International Journal of Science and Research Archive
eISSN: 2582-8185
Cross Ref DOI: 10.30574/ijsra
Journal homepage: https://ijsra.net/

(RESEARCH ARTICLE)

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Acute transfusion reactions in a district hospital: A 2-year retrospective review

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International Journal of Science and Research Archive, 2024, 11(01), 2587–2594

Publication history: Received on 12 January 2024; revised on 20 February 2024; accepted on 22 February 2024

Article DOI: https://doi.org/10.30574/ijsra.2024.11.1.0328

Abstract

Background: Blood transfusion is a life-saving intervention but carries numerous risks. It is therefore paramount to identify various adverse events associated with the procedure and to take stringent measures to reduce its occurrence. The aim of this study was to determine the incidence and analyse the type of acute transfusion reactions occurring in patients who required blood transfusion.

Materials and Methods: This study was a retrospective review and analysis of all acute transfusion reactions reported to the blood bank of Methodist Hospital, Wenchi-Ghana from January 2021 to December 2022.

Results: During the study period, a total of 5,857 units of blood were issued, out of which there was an incidence of 0.51% (n=30). Most acute transfusion reactions were observed in females and in patients between 26 – 45 years. The most common symptom was pruritus/itching (33.3%), followed by skin rash (23.3%) and urticaria (13.3%). Majority of the reactions were allergic (70%) followed by Febrile non-hemolytic transfusion reaction (20%). The frequency of transfusion reactions was significantly higher with packed red blood cell transfusion (50%).

Conclusion: Sensitization of all health personnel involved in the transfusion chain and strict hemovigilance program enforcement will help in improving the safety of blood transfusion.

Keywords: Acute Transfusion reaction; Blood transfusion; Hemovigilance; Febrile non-hemolytic transfusion reactions; Transfusion associated circulatory overload.

1. Introduction

Blood transfusion plays a crucial and invaluable role in contemporary healthcare. Blood and its components have vital physiological functions, such as transporting oxygen and nutrients, regulating body temperature, eliminating waste products, and contributing to the body's immune system [1]. Blood transfusion involves the transfer of blood products from a donor to a recipient, aiming to maintain the donor's health and benefit the recipient [2]. However, transfusion carries the potential for immunologic reactions in the recipient due to its multi-antigenic nature.

While blood transfusion can be life-saving, it can also lead to adverse reactions, some of which can be fatal. A transfusion reaction refers to any undesirable event that occurs in a patient during or after the administration of blood components. The severity of these reactions varies depending on factors such as age, gender, previous transfusions, diagnosis, type of components used, and the patient's clinical condition. These reactions can be classified as acute or delayed, based on the time of onset. Acute transfusion reactions occur either during the transfusion or within the first 24 hours afterwards [3] [4].

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Acute reactions resulting from transfusions include acute hemolytic transfusion reaction (AHTR), allergic reactions (such as anaphylaxis), transfusion-related acute lung injury (TRALI), transfusion-associated circulatory overload (TACO), febrile non-hemolytic transfusion reactions (FNHTR), complications of massive transfusion and sepsis. Delayed transfusion reactions, however, occur after the first 24 hours post-transfusion and include delayed hemolysis, post-transfusion purpura, and transfusion-associated graft versus host disease [5][6].

Febrile non-hemolytic transfusion reactions are characterized by the onset of fever (defined as an increase in temperature of ≥1 °C with respect to the baseline value) and/or shivers within 3 hours of transfusion. These reactions can manifest as either mild or severe. The mild form is characterized by a slight rise in body temperature without any accompanying symptoms. On the other hand, the severe form is marked by a significant fever, accompanied by shivering and other general symptoms [7].

Allergic reactions are often associated with the development of urticaria or other skin rashes, pruritus, laboured breathing, or angioedema, which manifest within a few hours of the transfusion. These reactions can be mild, presenting only with local urticaria or rash, which poses no immediate risk to the patients' lives and responds quickly to symptomatic treatments. However, they can also be severe, with a generalized rash accompanied by respiratory and/or cardiovascular manifestations, presenting as an anaphylactic reaction [8].

