

A Comparative Study on Blood Components Utilization in Selected Hospital-Blood Banks in Hail, K.S.A

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Abstract: Blood components preparations are undertaken to maximize the potential benefits of the components present in the whole blood. These blood components are indicated in the treatment of various conditions including bleeding disorders, trauma, and blood loss due to surgery. A retrospective study on blood components utilizations of King Khalid Hospital, Maternity Hospital and Hail General Hospital was conducted. The analysis revealed that King Khalid Hospital has the highest number of utilization for packed red blood cells, fresh frozen plasma and platelet concentrate. Hail General Hospital has the highest number of utilization for whole blood. Packed red blood cells is the blood component with the highest utilization among the three hospital-blood banks. Upgrading of inventory and management of blood and blood components is essential. Database linkage among the three hospitals on inventory of blood and blood products should be established to maximize the use of these resources and minimize the wastage.

Keywords: Blood components, Fresh Frozen Plasma, Packed red cells, Platelet concentrate, Retrospective study

I. Introduction

Blood is a bodily fluid that transports essential substances to the cells of the body and carries waste metabolites away from these same cells. It performs vital function essential for human survival. Blood is composed of cells and fluid known as plasma. White blood cells, red blood cells and platelets are the cellular components of blood which carry out specific function. Plasma also contains substances like coagulation proteins which also exhibit certain purpose.

Blood transfusion is the administration of donated blood products such as red blood cells, platelets, or plasma. It is indicated in the treatment of various conditions including bleeding disorders, trauma and blood loss due to surgery (1). Blood component therapy should only be given when the expected benefits to the patient are likely to outweigh the potential risks. The decision to transfuse blood components should be based on clinical assessment of the patient and his or her response to any previous transfusion as well as laboratory parameters (2). Blood components such as red blood cells, platelets and plasma derivatives are important in prophylaxis and treatment. Blood component therapy (the administration of components derived from human blood) is an established method for treating a range of conditions including blood loss and severe anaemia, and can both save lives and restore normal life expectancy(3).

Blood components preparation and separation are undertaken to maximize the potential benefits of all the components present in whole blood. These products should be managed and stored at their optimum storage temperature to maximize its use.

Good inventory management is necessary to ensure appropriate utilization of a precious resource. Not holding enough product can potentially put patients at risk, however having too much inventory can increase the age of blood at transfusion and increase wastage. Inventory management encompasses all of the activities associated with ordering, storing, handling and issuing of blood products (4).

This study aims to determine the blood component with the highest utilization in the three hospital-blood banks in Hail. Usage of each blood and blood components in each hospital-blood bank will be established. It will also provide information on blood components highly consumed by the three hospital-blood banks selected in the study.

II. Materials And Methods

It is a retrospective cohort study in which data concerning to utilization of blood and its component from January 2013 to December 2013 in blood bank of Maternity Hospital, King Khalid Hospital and Hail General Hospital were collected and analyzed.

Data of monthly utilization of different blood components for the year 2013 were collected from the record books of Maternity Hospital, King Khalid Hospital and Hail General Hospital. Collected data was treated

and classified and made comparative analysis on the utilization of blood components among the three hospital-blood banks selected in the study.

III. Results

Based on the analysis of the data in this study, the total number of blood and blood components utilization of King Khalid Hospital for the year 2013 is 4173 units, 2,484 units for Maternity Hospital and 1,408 units for Hail General Hospital.

Figure 1 presents the monthly utilization of different blood components and whole blood in three blood banks from January to December 2013. The monthly utilization of different blood components were analyzed and compared for the period of one year. It is revealed that number of blood and blood products utilization is high on the month of April for King Khalid Hospital and on the month of May for Maternity Hospital and Hail General Hospital on the month of March. This figure also shows that for the entire year of 2013, King Khalid hospital utilized the most number of units of blood components followed by Maternity Hospital and Hail General Hospital. This implies that King Khalid Hospital has a greater number of patients which require blood transfusion.

