Original Article

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Anaesthesia Section

Assessment of Intraoperative Blood Transfusion Practices during Elective Surgeries in a Tertiary Care Hospital: A Prospective Cross-sectional Study

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ABSTRACT

Introduction: Blood transfusion remains the cornerstone of managing volume depletion and blood loss during surgeries. There are always patients and situations which clearly benefit from blood transfusion intraoperatively. Crystalloids and colloids cannot replace blood, as a substitute when the patient's oxygen carrying capacity has been compromised. Anaemia in acute and chronic conditions is associated with increased risk of morbidity and mortality. Thus, blood transfusion has a very important role in the perioperative management of the patient.

Aim: To ascertain the common indications for which anaesthesiologists start perioperative blood transfusion, the rates of intraoperative overtransfusion, and to assess the variation in the blood transfusion practices at the study Institution from standard guidelines.

Materials and Methods: A prospective cross-sectional study was conducted on 168 patients patients operated at Seth G.S. Medical College and KEM Hospital, Mumbai, Maharashtra, India, from February 2017 to July 2017. The patients were adult American Society of Anaesthesiologists Physical Status (ASA-PS) I and II, undergoing elective surgeries and required transfused blood intraoperatively. Operating room anaesthesiologists completed a record form for each of the patient. The form included details of the patient like age, gender, weight, type and duration of surgery, preoperative haemoglobin (done within 48 hours preoperatively), intraoperative blood loss, fluids and blood, and blood products transfused intraoperatively. The postoperative Haemoglobin (Hb) levels (done between 6 hours-24 hours postoperatively) were also recorded.

Results: The study showed that, 76 out of the 168 (45.2%) patients, who were transfused blood intraoperatively had been overtransfused, i.e., their postoperative Hb values were more than 10 g/dL. Blood loss was the sole indication for transfusion in 41 out of 168 (24.4%) patients. Blood was transfused in patients with low preoperative Hb in 21/168 (12.5%) patients, while it was done on surgeon's request in 13/168 (7.7%) cases. Pallor, hypovolaemia and haemodynamic instability as sole indications included only 4.8%, 2.4% and 1.2% cases, respectively.

Conclusion: The present study revealed that a significant number (45.2%) of patients were overtransfused. A wide variation exists from the standard guidelines among anaesthesiologists. Implementation of restrictive transfusion strategies and a protocol-based intraoperative transfusion is required to optimise patient outcome.

Keywords: Anaemia, Blood loss, Crystalloids, Haemodynamic instability

INTRODUCTION

Transfusion of blood and/or blood products become essential and is life saving during major surgical procedures for various indications. However, blood is precious and scarce resource and allogeneic blood transfusion has its share of associated risks to the patient. Transfusion-associated morbidity includes haemolysis, post-transfusion hepatitis, transfusion-related acute lung injury, anaphylaxis, graft-versus-host disease, and acquired immunodeficiency syndrome [1]. Hence, optimisation of the risk-benefit ratio is necessary to reduce the incidence of critical events and adverse effects.

The variation in perioperative transfusion practices exists among the Anaesthesiologists or surgeons or the Institutions. This depends on many factors like patient's physical status, co-existing diseases, preoperative Haemoglobin (Hb) level, surgical and anaesthetic techniques, intraoperative blood loss, haemodynamic status, etc. The decision regarding perioperative transfusion is often difficult to make and involve clinical judgement. Previously published retrospective or prospective studies have shown that blood is frequently overtransfused [2,3]. The preoperative cross-matching and blood requisition are often based on worst-case assumptions by anaesthesiologists or surgeon as there is no procedure-specific evidence-based guidelines to order for the appropriate amount of blood products. This kind of practice increases the healthcare cost for the patient, depletion of blood bank resources, overburdening of blood bank personnel, and wastage of time [4]. To tackle this situation and facilitate the rational use of blood bank resources, and institution-specific Maximum Surgical Blood Ordering Schedule (MSBOS) was proposed. But there are certain drawbacks like individual differences in transfusion requirements, the requirement of electronic databases etc. [2].

The ASA and Italian Society of Transfusion Medicine and Immunohaematology (SIMTI) guidelines have recommended maintaining perioperative Hb levels higher than 6-8 g/dL in presence of risk factors or co-existing diseases [5,6]. However, these guidelines cannot be directly applied to all clinical situations and the recommendations should be considered carefully. Hence, despite these guidelines and the several risks of blood transfusion, surgeons and Anaesthesiologists are often liberal and frequently inconsistent in transfusion practice during the perioperative period. Allogenic blood misuse has been widely reported and despite recommendations and other educational efforts, it is still a problem [7]. Studies may help to identify the Institute-specific problems in transfusion practice and regulate the rate of inappropriate transfusion [8].

