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Study of 3 Cycles of Therapeutic Venesection in Polycythemia Patients at Tertiary Care Hospital at Navi Mumbai

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ABSTRACT

Background: Therapeutic venesection is a standard intervention in selected patients with elevated haematocrit, but its effect on plasma volume is less frequently quantified.
Methods: This retrospective observational study included 15 patients undergoing therapeutic phlebotomy. Haemoglobin, haematocrit, blood volume, and plasma volume were measured before and after each session.
Results: Among 15 male patients (mean age 45.8 years), 5 had primary and 10 had secondary polycythemia; following three standardized 350 ml phlebotomy sessions, mean hemoglobin decreased from 19.67 to 16.72 gm/dL and hematocrit from 58.9% to 49.9%, while compensatory plasma volume increased from 1,849 ml to 2,007 ml.
Conclusion: Therapeutic venesection produces a measurable decline in haemoglobin and haematocrit with a compensatory rise in plasma volume.

Keywords: Therapeutic venesection; plasma volume; haematocrit; polycythaemia; hyperviscosity.

INTRODUCTION

Therapeutic venesection remains a well-established treatment for disorders characterized by elevated red cell mass, iron overload, or hyperviscosity, including polycythaemia vera, selected secondary erythrocytoses, hereditary haemochromatosis, and porphyria cutanea tarda.[1] In polycythaemia vera, phlebotomy is a core first-line intervention, and maintaining haematocrit below 45% is associated with lower cardiovascular morbidity and thrombotic risk.[2] The physiological response to phlebotomy includes compensatory movement of fluid from the interstitial to the intravascular compartment, which helps to restore circulating volume after blood removal.[3] This plasma refill may influence both the immediate post-procedure haematocrit and the number of sessions required to reach the therapeutic target.In patients with elevated haematocrit, even modest reductions in red cell mass may improve blood viscosity, tissue perfusion, and symptoms related to hyperviscosity.[4] Because many patients require serial procedures, better characterization of post-phlebotomy plasma-volume changes may have practical value for follow-up planning and response assessment. We conducted a study of these effects on patients in our institute in the Indian population.

MATERIALS AND METHODS

2.1 Study design and setting

This was a retrospective observational study conducted in the tertiary care hospital at Navi Mumbai over 6 months.

2.2 Study participants

A total of 15 patients with elevated haematocrit undergoing therapeutic phlebotomy were enrolled after informed consent. Inclusion criteria were adults aged 18 to 65 years with raised haemoglobin and haematocrit values and symptoms or diagnoses warranting phlebotomy. Patients with low haematocrit, hypotension, hypovolaemia, pregnancy, lactation, menstruation, or refusal to consent were excluded.

2.3 Data collection and measurements

Clinical history, presenting complaints, diagnosis, and procedural details were recorded on a structured proforma. Haemoglobin and haematocrit were measured using an automated cell counter. Blood volume was estimated using a formula based on body weight and sex, and plasma volume was derived from blood volume and haematocrit. Pre- and post-procedure values after the first therapeutic phlebotomy session were used for the primary inferential analysis.

2.4 Procedure

Therapeutic phlebotomy was performed using a standard blood bag set with a 16G needle, and approximately 300 to 350 mL blood was withdrawn per session. Vital signs were monitored before and after the procedure. Post-phlebotomy samples were collected on the following morning and after 10 days after according to institutional clinical protocol.

2.5 Statistical analysis

Data were analysed using Excel 2025. Continuous variables were summarized as mean in a tabular chart.

RESULTS

Demographics

The clinical cohort consists entirely of male patients (15 individuals) with an average age of 45.8 years. The age distribution spans a relatively broad range, from the youngest patient at 32 years old to the oldest at 61 years old, indicating that this condition is affecting both young and middle-aged adults in this group.

Symptoms Based on Polycythemia Type

Patient symptoms showed a distinct correlation with their specific diagnosis. The 5 patients diagnosed with Primary Polycythemia (Polycythemia Vera) predominantly presented with severe neurological and cerebrovascular issues, most notably severe headaches, loss of consciousness, dizziness, and right-sided weakness. Conversely, the 10 patients with Secondary Polycythemia presented more frequently with cardiovascular and systemic complaints, including chest pain, dyspnea (shortness of breath), fatigue, palpitations, and blurry vision.

Average Weight

At the onset of treatment, the baseline average body weight across all patients was 62.5 kg (ranging from 49 kg to 75 kg). Weight remained largely stable throughout the duration of the three phlebotomy episodes.

Blood Drawn Each Time

The treatment protocol was highly standardized across the entire cohort. For every single phlebotomy session—whether it was the 1st, 2nd, or 3rd episode—around 350 ml of blood was consistently withdrawn from each patient.

