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Original Article

Blood Transfusion Trends in Thalassemia Patients at a Tertiary Care Hospital, Rajkot, Gujarat, India: A Retrospective Study-May 2025 to April 2026

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ABSTRACT

Background: Thalassemia is a hereditary hemoglobin disorder characterized by ineffective erythropoiesis and chronic anemia, necessitating lifelong regular blood transfusions in patients with transfusion-dependent disease. Although transfusion therapy significantly improves survival and quality of life. Evaluating blood transfusion trends at a tertiary care hospital provides valuable insights into transfusion practices, resource utilization and opportunities to optimize patient management and improve transfusion safety.

Objective: To determine the blood transfusion trends in thalassemia patients at a tertiary care hospital, Rajkot, Gujarat during the period from May 2025 to April 2026.

Materials and Methods: A retrospective observational study was conducted at the Department of Pathology of a tertiary care hospital, Rajkot, Gujarat. Medical records and blood bank data of patients who received blood transfusions during the study period were reviewed. Demographic details, thalassemia type, pre-transfusion hemoglobin level, transfusion frequency, number of packed red blood cell (PRBC) units transfused and blood groups were recorded and analysed using descriptive statistical methods.

Results: During this study period, total 472 thalassemia patients were studied, out of which 282 were pediatric patient which constitute 59.74% of thalassemia patients and 190 were adult patient which constitute 40.26% of thalassemia patients. Among these majority were male patients.

Conclusion: Regular blood transfusion remains the mainstay management for patients with thalassemia. This study highlights the prevailing transfusion trends at a tertiary care hospital and emphasizes the importance of timely transfusions, adherence to standardized transfusion protocols and careful monitoring. Optimizing transfusion practices and ensuring comprehensive patient follow-up can improve clinical outcomes and quality of life in patients with transfusion-dependent thalassemia.

Keywords*: Blood transfusion, Thalassemia, Packed red blood cells (PRBC), Transfusion trends, Pre-transfusion hemoglobin.*

INTRODUCTION

Thalassemia are a group of inherited, genetic disorders characterised by a reduced or absent production of normal globin chains (the proteins that make up hemoglobin). Among these disorders, transfusion-dependent β-thalassemia is one of the most common hereditary anemias worldwide and poses a significant public health challenge, particularly in countries such as India, where the carrier frequency ranges from 3% to 4% in the general population, with higher prevalence in Rajkot city itself between 2.7% - 3.5%. While carriers live normal lives, two carriers having a child together creates a

25% chance of severe transfusion dependent thalassemia. The burden of disease remains substantial due to the large number of affected individuals requiring lifelong medical care.

Regular blood transfusion is the key for management. Current transfusion strategies aim to maintain pre-transfusion hemoglobin levels between 9 and 10.5 g/dL, thereby minimizing complications related to chronic anemia.

Despite blood transfusion having undeniable clinical benefits in thalassemia, excess iron due to these repeated blood transfusions needs to be removed by using the expensive chelation treatment.

The increasing demand for safe and compatible blood products among patients with thalassemia places considerable pressure on transfusion services and blood banks. Tertiary care hospitals play a pivotal role in providing comprehensive transfusion support, including blood component preparation, compatibility testing, monitoring for transfusion reactions, and coordination of long-term patient follow-up. Understanding local transfusion practices is essential for ensuring adequate blood inventory, optimizing resource allocation and improving adherence to evidence-based transfusion guidelines.

MATERIALS AND METHODS

- **Study design and Setting**

This retrospective observational study was conducted in the Department of Pathology of a tertiary care hospital, Rajkot, Gujarat. The study analysed blood transfusion records of patients diagnosed with thalassemia. Data were collected from blood bank registers, laboratory information systems and patient transfusion records.

- **Study Duration**

The study included all eligible patients who received transfusion during the defined study period of May 2025 to April 2026.

- **Study Population**

The study population comprised patients with confirmed thalassemia who were registered for regular transfusion therapy at the tertiary care hospital.

