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ENHANCING PHLEBOTOMY SKILLS: EVALUATING THE EFFECTIVENESS OF ADVANCED TRAINING FOR MEDICAL NURSING STAFF

Amina SA¹, Shaheena Yassir^{*2}

¹Ph.D Scholar, Yenepoya Research Centre, Yenepoya (Deemed to be University), Derelakatte, Mangalore, Karnataka, India - 575018

²Associate Professor, Department of Biochemistry, Yenepoya Medical College, Yenepoya (Deemed to be University), Derelakatte, Mangalore, Karnataka, India - 575018

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Abstract

Introduction: About 60% of pre-analytical errors in clinical laboratories are caused by in vitro hemolysis. A blood sample's hemolysis could result in inaccurate estimations of the true concentrations and levels of various analytes in the blood. Apart from this, it causes unnecessary pain and discomfort of the patient and delay in diagnosis. Therefore, the purpose of the current study was to assess the effectiveness of medical nursing training using the sample rejection rate due to of hemolysis.

Materials and Methods: The research study was a pre and post interventional time bound study on the data pertaining to hemolysed samples received in the Biochemistry Department, Yenepoya Medical College Hospital Central Laboratory, during the time period from October 2022 to February 2022. Samples rejected due to hemolysis were analysed and training were given to the medical nursing staff by certified phlebotomists. Data were collected two months before and two months after the training, from the sample rejection book maintained in the Laboratory. The McNemar test was used to assess whether the training is helpful to decrease the proportion of hemolyzed samples.

Results: The rate of hemolysed samples decreased significantly in the month of training with the p value of < 0.0001 on comparing the rate of hemolysis before training. The rate of hemolyzed samples before training and during the intervention month differed significantly (2.2% vs. 1.35%).

Conclusion: The training demonstrated a significant short-term effect in reducing the rate of hemolysed samples; however, the long-term impact remains inconclusive. Since accurate laboratory test results are crucial for clinical decision-making, implementing frequent training sessions and ongoing medical education programs for medical staff can further lower the rate of hemolyzed samples, improve the quality of laboratory results, and improve clinical outcomes.

Keywords: Advanced training, Hemolysis, Medical Nursing Staff, Phlebotomy, Preanalytical error

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*Corresponding Author

Shaheena Yassir

INTRODUCTION

Accurate phlebotomy, according to the respective Clinical and Laboratory Standards Institute (CLSI) and World Health Organization (WHO) guidelines is the significant procedures in pre-testing quality control [1], and of 40-65% of laboratory pre-analytical errors, 60% is due to hemolysis [2]. Hemolysis signifies the burst of erythrocytes, led to release of their contents into the surrounding extracellular fluid [3]. Hemolysis may occur in vivo or in vitro. In vivo hemolysis occurs when the rate of erythrocyte destruction is increased. During blood collection and handling, in vitro hemolysis can happen when a tourniquet is used for an extended period of time, blood has to pass through a fine needle, tubes are shaken violently, samples are centrifuged before clotting is finished, or blood

specimens are frozen and thawed. All of these procedures can result in severe hemolysis [4]. Numerous studies have revealed that although nurses generally understand what hemolysis is, they typically lack knowledge about its potential causes or how it influences laboratory test results [5]. Hemolysis of blood sample would lead to misinterpretation of the actual concentration and estimation of several analytes in the circulation. Besides, repeated sampling is required, which necessarily increase health care cost, unnecessary pain and discomfort of the patient and it also cause delay in diagnosis [6]. Hemolysis occurs more frequently when samples are collected by non-laboratory staff, who may have varying levels of experience and training in phlebotomy. This can be reduced by training of the staff and by continuous medical education programs related to quality control [7]. Hence this study is aimed to evaluate at the efficacy of training of medical nursing using sample rejection rate due to hemolysis

MATERIALS AND METHODS

The study was a pre and post interventional time bound study on the data pertaining to hemolysed sample, received in the Biochemistry Department, Yenepoya Medical College Hospital Central Laboratory, during the time from October 2022 to February 2022 on which the study had examined in to the impact before and after training. Advanced training was given to the medical nursing staff by certified phlebotomists. Data were collected two months before and two months after the training from the sample rejection book maintained in the laboratory. The study began after obtaining approval from YEC-I with protocol number [YEC-I/2022/033].

Inclusion criteria: Samples rejected due to hemolysis and recorded in the sample rejection book at the Clinical Biochemistry Department, Central Laboratory, were included in the study.

