



## When to Transfuse? Identification of Transfusion Triggers in Anaemic Patients

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### Authors' contributions

This work was carried out in collaboration among all authors. Author HR designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors MR and SK managed the analyses of the study. All authors read and approved the final manuscript.

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### ABSTRACT

**Aims/ Objectives:** To identify the transfusion triggers in hospitalized patients for judicious use of blood products.

**Study Design:** Cross-sectional study.

**Place and Duration of Study:** Department of Haematology, Ali Medical Centre Islamabad, The duration of the study was from November 2018 to June 2019.

**Methodology:** In this study total number of transfusion events and the Hb transfusion triggers were analyzed for 265 patients. The threshold for transfusion was according to patient's clinical condition, the indication for admission and generally varied according to the situation and discretion of physician.

**Results:** Total 265 admitted patients were included in the study. The threshold for transfusion was  $8.6 \pm 1.7$ .

**Conclusion:** Liberal transfusion regimen can be safely used for surgical patients, severe hypoxic patients and patients with medical emergencies. However patients admitted with medical ailments that are otherwise stable should be given transfusion following restrictive transfusion regimen.

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**Keywords:** Anaemia; red cell concentrate; restrictive transfusion threshold; liberal transfusion threshold; haemoglobin.

## 1. INTRODUCTION

Anaemia is a common condition which is associated with increased loss of quality of life, organ failure and mortality [1]. It is characterized by decrease in haemoglobin, haematocrit or red blood cell concentration which is below a specific range for the age and sex of a person [2]. Common clinical conditions associated with anaemia are iron deficiency, chronic diseases, malignancies and blood loss [1].

According to World Health Organization (WHO) anaemia is defined as a haemoglobin  $<13 \text{ g dl}^{-1}$  (hematocrit  $<39\%$ ) for adult males and  $<12 \text{ g dl}^{-1}$  (hematocrit  $<36\%$ ) for adult non-pregnant Females [3]. Anaemia is a worldwide condition and approximately 25% of people have been afflicted by it [4]. In hospitalized patients categorically the causes are iron deficiency, suppression of erythropoietin and iron transport, trauma, phlebotomy, coagulopathies, adverse effects of medications and stress-induced gastrointestinal bleeding [5]. Blood transfusion is used as a supportive treatment for anaemia and hemorrhages. Although transfusions are associated with increased risk of infections due to various pathogens, immune-suppression, organ dysfunction and a higher mortality rate, but still significant numbers of critically ill patients receive transfusion during their hospital stay [5,6]. The developments in transfusion medicine are helpful in guiding the medical professionals to adopt more sophisticated techniques and approach for transfusion. These are helpful in making right decisions regarding transfusion and also minimizing the risks associated with transfusion [7].

Transfusion trigger is defined as that value of haemoglobin (Hb) below which RCC transfusion is indicated [8]. In anaemic patients, there is considerable uncertainty for the optimum transfusion threshold. The restrictive transfusion threshold uses a lower haemoglobin level to trigger transfusion (most commonly 7 g/dL or 8 g/dL) and the liberal transfusion threshold uses a higher haemoglobin level to trigger transfusion (most commonly 9 g/dL to 10 g/dL) [5]. In different randomized controlled clinical trials, it has been observed that a restrictive approach to red blood concentrate (RCC) transfusion that maintains Hb concentrations between 7.0 to 9.0

g/dL is equivalent to a more liberal strategy of maintaining Hb concentrations between 10.0 to 12.0 g/dL [9]. It should be emphasized that the decision to transfuse patients must be made on clinical grounds. If a patient's life is endangered by severe hemorrhage which can also lead to ischemic damage to organs then we cannot withhold the decision to transfuse. In other words red blood cell transfusion is a lifesaving intervention in patients with severe bleeding and shock [8]. The study has been performed to assess transfusion threshold in hospitalized patients. Transfusion is associated with different risks to patients. Judicial use of blood products should be the aim. This approach is adopted to avoid risks to patient's health and to decrease the economic burden.

## 2. MATERIALS AND METHODS

This was a prospective quantitative study of cross-sectional design. In this study total number of transfusion events and the Hb transfusion triggers were analyzed for 265 patients (males and females) admitted in a tertiary care hospital. The duration of the study was from November 2018 to June 2019. All the patients transfused during this period were included in the study. The patients admitted for orthopedic surgery, neurosurgery, gynecological surgery and general surgery, medical ailments and ICU patients were included in the study. A Hb concentration of  $< 13 \text{ g/dl}$  in males and  $< 12 \text{ g/dl}$  in females were taken as cut off for anaemia. The threshold for transfusion was arbitrary in our setup. It was according to patient clinical condition, the indication for admission and generally varied according to situation and discretion of physician. All patients who were on routine transfusion due to different diseases were not included in the study.