The present study aimed to evaluate the variation in perioperative transfusion practices in the tertiary care Institute. The objectives were to ascertain the common indications for which the Anaesthesiologists started perioperative blood transfusion and to ascertain the rates of intraoperative overtransfusion in patients undergoing elective surgeries.

MATERIALS AND METHODS

This prospective cross-sectional study was conducted at Seth G.S. Medical College and KEM Hospital, Mumbai, Maharashtra, India from February 2017 to July 2017. Prior ethical permission was taken from the Institutional Ethical Committee (No. EC/136/2016, dated 13.01.2017). This study was conducted at the General Surgery, Neurosurgery, Genitourinary, Gastroenterological, Orthopaedic and Plastic surgery operation theatres.

Inclusion criteria: A total of 168 ASA PS I and II patients, (ASA 1- Healthy patients, ASA 2- Mild to moderate systemic disease which is well controlled) aged 18-90 years of either sex, who had undergone various elective surgeries and were transfused blood or blood products, intraoperatively.

Exclusion criteria: Patients undergoing cardiac, transplant and paediatric surgeries. Patients or consultant Anaesthesiologists, who did not give consent or refused to participate in the study were also excluded.

Sample size calculation: The sample size was calculated by using the formula for the cross-sectional study based on the observations of a previous study [9]. A sample size of 168 cases was achieved according to the formula: $n=Z^2pqN^*e^2 (N-1)/Z^2pq$, where p=proportion percentage of the most common variable in the population studies, q=100-proportion, e=5%, N=Total cases, Z=1.96.

Study Procedure

A consultant anaesthesiologist was designated as the study coordinator and a trainee anaesthesiologist was assigned to visit the operation theatres daily. Each transfusion decision was decided independently by the anaesthesiologist, who was involved in intraoperative patient management. A record form was provided to the anaesthesiologists for each patient who required blood transfusion intraoperatively. The form included details of the patient like age, gender, weight, type and duration of surgery, preoperative Hb, intraoperative blood loss, fluids, blood and blood products transfusion intraoperatively and postoperative Hb levels. The incidence of intraoperative haemodynamic instability and requirement of ionotropic support were also recorded. The anaesthesiologists marked the indication (s) of intraoperative blood transfusion from the options given in the record form which included clinical pallor, blood loss, low preoperative Hb, hypovolaemia, haemodynamic instability, surgeon's request or any other specific cause, for which they were transfused blood. The identity and information of the patient and Anaesthesiologist were kept confidential.

Intraoperative blood loss was calculated from the gauze pieces used during surgery, by measuring the volume of blood in the suction bottle after deduction of any washing fluid given during the surgery and visual estimation of loss in the operative field. Two standard size gauze pieces were used during all the surgeries. The blood volume of fully-soaked small and large gauze pieces were 20 mL and 100 mL, respectively.

All the patients were followed-up for 24 hours, postoperatively. Their postoperative Hb levels- measured between 6 hours to 24 hours postoperatively- were documented in the case record form. Perioperative blood transfusion was defined as transfusion of Red Blood Cells (RBCs) (packed cells or whole blood) during or within 24 hours, after surgery. From the information obtained, the common indications for blood transfusion in our hospital were assessed. Based on the level of postoperative Hb, the study was conducted by evaluating the rate of appropriate blood transfusions and overtransfusions. The appropriateness of blood transfusion was associated with individual patient factors like age, sex, weight, type of surgery, type of anaesthesia given, and duration of surgery, blood loss during the surgery and also with the experience of the anaesthesiologist responsible for the transfusion.

The variation in blood transfusion practices was assessed. This cut-off was based on ASA Task Force Practice guidelines for perioperative blood transfusion and adjuvant therapies [5].

The standard indications for blood transfusion include:

1. Blood loss greater than 20% of blood volume, when more than 100 mL.
2. Hb level less than 8 g/dL.
3. Hb level less than 10 g/dL with major disease (e.g. emphysema, ischaemic heart disease).
4. Hb level less than 10 g/dL with autologous blood.
5. Hb level less than 12 g/dL and ventilator dependant.

A patient was considered overtransfused, if the post-transfusion Hb concentration was more than 10 g/dL. The ASA guidelines suggests that patients with Hb more than 10 g/dL rarely need transfusions [5].

