



## Retrospective Analysis of Transfusion Practices among Surgical Specialties in a Tertiary Care Institution

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### ABSTRACT

**Introduction:** Many elective surgical procedures require transfusion due to anticipated blood loss. The preoperative demand for blood is often an over-assumption as shown by the Blood Bank Records. This results in pre-emptive cross matching which renders a blood bag unavailable to other recipients thereby increasing the expiration of blood products and also causes overburdening of blood bank personnel, wastage of blood bank resources and time. The main aim of this present study is to improve the utilization of blood and to reduce the wastage of blood bank resources by adopting "Type and screen" (T&S) policy in departments with low transfusion probability.

**Materials and Methods:** Case records of all patients who underwent both elective and emergency surgeries in general surgery, gynecology and orthopedics were collected for a period of one year from 01 April 2016 to 31 March 2017 in our tertiary care institution. Transfusion parameters such as the number of units transfused, cross-matched were analysed. The calculated indices included Cross-Match to Transfusion Ratio (C:T ratio), Transfusion Probability (%T) and Transfusion Index (TI).

**Results:** It was observed that the transfusion probability in General surgery cases was high compared to gynecology and orthopedics.

**Conclusion:** Adoption of T&S policy over the Standard Blood Order Schedule (SBOS) for departments with low transfusion probability resulted in reduction of CT ratio, thereby improving the efficiency of the blood bank.

**Keywords:** Type & Screen, Transfusion probability, Surgery, Standard Blood Ordering Schedule,.

### Introduction

Many elective and emergency surgical procedures require transfusion due to excessive blood loss. The preoperative demand for blood is often an over-assumption of the actual blood loss. Based on the preoperative blood order, a blood bag is taken out for cross-matching. This renders it unavailable for other patients' use for a particular period (usually 72

hrs). For this reason, many a times, the newer blood bags get issued earlier than the older blood bags, which are kept cross-matched and reserved for specific elective surgical cases. If it is not transfused within the expiry date, the bag is likely to be discarded. This results in outdated of blood, overburdening of blood bank personnel, depletion of blood bank resources and wastage of time.

The initial Blood Ordering Schedule (BOS) was based on Mead's criterion which is calculated as  $1.5 \times$  Transfusion index (TI). According to this criteria, the no of blood units (PRBC) required for a particular surgical procedure is one and a half times the TI<sup>[1]</sup>.

Another policy which have proved successful is the Maximal Surgical Blood Ordering Schedule (MSBOS). The MSBOS provides a maximum value for the number of units to be cross matched for any given surgical procedure, based on the statistics of institutional usage. The MSBOS has been in use since 1975.<sup>[2]</sup> The MSBOS has improved the efficiency of blood utilization, but it has certain drawbacks. The MSBOS fails to account the individual differences in transfusion requirements between different patients undergoing the same surgical procedures.

A Surgical blood ordering schedule (SBOS) is an extended modification of the MSBOS. It takes into account both patient and surgical variables, such as pre and postoperative hemoglobin (Hb) level of the patient, gender, stature, the amount of surgical loss during each surgical procedure, type of surgical procedure etc. By establishing a Surgical Blood Ordering Equation (SBOE), each surgical team of a particular institution can develop its own blood ordering schedule and transfusion limits.<sup>[3]</sup> However, generalization of blood ordering has always been contested and presently there is a shift into patient-based ordering.

When a patient's blood is sent to the blood bank, it can be either 'typed and crossamatched' or 'typed and screened'. In the 'Type and Screen' (T&S) policy, the units are not cross-matched until an actual need for transfusion occurs. In such a case, a patient's sample is sent to the blood bank where it is just typed for ABO and Rh grouping and screened for the presence of any antibody in serum, without crossmatching.<sup>[4]</sup> If the screen is negative then ABO compatible blood can be issued, after quick-spin crossmatching. But if the antibody is detected in the serum, then the target antigen has to be determined and that target antigen negative blood has to be issued. Hence it has recommended to use

the T&S policy when the requirement is low, while in high blood-loss surgeries, it is better to have a blood ordering schedule.

### Objective

The main aim of this present study is to improve the efficiency of blood utilization and reduce unnecessary cross-matching as well as wastage of blood bank resources. This can be done by studying the blood ordering pattern and the transfusion practices of various surgical departments and establish a protocol based on transfusion probability. The second related objective was to use the T&S policy in departments with excessive ordering as experienced from past data.

