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Root cause analysis of non-infectious transfusion complications and the lessons learnt

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ABSTRACT

Background: Transfusion of blood and blood products can be associated with hazards which may be at times fatal. Timely reporting of transfusion reactions is imperative for root cause analysis and their prevention in future.

Methods: We retrospectively reviewed the transfusion reactions at our institution during last seven years. The data was retrieved from our computerized blood bank information system and by reviewing the medical charts of patients. The frequency of adverse effects, implicated products, wrong blood transfusion and its outcome were observed.

Results and conclusions: During study period (2006–2012), a total of 393,662 blood or blood products were transfused. There were 458 adverse events with an estimated rate of 1.16 per 1000 blood products administered. During 2011–2012, 121 transfusion reactions were reported of 119,921 transfused units. The most common adverse effects were allergic reactions (70 episodes of 121 or 57.8%) followed by febrile non hemolytic transfusion reactions or FNHTR (43 events of 121 or 35.5%). Transfusion associated dyspnea, circulatory overload and transfusion associated lung injury were less frequent. During the study period, 142,066 red cell units were transfused with nine recognized ABO-mismatch transfusions and two fatalities. The computed incidence of ABO-mismatch transfusion was 1 in 15,785 with a mortality rate of 1 in 71,033 units transfused. Etiology included: errors in final bed side check ($n = 5$), blood bank clerical errors ($n = 3$) and mislabeled tube ($n = 1$). A review of these cases prompted hospital transfusion committee for re-enforcing policies and protocols to minimize accidental ABO incompatible transfusions. We concluded that urticaria and FNHTR are the most frequent transfusion reactions in our setting. ABO mismatched blood transfusions are rare but preventable errors and result mainly from clerical imprecisions.

1. Introduction

The concept of blood transfusion evolved about 200 years back when animal blood was transfused to humans for various illnesses. In the 19th century, the first inter-human transfusion was done and was reserved as the ultimate life-saving therapy for patients with severe blood loss [1]. Since then, clinical blood transfusion has become an essential and life-saving therapeutic option. However, blood transfusion had never been absolutely safe and has been associated with significant risks [2]. The major risks of blood transfusion are transmission of infections and adverse transfusion reactions which may be fatal [3]. The risk of transmission of infectious agents by transfusion was minimized by improvements in donor screening and infectious disease testing in 1980s and 1990s. Now, the residual risks of noninfectious complications of transfusion have become more apparent [4]. Severe noninfectious complications account for most of the significant morbidity and mortality from blood transfusion. Based on

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the time of occurrence of transfusion reaction, they are categorized as acute and delayed [4,5].

Acute transfusion reactions (ATRs) occur within 24 h of the administration of blood or blood components [6]. The most commonly reported ATR are allergic and febrile non-hemolytic transfusion reactions (FNHTR). The actual incidence of ATR is uncertain but rates of 0.5–3% of transfusions have been reported [7].

Of all ATR, acute hemolytic transfusion reaction is of major concern as it can lead to significant morbidity and mortality. Acute hemolytic transfusion reaction occurs due to mismatch transfusion as a result of incorrect blood component transfused (IBCT) to the patient due to misidentification [8].

Delayed transfusion reactions occur after 24 h of transfusion. Transfusion reactions included in this category include transfusion associated graft versus host disease (TA-GVHD), post-transfusion purpura and delayed hemolytic transfusion reactions [9].

Blood transfusion is a life-saving therapeutic option but it is also associated with significant risks or hazards [10]. Recently, many developed countries have promoted safe transfusion practices through hemovigilance programs by reporting of transfusion reactions. There is variance in reporting ranging from voluntary reporting of only serious and incompatible blood component transfusion reactions in United Kingdom to mandatory reporting of all reactions in France [11]. In Pakistan, a national task force for safe blood transfusion is struggling for establishing a national hemovigilance program [12]. At our institutional level, it is mandatory to report every transfusion reaction.

Hemovigilance programs worldwide aim to detect and analyze untoward effects of blood transfusion in order to correct the causes and prevent their recurrence. Reporting of transfusion reactions helps in understanding the root causes and improves transfusion safety [13]. It has been observed that since wrong blood transfusion has a legal implication, the mismatched transfusions are often suppressed and under reported in hospitals. We consider it of utmost importance that not only these should be reported but thoroughly investigated to minimize their future occurrence. Sharing experiences is beneficial and promotes good transfusion practices. The objective of our study was to evaluate frequency of all transfusion reactions including ABO-mismatch incompatible red cell transfusions and their root cause analysis in our institute. Secondary objective was to discuss the preventive measures to avoid such happenings in future.

2. Materials and methods

2.1. Setting

Situated in the Southern Pakistan, Aga Khan University Hospital is a 700-bedded tertiary care academic institute. The institutes serve a number of specialized treatment including bone marrow and peripheral blood stem cell transplantations. It has a 100 bedded emergency department which provides comprehensive trauma management as well. Transfusion needs of all admitted patients are catered by hospital's own blood bank which was established in 1985. This was accredited by International Organization for Standardization (ISO) in 1998 and by the Joint Commission International (JCI) in 2006. Blood Bank is manned by a team of experienced and fully trained medical technologists who work under the supervision of full time hematologist to provide quality service round the clock. The blood bank is equipped with sophisticated instruments and skilled technologists. Annually 30,000 non-remunerated individuals donate blood following careful donor evaluation. The blood units are dispensed only after serological and nucleic acid amplification testing. The blood products are non-leucoreduced due to cost issues. However, in patients with repeated transfusions bed side filters are used for leucoreduction. For platelets, both whole blood derived and apheresis platelets are used.

AKUH Blood bank policies are derived from the guidelines of British Committee for Standards in Hematology (BCSH) and AABB, formerly the American Association of Blood Banks. The working guidelines adapted from these are available on blood bank website and printed copies are available in all units of the hospital. This allows all the staff involved in blood transfusion to be familiar with the local policy.

2.2. Medical training programme in pathology and transfusion medicine

The blood bank is owned by the Department of Pathology and Microbiology. There are five subsections of the department, namely, Hematology, Histopathology, Microbiology, Molecular Pathology and Chemical Pathology. The Hematology section is responsible for the blood bank. The Department offers post-graduation training in all the disciplines. About 40 residents are enrolled in the post-graduation training of which 12 are Hematology residents at any one time. It is the responsibility of the hematology resident rotating in blood bank to look after all the blood bank related issues including transfusion matters and report to the Consultant hematologist. In addition, the laboratory also offers Trainee Technologist Program. Trainees who have completed their masters in clinical sciences, are inducted each year in this one-year trainee technologist programme. The one-year trainee technologist programme is unique in Pakistan and has been very successful. Every year more than 30 trainees are inducted who rotate in each section including blood bank through a pre-defined programme. The trainees who are found competent are employed as full-time technologist in blood bank.

2.3. Transfusion reaction reporting

Any untoward event that occurs during or after blood transfusion not related to patients underlying illness is considered as a transfusion reaction. Additionally, if a wrong component is administered to the patient irrespective of any adverse effect is considered IBCT. A transfusion reaction form adapted from AABB is available in all the hospital units. Whenever a transfusion reaction occurs or is suspected, the form is filled by the patients' primary