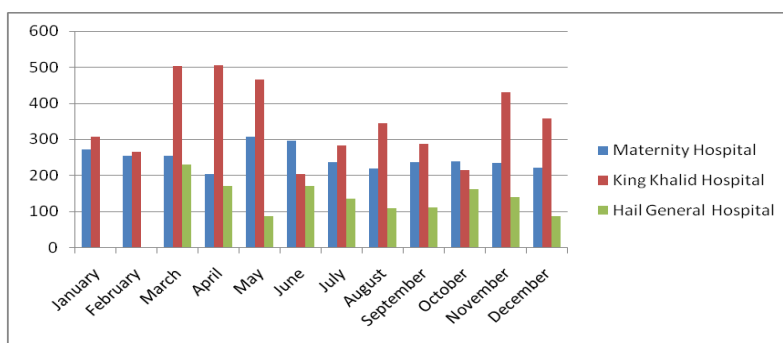


Fig. 1 Monthly Utilization of Blood and Blood Components

Hospital-Blood Bank utilization of blood and blood components is shown in Figure 2. The study showed that Blood Bank of King Khalid hospital utilized the highest number of units of packed red cells(2343 units) fresh frozen plasma (1057 units)and platelet concentrate (773) for the year 2013. As compared with two hospital-blood banks, Maternity hospital utilized 1355 units of Packed Red Cells and 1036 units of Fresh Frozen Plasma and 48 units of Platelet concentrate and Hail General Hospital utilized only 970 units of Packed Red cells, 263 units of Fresh Frozen Plasma and 79 units of Platelet concentrate. On the other hand 96 units of whole blood utilization was recorded for Hail General Hospital and 45 for Maternity Hospital. However no unit of whole blood utilization was recorded for King Khalid Hospital. This implies that King Khalid hospital admitted the most number of patients which require transfusion of packed red cells.

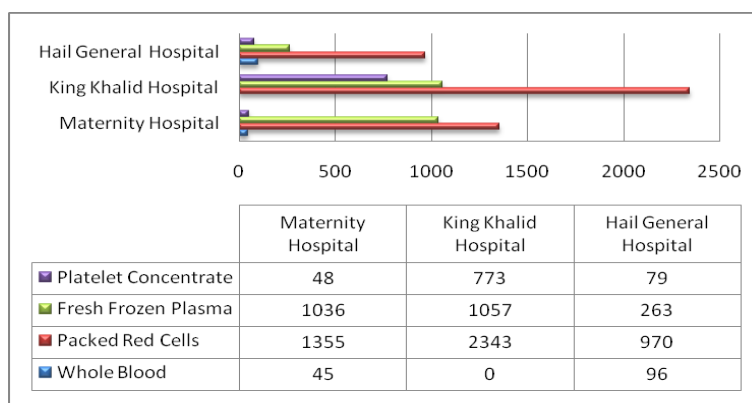


Fig. 2 Hospital-Blood Banks Utilization of Blood and Blood Components

Figure 3 presents the Percentage utilization of Packed Red Cells in the three selected hospital – blood banks . The chart shows that King Khalid Hospital obtained the highest percentage (50%)of Packed Red Blood Cells utilization for the year 2013. Maternity Hospital is second with 29% and Hail General Hospital with 21% of packed red cells utilization.