Acute hemolytic transfusion reaction (AHTR) is accompanied by clinical or laboratory features of hemolysis. Common signs of AHTR include fever, chills, chest pain, abdominal pain, back/flank pain, nausea/vomiting, diarrhoea, hypotension, pallor, jaundice, oliguria, diffuse bleeding, and dark urine. Laboratory features often include hemoglobinemia, hemoglobinuria, decreased serum haptoglobin, and unconjugated hyperbilirubinemia [9].

Transfusion-related acute lung injury (TRALI) presents similarly to adult respiratory distress syndrome. It is believed that anti-leukocyte antibodies lead to the formation of leukocyte emboli, which then aggregate in the capillaries of the lungs. This results in hypoxia, causing symptoms such as chills, cough, fever, and difficulty breathing. Although rare, bacterial sepsis can be fatal, with most cases caused by *Yersinia enterocolitica*. These reactions are commonly triggered by endotoxins, which can contaminate the samples during collection, component preparation, or thawing. Treatment is supportive with the use of broad-spectrum antibiotics [10].

Transfusion-associated circulatory overload (TACO) refers to a collection of signs and symptoms that occur within 6 to 12 hours of a transfusion, resulting in acute pulmonary oedema due to circulatory overload. TACO is the leading cause of transfusion-related morbidity and mortality worldwide, affecting 1% to 12% of at-risk populations [11].

Hemovigilance is a systematic monitoring process aimed at identifying and addressing transfusion-related adverse events. The primary objective of a hemovigilance system is to enhance transfusion safety and quality by collecting, analysing, and disseminating information on serious adverse reactions associated with transfusion of blood and its components. It involves continuous data collection and analysis to investigate the causes and outcomes of transfusion-related adverse reactions, with the ultimate goal of preventing their occurrence or recurrence [12][13].

In October 2022, Ghana launched its guidelines for hemovigilance. These guidelines serve as a comprehensive document for healthcare professionals in Ghana involved in various stages of the transfusion process. The aim is to provide guidance and standardize activities within the transfusion chain, considering the country's specific systems for managing transfusions.

This study aimed to determine the incidence and analyse the type of acute transfusion reactions occurring in patients who required blood transfusion. This audit will bring to the fore insights into acute transfusion reactions and will help to rectify their cause and improve safety of patients during blood transfusions.

2. Materials and methods

A comprehensive retrospective review was conducted on all transfusion reactions reported to the Methodist Hospital blood bank in Wenchi, Ghana, from January 2021 to December 2022 after permission was sought from the Hospital management board.

Methodist Hospital, located in the Wenchi municipality and Bono region of Ghana, is a primary care facility that serves as a referral centre and a member of the Christian Health Association of Ghana. With its crucial role in the healthcare system, it is essential to investigate and understand transfusion reactions occurring within its premises.

This study encompassed all patients who underwent blood transfusion at Methodist Hospital, Wenchi, and subsequently experienced acute transfusion reactions, which were duly reported to the blood bank. To maintain the integrity of the data, exclusion criteria were applied to cases with incomplete or limited information, such as age, gender, symptoms, and history of previous transfusions.

In the event of a transfusion reaction, the respective department promptly fills out a transfusion reaction form, initiating a series of clinical and laboratory investigations. The pre-transfusion data collected on this form includes patient's identification number, ABO and Rh group, type of product transfused, donor number and group, as well as the date, time, and vital signs at the start of the transfusion. Post-transfusion data encompasses the date, time, and volume of the transfusion, along with the patient's vital signs.

The blood bank conducts a meticulous investigation, thoroughly examining all relevant documents. This process involves checking the patient's sample and the transfusion product for any clerical errors. Additionally, post-transfusion samples are scrutinized for evidence of hemolysis and compared with both pre- and post-transfusion samples. Furthermore, the grouping, cross-matching, and direct antiglobulin tests from these samples are rechecked to ensure accuracy. To complete the investigation, bacteriological testing is performed by culturing samples obtained from the transfusion bag [14].

