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Audit of clinical use of blood products in a tertiary care hospital

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ABSTRACT

Objectives: Blood and its components are an important part of patient management treatment protocols and like drugs have property to cause adverse reactions in the recipients. To maximize the effectiveness, safety and utility clinicians and intravenous therapists should be knowledgeable about the potential risk of blood component therapy. Hence, regular audit of blood and its component usage is essential to access the blood utilization pattern and set ideal policies in all the blood using specialties.

Material and Methods: This is a prospective Study conducted in department of Transfusion Medicine at Vinayaka Mission Kirupananda Variyar Medical College & Hospital for a period of one year. Source of data was blood bank requisition forms and blood bank registers of patients who underwent elective or emergency procedures in the hospital, for which blood was ordered.

Results: The mean age of the study subjects was 41.8 years. The male : female ratio was 1.6 : 1. Majority of the study subjects were in the surgery department followed by Ortho and OBG. Majority of the study subjects belong to B+ve blood group followed by O+ve group and only 20% of the subjects belong to negative blood group. 70% of the subjects required blood transfusion for some kind of surgical intervention and only 28% had required blood transfusion related to medical causes. Majority required four units of PRC transfusion. Majority of the subjects had the haemoglobin levels in the range of 6–7 and the mean level was 6.56 gms%. Majority of the packed red cell was stored for 2 weeks or 5 weeks and the mean duration of storage was 4.3 weeks. A statistical significant improvement was observed in the mean haemoglobin levels in the post-transfusion period compared to the pre-transfusion haemoglobin. Only 5% of the times the reaction related to fever or anaphylaxis had occurred among the entire study subjects. 50% had completed the entire blood transfusion in less than 4 hrs and the mean duration was 4.3 hrs. 65.9% of the patients had appropriate blood transfusion based on the guideline and the remaining 34% had inappropriate blood transfusion. It is inferred from the table that the CTR, transfusion probability and the transfusion index was found to be above the guideline value to be considered as effective blood utilisation.

Conclusion: Regular audit of blood components is crucial so that appropriate measures can be taken for proper usage. Continuous medical education regarding the transfusion services for the clinicians and staff nurses have major role in improvement for the clinical transfusion practices in the hospitals.

Keywords: Transfusion audit, Appropriate utilization, Blood components

INTRODUCTION

The main aim of modern transfusion services is to maintain an adequate, safe, and efficient supply of blood components for therapeutic use.[1] Increasing pressure on both the supply and the demand for blood has focused attention on ensuring that appropriate clinical use is made of

available blood components. The World Health Organization proposed the rational use of blood and blood products to reduce unnecessary transfusions and minimize the risks associated with transfusion. Many countries have developed national guidelines on the appropriate clinical use of blood.[2,3] Blood and its components are an important part of patient management treatment protocols and like drugs have property to cause adverse reactions in the recipients. To maximize the effectiveness, safety and utility clinicians and intravenous therapists should be knowledgeable about the potential risk of blood component therapy.[4]

Hence, regular audit of blood and its component usage is essential to access the blood utilization pattern and set ideal policies in all the blood using specialties. In spite of the sophisticated blood banking services worldwide; indiscriminate use of blood components with either no indication or inappropriate indication continues. Clinical audit is a management tool for the appraisal and justification of appropriateness and efficiency of transfusion therapy, and an important part of the quality assurance program which can provide necessary information for improving transfusion medicine practice.[5] This study is aimed to assess the appropriate utilization of packed red blood cells transfusion in our institution and also to evaluate the changes in hemoglobin concentration before and after packed red blood cells transfusion.

MATERIAL AND METHODS

This is a prospective study conducted in the Department of Transfusion Medicine at Vinayaka Mission Kirupananda Variyar Medical College & Hospital for a period of one year. **Sample size:** 1500 units of packed red blood cell**. Inclusion criteria: 1)** All patients who receive packed red blood cells. 2) Patient who gave consent for the study for the current illness. **Exclusion criteria: 1)** Patient who do not give consent**. 2)** Patients who had received between the two transfusions, a treatment which can modify the parameters evaluated like iron preparations.