### Materials and Methods

Case history of patients who underwent both elective and emergency surgeries and the blood bank requisition forms with blood bank records were collected and a retrospective analysis of the data for a period of one year from 01 April 2016 to 31 March 2017 was undertaken. Various patient parameters such as age and gender, the type of surgical procedure (broadly divided into general surgery, gynaecology and orthopedic surgery), pre and post-operative hemoglobin levels were taken into account. Transfusion parameters such as the number of units transfused and cross-matched were tabulated. The indices calculated and analyzed were as below:

- 1) C:T Ratio = No of units crossmatched / No of units transfused.
- 2) Transfusion Probability (%T) = (No of patients transfused / No of patients crossmatched/ requisitioned)  $\times$  100
- 3) Transfusion Index (TI) = No of units transfused / No of units crossmatched.

An ideal and desirable C: T ratio should be 1:1, but it is never achievable. A more realistic, acceptable and reasonable C:T ratio is 2:1 for all surgical procedures. A blood ordering schedule was calculated using the standard blood ordering equation (SBOE) proposed by Nuttal et al<sup>[5]</sup> which is as follows:-

Number of RBC units required = predicted Hb fall(g/dl)-[preoperative Hb (g/dl)-postoperative hemoglobin(g/dl)]<sup>[6]</sup>. The predicted hemoglobin fall is calculated based on the amount of blood loss during each surgical procedure. It is based on the assumption that 1 unit of blood lost will decrease the patient's hemoglobin by 1 g/dl. The difference in the mean pre and mean post hemoglobin levels of the patient for each procedure gives the actual Hb loss for any surgical procedure. The post-operative Hb was taken at 24 hours post-surgery.

Due to excessive demands from Gynecology and Orthopedic departments in the past, a T&S policy was adopted to alleviate the loss of excessive cross matched units. The CT ratio and TI of these departments would be an indicator of the number of units salvaged due to the change in policy.

### Results

A total of 241 patients were included in the present study. There were 90 males and 151 female patients who were transfused. Out of the total 241 patients, 180 patients were below the age of 40 years and 61 patients were above the age of 40 years.[Table 1].

**Table 1: Socio-Demographic Profile of the patients**

Description		Total (N=241)	Percentage
Sex	Male	90	37.34
	Female	151	62.65
Age	<40	180	74.68
	>40	61	24.89

101 patients were admitted in General surgery department, 60 in Gynaecology and 80 were orthopaedics cases. The total requisition received for the 241 cases were 2220 units out of which only 616 units (27.7%) were transfused whereas 72.3 % were not transfused. The no of units of blood demanded for General Surgery cases were 998 and the no of blood units actually transfused were 422.(%T = 42.28%). The no of units of blood demanded for Gynaecological surgeries were 682 and the no of units actually transfused were 86 units (%T = 12.61%). The no units demanded in Orthopedic cases were 540 out of which 108 units were actually transfused (%T = 20%).

The T&S policy was followed for gynecological and orthopedic cases wherein all demanded units were typed for ABO group and screened for antibodies. The requisite units were cross-matched only on the actual demand by the clinician and issued thereafter. This reduced the number of units cross-matched, thereby reducing the C:T ratio. The number of units crossmatched for Gynaecological surgeries were 211 (against an initial requisition of 682) and out of these 86 units were actually transfused (C:T ratio - 2.45). In orthopedic cases, against a demand of 540 units, 196 were crossmatched and only 108 units were actually transfused (C:T ratio-1.81). The C:T ratio, transfusion probability, as well as transfusion index were formulated for each of the departments and is shown in [Table 2]. Also shown is the reduction in CT ratio for gynecological and orthopedic cases on adoption of the T&S policy which was significantly reduced by 5.48 and 3.19 respectively.

### Discussion

The study aimed to investigate the blood ordering pattern of the various surgical departments in our institution and transfusion practices. The study revealed that the demand for blood products is always in excess of the no of blood units which are actually transfused. The over-ordering of blood products without subsequent utilization has been observed by earlier workers. The current study revealed that 72.25% of the cross-matched blood was unutilized. Higher C:T has also been observed in a similar study by Vibhute et al<sup>[6]</sup>. They found that out of 1145 units of blood crossmatched, only 265 units were transfused ie 76.86% of the ordered and crossmatched blood were not utilized.<sup>[7]</sup> In our institution the probability of transfusion (%T) varied widely. A transfusion probability of 42.28 % for General surgery cases was observed, whereas it was 12.60 % for gynaecological cases and 20% for orthopaedics cases. This was found to be similar to a study carried out by Sonam kumara et al where it was found that CT ratio was high (low %T) in the Department of Obstetrics and gynecology and surgery.<sup>[8]</sup> It is also similar to the study by Babita