All statistical analyses were performed using SPSS Version 25 (SPSS Inc. Chicago, IL, USA).

3. Results

During the study period, a total of 5,857 blood units were issued from the blood bank, out of which 30 adverse transfusion reactions were reported. The incidence of acute transfusion reactions was 0.51%. There was a female preponderance (60%) in frequency of reactions over the male (40%) [Table 1]. Most reactions were noticed in patients between 26 - 45 years (33.3%) [Table 1]. The most common symptom was pruritus/itching (33.3%), followed by skin rash (23.3%) and urticaria (13.3%) [Table 2]. The frequency of transfusion reactions was significantly higher with packed red blood cells (50%) followed by whole blood (46.7%) [Table 3].

Majority of the reactions were allergic (70%) followed by FNHTR (20%). There were no reactions due to platelet concentrate transfusion and no bacterial growth were noticed during blood culture analysis.

Table 1 Distribution of Patient's gender and age

Variable	Frequency	Percentage (%)
Gender		
Male	12	40
Female	18	60
Age (years)		
< 18	9	30.0
18 – 25	4	13.3
26 – 45	10	33.3
46 – 59	3	10.0
>60	4	13.3

Allergic reactions and FNHTR were common in females than in males. However, transfusion-associated circulatory overload was common in males than in female [Table 5]. Blood group O+ was responsible for most transfusion reactions (50%) and resulted in majority (52.4%) of allergic transfusion reactions [Table 7]. The most common indication for blood transfusion in the hospital was Anaemia (83.3%) with a diagnosis of underlying cause. Only 10% of patients who were transfused had previous transfusion history. Medical, Pediatrics and Obstetrics & Gynaecology departments recorded the highest transfusion reactions with each department accounting for 30% of total transfusion reactions. There were no transfusion-related mortalities during the first 24 hours after blood transfusion.

Table 2 Frequency of symptoms of acute transfusion reaction

Symptom	Frequency	Percentage (%)
Pruritus/itching	10	33.3
Urticaria	4	13.3
Skin rash	7	23.3
Fever	3	10.0
Dyspnoea	3	10.0
Chills/rigors	3	10.0

Table 3 Frequency of acute transfusion reaction by blood component

Blood component	Number of reaction	Percentage of reaction due to individual components (n=30)
WB	14	46.7
PRBC	15	50.0
FFP	1	3.3
PC	0	0.0

WB: Whole blood, PRBC: Packed red blood cells, FFP: Fresh Frozen Plasma, PC: Platelet concentrate.

Table 4 Distribution of acute transfusion reaction by blood component

Type of acute transfusion reactions	WB		PRBC		FFP		PC		TOTAL	
	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)
ATR	9	64.3	12	80.0	0	0.0	0	0.0	21	70.0
FNHTR	3	21.4	2	13.3	1	100	0	0.0	6	20.0
TRALI	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
TACO	2	14.3	1	6.7	0	0.0	0	0.0	3	10.0
AHTR	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0

ATR: Allergic transfusion reaction, FNHTR: Febrile non-hemolytic transfusion reaction, TRALI: Transfusion-related acute lung injury, TACO: Transfusion associated circulatory overload, AHTR: Acute hemolytic transfusion reaction, WB: Whole blood, PRBC: Packed red blood cells, FFP; Fresh frozen plasma, PC: Platelet concentrate.

Table 5 Distribution of acute transfusion reaction by gender

Gender	ATR		FNHTR		TRALI		TACO		AHTR		Total	
	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)
Male	8	38.1	2	33.3	0	0.0	2	66.7	0	0.0	12	40.0
Female	13	61.9	4	66.7	0	0.0	1	33.3	0	0.0	18	60.0

ATR: Allergic transfusion reaction, FNHTR: Febrile non-hemolytic transfusion reaction, TRALI: Transfusion-related acute lung injury, TACO: Transfusion associated circulatory overload, AHTR: Acute hemolytic transfusion reaction.