Source of data was blood bank requisition forms and blood bank registers of patients who underwent elective or emergency procedures in the hospital, for which blood was ordered. Ethical approval was taken from the Institutional Ethical Committee. Patients' age and sex, diagnosis, type of procedure performed, pre-procedure hemoglobin level and number of blood units required to be cross matched and transfused were obtained from blood bank requisition form. The number of units prepared, cross matched and transfused as well as the number of patients for whom cross matching and transfusion were done was collected from blood bank registers. The blood which was cross matched but not transfused was considered as wasted. For the purpose of analysis, the department was categorized into Surgical, Obstetrics and Gynecology, Medicine and Oncology. Data were entered and analyzed using SPSS version 20. Blood utilization indices were computed with the following equation using MS Excel.

1. CTR = number of units cross matched/number of units transfused. A ratio of 2.5 and below is considered indicative of significant blood usage.
2. Transfusion probability (%T) = number of patients transfused/number of patients cross matched × 100. A value of 30% and above was considered indicative of efficient blood usage.
3. Transfusion index (TI) = number of units transfused/ number of patients cross matched. A value of 0.5 or more was considered indicative of significant blood utilization.[6]
4. Mead's criteria: MSBOS = 1.5 × TI.

RESULTS

The majority of the study subjects are in the age group between 40 and 60 years and the mean age was 41.8 years. Male: female ratio was 1.6 : 1. The majority of the study subjects were in the surgery department followed by Ortho and OBG. The most common blood group was B+ve blood group followed by O+ve group and only 20% of the subjects belong to negative blood group. About 70% of the subjects required blood transfusion for some kind of surgical intervention and only 28% had required blood transfusion related to medical causes [as depicted in Table 1]. Majority of our study subjects required four units of PRBC transfusion followed by three and two. The pre-transfusion hemoglobin levels of the patients were in the range of 6–7 gm% and the mean level was 6.56 gm% [as in Table 2]. Majority of the subjects had the hemoglobin levels in the range of 8–10 and the mean level was 9.1 gm% [as shown in Table 3]. About 5% of the times the reaction related to fever or anaphylaxis had occurred among the entire study subjects. Only 8% of the times there was emergency requisition from various departments for packed red cell transfusion. 65.9% of the patients had appropriate blood transfusion based on the guideline and the remaining 34% had inappropriate blood transfusion. According to the guidelines, PRC transfusion was indicated for Hb less than 7 gm% [Table 4]. the comparison between number of units cross-matched and number of units transfused was studied. It is inferred from Table 5 that the CTR, transfusion probability and the transfusion index was found to be above the guideline value and to be considered as effective blood usage.

Table 1: Distribution of the study subjects based on the indication for blood transfusion.

Indication for blood transfusion	Frequency	Percentage
Anemia	127	28.2
Preoperative	102	22.6
Intraoperative	87	19.3
Postoperative	134	29.7
Total	450	100

Table 2: Distribution of the study subjects based on the Hb levels.

Pre-Hb levels (gm%)	Frequency	Percentage	Post-Hb levels (gm%)	Frequency	Percentage
4–5	122	27.1	**4–5**	0	0
5.1–6	78	17.3	**5.1–6**	6	1.3
6.1–7	153	34	**6.1–7**	24	5.3
7.1–8	63	14	**7.1–8**	66	14.6
8.1–9	23	5.1	**8.1–9**	189	42
9.1–10	11	2.4	**9.1–10**	165	36.6
Total	450	100	**Total**	450	100

Table 3: Distribution of the study population based on the appropriateness of blood transfusion.

Appropriateness	Frequency	Percentage
Appropriate	989	65.9
Not appropriate	511	34
Total	1500	100

Table 4: Comparison between number of units cross-matched and number of units transferred.

