https://doi.org/10.48047/AFJBS.6.Si3.2024.2897-2903

African Journal of Biological Sciences

Journal homepage: http://www.afjbs.com

Research Paper Open Access

Successful management of intraoperative hemolytic transfusion reaction – A case report

Thamizhmathi Thangaraju*[1], Nandhini Loganathan[2], Saravanakumar Sundaresan[3], Kiruthiga Kamaleswaran[3]

Author details:

First and corresponding author: Thamizhmathi Thangaraju,Postgraduate,[1] Saveetha Medical College and Hospital, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai, Tamilnadu, India – 602105.
Second author :Nandhini Loganathan, Postgraduate, [2]Vinayaka Mission's Kirupananda Variyar Medical College & Hospital, Vinayaka Mission's Research Foundation(DU))
Third author: Saravanakumar Sundaresan, Head of the department, Department of Anaesthesiology, [3]Government Tiruvallur Medical College and Hospital
Fourth Author: Kiruthiga Kamaleswaran, Senior resident, [3]Government Tiruvallur Medical College and Hospital.

Authors affiliation with mail and ORCID ID:

1. Thamizhmathi Thangaraju, MBBS., Postgraduate, Saveetha Medical College and Hospital, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai. Mail Id: thamizhmathi.t@gmail.com. ORCID Id: 0009-0007-2667-3544
2. Nandhini Loganathan., MBBS., Postgraduate, Vinayaka Mission's Kirupananda Variyar Medical College & Hospitals, Vinayaka Mission's Research Foundation (DU), NH47, Sankari Main Road, Salem, Tamil Nadu, India. Mail: nandhu.roysterzz@gmail.com. ORCID Id: 0009-0009-0616-8625
3. Saravanakumar Sundaresan., MD, Associate Professor, Department of Anaesthesiology, Government Tiruvallur Medical College and Hospital, Tiruvallur, Tamil Nadu, India. Email: anaes.kumar@gmail.com. ORCID ID:0009-0003-8763-8321
4. Kiruthiga Kamaleswaran., MD., Senior Resident., Department of Anaesthesiology, Government Tiruvallur Medical College and Hospital, Tiruvallur, Tamil Nadu, India. Email: kirushanmathi@gmail.com. ORCID: 0009-0000-3688-1717.

Article Info

Volume 6, Issue Si3, July 2024
Received: 11 May 2024
Accepted: 19 June 2024
doi:
10.48047/AFJBS.6.Si3.2024.2897-2903

Abstract:
Background: Intraoperative hemolytic transfusion reactions (IHTR) are rare but potentially life-threatening events during surgery, necessitating prompt recognition and management to ensure patient safety. This case report illustrates the complexities of diagnosing and managing IHTR in a surgical setting. Case Report: A 36-year-old female with breast carcinoma undergoing a modified radical mastectomy developed an IHTR. Despite the absence of positive Coombs test results, the patient exhibited classic signs of IHTR including sudden onset of hemoglobinuria and respiratory distress post-transfusion. Immediate interventions included cessation of the transfusion and supportive care, followed by intensive monitoring and treatment in the surgical intensive care unit. Management and Outcome: The clinical team's rapid response to the adverse transfusion reaction involved re-intubation, intensive monitoring, and critical care management. These measures effectively stabilised the patient's condition, highlighting the importance of preparedness and protocol-driven approaches in managing IHTR. Conclusion: This case underscores the challenges of diagnosing IHTR, particularly when standard diagnostic tests fail to confirm the condition. The successful outcome demonstrates the critical role of vigilance, rapid clinical judgment, and adherence to transfusion protocols in surgical settings.

Keywords: Intraoperative complications, Transfusion reaction, Hemolysis, Blood transfusion,TRALI.

Introduction

Surgical procedures are akin to a complex ballet, where every movement is calculated and every step must be precisely executed. Despite such meticulous planning, unforeseen challenges can emerge, casting long shadows of complication across what was anticipated to be a routine operation. Among these potential pitfalls, the intraoperative hemolytic transfusion reaction (IHTR) is particularly daunting. This life-threatening event occurs when red blood cells are destroyed within the bloodstream, necessitating immediate and skilled intervention to prevent catastrophic outcomes[1].

