Case Report of a Transfusion-Associated Circulatory Overload Leading to Cardiac Arrest in a COVID-19 Positive Patient

Samar Albalooshi, MD* Abdulrahman Al Madani, MBBS, MRCPI, SB-Med, CFRCPI-Resp*

ABSTRACT

Although case reports have been made regarding adverse transfusion reactions, few have been made regarding blood transfusions leading to cardiac arrest. Today, we present a case of a COVID-19 positive Bahraini male, triple vaccinated, transfused with packed red blood cell (pRBC) after finding out he has low haemoglobin levels (64 g/dl) after routine laboratory investigations. During the blood transfusion, he developed hypertension, tachycardia and tachypnoea. The patient went into cardiac arrest within a few minutes of this presentation. Return of spontaneous circulation was achieved, and the patient was managed as transfusion-associated circulatory overload (TACO) with a good overall outcome.

Keywords: Blood transfusion, Reactions, Cardiac arrest

INTRODUCTION

The spectrum of transfusion-related blood reactions is broad. It can range from mild reactions such as simple allergy to life-threatening transfusion reactions, which include anaphylaxis, transfusion-associated lung injury (TRALI), transfusion-associated circulatory overload (TACO), acute haemolytic reaction and transfusion-related sepsis[1]. Many blood transfusions are done in emergency department settings, from massive transfusion protocols done in the acute trauma setting to transfusions of symptomatic anaemia. Although the percentage of patients contracting such adverse reactions is not uncommon, it is rarely anticipated and widely known to be underreported[2]. Although case reports have been made regarding adverse transfusion reactions, few have been made regarding blood transfusions leading to cardiac arrest. The reported cases that were found to lead to cardiac arrest were caused by hyperkalaemia from the blood products[3,4], also known as transfusion-associated hyperkalemic cardiac arrest (TAHCA). Today, we will present a case of an adverse transfusion reaction leading to cardiac arrest in a COVID-19 positive patient.

CASE REPORT

A 59-year-old COVID-19 positive Bahraini male, triple vaccinated with 2 Sinopharm vaccines and 1 Pfizer, was found incidentally to have Hb of 64 g/dl upon routine admission laboratory investigations. He has had multiple blood transfusions for low haemoglobin without any adverse events. He is hypertensive, dyslipidemia, post-stroke and previously had a prior percutaneous coronary intervention in 2019 due to an incidental finding of left ventricular dysfunction (ejection fraction 45%). Previously, he used to smoke but stopped smoking three years ago. After his stroke, he developed depression and was followed up in psychiatry for these symptoms. He was for transfusion of 2 units of packed red cells upon finding low haemoglobin levels. Each red cell was approximately 300ml, and each pack of 300ml was due to be given over 4 hours.

During the transfusion of the first unit, the patient complained about his inability to sleep and discomfort in his chest. He is noted to be anxious and repeatedly asking for medications to sleep. He is hypertensive with a BP of 170/80 and appears to be hyperventilating. After being given a benzodiazepine stat, the patient slept comfortably without other complaints. The second blood transfusion was delayed until the patient seemed to be comfortable at rest. Within a few ml of transfusion of the second unit, the patient suddenly desaturated to 60s. His blood pressure became hypertensive at 192/90, his heart rate was tachycardiac at 160 bpm, and the patient became tachypneic with RR 30. The patient was afebrile with a temperature of 36 degrees Celsius orally. The patient started to develop thick frothy secretions reaching up to his mouth. Transfusion was immediately stopped. Suctioning and high-flow nasal cannula was applied, and the patient was given diuretics, epinephrine and hydrocortisone. Within a few minutes of starting to suction the patient, he became pulseless and collapsed. Code blue was activated within minutes of the patient's deterioration. Two minijets of adrenaline were given, and CPR was done as per ACLS protocol. The patient was intubated and kept on FiO2 70%, VT 400, and PEEP 10. He was also kept on inotropic support (as adrenaline infusion) as his BP was found to be low 50/34.

