Section: Immunohematology

Original Research Article

RETROSPECTIVE AUDIT OF THERAPEUTIC PHLEBOTOMY FOR ASSESSMENT OF INDICATIONS AND ITS EFFICACY IN TERTIARY CARE TEACHING HOSPITAL NAVI-MUMBAI

Prasad Kulkarni[1], Simran Bandivadekar[2], Seema Gupta[3], Vaishali Thakare[4], Masum Reza[5], Ruth Miriam[6]

[1]Associate Professor, Department of Immunohematology and Blood transfusion (IHBT), Dr DY Patil Medical College, Navi Mumbai, Maharashtra, India.
[2]Postgraduate Student, Department of Immunohematology and Blood transfusion (IHBT), Dr DY Patil Medical College, Navi Mumbai, Maharashtra, India.
[3]Professor & Head, Department of Immunohematology and Blood transfusion (IHBT), Dr DY Patil Medical College, Navi Mumbai, Maharashtra, India.
[4]Professor, Department of Pharmacology, Dr DY Patil Medical College, Navi Mumbai, Maharashtra, India.
[5]Postgraduate Student, Department of Pharmacology, Dr DY Patil Medical College, Navi Mumbai, Maharashtra, India.
[6]Postgraduate Student, Department of Immunohematology and blood transfusion (IHBT), Dr DY Patil Medical College, Navi Mumbai, Maharashtra, India.

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Corresponding Author:
Dr. Ruth Miriam,
Postgraduate Student, Department of Immunohematology and blood transfusion (IHBT), Dr DY Patil Medical College, Navi Mumbai, India.
Email: ruthmthomas22@gmail.com

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ABSTRACT

Background: Phlebotomy, also known as blood letting or venesection and is the preferred treatment for blood disorders in which the red blood cells are removed. Therapeutic phlebotomy (TP)is indicated as an integral component of treatment of medical conditions. It is the cheapest and most effective method for removal of blood. **Aim and objective:** Determine effect of TP by recording the pre and post Hb, Hct and blood plasma volume and various indications for TP.

Material and Methods: We conducted a retrospective study of the therapeutic phlebotomy procedure in 131 patients, covering 286 episodes. Clinical details were recorded to evaluate improvement, and changes in hemoglobin, hematocrit, and plasma volume were determined by comparing pre- and post-procedure blood volumes.

Results: Most common indication observed was polycythemia vera under evaluation (45%). Pre and post TP, Hb and Hct values were recorded in 45 patients. Mean decrement in Hb was 4.20 ± 0.10 g/dL and Hct was 11.96 %, with significant variability among patients. Plasma volume was increased by 0.30 cum^2 and there is progressive increase in plasma volume from baseline in relation to frequency of TP.

Conclusion: Therapeutic phlebotomy is effective and minimally invasive treatment that reduces Hb, Hct, total blood volume and expands plasma volume. IHBT department should manage patients actively, while ensuring proper education and communication during follow-ups.

Keywords: TP- therapeutic phlebotomy, Hb – hemoglobin, Hct – hematocrit, PV- plasma volume, EPO- erythropoietin level.

INTRODUCTION

Therapeutic phlebotomy (TP) is a medical intervention involving the removal of a 350ml of blood from a patient's circulatory system. This procedure helps decrease the number of red blood cells and iron levels in the blood, aiding in the management of various disorders.[1] The indications of TP include Polycythemia Vera, Hemochromatosis, Porphyria cutanea tarda, Sickle cell disease, Non-Alcoholic Fatty liver disease (NAFLD) with hyperferritinemia. Physiology behind TP involves the removal of blood from the body, which triggers the bone marrow to produce new red blood cells. The