STATISTICAL ANALYSIS

All statistical calculations were done using Microsoft Excel 2019 (Microsoft Corporation, NY, USA) and Statistical Package for the Social Sciences (SPSS) version 25.0 (SPSS Inc., Chicago, IL, USA). Descriptive statistics such as mean and percentage were calculated to present univariate data such as age, sex, duration of surgery and indication of blood transfusion. To analyse factors associated with the appropriateness of blood transfusion; p-value<0.05 was considered as statistically significant. Patients were classified as appropriate transfusion and overtransfusion. To study the factors of categorical variables associated with the appropriateness of blood transfusion; Chi-square test was applied. To study factors of continuous variables related to the appropriateness of blood transfusion; unpaired t-test was applied.

RESULTS

The study recruited 168 patients who needed an intraoperative blood transfusion. A total of 12 Anaesthesiologists, who administered anaesthesia for these patients from various surgical sub-specialities filled the perioperative details in case record forms. In the study, 92 out of the 168 patients (54.8%) had been transfused blood appropriately, i.e. their postoperative post-transfusion Hb levels were less than 10 g/dL. Thus, almost half of the blood transfusions done intraoperatively were inappropriate as per the ASA guidelines. The demographic profile of 168 patients and 12 anaesthesiologists are shown in [Table/Fig-1,2] respectively. Majority of the patients (23.2%) were in 18-26 years age group. The age and sex of patients did not affect the appropriateness of blood transfusion significantly. A statistically significant overtransfusion was noted in patients with higher mean weight, as compared to appropriately transfused patients (p<0.05).

Characteristic frequency (%)			Appropriateness		p-value
			Appropriate	Overtransfusion	
Gender	Male	87 (51.8)	42 (45.7)	45 (59.2)	0.08
	Female	81 (48.2)	50 (54.3)	31 (40.8)	
Age (years) Mean±SD		44.27±18.67	45.98±18.131	42.18±19.234	0.191
Weight (kg) Mean±SD		53.96±9.725	52.21±9.818	56.08±9.236	0.01

[Table/Fig-1]: Demographic profile of patients.

Characteristic		Frequency (%)
Gender	Female	7 (58.3)
	Male	5 (41.7)
Age (years) Mean±SD		35.83±5.859

[Table/Fig-2]: Demographic characteristics of Anaesthesiologists.

Indications for transfusion, surgery, and type of anaesthesia are enumerated in [Table/Fig-3-5]. As shown in [Table/Fig-6] the mean duration of surgeries was 318.27 minutes. The duration of surgery did not affect the appropriateness of blood transfusion. The mean blood loss was 888.33 mL. The intraoperative blood transfusions were more appropriate when blood loss was more. [Table/Fig-3] shows various indications of blood transfusion in the study population. The rate of appropriate blood transfusion was significantly higher when it was done for more than one indication. In 7.7% of cases, blood was transfused despite the absence of any of these indications, on the request of the operating surgeon. Hypovolaemia and haemodynamic instability, were the less common indications for intraoperative blood transfusion.

Indication	Frequency (%)	Appropriateness	
		Appropriate	Overtransfused
Multiple indications	79 (47)	52 (65.82)	27 (34.18)
Blood loss	41 (24.4)	20 (48.78)	21 (51.22)
Low preoperative Hb	21 (12.5)	15 (71.42)	6 (28.58)
Surgeon's request	13 (7.7)	0	13 (100.0)
Intraoperative pallor	8 (4.8)	3 (37.5)	5 (62.5)
Hypovolemia	4 (2.4)	2 (50.0)	2 (50.0)
Haemodynamic instability	2 (1.2)	0	2 (100.0)
Total	168 (100)	92 (54.76)	76 (45.24)

[Table/Fig-3]: Indications and appropriateness of blood transfusion.

Surgery frequency (%)	Frequency (%)	Appropriateness	
		Appropriate	Overtransfusion
Spine	51 (30.4)	25 (49.02)	26 (50.98)
Orthopaedic	41 (24.4)	20 (48.78)	21 (51.22)
Neurological	33 (19.6)	20 (60.60)	13 (39.40)
General	15 (8.9)	11 (73.33)	4 (26.67)
Genitourinary	17 (10.1)	10 (58.82)	7 (41.18)
Gastroenterological	7 (4.2)	5 (71.42)	2 (28.58)
Plastic	4 (2.4)	1 (25.0)	3 (75.0)
Total	168 (100.0)	92 (100.0)	76 (100.0)

[Table/Fig-4]: Type of surgery and appropriateness of blood transfusion.