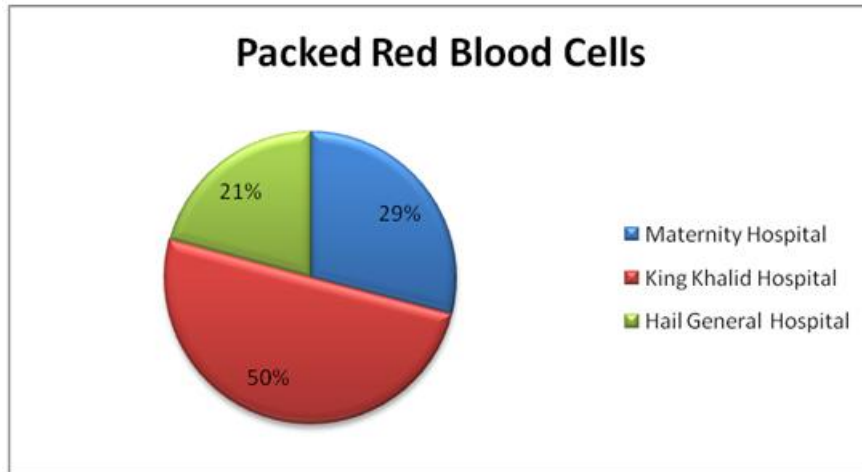


Fig. 3. Percentage Utilization of Packed Red Blood Cells.

Figure 4 presents percentage utilization of fresh frozen plasma in the three selected hospital- blood banks. It reveals that King Khalid and Maternity Hospitals utilized almost the same percentage of fresh frozen plasma utilization with King Khalid Hospital higher by 1%. King Khalid hospital utilized 45% of fresh frozen plasma as compared with Maternity Hospital which is 44%. Hail General Hospital has 11% utilization of FFP.

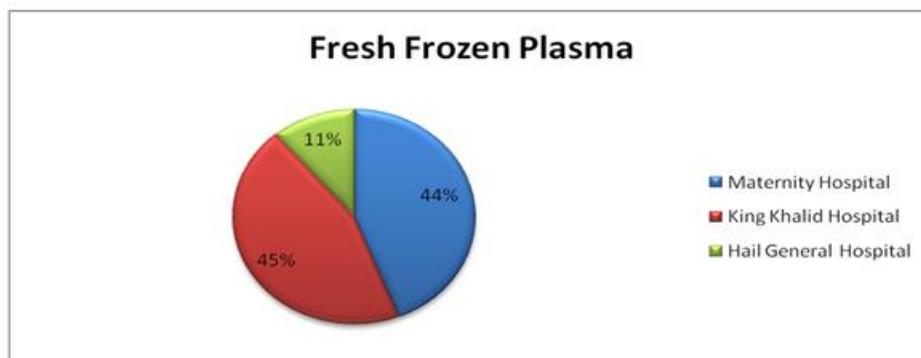


Fig. 4 Percentage Utilization of Fresh Frozen Plasma

Figure 5 presents the percentage Utilization of Platelet concentrate in three selected hospital –blood bank. It shows that the utilization of platelet concentrate is huge in King Khalid hospital with 86% while Maternity Hospital and Hail General Hospital is 9% and 5% respectively.

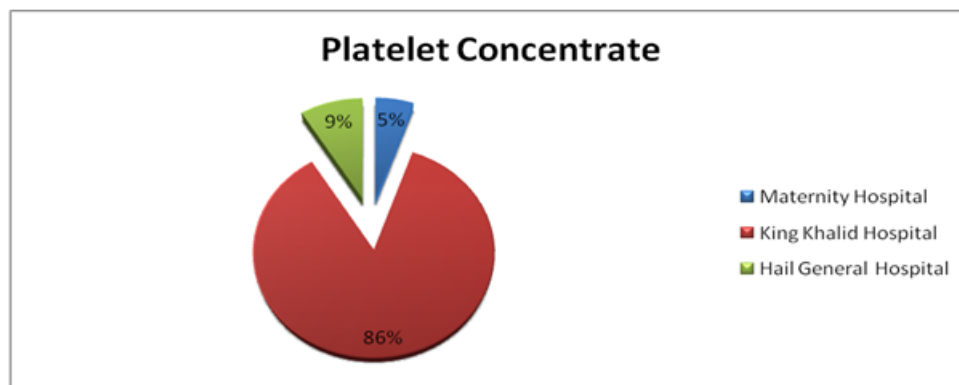


Fig 5 Percentage of Platelet Concentrate Utilization

Figure 6 shows the percentage utilization of Whole Blood in three selected hospital-blood banks. It reveals that Hail General Hospital utilized the most number of units of whole blood with 68% followed by Maternity Hospital with 32%. On the other hand King Khalid hospital has no record of whole blood utilization for the whole year of 2013.