new cells require iron, which is sourced from the body's stored iron. This process effectively reduces the body's overall iron levels, making TP a preferred treatment. In ancient times, therapeutic phlebotomy was known as bloodletting and began with the Egyptians around 3000 years ago. The practice reached its peak in 19th century Europe.[2] The generalized methods included venesection and arteriotomy, while localized methods involved scarification with cupping and the use of leeches. The primary instruments for this technique were called lancets and fleams. When blood is removed, the body compensates by stimulating the bone marrow to produce new red blood cells. The production of new red blood cells necessitates the use of iron to create hemoglobin. This iron is mobilized from the body's iron stores. Regularly scheduled phlebotomy sessions help to continuously reduce iron levels in the body as iron is utilized for new red blood cell production and removed along with the extracted blood. As is the usual starting point of treatment for most patients; a volume of blood is drawn at regular intervals and the hematocrit (Hct) and hemoglobin (Hb) concentrations are brought down within a period of weeks to months. It is an effective, minimally invasive treatment.[3] Its success depends on individualized treatment plans, regular monitoring, and patient compliance. The aim of this project is to study the efficacy of therapeutic phlebotomy by comparing the pre and post therapeutic phlebotomy hematological parameters and the various indications for therapeutic phlebotomy (TP) procedure.

MATERIALS AND METHODS

Study Design and Ethical Approval

This was a retrospective audit conducted in the Immunohematology and Blood Transfusion Department of a tertiary care teaching hospital of DY Patil university, Nerul, Navi-Mumbai. The study was approved by the Institutional Ethics Committee. Medical records of patients who underwent therapeutic phlebotomy (TP) between January 2022 and December 2023 were reviewed for data collection.

Patient Selection

The inclusion criteria were as follows

- Stable patients diagnosed with conditions treatable by phlebotomy.
- Patients who had informed consent and appropriate hemoglobin and hematocrit levels for undergoing TP, as advised by their attending physicians.
- Patients who underwent TP as part of their treatment plan.

Exclusion criteria included

- Pregnant women.
- Patients with any contraindications for phlebotomy.
- Patients who did not meet the inclusion criteria or had incomplete medical records.

Data Collection

The following parameters were assessed in this retrospective audit

Audit of TP Procedure

Total number of patients who underwent TP.
Number of TP events performed.
Indications for performing therapeutic phlebotomy.
Number of patients lost to follow-up.
Demographic details of the patients.
Number of patients with available follow-up data.
Assessment of TP Efficacy (Based on follow-up data):
Percentage of patients who underwent multiple TP episodes.
Comparison of pre-TP and post-TP hematological parameters (hemoglobin, hematocrit, and plasma volume).
Correlation between the number of TP episodes and post-TP changes in hematological parameters.

Phlebotomy Procedure

Therapeutic phlebotomy was performed according to standard clinical guidelines. A skilled senior hematologist conducted the procedure. The procedure involved:
Selection of patients based on appropriate hemoglobin and hematocrit levels.
Blood volume removal was adjusted to target specific therapeutic goals, with blood samples taken at predefined intervals to monitor changes in hematological parameters.
Post-TP, the hemoglobin concentration, hematocrit, and plasma volume were determined to assess the immediate effects of phlebotomy. Changes in peripheral blood volume during TP were estimated based on hemoglobin measurements taken at two distinct time points during the procedure.

Statistical Analysis

Data were entered into Microsoft Excel for initial organization, followed by statistical analysis using SPSS software (version 14.0, IBM, Armonk, NY, USA). Descriptive statistics were used to calculate frequencies and percentages. Statistical significance was evaluated using a 5% level of significance ($P < 0.05$).

RESULTS

During the study, 127 patients (122 males and 05 females) underwent 286 events of TP procedures with a median age distribution of 41 years (range 18 – 80 years). As shown in table 1 the majority of patients were referred to for TP from the medicine department (80 %). JAK 2 data was available with 15 patients and 03 (20%) of them were positive for JAK2 mutation was observed only in 13% (n = 18) of patient records. Most patients (64%) presented with acute clinical presentation with a mean interval of 2.4 days between appearances of symptoms and hospital

visit. Amongst them 82 (64%) patients were lost to follow-up after one TP. [Table 1]
As shown in fig 1, majority were males (96%) than female (4%)

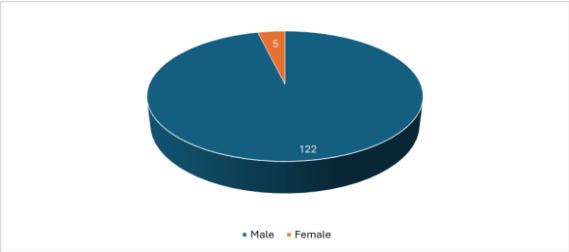

Figure 1: Gender distribution in patients with therapeutic phlebotomy

As shown in fig 2, majority patients were from middle age group 31-40 years (28%) and 41-50 (27%)years, (3%)very few from extreme age group.