As the field of medical science progresses, our understanding of the many facets of blood transfusions deepens. Despite these advances, the occurrence of IHTR serves as a stark reminder of the inherent complexities in maintaining the delicate equilibrium of patient care. This article seeks to provide a comprehensive exploration of IHTR, shedding light on its physiological underpinnings, identifying risk factors, and outlining crucial management strategies[2].

Hemolytic transfusion reactions (HTR) are feared for their potential to cause significant morbidity and mortality. These reactions can be categorized as either acute (AHTR) or delayed, each with its distinct clinical manifestations and challenges. Adding to the complexity of transfusion reactions is transfusion-related acute lung injury (TRALI). Characterized by pulmonary edema and hypoxemia that occur within six hours of a transfusion, in the absence of other causes of lung injury or circulatory overload, TRALI is now recognized as the leading cause of death related to blood transfusions[3].

Case Report:

A detailed case report of a 36-year-old female weighing 45kg diagnosed with breast carcinoma, scheduled for a modified radical mastectomy. The patient had a history of anaemia, which was

being treated with a transfusion of one unitof packed red blood cells (PRBC). During her preoperative assessment, her haemoglobin was recorded at 10.2 g/dL, with all other investigations returning results within normal parameters. There was no evidence of distant metastasis. The patient was classified under the American Society of Anesthesiologists Physical Status II and was scheduled for surgery two weeks following her initial assessment.

In the immediate preoperative period, the patient exhibited signs of pallor, and a complete blood count (CBC) performed the day before surgery showed a haemoglobin level of 9.1 g/dL. Given the major nature of the planned surgical procedure, an additional unit of PRBCs was requested. Her baseline vital signs were stable. General anaesthesia was administered, and the surgery commenced without incident. She was premedicated withInj.Glycopyrrolate 0.4mg, Inj.Midazolam 1mg, sedated with Inj.Fentanyl100mcg, induced with Inj.Thiopentone 135mg, Inj. Atracurium 25mg was used as a muscle relaxant. Anaesthesia was maintained with the inhalational agent sevoflurane along with Oxygen and air in the ratio of 1:2, and intermittent bolus of Inj.Atracurium5mg was used for maintenance.

The surgical dissection began concurrently with the initiation of the PRBC transfusion. The procedure lasted approximately 2.5 hours after which the patient was catheterized. Following successful surgery, the patient demonstrated adequate respiratory effort and was subsequently extubated.

However, within ten minutes of extubation, the patient experienced a sudden drop in oxygen saturation. She rapidly developed signs of distress, necessitating immediate reintubation. Notably, the urine collected in the urobag was dark red, suggesting hemoglobinuria. A point-of-care ultrasound (POCUS) conducted on the operating table indicated the presence of pulmonary edema, yet an echocardiogram confirmed good cardiac contractility and no valvular abnormalities. Additionally, IVC distensibility was assessed, effectively ruling out volume overload as a contributing factor.

Due to the acute onset of symptoms following the transfusion and the clinical findings, an intraoperative hemolytic transfusion reaction was suspected.The blood transfusion reaction form was duly filled, and the blood bag was returned to the blood bank.The patient was promptly transferred to the Surgical Intensive Care Unit (SICU) for postoperative elective ventilation and further management.

Subsequent investigations included both direct and indirect Coombs tests, which turned outto be normal, thus complicating the initial diagnosis. The Urine examination showed hemoglobinuria. The presence of hemoglobinuria and the clinical presentation strongly pointed towards a transfusion reaction. Chest X-ray (Figure 1) taken bedside showed features suggestive of pulmonary oedema. Bladder wash was given to rule out traumatic catheterisation.She was treated with loop diuretics and antibiotics, she was initially kept in volume control mode of ventilation with high PEEP(Positive End Expiratory Pressure), then changed to pressure control mode and the PEEP was also gradually reduced. She started improving symptomatically and was extubated after four days of elective ventilation. Figure 2 shows the progressive improvement of hemoglobinuria.

This case underscores the complexities of diagnosing and managing intraoperative hemolytic transfusion reactions, particularly when standard diagnostic tests do not confirm the initial suspicion. It highlights the critical importance of vigilant monitoring and rapid response to emergent complications during and after transfusions. The successful management of this patient, despite the challenges, provides a valuable learning opportunity for the medical community, emphasizing the need for a high index of suspicion and the readiness to employ

emergency measures in the face of unanticipated intraoperative events.Our case report is presented in the form of a table (Table 1).

