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Original Article

Frequency of Blood Transfusion Related Acute Adverse Reactions in a Tertiary Care Hospital in Islamabad

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Author`s Contribution

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ABSTRACT

Objective: To analyze the magnitude of adverse acute transfusion reactions in terms of contributing factors among in-patients receiving blood or blood components, and to determine the crossmatch to transfusion (C/T) ratio, transfusion probability (%T), and transfusion index (TI) of red cell concentrates.

Methodology: This study was conducted from August to October 2024, at Dr. Akbar Niazi Teaching Hospital (ANTH), Islamabad. The daily transfusion utilization of ANTH is an average of 15 units. A total of 527 red cell transfused patients were followed in this study. Socio-demographic and clinical data were collected from the HMIS. Baseline measurement and 24-hour periodic vital signs monitoring were conducted after each transfusion. In case of ATR, 4 mL of venous blood was drawn for CBC, blood grouping, direct antihuman globulin test (DAT), and crossmatching. Further, the following three indices were calculated for each patient separately, i.e. C/T ratio, transfusion probability, and transfusion index. Data were entered into and analyzed using Statistical Package for Social Science software (SPSS) version 26.0. A *P* value ≤ .05 was considered to indicate statistical significance.

Results: A total of 527 participants were included in this study, with more than half (56%) of them being females. The age of the participants ranged from 3 days to 88 years, and the median age of transfused patients was 34 years. The blood groups B positive (52.18%) and O positive (20.87%) were the most common ones. Acute transfusion reactions were observed in 0.38% of patients (2/527) and both were febrile non-haemolytic transfusion reactions. CT ratio was 1.69, TI 0.59, and %T 59.01.

Conclusion: The overall results of our analysis showed proper utilization of blood components at ANTH. Starting a hemovigilance system of monitoring, collecting, and evaluating data on adverse effects of blood transfusion locally and nationally will decrease the occurrence of acute transfusion reactions.

Keywords: Acute Transfusion Reactions (ATR), C/T Ratio, Transfusion Probability, Transfusion Index, Haemovigilance System

Introduction

Blood or blood product transfusions are an essential therapeutic intervention used to treat a variety of medical disorders, including chronic anaemia, trauma, and surgical blood loss.[1] Karl Landsteiner's discovery of blood groups in 1901 made modern blood transfusion therapy a reasonably safe practice.[2] Although transfusion therapy can save lives, moderate to severe acute adverse reactions can occur.[3]

These adverse reactions range from 0.02% to 10% and that results in roughly 1 in 250,000 deaths. Blood transfusion services are an essential aspect of the healthcare system; yet, blood transfusion is not, and likely never will be, without risk. Transfusion of blood products is a double-edged sword that should be utilized with caution. Advancements in donor screening and transfusion transmissible diseases testing have resulted in decreased risk factors connected with blood transfusions.[4] Blood plays a crucial part as every year; millions of lives are saved by safe blood. Insufficient blood or one of the blood components could put a person at risk of dying. According to WHO, globally more than 118.5 million units of donated blood are collected per year.[5]

Transfusion reactions are the unfavorable condition that may occurs during or after the blood transfusion. Based on their severity some of these reactions are minor and some are life threatening. Majority of these are acute reactions

that occur during transfusion and others are called delayed reactions that occurs after 24 hours of blood transfusion. In haemolytic transfusion reaction, the breakdown of red blood cells (haemolysis) occur. They may be acute or delayed. It may also occur due to ABO incompatibility, which can be severe or even cause death. The other one is non-haemolytic transfusion reactions where breakdown of red blood cell does not occur.[6]

It is vital to have a system in place for tracking, assessing, and reporting transfusion reactions due to the unpredictability of adverse reactions and this system is known as haemovigilance system.[7] This system aims to reduce the chance of adverse events and reactions by blood transfusions. In our hospital, up till now the haemovigilance data of adverse reactions have not been compiled, analyzed or shared with the hospital transfusion committee in our hospital. The haemovigilance system is of importance in recognizing possible areas in need of upgradation in the transfusion system.[8]

As these haemovigilance programmes are designed to reduce the dangers associated with transfusion by establishing a surveillance system. Unfortunately, Pakistan does not have such a national or regional programme, although it is mandatory to report transfusion reactions as per regulatory requirements.