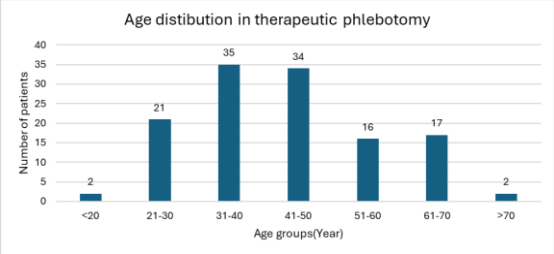

Figure 2: Age distribution

As shown in table 2, the most common indication was Polycythemia Vera Under Evaluation (Renal) and observed in 57 patients, followed by Polycythemia Vera. [Table 2]

As shown in fig 3, the maximum number of patient were prescribed 1and 2 episodes of TP 42% and 36% respectively.

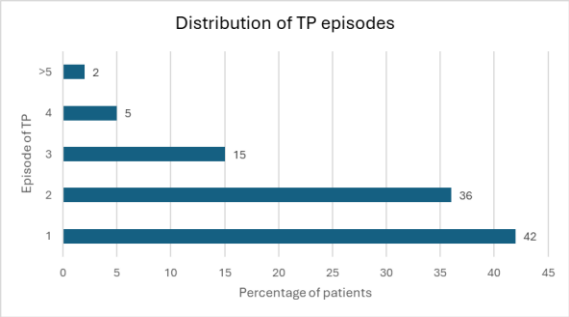

Figure 3: Distribution of phlebotomy episodes

As shown in fig 4 there is a progressive increase in mean decrement of Hb from 1st episode to 5th episode of TP (1.0 gm/dl Vs 2.2gm/dl) and HCT (2.8 Vs 5.0)

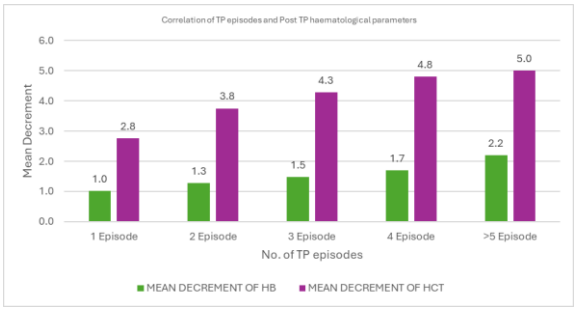

Figure 4: Correlation of TP episodes and Post TP hematological parameters

As shown in table 3, The response to TP with respect to drop in Hb, Hct and PV is represented in Figure The mean pre procedure Hb was 19.9 ± 1.22 g/dL and their drop in Hb was 4.20 ± 0.10 g/dL. Their pre-Hct was 58.01%, post-Hct was 46.05% and drop in Hct was 11.96%. The mean volume of blood removed in each event was 304 ± 58.1 ml. We estimated the difference in plasma volume before (PV1) and after (PV2) TP in these patients. Difference was observed in the plasma volume (2.13(+/- 0.43) Vs 2.43(+/- 0.48) cu/m2) after TP. [Table 1]

As shown in Fig 5, There was a progressive increase in plasma volume from baseline in relation to frequency of TP (0.1 Vs 0.61)

