SELF-ASSESSMENT OF PRE ANALYTICAL LAB ERRORS IN A TEACHING HOSPITAL OF BANGALORE

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ABSTRACT

Background: Laboratory services are the backbone of the modern health care sector. In spite of rapid advances in laboratory science, it is still susceptible to various manual and systemic errors.

Materials and Methods: The study was carried out on one thousand seven hundred consecutive venous samples received in January 2015 ,of which 1211 were outpatient and 489 were inpatient samples. The following categories of preanalytical errors were noted in the study.

1. Misidentification (Incorrectly labelled vials or incorrectly filled forms)
2. Incorrect samples (wrong choice of vials)
3. Clotted samples
4. Inadequate sample
5. Diluted samples
6. Hemolysed samples
7. Lipemic sample

Results: Preanlaytical errors were detected in 68 samples (4%). The most common preanalytical error was hemolysed sample (36%) followed by lipemic sample. The errors were more common in inpatient samples collected by staff nurse when compared to outpatient samples.

Conclusion: The preanalytical phase is a good contributor to laboratory error. In our study we demonstrated that the frequency of analytical errors in our laboratory routine (4%) is in accordance with the international scientific literature. Systematic documentation of frequency and type of lab errors should be done in every laboratory and corrective measures should be taken appropriately.

Keywords: Preanalytical, Laboratory errors, quality

INTRODUCTION

Laboratory services are the backbone of the modern health care sector. Effective laboratory service is the amalgamation of precision, accuracy, and speed of reports delivered to the patient. In spite of rapid advances in laboratory science, it is still susceptible to various manual and systemic errors. [1].

Laboratory diagnostics, a pivotal part of clinical decision making, is no safer than other areas of healthcare. In general when we speak of errors in the laboratory, we commonly refer to the analytical error. Preanalytical error decisively influences the total error and consequently the diagnostic accuracy [2].

Currently, pre-analytical errors account for up to 70% of all mistakes made in laboratory diagnostics, most of which arise from problems in patient preparation, sample collection, transportation, and preparation for analysis and storage. [3] While patient preparation and sample collection (including patient and sample identification, and specimen handling) are widely recognised as frequent sources of errors, greater attention should be paid to sample transportation. This area needs improvement initiatives, as there is an increasing trend towards consolidation of laboratory facilities, with a consequent need for long-distance sample transportation. [4]

The most commonly reported types of pre-analytical error are: a) missing sample and/or test request, b) wrong or missing identification, c) contamination from infusion route, d) haemolysed, clotted, and insufficient samples, e) inappropriate containers, f) inappropriate blood to anticoagulant ratio, and g) inappropriate transport and storage conditions. [5]

However, while the pre-analytical phase is known to be error-prone, only recently have data

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been collected to demonstrate that the errors occurring are mainly related to procedures performed outside the laboratory walls, by healthcare personnel not under the direct control of the clinical laboratory. [6]

The goal of the present study was to enumerate and analyse the prevalence of different preanalytical errors in that surfaced during sample collection of 1700 consecutive samples in the central laboratory department of a teaching hospital of Bangalore city.

MATERIALS AND METHODS

The current study was a prospective one and was carried out in the central laboratory of The Oxford Medical College Hospital & Research Centre. The Oxford Medical College Hospital and Research Centre is a relatively new medical college hospital with diverse clinical services, modern facilities and a highly skilled clinical staff. The clinical laboratory is a part of this structure, with a team of phlebotomists qualified for the collection of blood samples. The study was carried out on One thousand seven hundred consecutive venous samples received in January 2015, of which 1211 were outpatient and 489 were inpatient samples. The following categories of preanalytical errors/ variables were noted in the study.

1. Misidentification (Incorrectly labelled vials or incorrectly filled forms)
2. Incorrect samples (wrong choice of vials)
3. Clotted samples
4. Inadequate sample
5. Diluted samples
6. Hemolysed samples
7. Lipemic Samples

Data on time delay was not included

RESULTS

Out of the 1700 samples, 1211 were outpatient samples while 489 were inpatient samples. Preanlaytical errors were detected in 68 samples (4%). The occurrence of preanalytical errors in inpatient samples was noted to be 11.5 % while the same in outpatient samples was 1.1%.