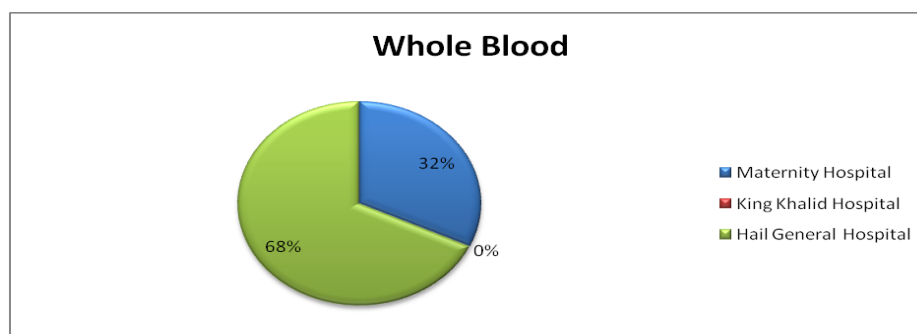


Figure 6. Percentage of Whole Blood Utilization

IV. Discussion

Blood transfusion comprises a significant part of different treatment practice. Blood must be transfused considering clear precautions because like drugs, blood and its components have the predisposition to cause side effects such as introduction of donor antigens in the recipient, exposure to transfusion transmissible diseases and transfusion reactions.

King Khalid Hospitals, Maternity Hospital and Hail General Hospitals prepare and separate blood components from whole blood to maximize its benefits. Packed red blood cells, platelet concentrate and fresh frozen plasma are prepared and utilized in these three hospital-blood banks as indicated for various medical treatment. Indications for blood utilization have been defined over the years. Presently, with advent of blood component usage for specific needs of patients, better guidelines have been suggested and put to practice globally. In many hospitals, it is now a standard practice of blood bank to manufacture different blood components from donated whole blood units and supply only components thereafter to patients {5}.

Instead of replenishment of blood loss through components, use of whole blood is recommended in certain situations. It is preferentially indicated in polytrauma, as in road accident casualties. An actively bleeding case with loss of more than 25% of total blood volume or an actively bleeding patient who has already received 4 units of PRBC needs to be transfused with whole blood as it not only replenishes the blood volume and oxygen-carrying capacity, it replenishes, and prevents dilution of, coagulation factors too. Giving whole blood produces better replenishment of blood volume, with introduction of foreign antigens from only one donor, hence exposing the recipient to lower immunological risk {6}.

In this study, the utilization of whole blood is only seen in significant numbers in Hail General Hospital as compared with Maternity Hospital with less utilization and King Khalid Hospital with no records of utilization for the period of one year. It is contrast with the result of study made in Nukem blood bank in India where utilization of whole blood is of highest as compared with the other blood components {7}. Symptoms of specific chronic anemia, leukemia, dialysis, and decreased oxygen-carrying capacity secondary to bleeding are all indications for transfusions of PRBC units. The current study revealed that packed red blood cells is the highest utilized blood components by the three hospital-blood banks in Hail. This finding was almost comparable to the study reported in Transfusion Medicine and Hemotherapy Journal where PRBC has the highest utilization among the other blood component {8}. Kaur, et al also supports the findings of this study where in their study showed that out of 1000 blood requisitions 67.8% of it is packed red blood cells {9}. But packed red blood cells utilization was only second compared to a study conducted in India where whole blood utilization ranked first{7}.

