VOLUME - 10, ISSUE - 10, OCTOBER - 2021 • PRINT ISSN No. 2277 - 8160 • DOI : 10.36106/gjra

Original Research Paper

Medical Science

BLOOD SUPPLY CHAIN: AN ANALYSIS OF DIVERSE CLINICAL CONDITIONS IN LIGHT OF THE IMPORTANCE OF LABORATORY TECHNIQUES AND TRANSFUSION ISSUES. A RETROSPECTIVE ANALYSIS OF HOSPITAL-BASED INCIDENTS

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ABSTRACT A blood transfusion is a medical procedure that is potentially considered a life-saving approach. Blood transfusion-related errors and complications can exist at any stage; from the time of blood collection to the time of blood transfusion. However, laboratory techniques play an essential role in avoiding such unfavourable outcomes. The current case study is aimed to provide an analysis of various clinical situations in light of clinical history and blood inventory. Two cases showed the presence of clinically significant antibodies (Anti-D and anti-Fy^a) with a high potential of developing HDFN or DHTR. Other cases were complicated with pre-existing anomalies. The results revealed a high value of laboratory approaches in reducing and preventing adverse outcomes of transfusion. Evidence emphasizes the importance of continuous development, technical training, adherence to instructions of all hospital departments in the complex pathway of blood delivery.

KEYWORDS : Significance of laboratory techniques, Blood inventory, Transfusion issues, Blood anomalies, Clinical significant antibodies

1.INTRODUCTION

The pathway of blood delivery is inherently characterized by its complexity. It involves distinct patients' care departments. The path symbolizes the infrastructure of the central dogma of the transfusion system. Pagliaro, Turdo, & Capuzzo (2009) reported three essential points; recipients' identification with at least two identifiers, correlation of the identifiers with laboratory samples, and emphasizes proper blood delivery of the suitable blood component and promptly to the correct recipient. The three steps have a deep essence and encompass a broad spectrum of processes where each has its own risk of failure.

Blood transfusion is commonly a safe procedure because denoted blood is carefully tested, handled and stored. It was estimated a total of 85 million RBCs units is being transfused globally (Carson et al. 2012). Basis of blood issuing is dependent on selection of safest blood in strong relation to blood inventory and clinical demands. There are many tests include under pre-transfusion procedures where each case differs significantly from one another. Blood bank is not the only involved section in monitoring transfusion processes; other laboratory departments stand as forecasting elements like haematology department were haemoglobin level is obtained to determine correct number of required blood. Moreover, chemistry department plays a vital role in providing a picture of biological processes inside the body (U&E as an example) for better management or the need of transfusion like in nephrology patients (Eschbach et al. 1989). However, failure and mistakes could exist at any stage where a recipient's body might develop a mild to a severe reaction to the transfused blood. Transfusion related-viral infections (HIV and HCV) reduced significantly due to NAT introduction as screening tests for donors (Zou et al. 2010). According to Yazdanbakhsh, Ware, & Noizat-Pirenne (2012), the initial trigger of alloimmunization is the antigenic differences between donor and recipient that highlight the presence of clinically significant antibodies. Alloimmunization's risk increases with an increased number of blood transfusions. Women showed more prevalence of being alloimmunized that partially explained due to exposures through pregnancies. Alloimmunization emerges to cause severe complications during pregnancy (Rhesus-negative mother with Rhesus-positive baby) as in case of HDFN (Poole& Daniels 2007). To a lesser extent, Anti-Fy^a can cause mild HDFN and found to be less rigorously monitored than HDFN triggered by anti-D, K and c. In an experience shared by Goodrick, Hadley, and Poole (1997); out of 68 pregnancies, three exhibited severe anaemia in which two received IUT, and their data suggest a close monitor that is similar to what is being practised in anti-D mediated HDFN if the anti-Fy^a titres exceed 64. Also, anti-Fy^a and anti-D found associated with DHTR in transfusion-dependent populations where they are clinically in long-term transfusion-demand and involve; sickle-cell anaemia, thalassemia syndromes, myeloid leukaemia, aplastic anaemia, acquired and chronic congenital anaemia (Leisch et al. 2017) (Vichinsky et al, 1990).

This case study aimed to provide a holistic view of the importance of approaches and transfusion practices covered in the lab by applying analysis to diverse clinical conditions.

2.Case Description

2.1. Examination and results:

Patients' request forms were verified with extreme caution to ensure that all details are matching in both samples and the request forms. All procedures were performed in parallel with controls to ensure validity of results. Pre-compatibility testing procedures initiated with patient identification, ABO/Rh typing, antibody screening and identification, and cross-matching.