Raghuwanshi et al in which the transfusion probability for surgical cases was found to be 48.98%. However the transfusion probability of Obstetrics and Gynaecology cases was 41.26%, which differs from our study. The overall transfusion probability was 57.62 % which is much higher as compared to the present study.<sup>[9]</sup>

TI with a value of >0.5 is indicative of significant blood utilization. The TI reported in the current study was 0.42 % for surgical cases, 0.12 % for gynaecology cases, 0.2 % for orthopaedics cases. In this study, TI of the surgery department was 0.42 which was close to the ideal value for significant blood utilization. The higher blood ordering pattern, especially in the Department of Obstetrics and Gynaecology (TI – 0.12% ) and Orthopaedics (TI - 0.2%), needs to be checked and excess blood demand should be reduced. TI < 0.5 has been reported by Aruselvi Subramanian et al .<sup>[10]</sup>

Excess ordering of blood as observed in the present study could have led to futile cross-matching, unnecessary holding of blood for a particular patient, thereby causing wastage and compounding the unavailability of blood products for genuine requirements. The change in policy from BOS to T&S policy for the gynecology and orthopedic surgeries resulted in minimal cross-matching excesses. A total of 1222 units were ordered by these two departments. 407 units of blood were cross matched and the remaining 815 units of blood were typed and screened only. Out of the 407 units crossmatched, only 194 units were issued. With an actual CT ratio of 1.81 and 2.45 against a projected CT ratio of 7.9 for gynecologic surgeries and 5 for orthopedic surgeries, if SBOS was being followed, approximately 75% of the workload due to cross-matching, record keeping, issue was reduced. This policy was anticipated and enforced based on previous two year data of the CT ratio and transfusion probability for similar surgeries.

The limitation of the present study is that the data was collected and categorized in three broad specialties. However, more useful insights would have been derived if data on the use of blood in medical cases could have been analysed. In the

present study, the patient variables such as pre and post Hb levels were included. Other parameters such as low weight, short stature which increases the efficiency of the SBOE were not taken into account. A prospective study to find out the efficiency of the SBOE in the surgical procedures may be helpful. At the same time, the type and screen policy should be adopted for simple surgical procedures when the requirement of blood is low. Various authors have studied on the implementation of Type and screen policy and have concluded that it can be implemented in Indian Blood Banks with no compromise on the quality of blood products and patient's safety.<sup>[11-15]</sup>

In the present study, it was observed that only 27.7% of the crossmatched units were transfused to the patients. 72.3 % of the total cross-matched units were not transfused. It is very important for every institutional blood bank to formulate a blood ordering schedule and the clinicians to take initiative to order blood for the surgical procedures in accordance with the SBOS for appropriate use of blood resources. Such schedules once implemented should undergo review at intervals of ideally 6 months, which will be helpful to assess the impacts of the newly executed policies. If any faults is noted at any level, it must be assessed carefully and prompt institution of any modification in the policies must be done.

Regular auditing of the blood bank patient records, demand and issue registers are also very vital to improve the blood utilization practices. The hospital blood transfusion committee should check up periodically to improve blood ordering, distribution and utilization practices of blood products. There should also be feedback from the treating clinicians, anaesthetists, surgeons, nurses as well as the blood bank staff and this should be finally assessed by the hospital transfusion committee.

### Conclusion

The reason for over-ordering of blood, for a particular surgical procedure, is frequently based on the subjective anticipation of the clinicians for blood loss instead of a standard blood ordering

schedule, which is limited for not accounting individual differences. Unnecessary cross-matching of blood is expensive and increases the burden of the laboratory staff. Institutional analysis of blood ordering is recommended for all types of surgeries. In addition, T&S policy is highly recommended for high CT ratio/ low transfusion probability cases.

This will save time and resources. Also a hospital blood transfusion committee is also recommended who will offer periodic checkups to scrutinize and improve blood ordering, handling, distribution and utilization.

**Table 2:** Comparison between number of units cross-matched and transfused of various surgical departments after adoption of T & S policy.

Department	No of units requisitioned (N=2220)	No of units cross-matched	No of units transfused	C:T Ratio	Reduction in CT ratio*	% T	TI
Surgery	998	998	422	2.34	-	42.28	0.42
Obstetrics and gynaecology	682	211	86	2.45	5.48	12.61	0.40
Orthopaedics	540	196	108	1.81	3.19	20	0.55

\*The reduction in CT ratio is calculated as : CT ratio without T&S policy where all units requisitioned are crossmatched minus Actual CT ratio

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