Table 6 Frequency of acute transfusion reaction by age

Age	ATR		FNHTR		TRALI		TACO		AHTR		Total	
	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)
<18	5	23.8	3	50	0	0.0	1	33.3	0	0.0	9	30.0
18 – 25	4	19.1	0	0.0	0	0.0	0	0.0	0	0.0	4	13.3
26 – 45	7	33.3	2	33.3	0	0.0	1	33.3	0	0.0	10	33.3
45 – 59	2	9.5	0	0.0	0	0.0	1	33.3	0	0.0	3	10.0
>60	3	14.3	1	16.7	0	0.0	0	0.0	0	0.0	4	13.3

ATR: Allergic transfusion reaction, FNHTR: Febrile non-hemolytic transfusion reaction, TRALI: Transfusion-related acute lung injury, TACO: Transfusion associated circulatory overload, AHTR: Acute hemolytic transfusion reaction.

Table 7 Distribution of acute transfusion reaction by blood group

Blood Group	ATR		FNHTR		TRALI		TACO		AHTR		Total	
	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)
A+	2	9.5	1	16.7	0	0.0	0	0.0	0	0.0	3	10.0
B+	6	28.6	2	33.3	0	0.0	0	0.0	0	0.0	8	26.7
AB+	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
O+	11	52.4	2	33.3	0	0.0	2	66.7	0	0.0	15	50.0
A-	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
B-	0	0.0	1	16.7	0	0.0	0	0.0	0	0.0	1	3.3
AB-	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
O-	2	9.5	0	0.0	0	0.0	1	33.3	0	0.0	3	10.0

ATR: Allergic transfusion reaction, FNHTR: Febrile non-hemolytic transfusion reaction, TRALI: Transfusion-related acute lung injury, TACO: Transfusion associated circulatory overload, AHTR: Acute hemolytic transfusion reaction

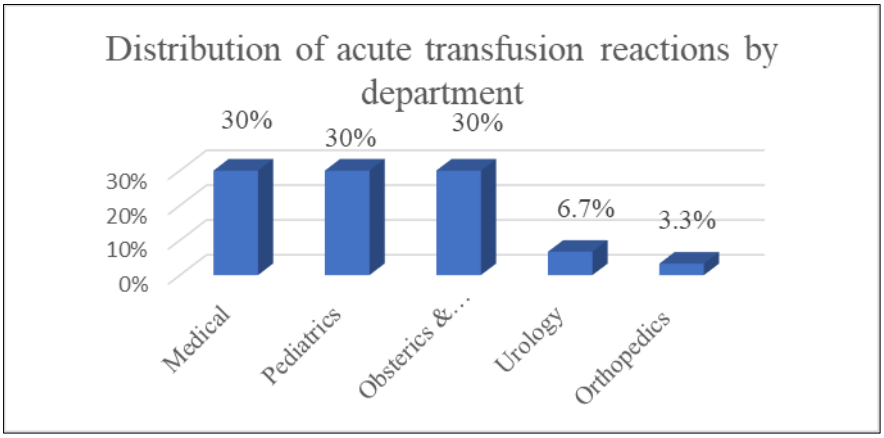

Figure 1 Distribution of acute transfusion reaction by departments

4. Discussion

The incidence of acute transfusion reactions ranges widely from 0.2% to 10% and mortality is approximately 1 in 250,000 [15]. Various hemovigilance systems across the globe have reported incidence of transfusion reactions over the years. The hemovigilance system of the Canadian province Quebec, reported an incidence of 0.35% of acute transfusion reactions [16]. The hemovigilance network of France reported a rate of 0.25 events per 100 blood components [17]. The incidence of acute transfusion reactions in this current study was 0.51% (30 out of 5,857) which is slightly higher than reported incidence in various published reports [18][19]. The finding in this study was quite lower than what was reported in other studies [13][14].