2.1.1. Case 1:

An AB Rh-negative female presented with aneurysm bleeding and requested for urgent transfusion of two bags of RBCs, FFP, and cryoprecipitate. The patient's tests were all compatible.

2.1.2. Case 2:

A pregnant lady with A Rh-negative blood type experienced vaginal bleeding and requested for 2-bags of RBCs. Antibody screening showed +++ reaction in cell I&II. Then it was identified to be anti-D through IAT and enzyme panel cells.

2.1.3. Case 3:

Traumatic case of a male with O Rh-positive blood group escorted to hospital because a vehicle accident. Physician suspecting a possible spleen rupture which triggers an urgent blood transfusion. Lab yielded compatible results to initiate transfusion.

2.1.4. Case 4:

A male patient is undergoing surgery with a blood group of O Rh-negative, and history of AML. Antibody screening demonstrates +++ reaction in cell I only, which eventually identified by antibody identification panel to be anti-Fy^a. Furthermore, crossmatch was incompatible.

2.2. Management and follow up (Selection of blood)

Allocation of bloodstock was relied on providing suitable

blood to the results of pre-compatibility tests. Then, to select whenever appropriate the first best option of blood group in order of preference and in light of the clinical background.

3. DISCUSSION

Selection of blood is an essential step and to be regarded as a high-risk procedure (McLoughlin et al. 2006). ABO-incompatibility now is classed as 'never event' as an incident that should not be occurred (Bolton-Maggs and Cohen 2013). Samples that tested positive for atypical antibodies can serve as an alert to communicate a message to the physician for a possible delay in supplying suitable blood. One case found to be incompatible; positive for anti-Fy^a and with a clinical anomaly of having AML. Finding blood that is negative to anti-Fy^a and in high frequency is a challenging task to lab and critical matter to the patient where alloimmunization could cause DHTR. As stated by Yudin and Heddle (2014), a case with Rh-negative; consider alloimmunization or passive anti-D. RHIG has a half-life of 3 weeks. However, it can be detected via sensitive anti-globulin tests in patient plasma for about 8-10 weeks after the injection. With time it is supposed to be diluted in circulation and revealing only a reaction grade that is not strong. The reaction was +++ with a history of previous transfusion which allows consideration of alloimmunization and not a passive anti-D. Therefore, such an obstetrical patient should be placed into close management to avoid severe complication associated with alloimmunization; HDFN, kernicterus, hydrops and IUD. Besides, associated-risks of management approaches (for instance, amniocentesis if Doppler scan is not available) and life-saving procedures as IUT need to be considered as well (Van Kamp et al. 2005). One patient reported having a possible ruptured spleen, which appeals multiple transfusions with at least 4-6 packed RBCs in the initial 24 hours. It is crucial to provide management of splenic trauma rapidly to maintain haemostasis (Coccolini et al. 2017). One patient with ruptured aneurism requested for RBCs and FFP transfusion. It can be suggested that FFP of males' donor will suit the patient for better outcomes. A study conducted by Gajic et al. (2007), revealed that intensive care unit patients who received FFP (3 or more units) from female donors experienced more diminished oxygenation, fewer days without ventilators and more tendency to increased hospital mortality. In comparison to precisely the opposite when treated with male FFP donors. In another study, patients undergoing ruptured aneurysm repair were documented to have reduced rates of postoperative complications; hypoxia and acute lung injury when only transfused with FFP from male donors (Wright et al. 2008).

The case study focused on reporting a brief holistic view of different cases to aid a safe transfusion, and deficiencies remain to be addressed scientifically. It has been approved that RBCs transfusions outweigh evidence on FFP, platelets and other blood components which continue to exist as a barrier to better outputs (Palmieri et al. 2007). An extreme necessity for funding high-quality studies. Establishment of transfusion evidence-based algorithms to change physicians' practice and provide pre-tagged bags with corresponding antigenic phenotypes that are expected to improve outcomes and reduce costs. Also, compulsory appliance of second sample of ABO/Rh typing policy before blood issue (BCSH et al. 2013), utilization of automated systems whenever possible for testing and issuing blood, and electronic bands for final identification of the right recipient.

In conclusion, the four cases analysed earlier; symbolize different scenarios that could exist in every lab where there is a limited blood inventory with or without clinical-demands that illustrates associated anomalies which can alter the course of blood transfusion. An imperative necessity to determine newly-established transfusion practices and allocation of blood inventory. Ultimately, having evidence-based SOP, vulnerability of staff awareness, importance of teamwork and communication of all hospital departments as well as more resilience that focuses on rectifying mistakes instead of a blame culture.

Acknowledgement

None

Conflict of interest

None

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