Figure 1 – Chest X-ray showing features of pulmonary oedema.

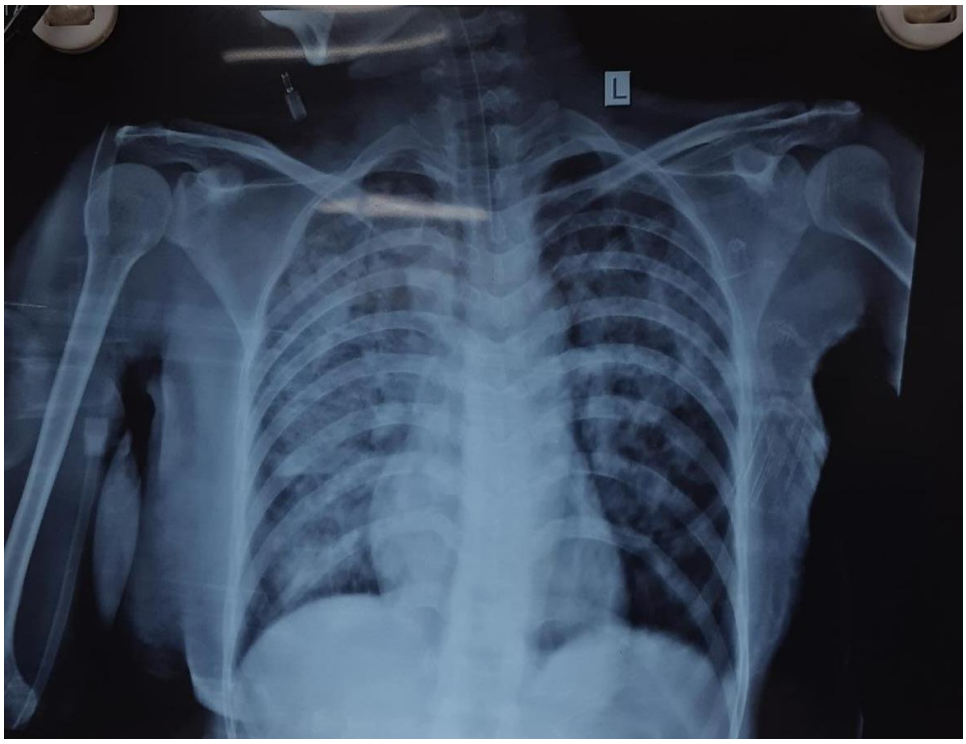

Figure 2 – Image showing a progressive decrease in haemoglobinuria.

Aspect	Details
Patient Background	36-year-old female with breast carcinoma, scheduled for modified radical mastectomy. History of anaemia treated with PRBCs. Preoperative Hb: 10.2 g/dL, Hb day before surgery: 9.1 g/dL. ASA Physical Status II.

Preoperative Status	Exhibited pallor. Stable vital signs. Additional PRBC unit requested due to major surgery.
Surgical Details	Surgery under general anaesthesia proceeded without incident. PRBC transfusion is initiated at the start of surgical dissection. Duration: 2.5 hours. Patient catheterized.
Postoperative Event	Post-extubation: sudden oxygen saturation drop, reintubation required due to respiratory distress. Dark red urine in the urobag, POCUS indicated pulmonary oedema, and Echocardiogram showed good cardiac function.
Diagnosis	An intraoperative haemolytic transfusion reaction is suspected due to acute symptoms post-transfusion and the presence of haemoglobinuria. Direct and indirect Coombs tests were normal.
Management	The patientwas transferred to the SICU for postoperative elective ventilation and further management.
Outcome & Conclusion	Despite the negative Coombs tests, clinical signs led to the diagnosis of IHTR. The case highlights the importance of vigilant monitoring and rapid response in managing IHTR, emphasizing the complexity of diagnosis.

Table 1 case report in table form.

