

## An Observational Study and Analysis of Anaemia and Red Blood Cell Transfusion Requirement in Various Intensive Care Unit in Tertiary Care Centre in Southern Rajasthan

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### ABSTRACT

**Background:** A proper identification of anemia and its underlying causes in ICU patients is required because various disorders may necessitate different diagnostic and therapeutic management strategies. **Objectives:** To study, prevalence of anemia and red blood cell transfusion among critically ill patients in various ICUs and its contribution to ICUs related morbidity and mortality. **Material & Methods:** A Hospital based observational study planned, including patients admitted in various ICUs and who develop anemia and required an RBC transfusion when they stay in ICU from the period of 1 July 2015 to 31 December. Complete hemogram noted on the first day, third day and at the time of discharge or transfer from ICU. **Results:** The present study showed the total patients are admitted (MICU, SICU & TICU) are 1485 & 462 units of PRBC was used during study period and Mean Hb at the time of admission in ICU was 9.20 gm% and mean Hb before at 1<sup>st</sup> transfusion was 7.57gm%. In this study observed that 54(35.76%) patients are CRP reactive that means they develop sepsis, which is cause for anemia and PRBC transfusion and patients who had acute bleeding and length of stay was  $\leq 3$  days had  $1.75 \pm 1.14$  mean units of PRBC transfused and who had not acute bleeding  $1.53 \pm 0.84$  units transfused. **Conclusion:** This study has highlighted that there is a scope for improvement of PRBC transfusion practices by strictly following the indications for use of PRBC in ICUs, and promoting the use of autologous blood during routine surgery to prevent sepsis and anemia in ICUs.

**Key-words:** Anaemia, Transfusion, Blood Donor, Haemoglobin.

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### INTRODUCTION

Transfusion dates to the first decade of the 19<sup>th</sup> century, with the discovery of distinct blood types leading to the practice of mixing some blood from the donor and the receiver before the transfusion. World Health Organization (WHO) states that a blood transfusion is the transfer of blood or blood products from one person (donor) to another person's bloodstream (recipient). This is usually done as a lifesaving maneuver to replace blood cells or blood products lost through severe bleeding,

during surgery when blood loss occurs or to increase the blood count in an anemia patient.<sup>1</sup> Anemia is common in critically ill patients and appears early during their intensive care unit (ICU) course. By day 3 after ICU admission, almost 95% of patients are anemic. The anemia in these critically ill patients persists throughout their ICU and hospital stay, with or without red blood cell (RBC) transfusion.<sup>2</sup> Delivery of oxygen to tissues depends upon hemoglobin level and tissue perfusion of oxygenated blood; anemia

will lead to a decreased capacity of oxygen transport, which is compensated by cardiac compensatory mechanisms. In critically ill patients these mechanisms might not be sufficient eventually resulting in tissue hypoxia and progression to multiple organ dysfunction syndromes. The presence of anemia patients in the ICU has been associated with the worse outcomes, including increased lengths of stay and increased mortality.<sup>2</sup>

The World Health Organization (WHO) defines anemia as hemoglobin < 13 g/dl (hematocrit <39%) for adult males and <12 g/dl (hematocrit < 36%) for adult non-pregnant females. There are no universally agreed grades of severity of anemia during critical illness. A proper identification of anemia and its underlying causes in ICU patients is required because various disorders may necessitate different diagnostic and therapeutic management strategies. It will be helpful to select appropriate treatment options like blood transfusion, erythropoietin therapy, and iron supplementation which influence the outcome in these critically ill patients.<sup>3</sup> Our study is to evaluate the anemia in ICU has diagnostic & therapeutic implication. Hence, the study is relevant with the practical implication in ICUs in RNT medical college Udaipur.

#### MATERIAL & METHODS:

A Hospital based observational study planned, including patients admitted in various ICUs and who develop anemia and required an RBC transfusion when they stay in ICU from the period of 1 July 2015 to 31 December. Complete hemogram noted on the first day, third day and at the time of discharge or transfer from ICU. C-reactive protein (CRP) measured on the first day and at the time of discharge or transfer from ICU. Other investigations as advised by attending physician based on primary diagnosis are noted as relevant to the study.