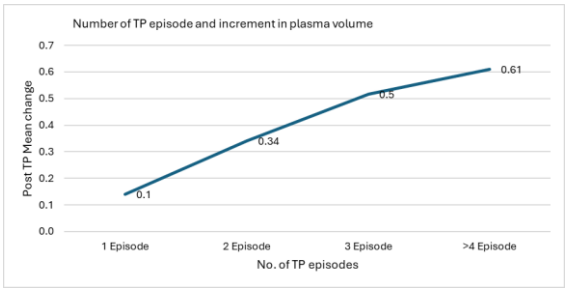

Figure 5: Number of TP episodes and increment in plasma volume

Table 1: Audit of Therapeutic Phlebotomy during Jan 2022- Dec 2023

• Total number of patients with therapeutic phlebotomy :127
• Total number of therapeutic phlebotomies: 286 episodes
• Patients referred from General medicine:107
• Test for JAK2 mutation: 15
• Positive JAK2 mutation: 3
• lost to follow up after 1 episode: 82(64%)
• Follow up data available: 45

Table 2: Indications and follow up (127)

Indications	Number of patients
Polycythemia Vera	35%
Polycythemia Vera Under Evaluation (Renal)	45%
Acute Non-Hemorrhagic Infarct With Polycythemia	2%
Erythrocytosis Under Evaluation	6%
Diabetes Mellitus With CKD And Hypertension	3%
Acute Coronary Syndrome	2%
Miscellaneous	7%

Table 3: Hematological parameters and TP

	Before Mean (± SD)	After Mean (± SD)
Hb gm/dl	19.9(1.22)	15.7 (1.12)
HCT (%)	58.01 (**4.05**)	46.05 (**3.9**)
PV (Cum^2)	2.13(0.43)	2.43(**0.48**)

DISCUSSION

Therapeutic phlebotomy (TP) is an essential part of the treatment of polycythemia and various diseases especially those associated with iron overload. It is also considered as adjunctive therapy for other disorders associated with polycythemia or sluggish circulation such as sickle cell disease, porphyria cutanea tarda, Nonalcoholic liver disease.[4] It is a safe and cost-effective treatment for these conditions. As per the current recommendation in polycythemia, TP should reduce Hct below 45% of the pre-TP levels. Availability of Therapeutic phlebotomy follow up data is difficult because loss to follow up is common problem. In this study the number of patients undergone for TP and number of TP events are in line with the similar study conducted by Gupta et al in Nov 2024.[5]

As per our study majority of patients have undergone more than once the therapeutic phlebotomy and majority of them have lost the follow up because of symptomatic relief after TP.[6] Amongst the total number of patients undergone the TP majority of them were referred from outside hospitals because of unavailability resources and set up for procedure. We could analyze the follow up data for 45 patients amongst 127 patients this could be because of unavailability of hematological test data and could be poor quality of life because of frequent TP.

The JAK2 mutation test is predictive of to have a myeloproliferative neoplasm (MPN). In the current study very, few patients have undergone this test after prescribing by physician, although it is a major diagnostic criterion but because it is costly patients are not doing it. We have observed similar results of therapeutic phlebotomy and similar results are seen with study conducted in 2018 “Effect of therapeutic phlebotomy on plasma volume in polycythemia patients”.[7,8]

Most common indication for TP, observed was polycythemia vera. In polycythemia vera, raised RBC volume, hematocrit (HCT) and reduced plasma volume PV is seen. TP (blood letting) procedure help to control these parameters. in our study there is statistically significant change were seen in all these parameters and progressive increase in plasma volume along with number of TP episodes. This proves that therapeutic phlebotomy done under standard guideline and as per rational indication, it is a effective safe and cost effective procedure.[9]

CONCLUSION

We have concluded that TP is a cost-effective treatment for management of Polycythemia Vera and diseases associated with polycythemia or sluggish circulation such as sickle cell disease, porphyria cutanea tarda, Nonalcoholic liver disease. We suggest that the IHBT department/ blood center should actively involve in this effective treatment

Strength of the study: This study includes analysis of primary data on various follow up parameters

Limitations of the study: small sample size, unavailability of JAK 2 mutation test in majority of patients. These results can help to rule out unable to treat cause, this is not possible with blood profile.

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