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Review Article

A study of pre-analytical errors in the clinical biochemistry laboratory of Shri Mahant Indresh Hospital, Dehradun

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ABSTRACT

Objective: The aim and objective of study was to categorize and calculate the percentage error of pre-analytical variables in the clinical biochemistry laboratory.
Materials and Methods: A Prospective study was Conducted at Central laboratory Department of Biochemistry Shri Mahant Indresh Hospital for a period of three months from December 2021 to February 2022.During this period different types of pre-analytical errors were monitored.
Results: Out of 279,137 samples received during the study period, 152 samples were found to be unsuitable for testing, accounting 0.054% of the rejection. All the samples were rejected due to different types of pre-analytical errors that are due to haemolysis 140 (0.050%) followed by wrong sample 6 (0.0021%), Typing error 3 (0.00107%) and Wrong ID 1(0.00035%).Out of these rejection 148 samples were from IPD and 4 samples were from OPD.
Conclusion: Pre-analytical errors occurring in each laboratory have to be checked. In this study pre-analytical errors in IPD samples were more than OPD samples. Such errors are not inevitable and can be avoided with diligent application of quality control, continuing education and effective collection system.

1. Introduction

Central clinical laboratory is the backbone to any hospital and clinical biochemistry is important branch in any clinical laboratory. I have taken the pre analytical errors in clinical biochemistry lab. Laboratory testing involves mainly three phases 1) Pre-analytical phase 2) Analytical phase 3) Post-analytical phase. The pre- analytical phase encompasses all the processes from time of laboratory request to sample analysed in lab. The analytical stage involves the analysis of analytes using automation especially in clinical biochemistry laboratory and validation of the test results. The post analytical stage refers to the interpretation of the results by laboratory consultants and reporting to the clinicians via printed reports.[1] Laboratory errors can occurs at any stage but pre and post analytical errors are more common. A lab is assessed by its quality indicators. In our lab the Quality indicators which we take our Quality control internal and external, the errors, the redos, reports not correlating. Recent studies have shown majority of errors are related to preanalytical phase of laboratory testing. The most common preanalytical errors include inappropriateness of test order, patient identification error, timing errors in sampling and preparation, haemolytic samples, lipemic samples, inappropriate transport and inappropriate sample collection tubes[2]

We are running lab 24 hours and have an NABL accredited lab therefore we are having quality control

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managed properly. Internal quality control is run thrice daily 2 levels in morning 2 levels in evening and 1 level at night. The pre analytical phase as is most important component of laboratory medicine. As stated by Sareen R In influence on laboratory results and patient care[3] states 70% of errors during total diagnostic process are during pre analytical phase.

The preanalytical phase comprises all of the processes occurring before the sample is processed in autoanalyzer. These include inappropriate tests that have been ordered improper sample collection , transport delays and illegible hand writing on requisition slips. As advances in laboratory in form of machinery has reduced the frequency of errors in form of analytical and post analytical phase.

Therefore lab like ours which are running lacks of samples in 1 month needs to watch for pre analytical errors occurring so that labs can improve their efficiency and results.

2. Material and Methods

A prospective study was done for a period of 3 months from December 2021- February 2022 in Clinical Biochemistry Laboratory of Shri Mahant Indresh Hospital, Patel nagar, Dehradun. All the samples coming to lab are being monitored in slots of inadequate sample, hemolysed sample, wrong id or name, wrong vacutainer.

3. Objectives

1. To decrease the percentage of errors occurring in each lab to increase the proficiency of the lab.
2. To categorize the pre analytical errors
3. To formulate corrective action/ measures to avoid errors.

4. Results

Out of 279,137 samples received during the study period, 152 samples were found to be unsuitable for testing, accounting 0.054% of the rejection. All the samples were rejected due to different types of pre-analytical errors that are due to haemolysis 140 (0.050%) followed by wrong sample 6 (0.0021%), Typing error 3 (0.00107%) and Wrong ID 1(0.00035%).Out of these rejection 148 samples were from IPD and 4 samples were from OPD.

5. Discussion

Now advances in science & technology and machinery have led to new paths to laboratory in metro cities as good load of machinery is available at every step to make a lab functional and it has converted manual and cumbersome testing processes to fully automated which ensures accuracy and with good speed. But lab without clinicians are of no use therefore at every step we need clinicians to send samples for us in a proper format of filling requisition slips and for sample analysis. All the 3 phases of analysis is important for it be preanalytical ,analytical or post analytical. Plebani and Carraro observed in their paper that the great majority of errors result from problems in the preanalytical or post analytical[4]

Hemolysis was the cause of majority of rejection of samples in our study. As such we are using vacutainers which is a closed system of blood collection which is easy but it needs trained staff which should have expertise on phlebotomy methods. Hemolysis occurs when blood is forced through fine needle, shaking the tubes vigorously and centrifugating the samples before clotting.[5] Proper training is been given to the staff who are doing phlebotomy in lab so that they can be familiarize to the standard protocols for sample collection and processing. There are various SOP which are being circulated to technicians and doctors for sample collection and processing which should be read by all. The samples from collection centre is being carried by our staff with full precautions and within time so that all samples can reach their respective departments on time.