The most common preanalytical error was hemolysed sample followed by lipemic sample. The distribution is as noted in table 1.

In the inpatient samples the most common error was hemolysed sample followed by lipemic sample. In the outpatient samples the situation was slightly better with the error rate being at 1.1 %. Here the most common error was lipemic sample followed by hemolysed sample.

We could not assess the other causes of preanalytical errors due to paucity of data especially time lag between sample collection and analytical process.

DISCUSSION

In the present study the occurrence of preanalytical errors was 4% which was much higher than seen in the study by Binita et al (1.1%) [7] while it was lower than seen in the study by Ashakiran et al (44.7%) .[8] A study done in Denmark by Pal Bela Szecsi and Lars Ødum for over one year period, found that preanalytical errors amounted to as high as 81%.[9]

Table 1: Distribution of Preanalytical errors in Inpatient and Outpatient samples.

	IPD (N=489) n (%)	OPD (N=1211) n (%)	Total (N=1700) N (%)
Misidentification	5 (7.3%)	1 (1.4)	6 (8.7)
Incorrect vials	7 (10.3%)	0	7 (10.3%)
Clotted Samples	2 (2.9%)	0	2 (2.9%)
Insufficient volume	3 (4.4%)	0	3 (4.4%)
Diluted sample	2 (2.9%)	0	2 (2.9)
Hemolysed sample	22 (32.3%)	3 (4.4%)	25 (36%)
Lipemic sample	15 (22%)	8 (11.7%)	23 (33.7%)
Total errors	56 (82%)	12 (18%)	68 (100%)

($\chi 2$=0.123E+6, P= 0, degree of freedom=1. This result is significant at $p < 0.05$).

Lippi and his fellow members in their study reported insufficient specimen quality and quantity accounting for over 60% of pre-analytical errors [10] and 1% patient misidentification errors .[2]

The ISO 15189: 2007 standard for laboratory accreditation defines the pre-analytical phase as 'steps starting in chronological order, from the clinician's request and including the examination requisition, preparation of the patient, collection of the primary sample, and transportation to and within the laboratory, and ending when the analytical examination procedure begins'.[11]

The occurrence of hemolysed sample (36%) was less when compared to the study by Binita et al (53.2%) [7] but much higher than in the study by Ashakiran et al (19.2%) [8]. Alsina et al. reported

an incidence of 29.3% of hemolyzed samples in their retrospective analysis of data from 105 laboratories .[12] The occurrence of hemolysed sample was 0.2% as reported by Rico´s et al .[13]

Hemolysis is responsible for the rejection of countless exams, like lactate dehydrogenase (LDH), acid phosphatase, and potassium tests, aspartate transaminase (AST), alanine transaminase (ALT), prothrombin time (PT), activated partial thromboplastin time (aPTT), among others.[14, 15, 16, 17] Factors related to the collection of diagnostic blood specimens, such as maximum time for tourniquet application, inadequate constriction of the forearm muscles, adequate selection of the needle gauge for venepuncture, may increase the incidence of hemolysis, and, consequently, sample rejection. [18]

The occurrence of Lipemic sample in the present study (33.7%) was much higher than the study by Binita et al (0.7%) [7]. Calmarza et al in their study on lipemic sample found greatest difference in concentration of alanine aminotransferase ALT(7.36%) and the smallest one in the concentration of glucose (0.019%). Clinically significant interference was found in phosphorus, creatinine, total protein and calcium. [19]

In the study by Jones B. A. et al [20], clotted sample was the most frequent reason for rejection of a complete blood count specimen (0.45%) followed by insufficient specimen quantity. In the present study too clotted sample, was a frequent reason for rejection of a complete blood count specimen.

Incorrect phlebotomy practice, lack of knowledge and non-compliance of the phlebotomist accounts for the majority of preanalytical errors due to hemolysis, inappropriate sample volume and collection using the incorrect container. Missing or incompletely filled requisition slips also hamper sample processing and contribute to preanalytical errors. [7]

CONCLUSION

The preanalytical phase is a good contributor to laboratory error. In our study we demonstrated that the frequency of analytical errors in our laboratory routine (4%) is in accordance with the international scientific literature. Systematic documentation of frequency and type of lab errors must be done in every laboratory and corrective measures should be taken appropriately.

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