The most frequent acute transfusion reaction in this present study was Allergic reactions followed by Febrile non-hemolytic transfusion reaction (FNHTR).The incidence of allergic reactions ranges from 1% to 3% of all blood transfusions and are the most common adverse events associated with blood transfusions. It manifests with urticaria, pruritus/itching, erythematous rash, angioedema and bronchospasm [20][21]. In this current study, allergic reactions (70%) and FNHTR (20%) were the most frequently observed transfusion reactions. This is similar to studies conducted in Japan and Malaysia which revealed that allergic reactions followed by FNHTR were the most frequently observed transfusion reactions[22][23]. On a contrary, studies conducted in Nigeria and Zimbabwe revealed that FNHTR was the frequently observed adverse event [24][25].

FNHTR is an acute transfusion complication defined by unexplained fever (> 1 ºC) within 4-6 hours after transfusion. It may be accompanied by chills, rigors, headache, nausea and vomiting [15]. FNHTR is caused by immunological factors such as the existence of preformed antibodies against white blood cells in blood components, which causes the release of pyrogens or the generation and release of biologically active cytokines by white blood cells during storage [26]. Research enquiries have demonstrated that, the incidence of FNHTR varies from 17% to 54% [27]. FNHTR was observed in 20% of acute transfusion reactions (6 out of 30) and whole blood was the most common blood component associated with FNHTR. The reasons for the difference in the frequency of FNHTR across different studies may be attributed to difference in recording symptoms by staff, therapeutic interventions to control fever and sometimes to causes that are not reported [3]. The optimal approach to decrease the incidence of FNHTR is pre-storage Leucocyte depletion which removes white blood cells before the release of cytokines. In a comparative study, the incidence of FNHTR in Leucocyte-depleted blood components was reduced (0.19%) compared to that of non-leucocyte depleted blood components (0.37%) [28]. In a similar study, the incidence of FNHTR reduced from 0.24% with non-leucocyte depleted blood components to 0.05% with leucocyte-depleted blood component [29]. Patients who developed FNHTR in this study were managed with Acetaminophen (Paracetamol).

In this present study, three cases of transfusion-associated circulatory overload (TACO) were noticed, giving an incidence of 0.05% (3 out of 5,857). This finding is comparable to other published studies [3]. The most common clinical feature observed in these patients was dyspnoea and occurred mostly in male patients who received whole blood transfusion.

There were no cases of transfusion-related acute lung injury (TRALI) in this current study. The true incidence of TRALI is unknown because there is significant under-reporting of the condition due to less awareness among medical professionals and due to confusion with other complications like TACO [30].

Adverse transfusion reactions can be reduced by improving the knowledge of healthcare professionals for prompt recognition. Medical professionals should understand the relevance of reporting minor and major transfusion events to the blood bank for investigation.

List of abbreviations

- ATR: Allergic transfusion reaction
- AHTR: Acute hemolytic transfusion reaction
- FNHTR: Febrile non-hemolytic transfusion reaction
- FFP: Fresh frozen plasma
- PRBC: Packed red blood cells
- PC: Platelet concentrate
- Rh: Rhesus
- SPSS: Statistical Package for Social Sciences
- TRALI: Transfusion-related acute lung injury
- TACO: Transfusion associated circulatory overload

- WB: Whole blood

5. Conclusion

The frequency of acute transfusion reactions in this study was found to be 0.51% (30 out of 5,857). Allergic and febrile non-hemolytic transfusion reactions were the most common adverse events. Majority of the reactions were due to packed red blood cell transfusion. Hemovigilance system plays a crucial role in optimizing blood safety and identifying problems in the transfusion chain. Competent and committed personnel, prompt reporting of all events and continuous education of medical professionals will help strengthen the hemovigilance system and reduce the frequency of transfusion reactions.

Compliance with ethical standards

Acknowledgment

The authors acknowledge staff of the blood bank for their support.

Disclosure of conflict of interest

No conflicts of interest with respect to the research, authorship, and/or publication of this article.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

Funding

The authors received no funding for this research work.

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