Type of anaesthesia	Frequency (%)	Appropriateness n (%)	
		Appropriate	Overtransfused
General	118 (70.2)	66 (55.93)	52 (44.07)
Spinal+Epidural	35 (20.8)	17 (48.57)	18 (51.43)
General+Epidural	13 (7.8)	8 (61.54)	5 (38.46)
Spinal	2 (1.2)	1 (50)	1 (50)
Total	168 (100.0)	92 (100.0)	76 (100.0)

[Table/Fig-5]: Technique of anaesthesia and appropriateness of blood transfusion.

The study included cases of blood transfusions done in different sub-specialities of surgery. The distribution of cases and appropriateness of blood transfusion in each type of surgery is shown in [Table/Fig-4].

As seen in [Table/Fig-7], the type of anaesthesia did not affect the appropriateness of transfusion. All the different types of anaesthesia administered had almost equal rates of appropriate transfusions and overtransfusions as can be seen. Of these, general plus epidural anaesthesia had the most favourable rate of appropriate transfusions amongst all the types of anaesthesia (61.54%) [Table/Fig-5].

Variables (Mean±SD)		Appropriate N=92	Overtransfused N=76	p-value	Max	Min
Duration of surgery (minutes)	318.27± 152.51	299.24± 141.757	341.32± 162.557	0.075	60	720
Blood loss (mL)	888.33± 654.87	1017.28± 84.363	732.24± 38.964	0.005	100	4000

[Table/Fig-6]: Duration of surgery and theamountof blood loss with respect to appropriateness of transfusion.
A p-value <0.05 is considered to be statistically significant

Type of anaesthesia	Appropriateness		Total
	Appropriate	Overtransfusion	
General anaesthesia	66 (71.7%)	52 (68.4%)	118 (70.3%)
Epidural+GA	8 (8.7%)	5 (6.6%)	13 (7.7%)
Spinal	1 (1.1%)	1 (1.3%)	2 (1.2%)
Spinal+Epidural	17 (18.5%)	18 (23.7%)	35 (20.8%)
Total	92 (100%)	76 (100%)	168 (100%)

[Table/Fig-7]: Comparison of type of anaesthesia with appropriateness of blood transfusion.

[Table/Fig-8] shows years of experience of the Anaesthesiologists after completing their MD Anaesthesiology.

Experience (Years) frequency (%)		Appropriateness	
		Appropriate	Overtransfused
Less than 5	3 (25.0%)	25 (47.2%)	28 (52.8%)
6 to 9	5 (41.8%)	24 (60.0%)	16 (40.0%)
More than 10	4 (33.2%)	43 (57.3%)	32 (42.7%)
Total	12 (100.0%)	92 (54.8%)	76 (45.2%)

[Table/Fig-8]: Years of experience of Anaesthesiologist and appropriateness of blood transfusion.

A majority (41.8%) of them had 6-9 years of experience. Anaesthesiologists with an experience of less than five years, overtransfused in 52.8% cases. Anaesthesiologists with 6-9 years of experience did the maximum number of appropriate blood transfusions. However, there was a slight decline in the percentage of appropriate transfusions by Anaesthesiologists, with more than 10 years of experience with 42.7% cases being overtransfused.

DISCUSSION

The present prospective cross-sectional study was conducted to determine the existing practice of blood transfusion during the perioperative period in a tertiary care hospital. This would help to study the appropriateness of the use of blood in various surgical sub-specialities, formulate blood ordering strategy, ensure rational use and avoid wastage of valuable resources like blood.

In the present study, it was found that 45.2% of patients who received intraoperative blood transfusion had been overtransfused as the postoperative Hb was more than 10 g/dL. According to ASA guidelines patients with Hb, more than 10 g/dL rarely need transfusions [5]. This finding was similar to various studies published in the literature. The incidence of overtransfusion in these studies varied between 19 and 53%. Niraj G et al., noticed a low rate of appropriate blood use (40.7%) in their prospective study in non cardiac surgery [3] whereas Gomathi G and Varghese RG found a high proportion of appropriate use of packed red cell [8]. But in contrast, Ranganathan P et al., observed comparable rates of overtransfusion of blood (51%) in cancer surgery [9]. This variation in the literature could be because of the difference in protocols followed by different Institutions and the criteria used to define overtransfusion.

