ORIGINAL RESEARCH PAPER

Transfusion Medicine

COMPARATIVE STUDY OF PRBC AND LEUKOREDUCED PRBC TRANSFUSION IN THALASSEMIA PATIENTS AT JK LON HOSPITAL BLOOD CENTRE, G.M.C., KOTA, RAJASTHAN

KEY WORDS: Thalassemia, Leukoreduced PRBC, FNHTR, Alloimmunization, Iron Overload, Hemoglobin Increment, Blood Transfusion Safety

Dr. Sukhveer Singh Kaviya Department of Immunohaematology & Transfusion Medicine, Government Medical College, Kota, Rajasthan, India

Dr. Prerna Singh Dhakar Asst. Prof., Department of Immunohaematology & Transfusion Medicine, Government Medical College, Kota, Rajasthan, India

ABSTRACT

Background: Thalassemia major necessitates regular red blood cell transfusions for patient survival. Conventional packed red blood cell (PRBC) transfusions, while essential, can lead to adverse outcomes such as alloimmunization, febrile non-hemolytic transfusion reactions (FNHTRs), and iron overload. Leukoreduced PRBCs (LR PRBCs) have been developed to minimize these complications. **Objective:** To compare clinical outcomes between standard PRBC transfusion and leukoreduced PRBC transfusion in thalassemia patients, focusing on transfusion-related reactions, hemoglobin increment, and serum ferritin levels over six months.

INTRODUCTION

Thalassemia major is a life-threatening hereditary anemia caused by defective hemoglobin synthesis. Chronic transfusion therapy remains the cornerstone of treatment but is often accompanied by complications such as alloimmunization, FNHTRs, and iron overload, compromising patient safety and treatment efficacy.

Leukoreduction, the removal of leukocytes from blood components, is an established strategy to mitigate transfusion-related complications. This study aims to assess the comparative benefits of LR PRBCs over conventional PRBCs in thalassemia patients by examining immunological responses, hematological efficacy, and iron burden.

Evidence from a 2019 systematic review and meta-analysis by Tan et al. demonstrated that leukodepleted PRBC transfusions reduced mortality by 31% and infections by 23% in patients undergoing major cardiovascular surgery, highlighting the broader clinical efficacy of leukoreduction beyond thalassemia management (Tan et al., 2019)[1].

Moreover, according to Gupta et al. (2021), leukodepletion effectively reduces alloimmunization, FNHTRs, and transfusion-transmitted infections in chronically transfused patients. Their findings from a tertiary care center in India reinforced the importance of leukoreduction in minimizing immune sensitization and infection risk among multi-transfused thalassemia patients (Gupta et al., 2021)[2].

MATERIALS AND METHODS

Study Design: Retrospective comparative study
Duration: Six months
Location: MBS Hospital/JK Lon Hospital and Blood Centre, Kota, Rajasthan, India
Sample Size: 50 diagnosed thalassemia major patients
Groups:

- Group A (n=25): Received standard PRBC transfusions
- Group B (n=25): Received leukoreduced PRBC transfusions

Preparation of Leukoreduced PRBCs: Whole blood was collected using Penta bag systems with in-line Mitra® leukofilters. Soft spin centrifugation was performed to separate plasma and buffy coat. The red cell component was mixed with SAGM and passed through the in-line leukofilter at 20–24°C to reduce leukocyte count to $<5 \times 10^6$ WBCs/unit.

Statistical Analysis: Data were analyzed using the chi-square test for categorical variables and the Student's t-test for continuous variables. A p-value of <0.05 was considered statistically significant.

Aims and Objectives

1. Compare the frequency of transfusion-related reactions, including FNHTRs and alloimmunization.
2. Evaluate hemoglobin increment following transfusion.
3. Assess serum ferritin levels over six months as an indicator of iron overload.

RESULTS

Parameter	Group A (PRBC)	Group B (LR PRBC)	p-value
Avg. Hemoglobin Rise	1.4 g/dL	1.6 g/dL	0.041*
FNHTR Incidence	14%	4%	0.031*
Alloimmunization Cases	4	0	0.038*
Average Serum Ferritin	3000 ng/mL	2850 ng/mL	0.044*
Transfusion Frequency	Every 15 days	Every 17 days	0.049*

*Statistically significant ($p < 0.05$)

Key Observations:

- LR PRBC transfusion significantly reduced the incidence of FNHTRs and eliminated alloimmunization.
- Hemoglobin increments were higher in the LR PRBC group.
- Serum ferritin levels were comparatively lower, indicating reduced iron burden.
- Patients receiving LR PRBCs had longer transfusion intervals, suggesting improved transfusion efficiency.

DISCUSSION

The findings affirm that leukoreduction markedly enhances transfusion safety and efficacy in thalassemia patients. The absence of alloimmunization in the LR PRBC group underlines its effectiveness in reducing immune sensitization. Furthermore, the greater hemoglobin rise and reduced serum ferritin levels in this group indicate better management of anemia and iron overload.

Chronic transfusion-dependent patients, such as those with thalassemia, benefit substantially from LR PRBCs. The statistical significance of the results ($p < 0.05$ across key parameters) further strengthens the clinical relevance of leukoreduction in transfusion therapy.

These results are consistent with findings from Tan et al. (2019)[1], whose systematic review and meta-analysis of randomized controlled trials found significant reductions in both mortality and infection rates among leukodepleted blood recipients.

Additionally, Gupta et al. (2021)[2] demonstrated that leukoreduction significantly decreased alloimmunization and FNHTR rates in transfusion-dependent patients. Their study emphasized the critical role of pre-storage leukodepletion in improving clinical outcomes in thalassemia, reinforcing our study's conclusions.

This study supports the routine implementation of leukoreduced components in transfusion protocols for multi-transfused populations.

CONCLUSION

Leukoreduced PRBCs significantly decrease immunological complications such as FNHTRs and alloimmunization while improving hematologic outcomes and reducing iron burden. These benefits support the routine implementation of LR PRBC transfusions in thalassemia management protocols, particularly in multi-transfused patients.

Adopting in-line leukofiltration methods can further enhance patient outcomes and align transfusion practices with global safety standards.

REFERENCES

[1] Tan, J., Yeoh, K. W., Surendra, N. K., Hwang, N. C., & Tay, C. K. (2019). Leukodepleted packed red blood cells transfusion in patients undergoing major cardiovascular surgical procedure: systematic review and meta-analysis. Annals of Cardiac Anaesthesia, 22(1), 55–62. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6410443/

[2] Gupta, A., Kaur, P., Kumar, H., & Sachdev, S. (2021). Clinical and immunological benefits of pre-storage leukoreduction in multitransfused patients: Experience from a tertiary care center in North India. Asian Journal of Transfusion Science, 15(1), 20–25. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8214224/