# A RETROSPECTIVE STUDY TO IDENTIFY THE CAUSES OF ANEMIA AND ASSESS ADHERENCE TO TRANSFUSION GUIDELINES AT A TERTIARY CARE REFERRAL HOSPITAL

[1]Pradeep Marur Venkategowda, [2]Manasa B. K., [3]Violet Mary, [4]Jagadisha R., [5]Purvik B., [6]Deepa Mahesh [7]Himaal Dev G. J., [8]Chaitra C. Rao, [9]Bharath Naidu, [10]Jayalakshmi M. Manjunath, [11]Anand Sutar, [12]Ranjitha, [13]Varun M. Nagaraja, [14]Adithya S Chiranjeevi, [15]Pooja C. Patil, [16]Aishwarya Kulkarni, [17]Nithya, [18]Rishika Jandial, [19]Arun, [20]Anusha Raj and [21]Soumya

[1,6,7,8,9,10,11]MD (Consultant). Fnb Critical Care Medicine, [2]Quality Manager, [3]Medical Records Department, [4]Blood Bank Officer, [5]MBBS, Resident, [12,13,14,15,16,17,18,19]MD (Consultant). Drnb Critical Care Medicine, [20]Medical Superintendent,

Department of Critical Care Medicine and Department of Transfusion Medicine, Apollo Hospital, Sheshadripuram, Karnataka.

**\*Corresponding Author: Dr. Pradeep Marur Venkategowda**

MD (Consultant). Fnb Critical Care Medicine, Department of Critical Care Medicine and Department of Transfusion Medicine, Apollo Hospital, Sheshadripuram, Karnataka.

## ABSTRACT

Approximately one-fourth of the world's population suffers from anemia. While anemia can be caused by several factors, Iron-deficient anemia is the most common type. As people age,[1] the prevalence of anemia increases, and it is more predominant in females.[2] This study assessed adherence to transfusion guidelines at tertiary care referral hospitals. The study was conducted for three months, and the data was analyzed retrospectively. A total of 150 anemic patients who received packed red blood cells (PRBCs) were included in the study. Most patients had nutritional anemia caused by deficiencies in Iron, Vitamin B12, and Folic acid. The O +ve patients had a high incidence of anemia, with 57 patients (38%) affected, and there was 100% adherence to PRBC transfusion criteria (where Hb <8 for non-cardiac patients and <10 for cardiac patients). This study sheds light on the primary causes of anemia in the Indian setting. It emphasizes the need for adequate treatment to reduce morbidity and healthcare costs borne by society and the government.

**KEYWORDS:** Blood Transfusion, Anemia, Adherence, Guidelines.

## INTRODUCTION

Hemoglobin levels lower than 13 gm/dl in adult males and lower than 12 gm/dl in adult females (less than 11 gm/dl in pregnant females) are considered anemia by the World Health Organization (WHO).[3] Blood transfusion is one of the ways to treat anemia. Patients with anemia tend to have longer stays in the ICU and increased mortality. This study was conducted to determine the causes of anemia and adherence to transfusion guidelines at tertiary care referral hospitals. Early detection and treatment of anemia can enhance the quality of life, decrease healthcare costs,[4,5] and reduce morbidity, and mortality.

## METHODOLOGY

This study was conducted at Apollo Hospital Sheshadripuram between October - December 2023 for 3 months. The study included patients who were admitted to Apollo Hospital Sheshadripuram and received blood transfusions. At our hospital, we follow WHO guidelines to define anemia, and blood transfusion is recommended when the hemoglobin level is less than 8 for non-cardiac patients and less than 10 for cardiac patients. The study documented the causes of anemia, the blood group of the patient, any comorbid conditions of the patient, and the specialist who advised blood transfusion. Additionally, the study noted adherence to PRBC transfusion criteria, documentation of blood transfusion indications, pre-transfusion testing compliance, informed consent documentation, monitoring and reporting of transfusion reactions, and post-transfusion monitoring practices.

**RESULTS**
We retrospectively analyzed data from a 3-month study of patients who received packed red blood cells (PRBC).

