



Transfusion Triggers in Cardiac Surgery Patients – A Retrospective Review

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Authors' contributions

This work was carried out in collaboration among all authors. Author IS wrote protocol and draft manuscript. Author AH designed the study and performed the statistical analysis. Author NVH did literature search. Author VKP reviewed and corrected the draft article. All authors read and approved the final manuscript.

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Review Article

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ABSTRACT

Aim: To determine the transfusion trigger for cardiac surgery patients and to determine the transfusion pattern in these patients.

Study Design: A retrospective cross sectional observational study.

Place and Duration of Study: This study was conducted in Department of Transfusion Medicine, SMCH, Chennai, between the periods of 2017-2020.

Methodology: This study was done by reviewing the blood bank records for patients undergoing cardiac surgery from 2017 to 2020. Patients with other comorbid conditions like cirrhosis, malignancy, those who underwent emergency surgeries and death during the surgery were excluded from the study. Patient data like age, diagnosis, number of components transfused, preoperative hemoglobin, and details of surgery done on the respective patients were reviewed from the blood bank records.

Results: A total of 100 patients were included in the study. Mean age of the patients was 53.3 ± 13.6 years. In our sample population 73% of patients underwent CABG procedure and they

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received packed red blood cell transfusions. Among the PRBC transfusions 93% of patients received liberal transfusions and 7% of patients received restrictive transfusions. Majority of patients in our study population about 58% belong to 45-64 years of age group.

Conclusion: We found that most of the transfusions done in cardiac surgery patients were done on liberal transfusion strategy. Thus, we conclude in our study most of the transfusions done on cardiac surgery patients followed liberal transfusion strategy, which would be less harmful to the patients.

Keywords: Liberal transfusion strategy; oxygen delivery; restrictive transfusion strategy; tissue hypoxia.

ABBREVIATIONS

PRBC : Packed Red Blood Cell;
CABG : Coronary Artery Bypass Grafting;
MR : Mitral Regurgitation;
TVD : Triple Vessel Disease;
RHD : Rheumatic Heart Disease;
MVR : Mitral Valve Repair;
AVR : Aortic Valve Repair

1. INTRODUCTION

Allogenic blood transfusions constitute about 40% to 90% of cardiac surgery patients [1]. Increased prevalence of anemia were noted in cardiac surgery patients. Anemia during perioperative period was arbitrarily defined as hemoglobin concentration less than 12 g/ dl and it occurs in 75% of cardiac surgery patients [2]. Several possible reasons for this, such as decreased red blood cell mass during surgery, usage of priming solutions such as crystalloids, bleeding during perioperative period, decreased hematopoiesis as a manifestation of chronic disease and inflammatory state [3]. Current transfusion guidelines recommend that restrictive transfusion strategy holds better practice for non-cardiac surgery patients which were supported by several observational studies and Randomized control trial (RCTs). Meta-analysis of RCTs done on cardiac patients and single large study like Transfusion Indication Threshold Reduction (TITRe 2) trial suggests that liberal transfusion strategy holds better practice for cardiac surgery patients. However, transfusions have been associated with high rates of morbidity and mortality in critically ill patients. Increased prevalence of coagulopathy and bleeding occurs in cardiac surgery patients that also contribute to bleeding manifestations and anemia occurring in cardiac surgery patients that necessitates Packed red blood cell (PRBC) transfusions [4]. Different studies suggest different thresholds but there was no concrete evidence suggesting optimal transfusion trigger for cardiac surgery patients. Hence, this study is

conducted in order to determine the transfusion threshold or trigger for cardiac surgery patients and to determine the transfusion pattern for cardiac surgery patients in our institute.

2. MATERIALS AND METHODS

This was a retrospective cross sectional observational study done by reviewing the blood bank records for patients undergoing cardiac surgery in last three years (2017 to 2020). Patients with other comorbid conditions like cirrhosis, malignancy, those who underwent emergency surgeries and death during the surgery were excluded from the study. A total of 100 patients were included in this study and data like age, diagnosis, number of components transfused, preoperative hemoglobin, and details of surgery done on the respective patients were reviewed from the blood bank records. Patient details like complications of surgery and survival rate of the patients were not available. All the data regarding the study subjects were entered in Microsoft Excel and statistical analysis were carried out at 5% level of statistical significance by using IBM SPSS statistics. The data distribution on categorical variables such as gender, diagnosis, type of surgery, components transfused were expressed as frequency and percentages. The continuous variable such as age was expressed as mean with standard deviation or median with range.

3. RESULTS AND DISCUSSION

A total of 100 patients were included in the study. The gender details of sample population were depicted in [Fig. 1]. Males were higher than females (77 vs 23).

Mean age of the patients was 53.3 ± 13.6 years. Mean age of male patients was 54.5 ± 14.0 years and that of female patients was 50.3 ± 11.0 years. The diagnosis, type of surgery, age and preoperative hemoglobin is described in [Table 1].

