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Preanalytical Errors in Hematology Laboratory- an Avoidable Incompetence

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ABSTRACT

***Background*:** Quality assurance in the hematology laboratory is a must to ensure laboratory users of reliable test results with high degree of precision and accuracy. Even after so many advances in hematology laboratory practice, pre-analytical errors remain a challenge for practicing pathologists. This study was undertaken with an objective to evaluate the types and frequency of preanalytical errors in hematology laboratory of our center.

***Methods*:** All the samples received in the Hematology Laboratory of Dayanand Medical College and Hospital, Ludhiana, India over a period of one year (July 2013-July 2014) were included in the study and preanalytical variables like clotted samples, quantity not sufficient, wrong sample, without label, wrong label were studied.

***Results*:** Of 4,71,006 samples received in the laboratory, preanalytical errors, as per the above mentioned categories was found in 1802 samples. The most common error was clotted samples (1332 samples, 0.28% of the total samples) followed by quantity not sufficient (328 sample, 0.06%), wrong sample (96 samples, 0.02%), without label (24 samples, 0.005%) and wrong label (22 samples,0.005%)

***Conclusion*:** Preanalytical errors are frequent in laboratories and can be corrected by regular analysis of the variables involved. Rectification can be done by regular education of the staff.

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Introduction

Quality assurance in the hematology laboratory is intended to ensure laboratory users of reliable test results. Imprecision and inaccuracy can occur due to pre-analytical, analytical and post analytical variables. With the recent advancement in technology and introduction of automation in hematology laboratories the analytical part of sample analysis is well taken care of if good quality control practices are followed. Post analytical errors like typographical errors can be avoided with laboratory interface systems and hospital information system in vogue. However, pre-analytical errors remain a challenge for practicing pathologists.

This study was undertaken to evaluate the types of pre-analytical errors in our tertiary care set up (1, 2).

Materials and Methods

This retrospective analysis was conducted over a period of one year (July 2013-July 2014)

in Hematology Laboratory of Dayanand Medical College and Hospital, Ludhiana, India. All samples received during this period were included in the study. The hospital is 1400-bedded one and sample collection is done using vaccutainers by trained technologists and nurses in the out patient department (OPD) collection center and wards respectively. A total 0f 4,71,006 samples from OPD and in patient department (IPD) were received. The preanalytical variables which hampered the results were classified as:

- Clotted samples
- Quantity not sufficient
- Wrong sample (eg. Coagulation profile in complete blood count vial)
- Without label
- Wrong label

Results and Discussion

Of the total 4,71,006 samples received in the laboratory, preanalytical errors, as per above mentioned categories was found in 1802 samples. The most common error was clotted samples (1332 samples, 0.28% of the total samples) followed by quantity not sufficient (328 sample, 0.06%), wrong sample (96 samples, 0.02%), without label (24 samples, 0.005%) and wrong label (22 samples, 0.005%) (Table 1). Clotted samples were frequent from the in-patient department however; the exact number could not be ascertained due to paucity of the data.

The haemolysed samples were not included in the study as it was difficult to identify hemolysis unless we centrifuge sample, conducted more frequently in biochemical tests. Other pre-analytical variables like lipaemic samples and diluted samples were not included in the study.

Lundberg while describing total testing cycle outlined a series of activities, right from arising of doubts in the clinician's mind, test selection, sample collection, sample transport to the laboratory, sample analysis, finally interpretation of reports and decision making by the clinician. These activities have traditionally been divided into three phases as pre-analytical, analytical and post-analytical (1-4).

A laboratory error is usually defined as a defect during the entire testing process (from ordering tests to reporting results) which can influence the quality of laboratory services. Pre analytical and post analytical phases are as important as the analytical phase as correction in the preanalytical variables can reduce the frequency of errors in the later phases (5).

Pre-pre-analytical comprises 46-68% of all errors and included inappropriate test request, patient/specimen misidentification, sample collected from infusion route, inappropriate container, handling, storage and transportation (6). In the present study, the preanalytical errors compound to about 0.38% (1802 samples) which is low. However in the present era of laboratory practice such incompetence can be completely avoided by proper training of nursing staff, phlebotomists and laboratory technical staff (7, 8).

The present study revealed clotted samples

Table 1
Depicting types and frequency of prenanlytical errors

	OPD+IPD	Percentage
Total Samples	4,71,006	-
Clotted Samples	1332	0.28
Insufficient quantity	328	0.06
Wrong sample	96	0.02
Wrong label	24	0.005
Without label	22	0.005
Total	1802	0.38

(0.28%) being the main reason of rejecting samples. The common reason of sample being clotted is improper mixing of sample and inadequate EDTA especially if vials are made in house. However in our set up this was attributed to improper mixing. Micro clots if present can be detected on peripheral blood smear but are usually difficult to recognize. No case of microclots was reported in the present study (7).

The insufficient quantity (328 samples, 0.06%) of sample was recognized mainly in pediatric patients where sampling can be some times very difficult especially if done by untrained personnel. Other authors have reported the diluted samples being another cause of rejection in pediatric age group, however this particular variable was not included in our study due to paucity of data (7-9).

Wrong sample (0.005%) and wrong label (0.005 %) were the other two variables identified. These type of errors can have serious adverse effects or can lead to completely wrong treatment of the patient (9).

Diluted samples u pto 0.04% is reported and suggested that whenever intravenous fluid is being administered in a patient's arm, blood should be drawn from the opposite arm (10). If an intravenous fluid is running in both arms, sample may be drawn after intravenous infusion is turned off for at least two min before venipuncture and applying the tourniquet below the intravenous infusion site (10).

As laboratories are going for various accreditations, there is lot of emphasis on reducing errors in laboratory practice to minimum possible level. The ISO 15189:2007 also emphasizes the importance of the quality management (QM) and encourages that QM should include internal quality control and inter-laboratory comparisons such as external quality assessment schemes. A list of items that should be included in the quality manual are transportation, collection, handling of samples, reporting of results and communications and other interaction with patients, health professionals, referral laboratories and suppliers while the monitoring the quality programme. The calibration and instrument function details and analytical system should also be noted. External quality assessment programmes should effectively check the entire examination process, including pre and post-examination procedures (10).

The pre-analytical errors can be avoided by proper training of staff, increased automation in laboratory which may include modern robotic technologies, information systems, computerized order entry, automated phlebotomy tray preparation etc. Barcodes also simplify specimen routing and tracking (11, 12).

Conclusion

Though there is a lot of development in analytical phase of testing in pathology labs, many errors still occur and they will continue to occur in pre-analytical phase, as there is human intervention in every step, right from filling the requisition form to receiving and preparing the samples for analysis. We believe these can be overcome by better coordination between labs and wards, continuing medical education programmes of laboratory staff, computerization of the labs and competency check of staff.

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The authors declare that there is no conflict of interests.

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