Exclusion criteria: Other causes of pre-analytical errors / sample rejection, such as blood clot, insufficient volume, samples with insufficient information and lipemic samples were excluded in the study

Statistical analysis

The frequency and percentages was used to summarize the hemolysed samples before and after training. The McNamar test was used to assess whether the training is helpful to reduce the proportion of hemolysed sample. The P-value less than 0.05 was considered statistically significant.

RESULTS

In the present study, the rate of hemolysed samples decreased significantly in the month of training, with the p value of < 0.0001 on comparing the rate of hemolysis before training as shown in Figure 1. The month-wise comparison of sample rejection due to hemolysis before and after training (Figure 2) showed a decline in the month of training and a month after, and later in the month of February, the rate of hemolysed samples is reported to 2.42%, which was similar to the rate before training. On comparing the number of hemolysed samples received based on the ward, the result showed the maximum number of hemolysed samples were from the medical ICU and found no reduction in the number of hemolysed samples even after training, as shown in figure 3 and figure 4

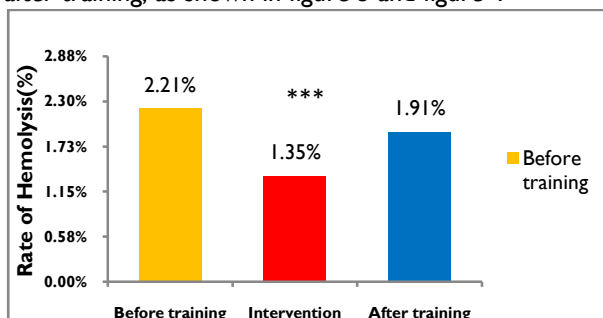


Figure 1: Comparison of sample rejection due to hemolysis before and after training.

Data are expressed as percentages. A p-value less than 0.05 was considered statistically significant (p < 0.0001).

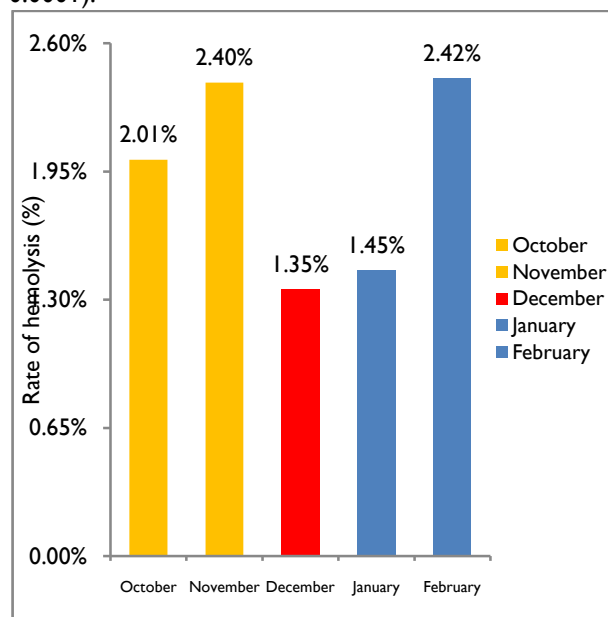


Figure 2: Month wise comparison of sample rejection due to hemolysis before and after training.

Data are expressed as percentages. A p-value less than 0.05 was considered statistically significant (**p < 0.0001).

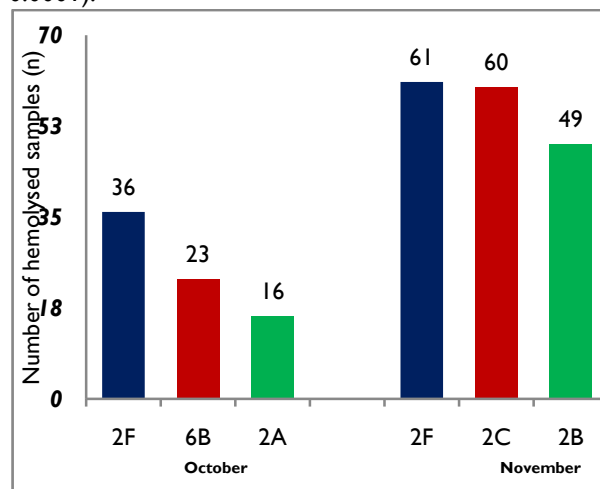


Figure 3: Ward wise comparison of highest sample rejection due to hemolysis before training