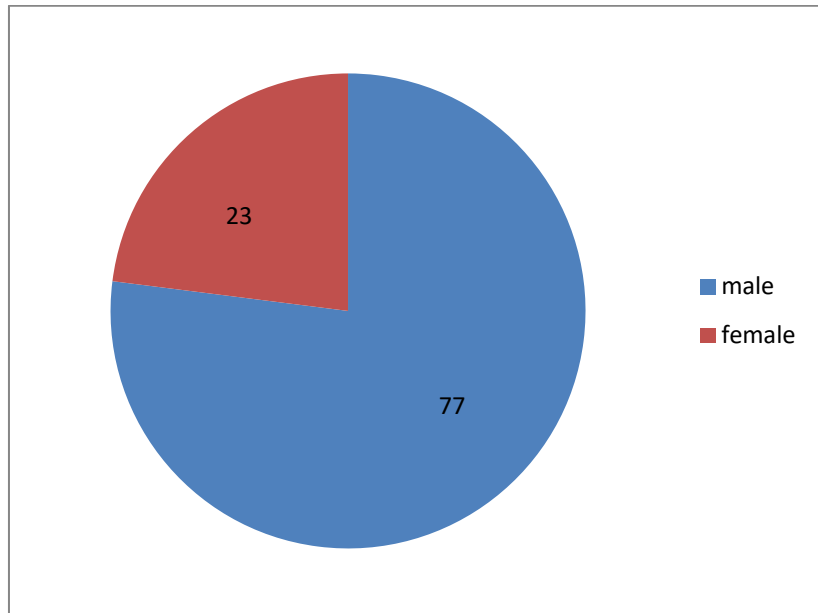


Fig. 1. Gender distribution

Table 1. Profile of patients who underwent cardiac surgery

	CONSTITUENTS	n/ %
DIAGNOSIS	CAD	72
	MR with CAD	1
	TVD	1
	RHD	19
	Pyopneumothorax	2
	Hydropneumothorax	2
	Hemothorax	1
	Pyothorax	2
	SURGERY	CABG
MVR		11
AVR		4
CABG with MVR		2
Double valve replacement		4
Drainage and ICD Insertion		2
Thoracotomy with decortication		4
AGE		15-24
	24-44	16
	45-64	58
	>65	23
Hb	Restrictive Hb<7 g/dl	7
	Liberal Hb< 10 g/dl	93

CABG: Coronary Artery Bypass Grafting; MR: Mitral Regurgitation; TVD: Triple Vessel Disease; RHD: Rheumatic Heart Disease; MVR: Mitral Valve Repair; AVR: Aortic Valve Repair

In our sample population 73% of patients underwent CABG procedure and they received packed red blood cell transfusions. Among the PRBC transfusions 93% of patients received liberal transfusions and 7% of patients received restrictive transfusions. Majority of patients in our

study population about 58% belong to 45-64 years of age group.

Cardiac surgeries are more prone for unexpected torrential bleeding leading to increased amount of blood transfusions. Different centers have

varied transfusion protocols for cardiac surgeries. Blood usage for cardiac surgeries may comprise significant amount in the total institutional usage of blood components [5]. The usage of blood components also varies due to differences in perioperative and intraoperative practices for different procedures. It also includes preoperative medications with antiplatelet agents and anticoagulants [6]. In our institution majority of blood transfusions and blood usage have been done for Coronary Artery Bypass Graft procedures (72%) in Coronary Artery Disease patients. It may be due to increased proportion of this procedure in cardiac surgeries.

The next important concern in cardiac surgery patients regarding transfusions is onset of anemia in these patients. Compared to other patient population, in cardiac surgery patients oxygen supply and utilization differs from patient to patient [7]. The reason for this difference in oxygen supply and utilization is due to the fact that these patients have impaired auto regulation and tissue hypoxia during cardio pulmonary bypass procedures. These patients are also prone for oxygen dependence post operatively due to systemic inflammation and mitochondrial dysfunction which occurs as a result of cardio pulmonary bypass [8,9]. It leads to increased PRBC transfusions in cardiac surgery patients.

Transfusion thresholds in cardiac surgery patients also differ from institute to institute. In our study we had assessed the transfusion thresholds in 100 patients by retrospective analysis and we found that liberal transfusion protocol (Hb < 10g/dl) was followed in 93% of patients and restrictive transfusion protocol (Hb < 7g/dl) was followed in 7% of patients. There are 6 randomized controlled trials (Murphy et al 2014, Shehata et al 2011, Hajjar et al 2010, Murphy et al 2007, Bracey et al 1999, Transfusion Indication Threshold Reduction [TITRe 2] trial and Transfusion Requirement After Cardiac Surgery [TRACS] trial) [10-14] comparing the liberal and restrictive transfusion threshold. These trials studied a total of 3,356 patients and they demonstrated the differences in different transfusion threshold protocols especially the clinical outcomes of the patients. Among those trials TITRe 2 trial was the only trial which showed the important differences in clinical outcomes in patients following different transfusion protocols and this trial is adequately powered in such a way that it influenced the meta-analysis of those 6 RCT's. TITRe 2 trial was a multicenter trial in which 92% of patients were transfused under liberal transfusion

threshold protocol after proper randomization [14]. Quantitative meta analysis of these 6 trials indicates a significant clinical benefit from liberal transfusion protocol. These trials are a prospective study assessing and comparing the clinical outcomes of restrictive and liberal transfusion protocols whereas our study is a retrospective analysis in order to determine the transfusion protocol followed in our institute in order to assess its efficiency.

The main strength of our study is that most of the patients in the study group had undergone surgery by the same surgeon thereby reducing the confounding variable of surgical skill based complications like excessive bleeding leading to transfusion requirements. Limitations of our study are that there is limited data regarding the surgical and clinical outcome of the patients. Data regarding age of PRBC transfused and post-operative complications like renal, pulmonary and liver manifestations were not assessed and hence association cannot be established.

4. CONCLUSION

We have assessed the transfusion practice for cardiac surgery patients retrospectively and we found that majority of transfusions were made under liberal transfusion protocol for cardiac surgery patients. More extensive study with larger sample size and longer follow up with more data including patient's clinical data and age of PRBC transfused may be done in order to get a clear consensus about the transfusion trigger and practice to be followed in cardiac surgery patients.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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