- **Inclusion Criteria**

➢ Patients with confirmed diagnosis of transfusion-dependent thalassemia (β-thalassemia major, β-thalassemia intermedia requiring regular transfusions or other clinically significant thalassemia syndromes).
➢ Patients who received one or more packed red blood cell (PRBC) transfusions during the study period.
➢ Includes all age groups and both males and females.
➢ Patients with complete transfusion records available for analysis.

- **Exclusion Criteria**

➢ Patients receiving transfusions for causes other than thalassemia.
➢ Patients with incomplete transfusion records.
➢ Patients who received transfusions outside the study period.
➢ Duplicate transfusion records.

RESULTS

A total of 472 patients diagnosed with thalassemia were included in the present study. Detailed evaluation of the study population revealed that females constituted 36.44% of the cases, while males accounted for 63.56%.

Data Collection

Relevant information was extracted using a structured data collection form. The following variables were recorded:

- Age and sex
- Type of thalassemia
- ABO and Rh blood group
- Pre-transfusion hemoglobin level
- Frequency of transfusion
- Number of transfusion episodes
- Number of PRBC units transfused
- Volume of blood transfused
- Type of blood component transfused
- Interval between successive transfusions

Blood Transfusion Protocol

Blood transfusions were administered according to institutional protocols and standard transfusion medicine guidelines. Pre-transfusion testing included ABO and Rh typing, antibody screening where indicated and compatibility testing by crossmatching. Packed red blood cells were issued after satisfactory compatibility testing. Patients were monitored during and after transfusion for any adverse transfusion reactions, which were managed according to hospital protocols.

Statistical Analysis

Data collected from patient records and blood bank registers were entered into Microsoft Excel.

Continuous variables, including age, pre-transfusion hemoglobin level, number of packed red blood cell (PRBC) units transfused and transfusion interval were assessed.

Categorical variables such as sex, type of thalassemia, ABO and Rh blood group, frequency of transfusions were summarized as frequencies and percentages.

Single Unit Transfusion done from May 2025 to April 2026 in tertiary care centre, Rajkot, Gujarat in both adult and pediatric patients is shown in bar graph:

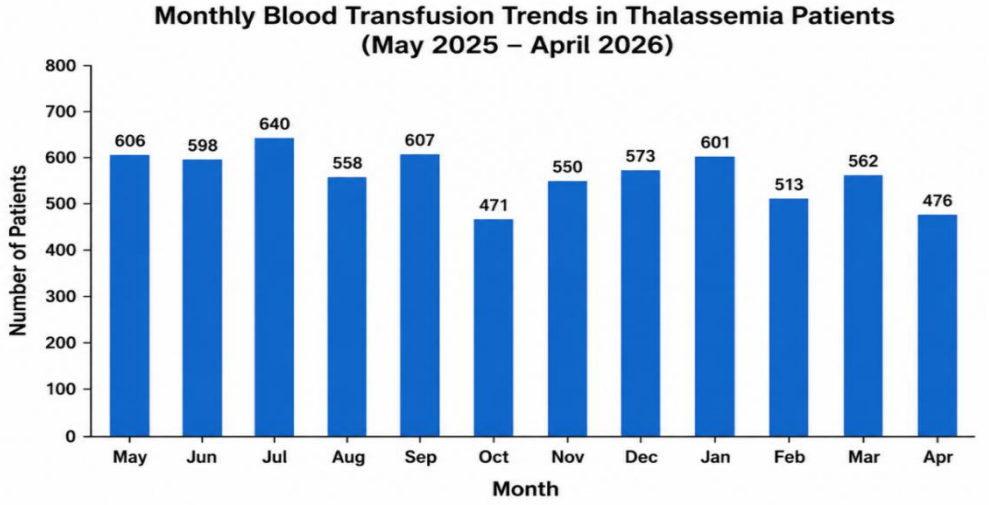

Figure 1. Monthly distribution of single-unit PRBC transfusions in thalassemia patients at a tertiary care hospital from May 2025 to April 2026.