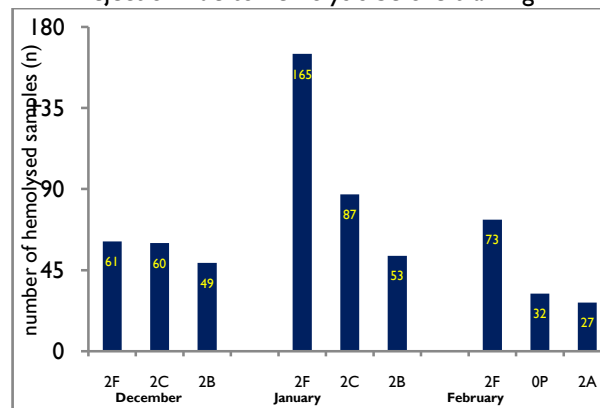


Figure 4: Ward wise comparison of highest sample rejection due to hemolysis after training.

DISCUSSION

The current study which was aimed to evaluate the efficacy of training of medical nursing staff, using rate of hemolysed sample as a tool, found a short-term reduction of hemolysed sample. Hemolysis can affect and alter the findings of several laboratory tests. It impairs the precision of plasma bilirubin assays, especially when evaluating kernicterus in neonates. Hemolyzed samples potassium levels might wrongly suggest serious abnormalities, which could result in an incorrect course of therapy. Furthermore, immunoassays that depend on non-isotopic detection techniques may be impacted by hemolysis⁸. However, we have not done the analysis based on the parameter. In the current study we considered all the hemolysed samples received in our biochemistry lab irrespective of the test requested. The study showed 2.41% of hemolysis before training, which reduced drastically to 1.35% within 20 days of training. Similar findings were showed in a study conducted by Chavan *et al*⁹. The effectiveness of training programs is determined by how effectively participants apply the knowledge and abilities that have acquired into their everyday tasks. About 40% of the advantages of training are promptly applied to their professions, according to studies; it reduces to 25% within a period of 6 month and to 15% by the end of 1 year⁹. In the current study though there was a reduction immediately that is in 2 months, rate of hemolysis increased in the 3rd month. This increase in rate of hemolysis was like the rate before training. This may suggest for a frequent continuous training for the beginners medical nursing staffs, till they become competent.

The current study showed maximum rate of hemolysed samples were from medical ICU. As majority of the ICU patients are critically ill, where the venous access is difficult at times. This may be one of the reasons for high rate of hemolysis in ICU, which suggest the need of special targeted extensive training for the staffs working in ICU. Pretlow *et al.*, in their study revealed, emergency department had 74% of hemolysed samples, among the total number of hemolyzed specimens received¹⁰. Sometimes, medical ICU staff use a syringe for sample collection and force blood into an evacuated tube, which is a suspected cause of excessive hemolysis. Another factor that may significantly impact hemolyzed specimens is the site of the blood draw. Staff are trained to draw blood from the antecubital fossa, but drawing from more distal areas may contribute to the problem.

During the training session, we observed that newly appointed staff were familiar with the term "hemolysis," but lacked understanding of its causes and its impact on laboratory test results. This was similar to the findings of Marendić, Mario, *et al.*, who conducted a study on croatian nurses¹¹. Apart from all these above mentioned causes, the hospitals with high attrition demands for frequent continuous training.

CONCLUSION

The training is found to have significant short term effect in reducing the rate, while long term effect remains inconclusive. Since clinical choices rely largely on laboratory data, repeated training and ongoing medical education programs for medical professionals can considerably lower the rate of hemolyzed samples, improving laboratory result quality and clinical outcomes. Regular assessments of competence and continuing education are essential to ensure correct technique and sustain high standards, as most hemolysis cases are associated with mistakes made during specimen collection.

LIMITATION

The current study was not a 'targeted training', and we have not assessed the competency check. The training was give only to draw blood from antecubital fossa, other peripheral access was not trained. We were not able to calculate the total number of samples received from each ward during ward wise analysis.

FUTURE ASPECTS

A well-planned case control study can be carried out in future to study short as well as long term effects of the intervention with competency check.

AUTHORS CONTRIBUTION STATEMENT

Dr. Shaheena Yassir conceptualized the study, and Mrs. Amina collected the data. Both Dr. Shaheena Yassir and Mrs. Amina analyzed the data, provided essential inputs for designing the manuscript, discussed the methodology and results, and contributed to the final manuscript

CONFLICT OF INTEREST

The conflict of interest is declared none

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