**Subject selection:** Based on following inclusion and exclusion criteria, a random selection of subjects for the study was made on the basis of a detailed history and proper clinical examination-

**Inclusion Criteria:** All patients admitted in the ICU during the study period in the age group of 15-65 years who were having hemoglobin less than 12.5 gm/dl in males and less than 11.5 gm/dl in females.

**Exclusion criteria:** All females and the patients who were under the age of 15 years with known congenital anemias or HIV positive patients or the patient with known malignancy and on chemotherapy.

#### RESULTS:

The present study showed the total patients are admitted (MICU, SICU & TICU) are 1485 & 462 units of PRBC were used during the study period (Table 1) and Mean Hb at the time of admission in ICU was 9.20 gm% and mean Hb before at 1<sup>st</sup> transfusion was 7.57gm% (Table 2). In this study observed that 54 (35.76%) patients were CRP reactive that means they develop sepsis, which is cause for anemia and PRBC transfusion (Table 3) and patients who had acute bleeding and length of stay was  $\leq 3$  days had  $1.75 \pm 1.14$  mean units of PRBC transfused and who had not acute bleeding  $1.53 \pm 0.84$  units transfused (Table 4). The our study showed patients who had transfused with 1 unit PRBC survival was 58.10% and PRBC transfused with >5 units survival was 0.91% (Table 5).

**Table 1: Total number of Patients in ICUs**

In	Total number of Patients in ICUs		Use of PRBC (Units)	
	N	%	N	%
MICU	556	37.44	129	27.92
SICU	461	31.04	156	33.77
PTICU	468	31.52	177	38.31
<b>Total</b>	<b>1485</b>	<b>100.00</b>	<b>462</b>	<b>100.00</b>

**Table 2 : Mean Hb Level (gm %)**

Time	Mean	SD
At the time of Admission	9.20	2.42
Before 1st transfusion	7.57	1.31

**Table 3: CRP Reactivity**

Reactivity	N	%
Yes	54	35.76
No	97	64.24
<b>Total</b>	<b>151</b>	<b>100.00</b>

**Table 4: Length of Stay and Mean Units Transfused**

Length of Stay	Acute Bleeding (mean units transfused)	
	Yes	No
<= 3 days	1.75 ± 1.14	1.53 ± 0.84
> 3 days	2.10 ± 1.48	1.69 ± 1.08
> 7 days	2.38 ± 1.79	1.90 ± 1.25

**Table 5: Units Transfused v/s Survival**

Units Transfused	Survived		Died	
	N	%	N	%
1	64	58.18	19	46.34
2	26	23.64	14	34.15
3	13	11.82	3	7.32
4	2	1.82	4	9.76
5	4	3.64	0	0.00
> 5	1	0.91	1	2.44
<b>Total</b>	<b>110</b>	<b>100.00</b>	<b>41</b>	<b>100.00</b>

**DISCUSSION:**

Anemia is a prevailing problem in critically ill patients that often results in frequent red blood cell (RBC) transfusions. In critically ill patients, however, RBCs may be destroyed before the normal 120 days because of hemolysis or splenic sequestration. Often these patients have T cells and monocytes, which are activated by microorganisms, cancer cells, causes inflammation, leading to increased levels of cytokines, interferons, tumor necrosis factor, interleukin 1, interleukin 6, and interleukin 10. These inflammatory markers lead to decreased iron absorption, iron laden macrophages, bone marrow