Additionally, the medical personnel under reports, which means that the majority of mild adverse events go unnoticed, making it unknown how frequently certain types of transfusion responses occur.[9]

ATRs can be caused by bacterial contamination, immunomodulation, alloimmunization, human mistake, and ABO incompatibility. Nonspecific, frequently overlapping symptoms can be a sign of a response. The symptoms of an acute transfusion reaction include chills, fever, urticaria (hives), and itching. Red urine, hypotension, high-grade fever, and respiratory distress all point to a more serious response.[10]

The objective of our study was to report acute transfusion reactions occurring in patients receiving transfusion of red cell concentrates (RCC) at Dr. Akbar Niazi Teaching Hospital, Islamabad.

Methodology

A prospective single centre study was carried out at the Department of Pathology and Transfusion Medicine, Dr. Akbar Niazi Teaching Hospital, Islamabad, a 500-bedded tertiary care teaching hospital. The study was carried out over a period of three months starting from August 2024 to October 2024.

The ethical approval was taken from Islamabad Medical & Dental College's Institutional Review Board (165/IMDC/IREB-2024). Ethical approval ensures that the study was conducted with the highest standards of integrity, respecting participants' rights and well-being throughout the research process.[11]

Informed consent was obtained from all participants, and the study was designed to minimize risks and discomfort to patients undergoing blood transfusion. Confidentiality and secrecy of patient data were strictly maintained, and all participants were assured that their participation was voluntary, with the option to withdraw from the study at any point without consequence.

The study was carried out in accordance with the Declaration of Helsinki and applicable local regulations governing clinical research. As the patients received a transfusion and were subsequently monitored for acute responses, data were gathered in real-time. Data were gathered with an emphasis on demographics, transfusion related factors, e.g., type of acute reaction, symptoms, and crossmatch compatibility, temperature before and after the reaction, and vital signs.

The data generated from the study were analyzed by using Microsoft Excel and SPSS version 25.0. Frequency, mean and other calculations were made at 96% CI. A p-value of <0.005 was considered significant.

One of the most important indicators for evaluating the efficacy and efficiency of using blood products in healthcare settings is the blood utilization indices. We also calculated these indices Crosshatch to transfusion ratio (C:T), Transfusion Index (TI) and Transfusion Probability (T%).

Results

During the study period, a total of 893 blood units were crossmatched for transfusion. Out of these, 527 units (59.0%) were transfused to patients, while 366 units (41.0%) were not used. CT ratio was 1.69, transfusion index 0.59, and transfusion probability 59.01 (Table I).

Table I: CT Ratio Data Analysis.	
Number of Crossmatch Units	893
Number of Transfused Units	527
Number of Not-Transfused Units	366
CT Ratio	1.69
Transfusion Index	0.59
Transfusion Probability	59.01

Among all the patients for whom crossmatching was done, 605 were female (67.7%) and 288 were male (32.3%). Transfusion rate was 56.0% for males and 44.0% for females (Table II).

Table II: Gender distribution.		
Variables	Gender	
	Male	Female
Crossmatch	288 (32.3%)	605 (67.7%)
Transfusion	295 (56.0%)	232 (44.0%)

Among transfused patients, the blood groups B positive (52.18%) and O positive (20.87%) were the most common ones (Table III).

Table III: Distribution of Blood Groups Among Transfused Patients		
Blood group	Frequency	Percentage
A+	85	16.13%
B+	275	52.18%
AB+	41	7.78%
O+	110	20.87%
A-	0	0.00%
B-	5	0.95%
AB-	1	0.19%
O-	10	1.90%

The blood was most frequently transfused among patients admitted to Obstetrics & Gynaecology (27.7%) and Emergency Department (27.7%), as shown in Table IV.

Table IV: Ward-Wise Distribution Patients.		
Obstetrics & Gynaecology	146	27.70%
Paediatrics	22	4.17%
Intensive Care Unit	83	15.75%
Oncology	41	7.78%
Bone Marrow Transplant	28	5.31%
Nephrology	121	22.96%
Surgery	49	9.30%
Gastroenterology	35	6.64%
Emergency Department	2	27.70%

We found two cases of febrile non-haemolytic transfusion reactions (FNHTR) in our investigation of 527 transfusions, resulting in an incidence rate of 0.38%. The group of symptoms included chills, anxiety and rigors, along with a body temperature increase of ≥1°C during or soon after transfusion, and no signs of underlying haemolysis.

