

A Comparative Evaluation of Hemolysis Rates Before and After Continuous Skill Training of Phlebotomists

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Abstract

Introduction: Hemolysis is one of the most common preanalytical errors that encountered in clinical laboratories. Hemolysis significantly affects the accuracy and reliability of laboratory test results. Improper blood collection procedures, inadequate sample handling, and insufficient training of phlebotomists contribute to increases hemolysis rates.

Aim: To evaluate the effect of continuous skill training of phlebotomists on the reduction of hemolysis rates in the tertiary health care laboratory, Diphu Medical College and Hospital.

Materials and Methods: A comparative Observational study was conducted in the central clinical laboratory, Diphu Medical College over a period of six months. Study was divided into two phases: pre training phase for three months and post training phase for three months. During Pre training period, Hemolysis rates were recorded. Continuous skill training focusing on venipuncture techniques, sample transportation, sample storage were conducted for phlebotomists at a regular interval for a month. Post training hemolysis rates were monitored. Data were analyzed using percentage comparison and statistical significance rate.

Results: A total 23,400 blood samples were analyzed during the study period. The pre training hemolysis rate was 6.57% and post training hemolysis rate was 3.28% after continuous skill training. The difference was statistically significant ($p < 0.05$).

Conclusion: Continuous skill training of phlebotomists significantly reduces hemolysis in clinical samples and improves laboratory quality.

Keywords: Pre analytical, Phlebotomist, TAT (Turnaround Time) Hemolysis, Skill Training.

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Introduction

Pre-analytical phase is considered the most important phase in laboratory medicine. Pre-analytical errors contribute the highest proportion of laboratory errors [1].

Hemolysis is a major pre-analytical error that significantly interfere with the accuracy and reliability of biochemical test results [2,3].

Hemolysed causes significant interference in serum Potassium, LDH, AST and Bilirubin estimation due to release of intracellular content from RBC as a result it may leads to falsely elevated serum potassium, LDH and AST. [4,5] Hemolysis may occur due various factors such as improper venipuncture, vigorous shaking of samples, the use of a narrow-gauge needle, prolonged application of tourniquet and improper transportation6 Hemolysed sample can lead to inaccurate biochemical test

results, delayed test reporting, repeated sample collection, increased laboratory workload and patients dissatisfaction.

Hemolysed sample negatively impacts the Laboratory Turn-Around-Time (TAT), and reduce the overall revenue generated by the laboratory due to increase operational cost.

Phlebotomist plays an important role in reducing the rate of hemolysis in blood samples. Competence based training and continuous education can significantly reduce pre-analytical errors.

Aims and Objectives

The present study was conducted to assess the effectiveness of continuous skill training of phlebotomist and technicians in reduction the rate of

hemolysis in a tertiary health care laboratory, Diphu Medical College and Hospital.

Method and Materials

This study was a comparative observational study conducted in the department of Biochemistry, Diphu Medical College and Hospital.

Duration of the study was 6 months from November 2025 to May 2026. All blood samples received for routine Biochemical investigations during the study period.

Inclusion Criteria: serum samples from outpatient and inpatient departments of Diphu Medical College and hospital.

Exclusion Criteria: improperly labelled specimens

- Incomplete requisition form
- Insufficient quantity samples
- Sample in wrong vials
- Clotted samples
- Lipemic samples

During first three months - November to January, the total number of hemolysed sample received in the laboratory was recorded daily in the "sample rejection register" hemolysis was identified visually and by automated "Hemolysis Index" assessment.

We have conducted continuous training and competence assessment at regular intervals for all phlebotomist. The training program included

- a) Proper venipuncture technique
- b) Appropriate needle selection
- c) Correct order of blood draw
- d) Gentle mixing of sample
- e) Proper transportation and storage
- f) Standard operative procedure for specimen collection
- g) Safety and exposure to occupational hazards
- h) Infection control practice

Demonstration and direct observation of sample collection procedure were conducted by clinical Biochemistry laboratory on a weekly basis. Written test and Practical competence assessment were performed among the phlebotomist and technicians. Standard operative procedures (SOPs) for sample collection and transportation were made easily accessible to all technicians and routinely followed in laboratory operations.

Following the training program hemolysis rates were monitored for another three months from March to May using the same criteria.

Statistical Analysis: Data were entered onto Microsoft-Excel. Hemolysis rates before and after training were calculated and compared.

Results and Observation

A total of 23,400 blood samples were analysed during the study period. Prior to the training program, the hemolysis rate was 6.57% and after the training program, the hemolysis rate was 3.28%.

Table 1: Comparison of Hemolysis Rate before and after Training of Phlebotomist.

Study Period	Total Sample	Hemolysed Sample	Rate Of Hemolysis
Pre- Training phase	11,700	769	6.57%
Post-Training phase	11,700	384	3.28%

Comparison of hemolysis rates demonstrated a statistically significant reduction after the skill training ($p < 0.0001$).

Discussion

Our study reported a hemolysis rate of 6.57%, which was a major contributor to preanalytical errors. Bonani et al observed that hemolysis was the most common error occurring during the preanalytical phase [7]. Similarly, Goswami et al. reported that hemolysis was one of the major cause of sample rejection in their study [8]. Toth J et al. Also observed that hemolysis was the most frequent pre analytical error, with 4.43% of the serum sample being hemolysed [9]. Begum F [10] found hemolysis rate 4.25% in Indoor patients and 3% in outdoor patients.

In our study, difficult venous access, rushed sample collection, and inappropriate needle selection were identified as possible causes of hemolysis in the Pediatric and Emergency departments.

The findings of this study demonstrate that continuous skill training significantly reduces hemolysis rate in blood samples, resulting in a reduction of 3.28%. Similar findings were observed in the study conducted by Amina SA et al [12]. Improper sample collection procedures are widely recognized as the leading cause of hemolysis. Reduction in hemolysis not only improves analytical accuracy but also decreases repeat sampling and testing, reduces laboratory expenditure, shortens turnaround time, and enhances patient satisfaction.

Conclusion

Hemolysis is a major preanalytical error that adversely affects laboratory quality and patient care. Continuous skill training, regular competency assessment, and strict adherence to standard operating procedures can significantly reduce hemolysis rates.

Ongoing education of phlebotomists should considered an essential component of laboratory

quality improvement programs. Conducting regular training and periodic monitoring of hemolysis rates as a quality indicator is recommended based on the findings of our study.

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