

## Original Article

# Inappropriate Packed RBC Transfusion in a Tertiary Care Center

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## Abstract

**Introduction:** Transfusion of packed red blood cells (pRBC) with appropriate indications is not only important for patient safety and well-being but is also crucial for proper utilization of resources and health care-related cost reduction. We aimed to investigate the clinical appropriateness of blood transfusion in Shariati Hospital, one of the largest academic medical centers in Tehran.

**Methods:** In this prospective observational study, 1000 transfusions of allogenic pRBCs from April 1<sup>st</sup> to October 31<sup>st</sup>, 2015 were included. The patients' characteristics, reason for hospitalization, indications for pRBC transfusions and ordering wards were collected.

**Results:** The mean level of hemoglobin before transfusion was  $7.4 \pm 2.3$  g/dL in the emergency department,  $7.5 \pm 1.0$  g/dL in medical wards,  $10.4 \pm 2.6$  g/dL in surgical wards, and  $9.1 \pm 2.2$  g/dL in the intensive care unit. The baseline hemoglobin levels differed significantly between the departments ( $P < 0.001$ ). Approximately 22% (219 patients) with hemoglobin level  $\geq 10$  g/dL received pRBC, which appeared to be unnecessary and inappropriate.

**Conclusion:** Despite current international guidelines emphasizing the importance of restricted transfusion policy, the transfusion of pRBC with insufficient indications occurred frequently in Shariati Hospital, particularly in surgical wards.

**Keywords:** Blood cell, erythrocyte transfusion, packed

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## Introduction

Transfusion of packed Red Blood Cells (pRBC) is an indispensable treatment for several medical conditions.<sup>1-4</sup>

Taken into account the immunological, physicochemical and infectious adverse events of pRBC transfusion as well as the high cost of preparation and storage of these products and their frequent shortage, their usage must follow an evidence-based guideline. This will minimize unwanted, and sometimes life threatening, adverse events and will prevent wasting valuable and often lifesaving resources. The optimal clinical practice is to use enough pRBC units to achieve the best clinical outcomes while avoiding inappropriate transfusions. Studies from Europe and China have demonstrated that more than one third of pRBC

transfusions were deemed unnecessary and inappropriate<sup>5,6</sup>; however, the magnitude of this problem is unknown in Iran. The aim of this study was to investigate the clinical appropriateness of blood transfusion in one of the main academic centers in Tehran, Iran.

## Materials and Methods

This prospective study was conducted in Shariati Hospital, one of the main tertiary centers affiliated to the Tehran University of Medical Sciences from April 1<sup>st</sup> to October 31<sup>st</sup>, 2015. One thousand consecutive patients who received pRBC during this period were included. Data were collected on the following variables: sex, age, underlying disease, hemoglobin levels before and after transfusion, ordering ward, and clinical indication for transfusion. The transfusion information for each patient was extracted from the hospital blood bank registry. All pRBC units transfused were allogeneic. Each transfusion event was considered a separate case, because we aimed to investigate the clinical appropriateness of transfusion practice in the hospital.

Continuous data were expressed as mean  $\pm$  standard deviation (SD) and comparisons were made with independent *t*-test as indicated. Categorical variables were described with frequencies and percentages and analyzed using Chi-square test. A *P*-value  $< 0.05$  was considered statistically significant. One-way analysis of variance (ANOVA) was conducted, and Bonferroni post-hoc testing was performed to compare the individual group means. All analyses were performed using IBM SPSS Statistics, version 22.0 (SPSS Inc., Chicago, IL).

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## Results

A total of 1000 transfusions for 682 patients (25.8% had more than one transfusion event) were included. The patients' demographics and gender-stratified information are shown in Table 1. The mean level of hemoglobin before transfusion was 7.4 ± 2.3 g/dL in the emergency department, 7.5 ± 1.0 g/dL in medical wards, 10.4 ± 2.6 g/dL in surgical wards, and 9.1 ± 2.2 g/dL in the intensive care unit. The baseline hemoglobin levels differed significantly between the departments ( $P < 0.001$ ).

Remarkably, 219 (21.9%) pRBC transfusions were ordered in patients with hemoglobin level ≥ 10 g/dL. Approximately 89% of transfusion orders were signed by residents, 6% by clinical fellows and 5% by attending physicians.

We divided transfusion necessity into two categories, 1)

restrictive, which recommends transfusion when hemoglobin is less than 8 g/dL, and 2) liberal, which recommends transfusion when hemoglobin is less than 10 g/dL. The overall incidence rates of pRBC transfusion with lack of appropriate clinical indication were 21.9% and 50.1% based on liberal and restrictive guidelines, respectively. Table 2 summarizes the results of pRBC transfusion for different wards and various indications.

## Discussion

Blood products are of great value as a treatment option for many patients and must be prepared and administered appropriately. Its improper use will not only cause a shortage, but also harbors great medical and economical risks for patients and society.