**Table 1: shows their baseline characteristics and comorbidities.**

| SL.NO | Baseline characteristics (at admission). | Male | Female |
|-------|------------------------------------------|------|--------|
| 1. | Age. | 54.72 | 55.96 |
| 2. | Sex. | 89 | 61 |
| 3. | Heart rate. | 84.55 | 79.43 |
| 4. | Blood pressure. | 147/82 | 134/76 |
| 5. | Spo$_2$. | 96.50 | 95.89 |
| 6. | Average hemoglobin. | 7.34 | 7.62 |

In our study, males and females had an average age of over 50. Anemia was more commonly observed in males (89 patients) than in females (61 patients). The average hemoglobin level at the time of admission was 7.34 gm/dl in males and 7.62 gm/dl in females.

Table 2 presents the causes of anemia observed among the patients admitted to our hospital. The most common type of anemia affecting patients in the ICU is nutrition deficiency-related anemia, which was observed in 33 patients (22.75%). This kind of anemia is primarily caused by a lack of essential nutrients such as iron, vitamin B12, and folic acid.

**Table 2: shows the causes of anemia in patients who were admitted to the ICU.**

| SL.NO | Causes of Anemia | Total (150 patients). | Percentage. |
|-------|------------------|-----------------------|-------------|
| 1. | Nutritional. | 33 | 22.75 % |
| 2. | Malignancy. | 15 | 10.34 % |
| 3. | General / Orthopedic surgery. | 13 | 8.96 % |
| 4. | Tropical infection. | 12 | 8.27 % |
| 5. | Chronic kidney disease. | 11 | 7.58 % |
| 6. | Cardiac surgery. | 11 | 7.58 % |
| 7. | Sepsis. | 8 | 5.51 % |
| 8. | Chronic liver disease. | 6 | 4.13 % |
| 9. | Trauma (RTA). | 6 | 4.13 % |
| 10. | Leukemia. | 6 | 4.13 % |
| 11. | Brain surgery. | 4 | 2.75 % |
| 12. | Upper GI bleed. | 4 | 2.75 % |
| 13. | ECMO. | 4 | 2.75 % |
| 14. | Drug-induced. | 3 | 2.06 % |
| 15. | Ischemic heart disease. | 3 | 2.06 % |
| 16. | Burns. | 3 | 2.06 % |
| 17. | Ectopic pregnancy/LSCS | 2 | 1.37 % |
| 18. | CNS bleeding. | 1 | 0.68 % |
|  | Total | 145 | 100 % |

The next highest group of patients (10.34%) had malignancy. About 13 patients (8.96%) had undergone general or orthopedic surgery, followed by 12 patients (8.27%) with tropical infections or chronic kidney disease. Cardiac surgery patients accounted for 11 (7.58%) of the transfusions, while 8 (5.51%) had sepsis, 6 (4.13%) had leukemia or chronic liver disease, and 6 (4.13%) had trauma from road traffic accidents. Brain surgery patients accounted for 4 (2.75%) of the transfusions, while ischemic heart disease, drug-induced conditions, and burns patients each accounted for 3 (2.06%). Only 2 patients (1.37%) had undergone ectopic pregnancy/LSCS, and 1 patient (0.68%) had central nervous system bleeding.

The table in the report shows which doctors advised the PRBC transfusion. The highest number of blood transfusion advice was given by a general physician for 56 patients (38.62%). Surgeons advised transfusions for 37 (25.51%) patients, while oncologists advised transfusions for 21 (14.48%). Nephrologists and medical gastroenterologists advised transfusions for 11 (7.58%) and 10 (6.89%) patients respectively.

**Table 3: shows specialist-related blood transfusion (PRBC's) advice.**

| SL.NO | Doctor's | Total (150 patients). | Percentage. |
|---|---|---|---|
| 1. | General Physician. | 56 | 38.62 % |
| 2. | Surgeon's. | 37 | 25.51 % |
| 3. | Oncologist. | 21 | 14.48 % |
| 4. | Nephrologist. | 11 | 7.58 % |
| 5. | Medical Gastroenterologist. | 10 | 6.89 % |
| 6. | Intensivist. | 4 | 2.75 % |
| 7. | Cardiologist. | 3 | 2.06 % |
| 8. | Gynecologist. | 2 | 1.37 % |
| 9. | Neurologist. | 1 | 0.68 % |
| | Total | 145 | 100 % |

Fewer blood transfusion advice was provided by Intensivist 4 (2.75%), Cardiologist 3 (2.06%), Gynecologist 2 (1.37%), and Neurologist 1 (0.68%).

