Original article

Analysis of various errors in receipt of samples in the Biochemistry laboratory of a Tertiary Care Hospital

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Abstract

Introduction-Common statement is that errors most likely occur in analytical phase. With improvement in technology it is the preanalytical phase in which maximum error occurs and sample receipt is important part contributing to pre analytical errors. A study was undertaken to examine the various causes of errors involved in receipt of samples at the laboratory in a span of one year.

Methods-In the Biochemistry department serum, plasma, urine and body fluid samples and request forms were checked for improperly filled requisition forms, insufficient sample, hemolysis, lipemia, wrong container etc. & results analyzed.

Observations and results-We found maximum percentage of error due to hemolysis among serum sample accounting to 3.18 % and this was followed by improperly filled requisition forms which includes requisition forms with no diagnosis, requisition form with incomplete patient particulars, requisition form with no ward/OPD written and requisition form with no signature of doctor accounting to 2.47 % .Among plasma samples maximum error was in filling requisition form with no diagnosis accounting to 2.33%. Wrong container was main cause of error among body fluids accounting to 1.20 %.Among urine sample maximum error was in requisition form with no signature of doctor accounting to 0.30 %.

Conclusion-Proper sensitization of all personnel (nursing staff, doctors, phlebotomist & clerical staff) in hospital and training is therefore the need of the hour to make laboratory services better & improve patient care.

Keywords-Hemolysis, Lipemia, Serum

Keynotes-Preanalytical errors are important contributors to laboratory errors

Introduction

Quality systems are the mainstay of clinical laboratory management. Laboratory testing is important source of medical error that affects patient safety[1-3]. The laboratory testing process must be continually monitored and evaluated to ensure reliable test results for efficient patient management. A common assumption is that errors are most likely to occur in the analytical phase, the component of laboratory testing considered the most complex. In the past decades, a ten-fold reduction in the analytical error rate has been achieved, thanks to improvements

in the reliability and standardization of analytic techniques, reagents, instrumentation, and advances in information technology, quality control and quality assurance methods[4, 5]. Preanalytical phase is undervalued and less consideration is given to this phase.Most mistakes are human errors occurring before sample reaches the laboratory i.e. the preanalytical phase[6-11].Erroneous request forms and erroneous samples are important givers to the errors in preanalytical phase[12-14].

As a large government tertiary care hospital laboratory which is also NABL accredited, we participate and invest considerable time and effort in maintaining the quality through various quality control programs, and complying with government and NABL regulations. However, a large problem in our hospital is that it is widely spread. This results in many errors in receipt of samples as the sample collection center and the lab are far apart and samples are carried by hand to the testing laboratory.

Aims & Objectives

Aims & objectives of this study is to examine the various causes of errors involved from receipt of samples at the laboratory till it is analyzed in a span of one year.

Material & Methods

The study was conducted at the Biochemistry department, Armed Forces Medical College, Pune from Oct 14 to Sept 15. Institutional ethical committee clearance was accorded to the study.After receiving the specimens in the biochemistry department; a laboratory technologist evaluates the samples and request forms for misidentification errors (Name, ward etc.), inappropriate container, inadequacy of sample collection, hemolysis, lipemia, wrong container etc. Any probable errors are reported to the ordering department and request is sent for a new fresh sample. Also, the errors are recorded in a roster. All the samples (plasma, serum, urine and body fluids) received at our laboratory during this period were checked for errors which could result in significant difference to results. The requisition forms for serum and plasma were: evaluated based on NABL guidelines and the following parameters studied

a) Requisition form with no diagnosis
b) Requisition form with incomplete patient particulars
c) Requisition form with no ward/OPD written
d) Requisition Form with no signature of doctor
e) Hemolysed sample
f) Lipemic sample
g) Sample insufficient
h) Mismatch ID
i) Wrong container

Parameters studied for urine and body fluids were:-

a) Requisition form with no diagnosis
b) Requisition form with incomplete patient particulars
c) Requisition form with no ward/OPD written
d) Requisition Form with no signature of doctor
e) Wrong container
f) Mismatch ID
g) Wrong container

All the above results were collected overa period of 12 months and analyzed

Observations & Results

There were a total of 31,235 serum samples, 44938 plasma samples, 2941 urine and 749 body fluid samples received during the one year period.

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Table 1: Analysis of errors in serum and plasma samples

Type of errors	Serum	% error	plasma	% error
Total sample received	31235		44938	
Requisition form with no diagnosis	370	1.18	1049	2.33
Requisition form with incomplete patient particulars	127	0.41	246	0.55
Requisition form with no ward/OPD written	142	0.45	255	0.57
Requisition Form with no signature of doctor	135	0.43	144	0.32
Hemolysed sample	994	3.18	154	0.34
Lipemic sample	59	0.18	4	0.008
Sample Insufficient	39	0.12	2	0.004
Mismatch ID	5	0.02	18	0.040
Wrong container	48	0.15	12	0.026

As seen in the above Hemolysis of samples among the serum sample is the most common cause of error accounting to 3.18 %. Improperly filled requisition forms which include requisition forms with no diagnosis, requisition form with incomplete patient particulars,requisition form with no ward/OPD written and requisition form with no signature of doctor is the second most common error among the serum sample accounting to 2.47 %. Among the plasma samples maximum percentage of error was 2.33% in filling requisition form with no diagnosis written followed by requisition form with no ward/OPD written accounting for 0.57 % of total error.