Discussion

In this study, 893 units were crossmatched while 527 of them were transfused, giving a crossmatch-to-transfusion (C:T) ratio of 1.69. This ratio represented a reasonable degree of blood use efficiency and is consistent with worldwide standards. The application of the crossmatch to transfusion (C/T) ratio was initially suggested by Boral Henry in 1975.[12] The optimal C:T ratio is 1.0, which means that every crossmatched unit should be transfused. However, in clinical settings, a C:T ratio of 2.5 or below is seen to indicate effective blood use.[14] Furthermore, another study from Islamabad illustrated that out of 5,957 requests, only 3,895 were actually transfused whereas 2,062 were not transfused which gave the C:T ratio of 1.52.[14] Therefore, our ratio of 1.69 shows good operational efficiency while keeping sufficient safety margins for unforeseen clinical needs.

A significant trend emerged in the gender-based distribution of transfusions: 56% of transfusions were given to female recipients, compared to 44% to male recipients. Significant background for this distribution is provided by the World Health Organization's studies, which emphasize the substantial influence of bleeding during childbirth and gynaecological disorders on the need for transfusions, especially in areas with inadequate resources.[15] In spite of biological variations, this pattern also reflects particular healthcare issues faced by women in developing nations. Rh-positive blood types make about 96% of transfusion units, which is in line with worldwide epidemiological trends. However, the most notable result was that 52.2% of transfusions were given to B+ blood types. This is an important change from the patterns usually seen in Western countries, where O+ usually predominates in transfusion needs.[16]

The relatively high need for B+ blood reflects the local population's distinct genetic composition, highlighting the necessity of knowing regional differences in blood type distribution. This tendency needs customized methods to donor recruiting and inventory management that vary significantly from normal global standards. Understanding these distinct geographical trends is critical for creating targeted blood donation programmes and maintaining adequate blood type reserves. The distribution of blood usage by wards gives useful information on institutional transfusion trends. The finding that Obstetrics & Gynaecology services used the greatest number of units (146), followed by Nephrology (121) is equivalent with predicted clinical patterns.[17] The high use in obstetrics and gynaecology reflects both the department's patient load and the urgency of its transfusion requirements, notably in addressing obstetric haemorrhage and gynaecological procedures. The significant consumption of nephrology services underscores the continuous transfusion needs of patients with chronic renal disease. This usage pattern offers useful information for inventory control and resource allocation, enabling more effective blood bank operations and better departmental readiness.

The observed incidence rate (0.38%) of FNHTR aligns with worldwide published FNHTR incidence rates, which generally range between 0.1% and 1% of all transfusions[18]. A study done in a tertiary care hospital in Southern Punjab of Pakistan showed the same incidence rate of FNHTR. In this study out of 6,050 blood transfusions, 23 (0.38%) developed adverse transfusion reactions and FNHTR was the commonest adverse transfusion reaction.[19] This low transfusion reaction rate indicates that our transfusion service is successfully carrying out preventative measures.

The documented reactions were presented with the classical symptoms associated with FNHTR: fever, chills, and rigors. The medical symptoms seen in our cases are similar to those documented in earlier studies, which further support our findings.[20]

The low percentage of ATR in our study (0.38%) indicates that safety procedures are relatively effective at ANTH. The blood bank at ANTH thoroughly screen (both behavioral and serological) all blood donors before accepting their donations. This entails assessing their health, reviewing their medical history, and extensively analyzing their blood in the laboratory through serological assays. When patients had reactions to blood transfusions, we took specific efforts to aid. Even though these ATR are often moderate, we constantly double-check to ensure there are no other major issues. In both reactions reported in our study, patients improved after receiving proper treatment. Robust haemovigilance systems are essential for transfusion service to track and report transfusion reactions.[21] Early response identification and timely management are made possible by this methodical approach to adverse event tracking. FNHTR documentation aids in continuous quality evaluation and finds areas where transfusion safety procedures should be strengthened. The low FNHTR incidence rate found in our study highlights the need to keep monitoring systems for transfusion reactions while also pointing to the successful use of preventative measures. This finding directs ongoing quality improvement efforts in transfusion medicine practice and offers useful data for comparing transfusion safety standards.

Conclusion

The overall results of our analysis showed proper utilization of blood components at ANTH. Starting a haemovigilance system of monitoring, collecting, and evaluating data on adverse effects of blood transfusion regionally and nationally will decrease the occurrence of acute transfusion reaction.

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