Fresh Frozen Plasma is a blood component prepared from whole blood or collected by apheresis, frozen within time limits and at a temperature such as to preserve the labile clotting factors adequately{10}. FFP prepared from units of whole blood and that derived from apheresis are therapeutically equivalent in terms of haemostasis and side effects {11}. FFP contains normal levels of the stable clotting factors, albumin and immunoglobulins. It contains at least 70% of the original coagulant factor VIII and at least similar quantities of the other labile clotting factors and natural inhibitors of coagulation {10}. The transfusion of FFP is indicated in the following situations: Correction of congenital deficiencies of clotting factors, for which there is not a specific concentrate, or acquired deficiencies of multiple clotting factors {12}, apheretic treatment of thrombotic microangiopathies (thrombotic thrombocytopenic purpura, haemolyticuraemic syndrome {13}, haemolytic anaemia elevated liver enzymes and low platelet count, reconstitution of whole blood for exchange transfusion {14}, hereditary angioedema due to deficiency of the esterase, in the absence of the inactivator of C₁ specific plasma derivative{15}.

Fresh Frozen Plasma is the second blood component with high number of utilization in the three hospital- blood banks involved in this study. The result is analogous to the study conducted by Venkatachalapathy, et.al on a Prospective Audit of Blood Transfusion Requests in RI Jalappa Hospital and

Research Center for Blood and Blood Components where Fresh Frozen plasma also ranks the second with high number of utilization among the other blood components {16}. On the other hand, in the study made at Nukem blood bank in India on the comparative usage of different components of blood, FFP was the third in rank in the number of blood component usage {7}.

A platelet concentrate (PC) can be obtained from a donation of fresh whole blood, which is centrifuged, or from an apheretic donation {17}. The transfusion of platelets is indicated for the prophylaxis and treatment of haemorrhage¹ in patients with thrombocytopenia or with primary or secondary functional disorders of platelets {18}. The decision to transfuse PCs must not be based exclusively on the platelet count¹. The absolute indication is severe thrombocytopenia together with clinically relevant bleeding. All the other indications are more or less relative and depend on the clinical condition of the patient.

The result of this study revealed that platelet concentrate is the third blood component with high number of utilization. Unlike in the study conducted in a tertiary care hospital in India, it was found out that platelet concentrate is the blood component with lowest utilization as compared with whole blood, packed red blood cells and fresh frozen plasma. However, in the study conducted at the University Hospital of Munster, the accounts of platelet transfusions are relatively high but packed red blood cells are the most frequently utilized blood component followed by fresh frozen plasma.

It is important for the blood bank to be able to fulfill the demands for this life-saving product and at the same time, evaluate and assess the existing trends of blood ordering. This is important to prevent misuse which may lead to shortage of blood availability and thus denial of blood supply to someone in a life-threatening situation.

V. Conclusion

This study provides information on blood component utilization in three hospital-blood banks in Hail. It demonstrates the percentage utilization of the three hospital-blood banks for blood and its components. King Khalid hospital presented the highest number of utilization for packed red cells, fresh frozen plasma and platelet concentrate followed by Maternity Hospital and Hail General Hospital with the lowest utilization of packed red blood cells, fresh frozen plasma and platelet concentrate. On the other hand, Hail General Hospital has the highest utilization of whole blood followed by Maternity Hospital. Kind Khalid hospital has no utilization of whole blood for the entire year. Among the blood components, packed red blood cells has the highest number of utilization in the three hospital followed by fresh frozen plasma, platelet concentrate and whole blood. In the analysis of data, it is also shown that King Khalid hospital has the highest utilization of blood components on the month of March, Maternity Hospital and Hail General Hospital on the month of May and April, respectively.

VI. Recommendation

Blood and its components are a very important resource and hence should be used in a justifiable manner. It is recommended that the hospital- blood banks should upgrade their inventory management of blood and its components including records of wastages. System data network on the inventory of blood and blood components should be established among these three hospitals in Hail to minimize wastage.

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