Table 2: Analysis of errors in urine and body fluids received

Type of errors	Urine	%error	Body fluids	% error
Total sample received	2941		749	
Requisition form with no diagnosis	6	0.20	0	-
Requisition form with incomp pt particulars	4	0.13	4	0.53
Requisition form with no ward/OPD	7	0.23	3	0.40
Requisition Form with no signature of doctor	9	0.30	3	0.40
Sample Insufficient	0	-	2	0.26
Mismatch ID	0	-	0	-
Wrong container	3	0.10	9	1.20

In body fluid samples the most common error was use of wrong container accounting to 1.20 % followed next by requisition form with incomplete patient particulars accounting to 0.53 %.In urine sample the most common error was requisition form with no signature of doctor accounting to 0.3 % of total error followed by requisition form with no ward/OPD written as the second most common error accounting to 0.23%.

Discussion

Medical laboratory test results are instrumental in the decision-making by clinical doctors. Some studies have found that about 70% of clinicians' decisions are based on laboratory results. Therefore, the quality, accuracy, and precision of laboratory results are indispensable in clinical care[15]. With this high degree of influence on patient care day to day, the quality of laboratory testing and reporting is of utmost importance. Further the testing process is complex with numerous but important steps all of

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which can contribute to errors in the results. In addition it involves multiple agencies, personnel and activities in the whole hospital. Right from the Doctor who orders the test to the nursing staff or phlebotomist who draws the sample to transportation to lab and actual analysis; there can be various levels of failure.

Over the past few decades there had been a boom in automation with emphasis on instrumentation and quality checks and controls. Availability of good quality calibrators, standards and wide variety of external quality control programs has resulted in precise and accurate reports generated. However, still the lacunae to be filled at major hospitals are in the preanalytical phase. Proportion of errors associated with pre- and post-analytical phases of testing is 4–5 times higher than that seen in analytical phase with preanalytical phase representing over half of the errors. The preanalytical factor may even consist of 46–68.2% of total errors with a high error rate whereas 18.5–47% of total errors have been found in postanalytical phase[16].Our study found hemolysis of samples among the serum samples as the most common cause of error accounting to 3.18 %. In regards to sample related errors our study results are similar to Kapoor et al[17] which shows error due to hemolysis as high as 29.99 % and as the leading cause of pre analytical error. Lippi et al[18] had reported hemolysis frequency of 0.77 % & 0.381 % for outpatient and inpatient respectively.The causes of hemolysis may be varied -mixing additive tubes too vigorously or using rough handling during transport, pulling back the plunger on a syringe too quickly, using a needle with too small of a bore for the venipuncture, using too large a tube when using a small diameter butterfly needle, forcing the blood from a syringe into an evacuated tube or even excessive fist clinching. Many of these samples of gross hemolysis become unacceptable for testing.

Another important error identified wasimproperly filled requisition forms which include requisition forms with no diagnosis, requisition form with incomplete patient particulars, requisition form with no ward/OPD and requisition form with no signature of doctor is the second most common error among the serum sample accounting to 2.47 %. These deficiencies can result in incorrect identification of patients which release of report, loss of reports and will have a great impact on the perceived efficiency of the laboratory. Since most of the requisitions are being generated at various wards and OPDs by various doctors and nursing staff, a great amount of sensitization of doctors and nursing staff by the management would be required for correcting these deficiencies.Most common cause of error in body fluid in our study was wrong container accounting an error of 1.20 %. Lippi et al[18] reports use of inappropriate container for 0.04 % & 0.03 % of outpatient and inpatient respectively.Among the plasma samples maximum percentage of error was 2.33% in filling requisition form with no diagnosis. Knowledge of diagnosis is must and helps clinical biochemist to validate the results and correlation of results with clinical condition serves as a means of ensuring quality control[19]. In our study, on follow up of hemolysed samples we found that they were not from one particular ward /OPD. Similar findings were seen in case of wrong container used for collecting body fluid. This can be attributed to being a teaching institution many a times sample collection was being done by trainee nursing staff & trainee resident doctors which may have contributed to the same.

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Conclusion

In the last 40 years, there has been an impressive decrease in error rates, particularly for analytical errors, the preanalytical errors especially sample collection and transport remains the major challenge in any laboratory services. The most commonly found errors in receipt of samples were hemolysed sample. Proper sensitization of all the personnel (nursing staff, doctor, phlebotomist and clerical staff) in the hospital and training is therefore the need of the hour to make laboratory services better and improve patient care.

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