Department	Number of blood units		Number of patients		C : T ratio	%T	TI
	Cross-matched	Transfused	Cross-matched	Transfused			
Medicine	548	128	113	62	4.09	54.8	1.13
OG	926	212	110	69	4.36	62.7	1.9
Ortho	2013	418	165	89	4.8	53.9	2.53
Pediatrics	428	101	101	64	4.23	63.3	1.00
Surgery	3068	641	212	166	4.78	78.3	3.02

DISCUSSION

Blood is scarce resource. Inappropriate transfusion of blood and blood product cause the waste of precious community resources, unnecessarily expose patients to transfusion risks, and reduce the availability of particular blood products for patients who need transfusion support.[6] Data from many developing countries have shown gross over-ordering of blood in 40%–70% of patient transfused,[7] the apparent reasons are apprehension of immediate risk to the patient and misperception of role of blood component in the treatment.

One important tool for improvement of blood transfusion practice is an audit of blood requisition forms and blood component utilization.[8] Internal audits form an integral part of the quality control program in any blood bank, like in any other organization.[9,10] This inappropriate use of blood and its components have a significant impact on the patients and the hospital staff in the form of healthcare cost,[11,12] wastage of resources, depriving more needy patients and transmission of infection with unnecessary allergic reaction leading to high mortality and morbidity in patients.

The study aimed to investigate the blood ordering pattern and transfusion practices. The study revealed that the blood products which are cross matched for the purpose of transfusion are not transfused, and this impacts the transfusion services by underutilization or over-ordering of blood products. The CTR in some procedures in our study varied from 4 to 4.8, and there is over-ordering of blood products in many procedures. The over-requisition of blood without subsequent utilization has been reported by earlier workers.[11-13]

The reason of over-ordering for blood is frequently based on the subjective anticipation of blood loss instead of audit-based estimates of the requirement in a particular procedure. The practice of making blood ready before scheduling a surgery may also be responsible for such a scenario combined with the fact that there is a great tendency to request more units of blood for elective procedures than what is actually required.

The current study revealed that 55% of the cross matched blood was unutilized. Higher CTRs have also been reported by Collins *et al.*[13] among the surgical categories, wherein the percentage of cases where none of the issued red blood cells were transfused ranged up to 93%, suggesting that gross over-ordering of cross-matches are seen in certain surgeries.[14] Similar findings were observed in our study where the surgical procedures of cesarean section, postpartum hemorrhage, prolapse uterus, and carcinoma of oral cavity had higher CTRs. Further procedures such as ovarian cystadenomas, chronic subdural hematoma, and incomplete abortions also had high CTRs.

The CTR is used for evaluating blood transfusion practices. The overall CTR of 4.21 observed in the current study is considered to be indicative of inefficient blood usage. Still, the CTR widely varied and was very high in many surgeries of the Department of Surgery and Gynecology and Obstetrics. Similar findings regarding certain surgeries are observed in another study by Subramanian *et al.*,[15] which revealed that certain surgeries such as cholecystectomy (open/laparoscopic), thyroidectomy, ureterolithotomy, gastro/cysto-jejunostomy, vagotomy/pyloroplasty, incisional hernia repair, varicose vein surgery, and omentopexy had none of the three indices showing optimum blood utilization. [15]

The probability of transfusion for a given procedure (%T), which signifies the probability of transfusion, and a value of 30% and above have been suggestive of significant blood usage.[16] The results of the present study revealed an overall transfusion probability of 62.6% as %T is dependent on the number of patients transfused and indicates appropriate transfusion as compared to number of units cross-matched per patient which were in excess of those transfused. This finding is similar to the study by Subramanian *et al.*, in which %T for laprotomy, vascular surgery, amputation, few neck procedures and orthopedic procedures was less than 50%.[15]