Chest x-rays before transfusion showed no clear infiltrates (Figure 1), but chest x-rays followed the reaction showed flash pulmonary oedema, as noted below (Figure 2).

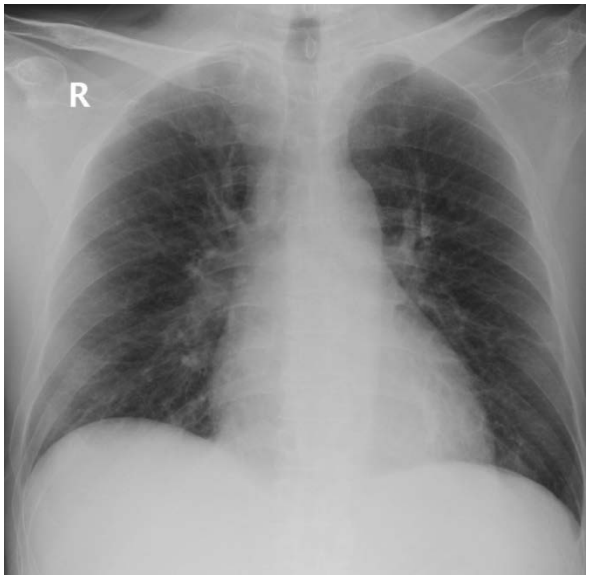

Figure 1: This first CXR represents the patient before transfusion

* Bahrain Defence Force
Royal Medical Services. Bahrain.
E-mail: dr_almadani@hotmail.com

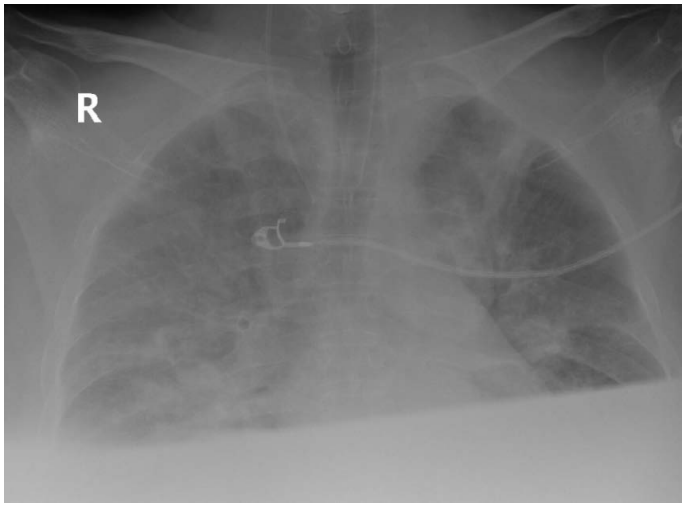

Figure 2: CXR taken post-intubation, arrest and transfusion reaction

The patient was followed by ICU and extubated three days after receiving aggressive diuretic therapy and IV antibiotics for secondary infection. He was kept on a Venturi mask, then a nasal cannula, and tapered to room air. He remained in the ICU side of the facility for a total of 5 days and then shifted to the regular monitoring side of the facility. The patient was discharged ten days after his initial presentation. On discharge, the patient was back to his baseline status with no new neurological features or signs.

Due to the presence of tachycardia, tachypnoea, hypertension with evidence of respiratory distress, and flash pulmonary oedema with ejection fracture of 45%, the patient was managed as transfusion-related circulatory overload (TACO).

DISCUSSION

The diagnosis of transfusion-associated circulatory overload (TACO) is difficult, especially as there is a variation of guidelines for the diagnosis[5]. These include the Centre for Disease Control and Prevention (CDC), the British Committee for Standards in Hematology (BCSH) and the International Society for Blood Transfusion (ISBT) as listed below.