Discussion:

This detailed case report of a 36-year-old female undergoing a modified radical mastectomy highlights the complexities and challenges of managing intraoperative hemolytic transfusion reactions. The rapid onset of symptoms following a transfusion, coupled with non-confirmatory results from standard diagnostic tests such as Coombs tests, emphasizes the necessity for alternative diagnostic approaches, as evidenced by studies like Strobel E.et al.[4]. The American Association of Blood Banks' guidelines, which call for an immediate cessation of transfusion and supportive care as noted by Soutar R et al.[5], were effectively adhered to in this case, demonstrating successful crisis management. Research by Gehrie EA et al.[6] discusses the increased risk of hemolytic transfusion reactions among certain populations, such as those with previous transfusions or underlying autoimmune disorders. The introduction of more sensitive detection methods could aid earlier diagnosis and potentially prevent adverse outcomes, a prospect discussed by Hendrickson JE et al.[7]. Furthermore, Kaur P et al.[8]underline the importance of education and training in recognizing and managing transfusion reactions, while Delaney M et al.[9] review transfusion protocols to minimize risks, suggesting that tailored strategies could reduce reaction incidence. The utility of point-of-care ultrasound (POCUS) in immediate complication assessment during surgery, validated by Naji A et al.[10], was crucial in this case.Blood component transfusion reactions span from mild to potentially life-threatening, encompassing a spectrum of severity.Transfusion-associated circulatory overload (TACO) frequently manifests as pulmonary edema, predominantly arising from volume excess or circulatory overload[11].In our case, volume overload was ruled out with the help of POCUS. D'Alessandro A.et al.[12] propose innovations in transfusion safety through more personalized approaches, and Chandrashekar S et al.[13]cover the legal and ethical considerations vital for managing patient expectations and medical responsibilities. Lastly, the global perspectives on hemolytic transfusion reactions, surveyed by Fathima VJ et al.[14], provide a broader

understanding of how different healthcare systems tackle these challenges, offering valuable insights into global practices and outcomes.

The presented case report of a 36-year-old female undergoing a modified radical mastectomy with subsequent intraoperative hemolytic transfusion reaction (IHTR) illustrates the complexities and multifaceted challenges faced in clinical practice during transfusion medicine. This case underscores the critical importance of vigilant monitoring, swift clinical judgment, and a robust response protocol to effectively manage unexpected complications such as IHTR.

The quick onset of symptoms post-transfusion in this patient, notably the sudden drop in oxygen saturation and the development of hemoglobinuriaemphasises the need for continuous intraoperative monitoring and the readiness to intervene promptly. By definition, TRALI should occur within 6 hours of transfusion[15]. In our case,it has occurred within 2 hours of transfusion. Despite the absence of confirmatory results from the standard Coombs tests, the clinical signs strongly pointed towards a transfusion reaction, highlighting the limitations of current diagnostic tests in certain clinical scenarios. This situation calls for an awareness of the possibility of false negatives in diagnostic testing, reinforcing the need for clinical vigilance and considering alternative diagnostic tools.

The management of this case adhered closely to established guidelines from the American Association of Blood Banks, which recommend the immediate cessation of the transfusion and the initiation of supportive care measures. The effectiveness of the emergency response in this case, including the reassessment of the patient using point-of-care ultrasound (POCUS) to quickly gauge the severity of the reaction and the immediate care provided in the surgical intensive care unit, demonstrates the importance of a well-coordinated, multidisciplinary approach to patient care.

Furthermore, this case serves as a poignant reminder of the ongoing need for education and training in the recognition and management of transfusion reactions. Healthcare providers must have knowledge and skills to deal with such emergencies. Continued medical education and training simulations can greatly enhance preparedness for these rare but critical events.

Innovations in medical technology and the refinement of transfusion protocols could further mitigate the risks associated with transfusions. The future of transfusion medicine may benefit from more personalized approaches and the development of more sensitive and specific diagnostic tests that could better predict and identify adverse reactions before they escalate to critical levels.

Conclusion:

This case highlights the dynamic and sometimes unpredictable nature of transfusion medicine, stressing the essential roles of continuous education, vigilant monitoring, and prompt, effective clinical responses. It also underscores the importance of adopting advanced technologies and tailored transfusion strategies to improve patient outcomes and safety in surgical and transfusion practices.

No conflicts of interest
No funding
Consent for publication has been obtained from the patient

References:

(1) Benson, A. B.; Moss, M.; Silliman, C. C. Transfusion-Related Acute Lung Injury (TRALI): A Clinical Review with Emphasis on the Critically Ill. *Br. J. Haematol.***2009**, *147* (4), 431–443. https://doi.org/10.1111/j.1365-2141.2009.07840.x.