suppression, and decreased erythropoiesis, leaving the patient unable to secrete the level of erythropoietin necessary to increase RBC production.<sup>4</sup> In patients who become anemic because of blood loss, these inflammatory markers increase vasodilatation and vascular permeability, which worsens bleeding. Phlebotomy practices also contribute to anemia, within ICU patients having a mean of 41 ml of blood samples withdrawn per day. Surgery, stress-related gastrointestinal bleeding, myelosuppressive drugs, malnutrition, renal insufficiency, and endocrine disorders also contribute to anemia in the critically ill.<sup>5</sup> This present study, though probably first of its kind in southern Rajasthan population, is an attempt forward in a series of previous studies done internationally to study the anemia and RBC transfusion in critically ill patients. The data obtained from our study is to be discussed here and the results have been compared to other similar studies. In our study the total patients admitted in ICUs (MICU, SICU and PTICU) were 1485, out of these 1291 (86.94%) patients develop anemia within three days stay in ICU. This data shows that the prevalence of anemia in ICUs is 86.94% in our study.

Patients who were admitted in ICUs had mean admitting Hb at the time of admission in ICU was 9.20 gm% and mean Hb before at 1<sup>st</sup> transfusion (transfusion trigger) was 7.57gm%. The mean admitting Hb in Vincent et al<sup>3</sup> study was 11.0gm%, which resembles our study in PTICU. The hemoglobin value that should trigger a transfusion of RBCs is currently under debate. The *Surviving Sepsis Campaign Guidelines* recommend giving patients a transfusion when the hemoglobin level is less than 7 g/dL with a goal of maintaining a hemoglobin level of 7 to 9 g/dL; however, this does not include patients with active hemorrhage, myocardial ischemia, or lactic acidosis.

On the other hand, the American Society of Anesthesiologists Task Force does not recommend giving a patient a transfusion on the basis of the patient's hemoglobin value, but rather recommends that the decision be based on the clinical situation. Because of the continuing debate over transfusion, health care providers should continue to monitor each patient's clinical picture. The health care team should watch for blood loss, monitor for signs of inadequate perfusion and ischemia in the form of vital signs and urine output, and track the patient's hemoglobin values. These data conclude that more stay in ICU more chance of anemia development, in study of Vincent et al<sup>3</sup> 70% patients were transfused who stay more than 7 days which resembles our study. Our study has found a correlation between blood transfusions and mortality, likely as the study by "Corwin et al<sup>6</sup> and Ruttinger et al<sup>7</sup> were from 1996 to 2003 and 1993 to 2003" and Statistical analysis revealed controversial results in the study by Vincent et al<sup>3</sup>.

In the study by Vincent et al<sup>3</sup>, more than 75% of the ICUs were transfusing leucocyte reduced blood. Taylor et al<sup>8</sup> and Netzer et al<sup>9</sup> also reported an association between leucoreduced blood and decreased rates of mortality. Our Study is also correlated with the study of "Tara Ann Collins, CRNP"<sup>10</sup> the number of units of RBCs appears to correlate with increased mortality, so the number of units transfused should be as few as possible. When a clinician decides to give a patient a transfusion of RBCs, 2 units are often transfused. It is, however, not always necessary to transfuse 2 units of blood. The expected response in hemoglobin level should be an increase of 1 g/dL per unit of blood transfused. If a stable patient with no known history of heart disease or active hemorrhage has a hemoglobin level of 7 g/dL and is given a transfusion of 1 unit of

blood, the hemoglobin level should increase to 8 g/dL. One unit of blood should be transfused, and then the hemoglobin level should be measured. If an appropriate response in the level is noted, it may not be necessary to transfuse more blood products. However, if an appropriate response is not noted, then more blood should be transfused. This advice may not apply in emergency situations, in patients with active hemorrhage, or in patients showing signs of ischemia. Transfusing only 1 unit of blood decreases the risk of mortality and also decreases the risk of transfusion transmitted infections.

### CONCLUSION:

In critical care patients, restrictive RBC transfusion strategy is not worse than liberal transfusion strategy. This study has highlighted that there is a scope for improvement of PRBC transfusion practices by strictly following the indications for use of PRBC in ICUs, and promoting the use of autologous blood during routine surgery to prevent sepsis and anemia in ICUs.

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**Conflicts of Interest:** None.

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