Regarding TI, a value of 0.5 or more is indicative of significant blood utilization.[17] The TI reported in the current study was 1.9. Reports of TI in the range of 0.1 to 0.4 has also been reported in various surgical procedures.[18] This finding of higher blood ordering pattern, especially in the Department of Surgery and Obstetrics and Gynecology, needs to be revised and over-ordering of blood should be minimized. The Obstetrics and Gynecology and Surgery Unit had the highest consumption of requested blood with a CTR of 4.36 and 4.78, respectively, and %T of 62% and 78.3%, respectively. Although the overall CTR is raised, still the %TI reflects appropriate blood usage for the respective departments as this finding may reflect the anticipated transfusion requirement of patients with cesarean section, postpartum hemorrhage, prolapsed uterus and debulking surgery for carcinomas which lead to more number of blood units being cross matched per patient and less number of units transfused per patient. Furthermore, low incidence of prophylactic patient blood management in the aforementioned conditions may have contributed to high CTR.

In the absence of an explicit MSBOS, ordering for blood transfusion is frequently based on the subjective anticipation of blood loss instead of audit-based estimates of the requirement in a particular procedure. The current deficiency of explicit MSBOS in our hospital is the major factor responsible for this. Based on the findings in our study, a Maximal Surgical Blood Order Schedule calculation by the formula $1.5 \times TI$[19] has been suggested to the hospital transfusion committee. The formulation of data-driven MSBOS and adhering to transfusion guidelines and prospective audit allied to educational programs may be effective in modifying clinician's behavior in ordering transfusions and, therefore, reduce the number of unused units and generate considerable cost savings.[20] However, transfusion requirements are subjective, and there is no fool proof way which can estimate blood loss or intraoperative modifications. The universal implementation of MSBOS within the institute is another hurdle.[21] Other measures with proven improvement in CTR and %T are type and screen (T and S), save and abbreviated crossmatch.[20] The MSBOS specifies the number of blood units to be routinely cross matched for elective surgical procedures based on retrospective analysis of actual blood usage for these procedures.[20] The T and S is determination of the patient's ABO group and Rh type and screening for unexpected, clinically significant allo-antibodies. If the screen is negative, ABO-compatible blood from the local inventory can be used with a quick spin crossmatch. By contrast, if the antibody screen is positive, then workup is necessary to determine the target antigen and identifying antigen-negative units for transfusion. The limitation of our study is that data

was collected and categorized into four broad specialties, however data on use of blood in OT/Critical Care, surgical specialty may have provided more useful insights.

Blood bank audits feature frequently in transfusion medicine literature from developed and less so from developing countries.[22-24] Almost all authors agree that such audits are just one initial step in the way to develop and promote good transfusion practice and avoid unnecessary transfusion and wastage of blood products. The value and effectiveness of these audits will be enhanced further if practicing physicians are made familiar with the outcome of the audits. This step should be supplemented with educational programs, in the form of lectures, clinical presentations, and short conferences, in the hope that attending physicians will change their behavior and attitude to hemotherapy. The greatest expected benefit will be significant reduction in the number of transfused blood components and also in the number of patients transfused for inappropriate reasons and, of course, reduction in health care expenses.[25-27] In this way the ultimate goal of promoting future safe and effective blood transfusion practice will be fulfilled. Recently, programmed implementation of more restrictive transfusion policies, such as Patient Blood Management (PBM)[28] and Maximum Surgical Blood Order Schedule (MSBOS), would result in a significant reduction in overall consumption of red cells.[29]

CONCLUSION

Developing a blood ordering policy, which is a guide to expect normal blood usage for surgical procedures, can decrease over-ordering of blood, thereby reducing unnecessary compatibility testing, returning of unused blood and wastage due to outdating. It also allows for a more efficient management of blood inventory. In this respect, the hospital blood transfusion committee has to implement MSBOSs for selected surgical procedures, conduct regular auditing about the effectiveness of the blood requesting policy using the CTR and offer periodic feedbacks to improve blood ordering, handling, distribution and utilization practices of this scarce resource.

Declaration of patient consent

Institutional Review Board (IRB) permission obtained for the study.

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Conflicts of interest

There are no conflicts of interest.

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