The bar graph illustrates the monthly number of single-unit PRBC transfusions. The highest number of transfusions was recorded in **July (640)**, while the lowest was observed in **October (471)** during the study period.

Pediatric Thalassemia:

Age and Sex: -

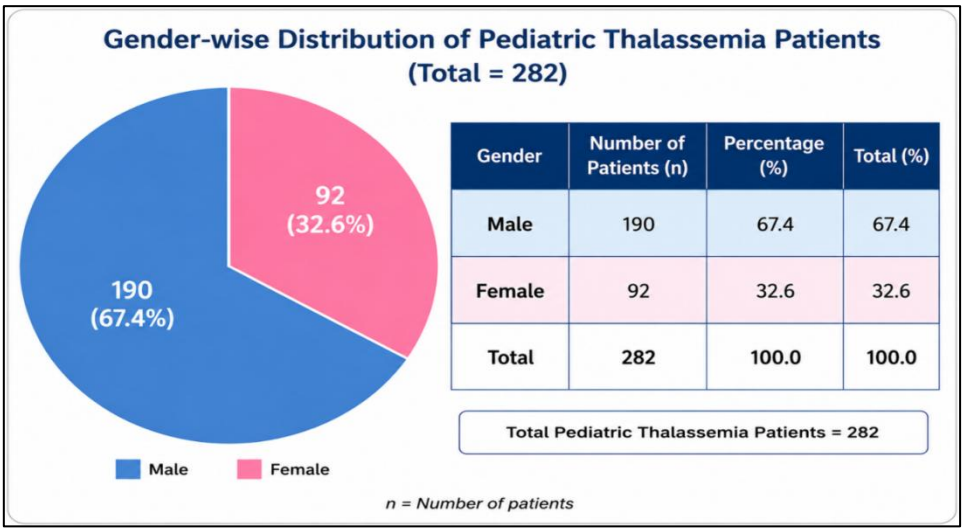

Figure 2: Gender-wise distribution of Pediatric Thalassemia patients, which consist age group from 0 to 12 years of age, out of which Males are in majority.

Among the 282 pediatric thalassemia patients, 190 (67.4%) were males and 92 (32.6%) were females, giving a male-to-female ratio of 2.07:1. Male predominance has also been reported in several Indian studies of transfusion-dependent β-thalassemia, although the disease itself is inherited in an autosomal recessive pattern and does not have a true biological sex predilection.

Type of Thalassemia: -
All the pediatrics patient of thalassemia taken in this study are diagnosed as **β-thalassemia Major**.

ABO and Rh Blood Group: -
Blood grouping of 282 patients diagnosed as β-thalassemia Major is shown in tabulated form as follows:

BLOOD GROUP	NUMBER OF PATIENTS	PERCENTAGE
A Positive	79	28.01
B Positive	66	23.40
O Positive	106	37.58
AB Positive	16	5.67
A Negative	3	1.06
B Negative	6	2.12
O Negative	6	2.12
AB Negative	0	0.00
Total	282	100

Among the study population, Blood group "O Positive" is most prevalent (37.58%) followed by "A Positive" (28.01%). Rh positive patients constituted the majority.

Pre-transfusion Hemoglobin level: -
The mean pre-transfusion hemoglobin level among study patients was 6.5 ± 2 gm/dl (4.5gm/dl to 8.5 gm/dl).

Frequency of Transfusion: -
The frequency of blood transfusions in patients with β-thalassemia depends on the severity of the disease and whether the patient has transfusion-dependent or non-transfusion-dependent thalassemia.

Type of β-thalassemia	Typical transfusion frequency	Target pre-transfusion Hb
Transfusion-dependent β-thalassemia (β-thalassemia major and severe forms)	Every 2–5 weeks (most commonly every 3–4 weeks).	9.0–10.5 gm/dL
Non-transfusion-dependent β-thalassemia	Occasional transfusions only during pregnancy, surgery, infection, or severe anemia.	Individualised

Number of PRBC units transfused: -
The number of packed red blood cell (PRBC) units transfused in patients with transfusion-dependent beta thalassemia depends on the patient's body weight, pre-transfusion hemoglobin level and the desired post-transfusion hemoglobin target.