Relationships Between Hemoglobin, Hematocrit, and Plasma Volume

The serial removal of 350 ml of blood demonstrated a clear, predictable physiological response. Over the three episodes, average Hemoglobin (Hb) levels steadily declined from a pre-treatment baseline of 19.67 gm/dL down to 16.72 gm/dL. Similarly, average Hematocrit (Hct) dropped significantly from 58.9% to 49.9%. In an inverse relationship to these declining red blood cell metrics, the average Plasma Volume (PV) progressively increased from 1,849 ml to 2,007 ml as shown in figure 1. This occurs because as whole blood is removed, the body rapidly replaces the lost volume with plasma (fluid) rather than red blood cells. This compensatory increase in plasma volume effectively dilutes the blood, lowering its viscosity and alleviating the patients' initial symptoms.

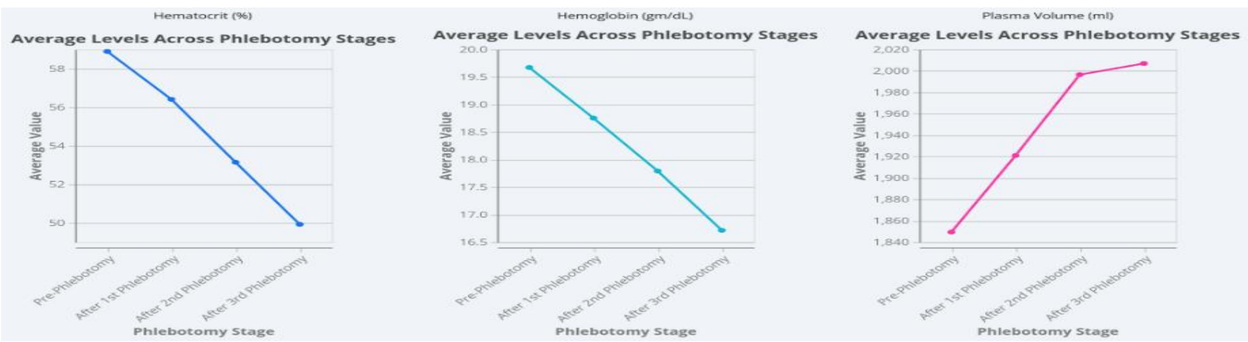

Figure 1- Showing changes in Hemotocrit, hemoglobin and plasma volume over serial phlebotomies.

DISCUSSION

Among 15 male patients (average age 45.8 years), 5 had Primary and 10 Secondary Polycythemia. Across three standardized 350ml phlebotomy sessions, average Hemoglobin fell from 19.67 to 16.72 gm/dL, and Hematocrit dropped from 58.9% to 49.9%. Conversely, compensatory average Plasma Volume increased from 1,849 ml to 2,007 ml.

These findings are comparable with prior studies showing that therapeutic phlebotomy effectively lowers hematocrit in polycythemia. In a serial fixed-volume protocol, mean hematocrit declined from 57.11% to 46.27%, with significant improvement in laboratory and clinical parameters. Another study in patients with polycythemia vera and secondary polycythemia showed reduction of mean hematocrit from 50.4% to 46.5% and confirmed that multiple phlebotomies are usually required to achieve target control.[5] Current reviews and guideline summaries recommend phlebotomy as first-line therapy in PV with a target hematocrit below 45%,supporting the clinical relevance of the observed decline in the present series.

Murugesan et al. (prospective, n=134, median age 49) examined volume shifts, demonstrating that TP expands plasma volume (averaging 2.51 ± 1.58 mL/kg) and yields immediate symptomatic relief for 60% of patients. In our study, the average increase was 1.11 ml/kg per phlebotomy episode, with a total cumulative increase of 3.16 ml/kg per patient across all episodes.[6] Gupta et al. (retrospective, n=159, median age 44) evaluated laboratory impacts, finding that haematocrit reduction requires more phlebotomy cycles (four or more) compared to haemoglobin (three sessions),[7] this contrast with our study where the hemoglobin levels still were high (Average 16.72 gm/dl), however had resolution of their symptoms. The final hematocrit in the present study remained slightly above the recommended target, indicating that medical management with hydroxyurea or five to six cycles of phlebotomies may produce meaningful improvement. This may reflect the interval between procedures, differences in plasma refilling, baseline erythrocytosis, or the need for additional cytoreductive therapy in some cases.

This study has few limitations. The sample size and study duration of study is small. A large sample size with longer duration study is recommended for future studies. Only 3 cycles of phlebotomy were used in this study, however we had seen that these patients on resolution of symptoms had reverted back to the medical line of management with hydroxyurea.

CONCLUSION

Therapeutic phlebotomy significantly lowers haemoglobin and haematocrit and is associated with a compensatory increase in plasma volume in patients with elevated haematocrit.

Declarations

Conflicts of interest: The author declares no conflict of interest.

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