Out of the total samples received to biochemistry lab from DEC-FEB 2022 were 279137 out of these the number of samples which were hemolysed were 140(0.050) that was the maximum pre analytical error is our lab. Rest all were minors such as wrong sample wrong id or short sample. Sezeci BP and Odum L observed 81% pre analytical errors and stated that each laboratory should record their errors in structured manner. Binita Goswami et al scrutinized data for 67438 routine venous blood specimens and errors were documented over a period of 1 year and they found that pre analytical errors were most common 77.1% followed by post analytical 15% and analytical 7.9% respectively.[6]

Total number of samples with wrong samples were 6 and wrong id was just 1 therefore only minor percentage was 0.0021% & 0.00035% was the error in total. Now as bar coding is there therefore we have decreased that kind of error also. Therefore in all our lab is one of the best laboratory in Uttarakhand with large sample load and with very less errors that too preanalytical errors which are usually caught before release of reports. Our lab reports presion and accuracy is very good with good affluent staff in form of doctors and technicians.

Advances in science and technology have led to many path breaking advances in field of medical diagnostics that have transformed laborious, manual and cumbersome testing methods into fully automated tests which yields reliable, rapid, accurate and précised results. With advances in laboratory the errors in analytical and post analytical phase has decreased because of LIS (Laboratory Information System) now a days notable errors has been noted in pre analytical phase due to which results are altered and its reliability can be questioned.

Table 1: Distribution of parameters in 3 months

Months	Haemolysis	Wrong samples	Short samples	Typing error	Wrong ID	Total samples received
December	71 [0.070%]	4 [0.0039%]	2 [0.0019%]	2 [0.0019%]	1 [0.0009%]	100228
January	33 [0.036%]	Nil	Nil	nil	Nil	89504
February	36 [0.040%]	2 [0.0022%]	Nil	1 [0.0011]	Nil	89405
Total	140 [0.050%]	6 [0.0021%]	2 [0.00071%]	3 [0.0010%]	1 [0.00035%]	279137 [0.054%]

Now a days focus of research is more on pre analytical phase errors. Earlier to improve analytical errors focus was on Quality control therefore in each lab proper internal and external quality control is being monitored properly time to time. However post and pre analytical errors were neglected worldwide and currently many studies are focussing on importance of pre-analytical phase to obtain accurate results. An American pathologist program conducted a study enrolling 660 laboratories and showed that order error rate from OPD was 4.8%.[7] Among all types of pre analytical errors the most common error was found to be hemolysis which accounted for 1.83% of total sample rejection which is similar to many studies.[8] As hemolysis has effect on various parameters like Potassium(K), Acid Phosphatase (ACP), Lactate Dehydrogenase (LDH), Aspartate transaminase(AST), Alanine transaminase(ALT), Creatinine, Creatinine kinase(CK), aalbumin, Alkaline phosphatase(ALP), Gamma glutamyl transferase (GGT), glucose, bilirubin and sodium(Na) are underestimated when hemolysed sample are used. Therefore counselling and proper training for cleansing the venipuncture site with alcohol and not allowing the site to dry appropriately, syringe draws or proper usage of vacutainers , ways how to transfer blood into tube and not allowing the serum specimen to clot for recommended amount of time can result in fibrin formation in serum.

6. Conclusion

Our lab is Nabl accredited and we have good amount of samples. We have a fully functional fully automated lab with LIS, Bar coding. Proper functional collection centers transporting blood and other samples to various labs such as biochemistry, microbiology and pathology. Pre-analytical errors occurring in each laboratory have to be checked. In this study pre-analytical errors in IPD samples were more than OPD samples. Such errors are not inevitable and can be avoided with diligent application of quality control, continuing education and effective collection system.

All processes such as sample collection, sample processing, sample analysis from a consultant ordering the test to final release of reports. Our basic focus is on minimization of pre analytical errors as analytical and post analytical we have full control on because of automation. Our study recommends proper training of staff nursing and technicians to withdraw samples to put bar coding and to check each sample before putting it into process.

7. Source of Funding

None.

8. Conflict of Interest

None.

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