Typical PRBC requirement per transfusion:

- **10–15 mL/kg** of leukoreduced PRBCs per transfusion.
- In some patients with lower pre-transfusion Hb (<9 g/dL), **15–20 mL/kg** may be required.
- The aim is to achieve a **post-transfusion Hb of approximately 13–14 gm/dL** while maintaining a **pre-transfusion Hb of 9.0–10.5 gm/dL**.

Type of Blood component: -

Blood Component	Routine Use	Indication
Leukoreduced Packed Red Blood Cells (PRBCs)	Yes	Standard treatment for chronic transfusion therapy
Red Cell Concentrate	Yes	Standard treatment for chronic transfusion therapy
Whole Blood	No	Modern transfusion practice favors PRBCs over whole blood

Leukoreduction RBC is preferred because:

- Reduces febrile non-hemolytic transfusion reactions.
- Decreases alloimmunization.
- Lowers the risk of transmission of leukocyte-associated viruses such as Cytomegalovirus.
- Improves overall transfusion safety in chronically transfused children.

Interval between successive transfusions: -
Successive transfusion depends on hemoglobin level of patient as follows:
If Hemoglobin level is between 8-7 gm/dl: 15-18 days interval.
7-6 gm/dl: 12-15 days interval.
6-5 gm/dl: 8-10 days interval.
<5 gm/dl: Repeat.

Adult Thalassemia:
Adult thalassemia patients are distributed in two age groups of:
(i) 13-18 Years of age.
(ii) 18 and above Years of age.

Age and Sex: -

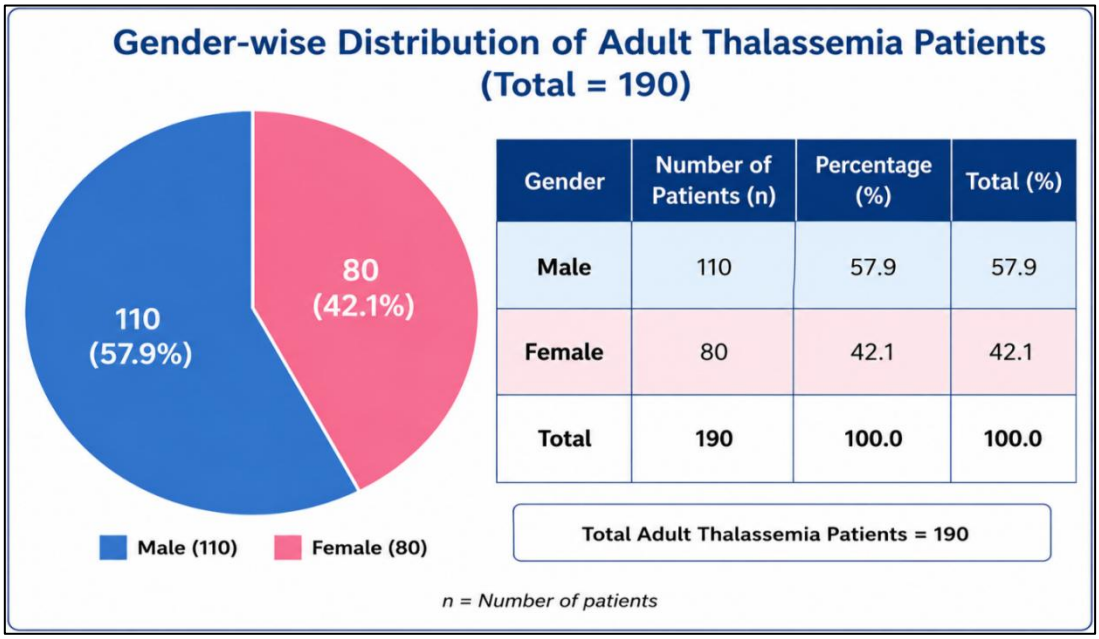

Figure 4: Gender-wise distribution of Adult Thalassemia patients, which consist age group from 13 and above years of age, out of which Males are in majority.

