythrocyte suspension (ES) replacements within 4 hours [5]. The definitions of both TACO and TRALI are shown in **Table 1** and **Table 2** [6].

Table 1. TACO definition [6].

Transfusion-Associated Circulatory Overload (TACO)		
Case Definition	Severity	Imputability
<p>Definitive: New onset or exacerbation of 3 or more of the following within 12 hours of cessation of transfusion: (At least 1 of the following:)</p> <ul style="list-style-type: none"> Evidence of acute or worsening respiratory distress (dyspnea, tachypnoea, cyanosis and decreased oxygen saturation values in the absence of other specific causes) and/or Radiographic or clinical evidence of acute or worsening pulmonary edema (crackles on lung auscultation, orthopnea, cough a third heart sound and pinkish frothy sputum in severe cases); or both AND Elevated brain natriuretic Peptide (BNP) or NT-pro BNP relevant biomarker Evidence of cardiovascular system changes not explained by underlying medical condition (elevated central venous pressure, evidence of left heart failure including development of tachycardia, hypertension, widened pulse pressure jugular venous distension, enlarged cardiac silhouette and/or periferal edema Evidence of fluid overload 	<p>Non-severe: Medical intervention (e.g. symptomatic treatment) is required but lack of such would not result in permanent damage or impairment of a bodily function, Severe: Inpatient hospitalization or prolongation of hospitalization is directly attributable to the adverse reaction, persistent or significant disability or incapacity of the patient occurs as a result of the reaction, or a medical or surgical intervention is necessary to preclude permanent damage or impairment of a body function. Life-threatening: Major intervention required following the transfusion (e.g. vasopressors, intubation, transfer to intensive care) to prevent death. Death: The recipient died as a result of the adverse transfusion reaction. Death should be used if death is possibly, probably or definitely related to transfusion. If the patient died of a cause other than the transfusion, the severity of the reaction should be graded as appropriate given the clinical circumstances related to the reaction. Not determined: The severity of the adverse reaction is unknown or not stated.</p>	<p>Definite: No other explanations for circulatory overload are possible. Probable: Transfusion is a likely contributor to circulatory overload AND EITHER The patient received other fluids as well OR The patient has a history of cardiac insufficiency that could explain the circulatory overload, but transfusion is just as likely to have caused the circulatory overload. Possible: The patient has a history of pre-existing cardiac insufficiency that most likely explains circulatory overload. Not determined: The relationship between the adverse reaction and the transfusion is unknown or not stated.</p>

Table 2. TRALI definition [6].

Transfusion-Related Acute Lung Injury (TRALI)		
Case Definition	Severity	Imputability
<p>Definitive: NO evidence of acute lung injury (ALI) prior to transfusion</p> <p>AND ALI onset during or within 6 hours of cessation of transfusion</p> <p>AND Hypoxemia defined by any of these methods:</p> <ul style="list-style-type: none"> • PaO₂/FiO₂ less than or equal to 300 mmHg • Oxygen saturation less than 90% on room air • Other clinical evidence <p>AND Radiographic evidence of bilateral infiltrates</p> <p>AND No evidence of left atrial hypertension (<i>i.e.</i>, circulatory overload)</p>	<p>Non-severe: Medical intervention (e.g. symptomatic treatment) is required but lack of such would not result in permanent damage or impairment of bodily function.</p> <p>Severe: Inpatient hospitalization or prolongation of hospitalization is directly attributable to the adverse reaction, persistent or significant disability or incapacity of the patient occurs as a result of the reaction, or a medical or surgical intervention is necessary to preclude permanent damage or impairment of a body function.</p> <p>Life-threatening: Major intervention required following the transfusion (e.g. vasopressors, intubation, transfer to intensive care) to prevent death.</p> <p>Death: The recipient died as a result of adverse transfusion reaction. Death should be used if death is possibly or definitely related to transfusion.</p> <p>Not determined: The severity of the adverse reaction is unknown or not stated.</p>	<p>Definite: There are no alternative risk factors for ALI present.</p> <p>Possible: There is evidence of other causes for acute lung injury such as:</p> <p>Direct Lung Injury</p> <ul style="list-style-type: none"> • Aspiration • Pneumonia • Toxic inhalation • Lung contusion • Near drowning <p>Indirect Lung Injury</p> <ul style="list-style-type: none"> • Severe sepsis • Shock • Multiple trauma • Burn injury • Acute pancreatitis • Drug overdose <p>Ruled out: There is conclusive evidence beyond reasonable doubt of a cause other than the transfusion.</p> <p>Not determined: The relationship between the adverse reaction and the transfusion is unknown or not stated.</p>

Unfortunately, both TACO and TRALI are potentially life-threatening, and treatment options are very limited. For TRALI, hemodynamically supportive treatments are mainly used, while for TACO, diuresis is also a key part of treatment. Blood transfusions can be lifesaving when necessary, but using them without a clear reason can pose serious, unnecessary risks to the patient. Before deciding on a blood transfusion, it's essential to thoroughly review the patient's history, physical exam, and any existing health conditions.

Ethical Approval

Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

Conflicts of Interest

No conflicts of interest have been declared.

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Abbreviations

TACO	Transfusion-Associated Circulatory Overload
TRALI	Transfusion-Related Acute Lung Injury
CT	Computed Tomography