(2) Panch, S. R.; Montemayor-Garcia, C.; Klein, H. G. Hemolytic Transfusion Reactions. *N. Engl. J. Med.***2019**, *381* (2), 150–162. https://doi.org/10.1056/NEJMra1802338.

(3) Ackfeld, T.; Schmutz, T.; Guechi, Y.; Le Terrier, C. Blood Transfusion Reactions—A Comprehensive Review of the Literature Including a Swiss Perspective. *J. Clin. Med.***2022**, *11* (10), 2859. https://doi.org/10.3390/jcm11102859.

(4) Strobel, E. Hemolytic Transfusion Reactions. *Transfus. Med. Hemotherapy Off. Organ Dtsch. Ges. Transfusionsmedizin Immunhamatologie***2008**, *35* (5), 346–353. https://doi.org/10.1159/000154811.

(5) *Guideline on the investigation and management of acute transfusion reactions - PubMed*. https://pubmed.ncbi.nlm.nih.gov/37211954/ (accessed 2024-04-25).

(6) Gehrie, E. A.; Savani, B. N.; Booth, G. S. Risk Factors for Hemolytic Transfusion Reactions Resulting from ABO and Minor Red Cell Antigen Incompatibility: From Mislabeled Samples to Stem Cell Transplant and Sickle Cell Disease. *Blood Rev.***2021**, *45*, 100719. https://doi.org/10.1016/j.blre.2020.100719.

(7) Hendrickson, J. E.; Fasano, R. M. Management of Hemolytic Transfusion Reactions. *Hematol. Am. Soc. Hematol. Educ. Program***2021**, *2021* (1), 704–709. https://doi.org/10.1182/hematology.2021000308.

(8) Kaur, P.; Kaur, G.; Kaur, R.; Sood, T. Assessment of Impact of Training in Improving Knowledge of Blood Transfusion among Clinicians. *Transfus. Med. Hemotherapy Off. Organ Dtsch. Ges. Transfusionsmedizin Immunhamatologie***2014**, *41* (3), 222–226. https://doi.org/10.1159/000362896.

(9) Delaney, M.; Wendel, S.; Bercovitz, R. S.; Cid, J.; Cohn, C.; Dunbar, N. M.; Apelseth, T. O.; Popovsky, M.; Stanworth, S. J.; Tinmouth, A.; Van De Watering, L.; Waters, J. H.; Yazer, M.; Ziman, A.; Biomedical Excellence for Safer Transfusion (BEST) Collaborative. Transfusion Reactions: Prevention, Diagnosis, and Treatment. *Lancet Lond. Engl.***2016**, *388* (10061), 2825–2836. https://doi.org/10.1016/S0140-6736(15)01313-6.

(10) Naji, A.; Chappidi, M.; Ahmed, A.; Monga, A.; Sanders, J. Perioperative Point-of-Care Ultrasound Use by Anesthesiologists. *Cureus13* (5), e15217. https://doi.org/10.7759/cureus.15217.

(11) *Transfusion-associated circulatory overload (TACO) - UpToDate*. https://www.uptodate.com/contents/transfusion-associated-circulatory-overload-taco (accessed 2024-04-25).

(12) D'Alessandro, A.; Liumbruno, G. Personalised Transfusion Medicine. *Blood Transfus.***2019**, 255–257. https://doi.org/10.2450/2018.0142-19.

(13) Chandrashekar, S.; Kantharaj, A. Legal and Ethical Issues in Safe Blood Transfusion. *Indian J. Anaesth.***2014**, *58* (5), 558. https://doi.org/10.4103/0019-5049.144654.

(14) *(PDF) Spectrum of hemolytic transfusion reactions from tertiary cancer center over a 1-year period*. https://www.researchgate.net/publication/375761111_Spectrum_of_hemolytic_transfusion_reactions_from_tertiary_cancer_center_over_a_1-year_period (accessed 2024-04-25).

(15) Toy, P.; Lowell, C. TRALI - Definition, Mechanisms, Incidence and Clinical Relevance. *Best Pract. Res. Clin. Anaesthesiol.***2007**, *21* (2), 183–193. https://doi.org/10.1016/j.bpa.2007.01.003.