A total of 190 adult transfusion-dependent thalassemia patients were included in the study. Of these, 110 (57.9%) were males and 80 (42.1%) were females, yielding a male-to-female ratio of 1.38:1.

Type of Thalassemia: -
Out of 190 patients of adult thalassemia documented in study population, **154** patients are diagnosed as **β-thalassemia** and **36** patients are diagnosed as **Thalassemia intermedia**.

ABO and Rh Blood Group: -
Blood grouping of 190 patients of adult population is shown in tabulated form as follows:

BLOOD GROUP	NUMBER OF PATIENTS	PERCENTAGE
A Positive	34	17.89
B Positive	64	33.68
O Positive	67	35.26
AB Positive	10	5.26
A Negative	1	0.52
B Negative	6	3.05
O Negative	8	4.21
AB Negative	0	0.00
Total	190	100

Among the study population, Blood group "O Positive" is most prevalent (35.26%) followed by "B Positive" (33.68%). Rh positive patients constituted the majority.

Pre-transfusion Hemoglobin level: -
For an adult transfusion-dependent β-thalassemia cohort, the pre-transfusion hemoglobin (Hb) is commonly maintained between 9.0 and 10.5 g/dL.

Frequency of transfusion: -
Approximately 2 or 3 times transfusion is needed in a month for maintaining the target hemoglobin.

Number of PRBC units transfused: -
For an adult transfusion-dependent β-thalassemia cohort, most patients receive 1 unit of packed red blood cells (PRBCs) per transfusion session.

Table: Volume of transfusion for a desired increase of Hb

Target increase in Hb level	Haematocrit of the blood bag			
	50%	**60%**	**75%**	**80%**
1 gm/dl	4.2 ml/kg	3.5 ml/kg	2.8 ml/kg	2.6 ml/kg
2 gm/dl	8.4 ml/kg	7.0 ml/kg	5.6 ml/kg	5.2 ml/kg
3 gm/dl	12.6 ml/kg	10.5 ml/kg	8.4 ml/kg	7.8 ml/kg
4 gm/dl	16.8 ml/kg	14.0 ml/kg	11.2 ml/kg	10.4 ml/kg

Type of Blood component: -
All adult patients taken in study population receive only Leukoreduced red cell concentrate (LR-RCC).

Interval between successive transfusions: -
Successive transfusion in adult thalassemia patients takes minimum of 8 days and maximum of 15 days.

DISCUSSION

The present retrospective study provides an overview of blood transfusion trends among transfusion-dependent thalassemia patients attending a tertiary care hospital in Rajkot, Gujarat. A total of 472 patients were included, with pediatric patients constituting the majority of the study population. Male predominance was observed in both pediatric and adult groups.

Regular packed red blood cell (PRBC) transfusion remained the cornerstone of management for all transfusion-dependent patients. The use of leukoreduced PRBCs and routine pre-transfusion compatibility testing in the present study reflects adherence to current transfusion medicine guidelines and contributes to improved transfusion safety. Universal cross-match compatibility and the absence of major incompatibility further indicate effective blood bank practices.

Most adult patients maintained pre-transfusion hemoglobin levels close to the recommended target of 9–10.5 g/dL, although a proportion of patients continued to receive transfusions at lower hemoglobin levels. Maintaining adequate pre-transfusion hemoglobin is essential to suppress ineffective erythropoiesis, prevent skeletal deformities, improve growth in children and reduce disease-related complications.

The predominance of Rh-positive blood groups and the high frequency of O Positive blood group among study participants have practical implications for blood inventory management. Knowledge of local blood group distribution enables blood banks to maintain adequate stocks and ensure timely availability of compatible blood for chronically transfused patients.