There is no international guideline for appropriateness of blood

**Table 1.** Patients' characteristics and laboratory results.

	Male patients (n = 488)	Female patients (n = 512)
Age (year); mean ± SD	47.3 ± 20.7	46.5 ± 18.2
Blood group; n (%)		
O	220 (45.1)	221 (43.2)
A	147 (30.1)	158 (30.9)
B	97 (19.9)	101 (19.7)
AB	24 (4.9)	32 (6.3)
Rh group positive; n (%)	436 (85.2)	426 (87.3)
Ward type; n (%)		
Emergency	133 (27.3)	148 (28.9)
Intensive Care Unit	73 (15.0)	54 (10.5)
Surgical	107 (21.9)	145 (28.3)
Medical	175 (35.9)	165 (32.2)
Clinical indication; n (%)		
Gastrointestinal bleeding	76 (15.6)	78 (15.2)
Trauma	25 (5.1)	12 (2.3)
Pre-operative	84 (17.2)	118 (23.0)
Post-operative	84 (17.2)	102 (19.9)
Blood disorder	232 (47.5)	195 (38.1)
Other (including unknown)	43 (8.8)	67 (13.1)

**Table 2.** Restrictive and liberal strategies by ward and indication.

	Restrictive strategy*		Liberal strategy*	
	<8 g/dL	≥8 g/dL	<10 g/dL	≥10 g/dL
Ward type; n (%)				
Emergency	194 (69.0)	87 (31.0)	244 (86.8)	37 (13.2)
Intensive care	35 (27.6)	92 (72.4)	95 (74.8)	32 (25.2)
Surgical	40 (15.9)	212 (84.1)	120 (47.6)	132 (52.4)
Medical	230 (67.6)	110 (32.4)	322 (94.7)	18 (5.3)
Total	499 (49.9)	501 (50.1)	781 (78.1)	219 (21.9)
Clinical indication; n (%)				
Gastrointestinal bleeding	92 (52.7)	62 (40.3)	142 (92.2)	12 (7.8)
Trauma	11 (29.7)	26 (70.3)	21 (56.8)	16 (43.2)
Pre-operative	28 (13.9)	174 (86.1)	94 (46.5)	108 (53.5)
Post-operative	40 (21.5)	146 (78.5)	109 (58.6)	77 (41.4)
Blood disorder	316 (74.0)	111 (26.0)	408 (95.6)	19 (4.4)
Other (including unknown)	72 (65.5)	38 (34.5)	106 (96.4)	4 (3.6)

\*All P-values < 0.01

transfusion on the global level but national and institutional protocols exist. A liberal transfusion strategy has been implemented for many years to transfuse pRBC when hemoglobin is equal or less than 10 g/dL. Nevertheless, due to risks of transmission of blood borne infections, occurrence of transfusion reactions, cost implications and other factors such as iatrogenic hemochromatosis, the appropriate hemoglobin threshold has shifted recently to a more restrictive strategy using 7 or 8 g/dL as cut-off.<sup>7-10</sup>

The American Association of Blood Banks (AABB) guideline recommends restrictive transfusion strategy; hemoglobin less than 7 g/dL as an overall transfusion threshold and hemoglobin of 8 g/dL or less in postoperative settings.<sup>4</sup> The European Society of Cardiology recommends blood transfusion only when hemoglobin level is below 8 g/dL even in patients with acute coronary syndrome.<sup>11</sup> Recent evidence supports use of restrictive transfusion in most patients.<sup>12,13</sup> Our study underscores the fact that by utilizing the restrictive approach, nearly half of blood transfusions occurred with insufficient appropriate indication. Even using the liberal approach, approximately one out of five pRBC transfusions had no appropriate clinical indication. A previous study in developed countries found that approximately 33% of pRBC transfusions were inappropriate.<sup>5</sup> Similar results were shown in a study from China with 37% use of irrational transfusions.<sup>6</sup>

Using restrictive criteria, our study also showed rates of inappropriate pRBC transfusion at 72.4% in the intensive care unit, 84.1% in surgical wards, and 32.4% in medical wards. Among the surgical subspecialties, inappropriate transfusion was most common in the neurosurgery service. More regular educational program, hemovigilance workshop attendance and less conservational attitude in medical wards may explain the difference of transfusion thresholds observed among surgical and medical wards. This study also revealed that surgical residents use a liberal strategy for blood transfusion and are more likely to order pRBC transfusion with inappropriate clinical indication. The assumption that a higher hemoglobin level will grant a safer surgery and postoperative course is not evidence-based. Surgical residents may order transfusion for critically ill patients before surgery with the assumption to prevent insufficient oxygenation during surgical operations. This type of practice is based on very weak evidence coming from small and poorly designed studies.<sup>14</sup>

The potential reasons for the observed results regarding restrictive transfusion policy include absence of a national or at least institutional guideline for blood transfusion among different wards, lack of information with regard to the newer restrictive strategy, unjustified anxiety related to adverse outcome for patients undergoing surgical procedures because of blood loss, incorrect estimate of pRBC units needed to sufficiently increase hemoglobin, and negligence about using alternatives of pRBC including intravenous fluids.

Based on the result of hemovigilance programs and patient blood management program regarding improvements of transfusion safety,<sup>15-18</sup> we suggest periodically implementing these programs with educational purposes that might be useful for improving adherence to recent transfusion guidelines. Also, devising a comprehensive and evidence based institutional policy may help medical centers to avoid extra risks and burdens of inappropriate

transfusions and more careful resource management.

In conclusion, we found that despite current international guidelines emphasizing the importance of restricted transfusion policy, blood use has not decreased in Shariati Hospital, particularly in surgical wards. Although physicians' judgment is highly important in clinical settings, in order to prevent transfusion related complications and reduce the cost of treatment, clinical guideline with institutional regulation should become available to prevent unnecessary and inappropriate blood transfusion.

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