## 3. RESULTS

Total 265 admitted patients were included in the study. The threshold for transfusion was  $8.6 \pm 1.7$ . The transfusion threshold when assessed categorically for surgical, medical, ICU patients separately, it was 9 for surgical patients but 8 and 7.8 for medicine and ICU patients respectively. The orthopaedic surgery patients had a transfusion threshold of 9 gm /dl as shown in Table 1.

**Table 1. Transfusion thresholds**

	<b>Mean</b>	<b>S.D</b>
Surgery	9	± 1.6
Medicine	8	± 1.8
ICU	7.8	± 1.3

#### 4. DISCUSSION

Blood transfusion is a logical solution in patients who are critically ill and anaemic. The controversy arises when the threshold for transfusion is to be selected. In this study the aim was to assess the transfusion threshold in our hospital setting, with the focus to avoid unnecessary transfusions. The restrictive transfusion threshold is associated with decreased morbidity, reduced hospital stay and less burden on blood bank. The patients who are anaemic but otherwise stable are strong candidates for restrictive transfusion regimen. But on the other hand liberal transfusion threshold is required for cardiac, neurosurgery and intensive care patients [10].

In a systemic review on the patients with neurological injury it was emphasized that the concentration of haemoglobin that is considered to be in the minimum acceptable range is 9-10 gm/dl. It was further seen that a Hb threshold of >11 is associated with decreased incidence of cerebral vasospasm, but at the same time it is associated with increased viscosity and decreased cerebral blood flow. In our study the transfusion threshold was 8.6 gm /dl, but when assessed categorically for surgical, medical and ICU patients separately it was 9 for surgical patients but 8 and 7.8 for medicine and ICU patients respectively [11].

In a study by Sussane et al. on patients undergoing major orthopaedic surgery it was emphasized that the increased risks cannot be associated with either liberal transfusion threshold or restrictive transfusion threshold. It was a consensus that patients with cardiac disease and critically ill patients are candidates for more liberal transfusion. It was further seen that to assess whether preoperative, perioperative or postoperative period is the preferable time for transfusion so as to maximize its benefits, more research is needed [10]. In our study the orthopaedic surgery patients had a transfusion threshold of 9 gm /dl but for medical patients it was 8 g/dl.

However if we follow the transfusion guidelines the RCC transfusion threshold for stable medical

and surgical patients is  $\leq 7$  g/dl, for patients with cardiac disease it is  $\leq 8$  g/dl but the critically ill patients with sepsis may be transfused at a Hb level  $\leq 10$  g/dl. In our study the orthopedic surgery patients had a transfusion threshold of 9 gm /dl but for medical patients it was 8 g/dl.

In a study by Carson et al. on patients admitted in hospital in different specialties it was shown that transfusion can be avoided with haemoglobin level above 7 to 8 g/dl. Following a restrictive threshold decreases transfusion frequency significantly. But at the same time they agreed that there is insufficient data to guide about patients with cardiac disease, neurological injury and haematological malignancies etc [9].

In a study by Zulfiqar et al. on patients of neurosurgery after head injury it was seen that seen that the minimum threshold for transfusion is still under evaluation. It is believed that the high metabolic requirements of the brain may render the brain susceptible to injury at a low Hb concentration or a low Hct. It was further seen that a three-fold increase in hospital mortality is associated with a mean 7 day Hb level of <9 gm /dl. In our study the neurosurgery patients had a transfusion threshold of 9 gm/dl, which is in agreement with this study [12].

In a review article by Annemarie et al. it was emphasized that cardiac patients are candidates of more liberal transfusion threshold >8 gm/dl. It was further supported by the fact that restrictive transfusion regimen can lead to increase in frequency of acute coronary syndrome in cardiac patients. In our study the patients with medical ailments were transfused at a threshold of 8 gm/dl [13].

In a study by Marek et al. it was seen that restrictive transfusion regimen is cost effective and is associated with less risk of transfusion associated complications. But it was emphasized at the same time that when we are considering patients with bleeding, haemorrhage or ischemia to brain or myocardium, a more liberal transfusion strategy must be followed, in order to give benefit to patient [14]. A comprehensive patient specific management should be main consideration.

#### 5. CONCLUSIONS

Liberal transfusion regimen can be safely used for surgical patients, severe hypoxic patients and patients with medical emergencies. However

patients admitted with medical ailments that are otherwise stable should be given transfusion following restrictive transfusion regimen. Identification of transfusion triggers is of significant importance to avoid unnecessary transfusion. It can reduce transfusion transmitted infections and burden on blood bank. Economic burden on patient and hospital can also be reduced.

## CONSENT

As per international standard or university standard, patient's written consent has been collected and preserved by the author(s).

## ETHICAL APPROVAL

As per international standard or university standard, written approval of Ethics committee has been collected and preserved by the author(s).

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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