Overall, the study demonstrates that standardized transfusion protocols, routine use of leukoreduced PRBCs and meticulous compatibility testing provide safe and effective transfusion support for patients with transfusion-dependent thalassemia. Continuous monitoring of transfusion practices and periodic audits are essential to further improve patient care and optimize blood bank resource utilization.

Table: Comparison of Demographic and Clinical Profile with Other Studies

Author (Year)	**Study Place**	**Sample Size**	**M: F Ratio**	**Type of Thalassemia**
Present Study, 2026	Rajkot, Gujarat	472	Pediatric- 2.07: 1 Adult- 1.38:1	Pediatric: 282 (100%) **β-thalassemia major**; Adult: 154 (81.1%) **β-thalassemia major** and 36 (18.9%) **thalassemia intermedia**
Pattanashetti et al.	Karnataka	35	Not available	All enrolled patients had transfusion-

(2016)				dependent **β-thalassemia major**.
Sawhney & Sharma (2021)	Jammu	276	2.7:1	Approximately **92.4%** of patients had **β-thalassemia major**, with a small proportion having other forms of thalassemia.
Parmar et al. (2023)	Jamnagar, Gujarat	222	Not available	All patients were diagnosed with **transfusion-dependent β-thalassemia major**.

The findings of the present study are comparable with previous Indian studies. Pattanashetti et al. (2016) reported that all patients had transfusion-dependent β-thalassemia major, which is similar to the present study where all pediatric patients had β-thalassemia major. However, the present study also included adult patients with thalassemia intermedia (18.9%), showing a wider disease spectrum.

Sawhney and Sharma (2021) also reported a male predominance (male ratio 2.7:1), similar to the present study, which showed male predominance in both pediatric (2.07:1) and adult (1.38:1) groups. In both studies, β-thalassemia major was the most common type of thalassemia.

Parmar et al. (2023) found that all patients had transfusion-dependent β-thalassemia major, which is comparable to the pediatric findings of the present study. The larger sample size and inclusion of both pediatric and adult patients in the present study provide a more comprehensive overview of transfusion-dependent thalassemia.

Table: Comparison of Blood Group in Thalassemia patients with Other Studies.

Author (Year)	Study Place	Most Common Blood Group	Rh Status
Present Study, 2026	Rajkot, Gujarat	O Positive (Pediatric 37.58%; Adult 35.26%)	Predominantly Rh positive
Sharma et al. (2023)	North India	B Positive	95.5% Rh Positive
Sinha et al. (2017)	Mumbai, India	O Positive	>90% Rh Positive
Agarwal et al. (2014)	Multicentric India	O Positive (37.1%) followed by B Positive (32.3%)	94.6% Rh Positive
Munkongdee et al. (2020)	Thailand	O Positive	>95% Rh Positive

The present study showed that O positive was the most common blood group in both pediatric and adult patients, and most patients were Rh positive which is similar to the findings of Sinha et al. (2017) and Agarwal et al. (2014), along with other countries study like Munkongdee et al. who also reported O positive as the most common blood group with a high proportion of Rh-positive patients. However, Sharma et al. (2023) found B positive to be the most common blood group, although the Rh-positive status was similar to the present study. The difference in ABO blood group distribution may be due to regional variations in the study population.

CONCLUSION

This study demonstrates that regular leukoreduced PRBC transfusions with routine compatibility testing provide safe and effective transfusion support for patients with thalassemia. A clear male predominance was observed in both pediatric and adult groups. Blood group analysis showed O Positive as most prevalent group in both age groups with Rh-positive patients constituting the majority. Continuous adherence to standardized transfusion protocols and regular monitoring can further improve patient outcomes and transfusion safety.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this study.

SOURCE OF FUNDING

No external funding was received for this study.

AUTHOR CONTRIBUTIONS

Concept and study design: Dr. Amit Agravat, Dr. Kunal Kumbhare
Data Collection and Data Analysis: Dr. Kunal Kumbhare
Manuscript drafting and literature review: Dr. Amit Agravat
Manuscript review, editing and final approval: All authors.

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