It was observed that age and sex ratio did not affect the rate of overtransfusion in present study patients. However, overtransfused patients had a higher bodyweight, as compared to those who were appropriately transfused. The reason for this statistically significant difference could be due to the consideration of total body weight, instead of ideal body weight (as is followed by Anaesthetists in the study Institute) which led to an overestimation of the maximum tolerable blood loss in these patients.

The most common indications for perioperative transfusion in the present study was due to multiple factors (47%), followed by acute blood loss (24.4%). Niraj G et al., observed low Hb as the primary trigger (72%) for transfusion in their study [3]. The most common indications for perioperative transfusion were blood loss exceeding the maximum allowable loss and low intraoperative Hb in a study conducted by Ranganathan P et al., [9]. Considering clinical anaemia by examination of a patient's conjunctiva as the primary trigger resulted in 40.7% transfusion in a study by Choy YC et al., [7]. Intraoperative pallor as the transfusion requirement criteria was probably a crude method -which was not ideal- so resulted in 62.5% overtransfusion in the study.

Ranganathan P et al.,observed the highest rate of overtransfusion (63%) in patients who had no documented indication for transfusion. The study shows that it must be insisted to properly document the transfusion trigger in intraoperative notes, as it was proven to decrease in the incidence of inappropriate transfusions significantly [9].

In the present study, although the duration of surgery did not significantly affect the rate of overtransfusion, the variation observed among various sub-specialities. It was observed there was overtransfusion in more than 50% of cases in spine and orthopaedic surgeries. However, general surgery showed favourable scenario in which 73.33% of cases were appropriately transfused. Kucchal A et al., also observed similar findings in their study [10].

In the present study, the anaesthesia technique did not seem to affect blood transfusion practice significantly. However, regional anaesthesia is proven to be associated with lower blood loss and transfusion requirements as compared to general anaesthesia [11]. It was observed that a wide variation in the transfusion practices amongst the Anaesthesiologists in the same hospital. Anaesthesiologists with 5-10 years of experience, transfused the blood appropriately in the maximum number of cases. This showed clinical experience probably improved the clinical judgement of Anaesthesiologists regarding intraoperative transfusion. However, there was a slight increase in the overtransfusion rate (42.7%) by Anaesthesiologists with more than 10 years of experience. Probably a more liberal blood transfusion strategy was used by the older generation of Anaesthesiologists, according to their experience.

It was found there was a wide variation in the transfusion practices followed by different Anaesthesiologists in the same Institute. No single protocol or guideline was adhered to by the anaesthesiologists, which contributed to the high rates of overtransfusion. Each one had their own individualised management and decision making, when it came to transfusing blood to the patient. It could be speculated that, the reason for a high rate of overtransfusion could be due to:

1. Lack of implementation of a standardised protocol for blood transfusion.
2. Lack of adherence to uniform transfusion guidelines by the anaesthesiologists.
3. No documentation of the indication for transfusion.
4. A lack of supervision and audit of the existing transfusion practices by the Institute, regularly.

McEwen J and Huttunen KH in their study on transfusion practice in Neuroanaesthesia suggested that clinicians should consider blood conservation strategies and understand potential risks and benefits of blood transfusion [12].

It is the need of the hour to increase awareness regarding the risks and lack of benefit of overtransfusion. There is a need to have a uniform transfusion protocol, point-of-care intraoperative Hb testing, proper documentation of indication, perioperative blood conservation strategies and transfusion audits at regular intervals to ensure judicious blood transfusion in the perioperative setting. Appropriate measures of blood transfusion and implementing restrictive blood transfusion strategies in Institutions, their implementation and feedback, to bring down overuse and to improve the blood transfusion practices is needed.

Limitation(s)

The present prospective study involved only ASA I and II patients. The study included, only RBC transfusions (packed cells or whole blood) and transfusion of fresh frozen plasma and platelets were not considered for analysis. Plastic surgery and gastroenterological surgery had only four and seven cases, respectively which were not enough to reach any conclusive results. A future study with a larger population and multicentre studies are warranted.

CONCLUSION(S)

The present study throws light on the blood transfusion practices followed in a tertiary care Institute. A wide variation exists among Anaesthesiologists and from the standard guidelines in the blood transfusion practices in the Institute where the present study was conducted. The most common indication for blood transfusion was found to be blood loss followed by low preoperative Hb. Implementation of restrictive transfusion strategies and a protocol-based management of blood transfusion intraoperatively, is the need of the hour, in order to optimise patient outcome and to conserve this dwindling reserve of blood.

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