CDC[6]: Hemovigilance Module Surveillance Overview definition of "definitive TACO" as revised by 2022

New onset of three or more of the following within 12 hours of cessation of transfusion				
Acute respiratory distress, as evident by tachypnea or dyspnoea, cyanosis and reduced saturation.	And/ or	Radiological or clinical evidence of acute or worsening pulmonary oedema, e.g., crackles, orthopnea, presence of S3 heart sound	And/ or	Elevated pro-BNP Evidence of cardiovascular system changes such as elevated central venous pressure not explained by prior condition Evidence of fluid overload

ISBT guidelines[7]: revised reporting guidelines for surveillance diagnosis of TACO in 2017

Acute respiratory distress up to 12 hours after transfusion and should exhibit 1 or 2 of the criteria below:
Acute or worsening pulmonary oedema by clinical examination or radiological imagining
Evidence of cardiovascular system changes such as elevated central venous pressure not explained by prior condition
Evidence of cardiovascular system change not explained by a patient medical condition
Evidence of fluid overload, e.g., positive fluid balance, response to diuretic therapy
Elevated in pro-BNP greater than 1.5 times than pre-transfusion value

BCSH guidelines[8] include TACO under the umbrella of acute transfusion reactions (ATR), which also include transfusion-associated lung injury (TRALI) and transfusion-associated dyspnea and proposes that initial treatment of ATR should not be dependent on classification but directed by signs and symptoms.

Broadly, the definition of transfusion-associated circulatory overload requires the presence of three signs of acute pulmonary oedema in a background of a blood transfusion, usually within 12 hours.

The initial presentation of the patient's transfusion reaction included chest discomfort, restlessness, hyperventilation and hypertension. Depending on the guidelines used in various institutes, the patient may not fulfil the criterion for TACO as he only had vague symptomatology prior to deterioration and arrest. However, regardless of the guidelines, acute life-threatening transfusion reactions should be considered in any symptomatic patient receiving a blood transfusion, even if symptomatology is vague or does not fulfil any criterion at present.

Despite a systematic review showing that proBNP may be used as a marker to help guide the diagnosis of TACO[9], it remains to be a clinical diagnosis and a challenging one to make. In addition, transfusion reactions such as TACO often mimic the symptomatology of the patient's disease (as in cardiac or renal overload) or may be confused with other acute transfusion reactions such as TRALI, so diagnosis may be even more challenging to make.

As mentioned previously, TRALI and TACO are often confused in acute care settings due to the overlap of symptomology and may make diagnosis more difficult. Whilst TACO occurs as a result of an increase in hydrostatic pressure in a patient with a positive fluid balance leading to extravasation of fluid into alveoli and tissues, TRALI's pathophysiology is mainly hypothesised to be due to the reaction of anti-HLA antibodies or biologically active lipids in a pro-inflammatory environment, such as blood transfusion or sepsis leading to acute respiratory distress syndrome (ARDS)[10]. Despite varying pathophysiology, both present with respiratory distress, bilateral diffuse infiltrates and tachycardia. However, TACO tends to occur in patients with a positive fluid balance. They also tend to be hypertensive with elevated proBNP. The fluid causing pulmonary oedema in TACO is transudative due to hydrostatic pressure changes, as mentioned before. Due to this, TACO patients respond positively to diuretics. In contrast, TRALI patients tend to be hypotensive, commonly febrile, have minimal changes in proBNP and have exudative fluid due to the inflammatory mediated pathophysiology. As a result, they do not respond to aggressive diuretic management as with TACO patients.

CONCLUSION

Transfusion-associated circulatory overload (TACO) is an underreported transfusion reaction that is difficult to diagnose

due to multiple factors, including different diagnosis guidelines and overlap with other adverse transfusion reactions and patient's disease symptomatic, such as cardiac or renal overload. However, acute life-threatening transfusion reactions, including TACO, should be considered in all symptomatic patients receiving blood transfusion regardless of the severity of their symptoms, as deterioration may be rapid and devastating.

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Competing Interest: None.

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