Table 4 lists the different blood groups and their association with anemia.

**Table 4: Different blood group patients requiring blood transfusion.**

| SL.NO | Blood group. | Total (150 patients). | Total number of patients in 3 months. |
|---|---|---|---|
| 1. | O +ve | 57 | 38.00 % |
| 2. | B +ve | 39 | 26.00 % |
| 3. | A +ve | 34 | 22.66 % |
| 4. | AB +ve | 07 | 04.66 % |
| 5. | A -ve | 06 | 04.00 % |
| 6. | B -ve | 04 | 02.66 % |
| 7. | O -ve | 02 | 01.33 % |
| 8. | AB -ve | 01 | 0.66 % |
| | TOTAL | 150 | 100 % |

Among the patients with O +ve blood group, around 57 patients (38.00%) required the highest amount of blood transfusion, followed by B +ve blood group patients (39 patients, 26%), A +ve blood group patients (34 patients, 22.66%), AB + ve blood group patients (07 patients, 4.66%), A-negative blood group patients (06 patients, 4.00%), B-negative blood group patients (04 patients, 2.66%), O-negative blood group patients (02 patients, 1.33%), and AB-negative blood group patients (01 patients, 0.66%).

Table 5 mentions the comorbidities of the patients. Type-II Diabetes mellitus was found to be the most common comorbid condition in patients who received blood transfusions (43 patients, 28.66%).

**Table 5: Showing comorbidities among patients who received a blood transfusion.**

| SL.NO | Comorbidities | Total (150 patients). | Total number of patients in 3 months. |
|---|---|---|---|
| 1. | Diabetes Mellitus - II | 43 | 28.66 % |
| 2. | Systemic Hypertension. | 41 | 27.33 % |
| 3. | Carcinoma. | 20 | 13.33 % |
| 4. | Coronary artery disease. | 18 | 12.00 % |
| 5. | Hypothyroidism. | 08 | 05.33 % |
| 6. | Chronic kidney disease. | 08 | 05.33 % |
| 7. | Obesity. | 08 | 05.33 % |
| 8. | Leukemia. | 06 | 04.00 % |
| 9. | Chronic liver disease. | 04 | 02.66 % |
| 10. | Parkinson's disease. | 02 | 01.33 % |
| 11. | Cerebro vascular accident. | 01 | 0.66 % |
| 12. | Seizures. | 01 | 0.66 % |
| 13. | No comorbidities. | 15 | 10.00 % |

The data shows that the next most prevalent comorbid condition among patients is systemic hypertension, with 41 cases (27.33%). This is followed by carcinoma with 20 cases (13.33%), and coronary artery disease with 18 cases (12%). Hypothyroidism, chronic kidney disease, and obesity each had 8 cases (5.33%). Leukemia had 6 cases (4%), the chronic liver disease had 4 cases (2.66%), and Parkinson's disease had 2 cases (1.33%).

Cerebrovascular accident and seizure disorder each had 1 case (0.66%). A total of 15 patients did not have any comorbid conditions.

The doctors' adherence to transfusion guidelines, documentation, and compliance with the whole process are listed in the table.

**Table 6: showing adherence to transfusion guidelines.**

| SL.NO | Transfusion practices. | Adherence. |
|-------|------------------------|------------|
| 1. | Adherence to PRBC transfusion criteria (If Hb <8 for non-cardiac patients, <10 for cardiac patients). | 100 % |
| 2. | Documentation of blood transfusion indications. | 100 % |
| 3. | Pre-transfusion testing compliance. | 100 % |
| 4. | Informed consent documentation. | 100 % |
| 5. | Monitoring and reporting of transfusion reactions. | 100 % |
| 6. | Post-transfusion monitoring practices. | 100 % |

The duration of hospital stay and mortality have been highlighted in Table 7.

**Table 7: mentions the hospital stay and mortality of the patients.**

| SL.NO | | Anemic patients. | Non-anemic patients. |
|-------|--|------------------|----------------------|
| 1. | Duration of hospital stay. | 4.52 days. | 2.93 days. |
| 2. | Mortality rate. | 19 % | 16 % |

The anemic patients stayed for 4.52 days in hospital as compared to non-anemic patients (2.93 days). The mortality rate was also high as compared in anemic patients 19 % as compared to non-anemic patients (16%).

## DISCUSSION

Blood transfusion is a life-saving procedure that is commonly used in hospitals. Since there are minor complications associated with blood transfusion, it is necessary to obtain consent from the patient or their legal guardian before proceeding. In India, the legal framework for blood transfusion is provided by The Drugs and Cosmetics Act of 1940. Red blood cell transfusions are given to increase hemoglobin levels in the blood and improve oxygen delivery to tissues. Ideally, one unit of packed red blood cells (PRBC) should increase hemoglobin levels by 1 gram/dl. PRBCs are prepared from whole blood by removing 250ml of plasma. Sometimes, leukocytes are also removed to prevent a febrile transfusion reaction.[6]

Symptoms of anemia include shortness of breath, easy fatiguability, dizziness, light-headedness', fast heartbeat, lack of concentration, irritability, loss of appetite, numbness of hands and feet, poor wound healing, congestive heart failure, mouth ulcers, angina, and muscle cramps.

Anemia can have multiple causes, including iron deficiency, deficiency of Vitamin B12 and Folic acid, anemia due to chronic disease, leukemia, hemorrhage, infections, hemolysis, bone marrow suppression, medications, inherited causes such as Thalassemia and Sickle cell, and immune destruction. Previously, the 10/30 rule was used for PRBC transfusion, which meant that PRBC transfusion was initiated when Hemoglobin levels were 10 gm/dl and hematocrit levels were 30%, irrespective of the patient's clinical presentation.[7] In

case of bleeding, blood transfusion was used when blood loss > 1500 ml or loss of 30 % of blood volume.[8] Blood transfusion is linked with both infectious and non-infectious complications. Therefore, many clinical trials recommend red blood cell transfusion at lower hemoglobin levels.[9]

In 1999, a randomized control trial compared two different blood transfusion approaches. The first approach was restricted blood transfusion, which involved a hemoglobin level of 7-9 gm/dl. The second approach was liberal blood transfusion, which involved a hemoglobin level of 10-12 gm/dl. The study found that restricted blood transfusion resulted in a decrease in 30-day hospital mortality and a decreased need for PRBCs (packed red blood cells) transfusion. The researchers recommended considering PRBC transfusion only when the hemoglobin level is less than 7 gm/dl.[10] In 2023, the Association for the Advancement of Blood and Biotherapies (AABB) recommended guidelines for RBC transfusion based on their evaluation of 45 randomized trials that involved 20599 participants. The recommendations state that, for hemodynamically stable adults, RBC transfusion should only be given when the hemoglobin concentration is less than 7 gm/dl. However, when adults undergo cardiac surgery, the transfusion threshold should be increased to 7.5 gm/dl. For patients with preexisting cardiovascular disease or those undergoing orthopedic surgery, the threshold should be further increased to 8 gm/dl.[11]

Complications that may arise from blood transfusions can be classified into two categories: acute and delayed. Acute complications are those that happen within minutes to 24 hours of the transfusion and may include non-infectious reactions[12] such as allergies, urticaria, anaphylactic reactions, hemolysis, coagulation, fever, metabolic complications, volume overload, and acute lung injury. Delayed complications,[13] on the other hand,

occur after days, weeks, or months of the transfusion. These may include infections such as Hepatitis B and C, Human Immunodeficiency Virus (HIV) infection, and in rare cases, Malaria, Influenza, and West Nile virus infection.

## CONCLUSION

Anemia is prevalent in the general population, particularly in India, due to nutritional deficiencies and has a significant impact on quality of life. It is treated with iron, vitamin B12, and folic acid supplements, and sometimes with blood transfusions. Early diagnosis, adherence to transfusion guidelines, and proper monitoring can help reduce healthcare expenses.

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