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PREANALYTICAL ERRORS AND TURNAROUND TIME IN EMERGENCY BIOCHEMISTRY LABORATORY IN A TERTIARY CARE HOSPITAL IN NEW DELHI

Biochemistry

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ABSTRACT

BACKGROUND & OBJECTIVES : It is important to ensure quality of laboratory results. This study aimed to identify the pre-analytical errors and also the turnaround time in the emergency laboratory at a tertiary care hospital in Delhi.
MATERIALS & METHODS : A cross-sectional study was done on a total of 2,73,111 samples received in the emergency laboratory from September 2018 to August 2019 and an analysis of occurrence of pre-analytical errors was done, retrospectively. Additionally, the TAT of the lab was evaluated over a period of two months from July 2019 to August 2019.
RESULTS : 10.58 % of total samples received were rejected. Overall TAT was found to be 108 minutes (median value).
CONCLUSION : Hemolysis was found to be the most common cause of rejection in the emergency biochemistry laboratory. Also, the most time-consuming step was analysis in auto-analyzer with respect to contribution to TAT.

KEYWORDS

Pre-analytical errors, turnaround time, sample rejection, clinical biochemistry

INTRODUCTION:

Medical biochemistry laboratories play an important role in modern-day diagnosis. Therefore, more importance is given to ensure the quality of laboratory tests. The errors in laboratory are classified into pre-analytical, analytical and post-analytical phase depending on the time of presentation. As per current literature, most of the laboratory errors are either pre-analytical (46-48%) or post-analytical (18-47%) whereas 7-13% errors occur in the analytical phase.[1] Also, the pre-analytical phase is the most significant and difficult to control and maintain because a lot of professionals are involved in this phase.[1] Moreover, they are rarely covered by quality control programs. International federation of clinical chemistry and laboratory medicine working group for laboratory errors and patient safety (IFCC-WG-LEPS) has highlighted the most common pre-analytical errors in laboratory practice.[2] The present study was undertaken to study the prevalence and types of pre-analytical errors in the clinical biochemistry emergency laboratory at a tertiary care hospital in New Delhi, India.

MATERIALS AND METHODS:

The current study was conducted at the Biochemistry laboratory of New emergency building of Safdarjung Hospital. This laboratory receives blood samples from all the emergency wards as well as non-routine samples for inpatient patients from rest of the wards of the hospital. Rejected samples in the emergency laboratory from September 2018 to August 2019 were reviewed retrospectively. Data was collected from entry registers and rejected samples registers.

Also, the Turnaround time (TAT) of emergency biochemistry samples were evaluated over a period of two months from July 2019 to August 2019 and total of 48,031 samples were studied. The time intervals between the stages of workflow (from receiving samples till dispatch of reports) were recorded. All samples from respective wards reach the receiving counter from where they are sent to the biochemistry lab. Samples are then sorted, centrifuged and analyzed on Beckman Coulter Olympus AU 480 . Reporting is done on the respective requisition forms , data entered in the sample register , reports signed and validated by the duty doctor and finally reports are sent for dispatch to the respective wards. Parameters done on blood samples in emergency laboratory include glucose, urea, creatinine, total bilirubin, direct birubin, ALP, ALT, AST, amylase, sodium, potassium, chloride, creatine kinase, creatine kinase-MB and lipase.

Statistical analysis was conducted using Microsoft Excel 2016 program..Calculations of rejected specimens of biochemistry lab was presented as number and percentage. Data of TAT was expressed as median and range. Bar diagrams and pie-charts were used to depict the data graphically.

RESULTS:

Out of total of 2,73,111 samples received in the laboratory, 28,904 were rejected owing to various reasons as shown in table 1. As can be seen in the table, 18,250 samples were rejected due to hemolysis, which is most common cause of rejection in this study. The findings have been shown graphically in Figure 1.

Table 1: Table Showing Frequencies Of Different Pre-analytical Errors Observed

S.NO.	REJECTION CRITERIA	NO.OF SAMPLES , n	FREQUENCY (%)
1.	Quantity not sufficient (QNS)	6,570	22.73
2.	Hemolyzed samples	18,250	63.14
3.	Lipemic samples	03	0.01
4.	Labeling errors	1,825	6.31
5.	Inappropriate tube	365	1.26
6.	Test not done/ available	10	0.03
7.	Clotted samples	348	1.20
8.	Sample contaminated	730	2.52
9.	Sample mix ups	803	2.77
TOTAL SAMPLES REJECTED		28,904	10.58 (total rejection rate)
TOTAL SAMPLES RECEIVED		2,73,111	-

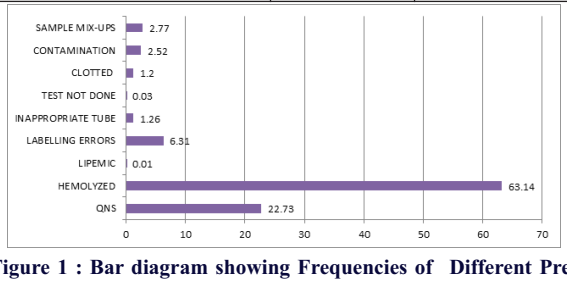

Figure 1 : Bar diagram showing Frequencies of Different Pre-analytical errors observed (QNS: quantity not sufficient)

To study the TAT in the lab, the time taken for complete sample processing from receiving samples in the lab till dispatch of reports

was recorded as shown in table 2 and figure 2.

Steps Involved	Sample received – sample loading into autoanalyzer	Analytical period (in autoanalyzer)	Reporting – dispatch of reports	Total TAT (minutes)
Average Time Taken In Minutes (n=48,031)	33 *(18-45)	46*(20-54)	29*(10-45)	108
% Of Each Stage	30.55%	42.59%	26.85%	100 %

TABLE 2 : Table showing time taken to complete different steps of sample processing expressed as median and range; * median value

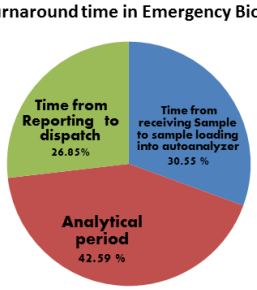

FIGURE 2: Pie-chart showing different steps of sample processing and their contribution towards TAT.

DISCUSSION:

In the modern diagnostic laboratories, errors are more commonly seen in pre- and post-analytical phases than in the analytical phase because these phases are not in direct control of laboratory personnel.[3] Majority of the pre-analytical errors are preventable.[4,5,6]

In the current study, the incidence of the rejected specimens in the emergency biochemistry was 10.58 %. Previous studies have reported the incidence of biochemistry samples ranging from 0.3% to 6 % .[7,8,9,10,11,17]

In the present study, hemolysis was the most common reason for sample rejection.(63.14 % of total rejections). Gokhan C [11] has reported incidence of hemolysis related rejection as 74.1 %. Similar findings were found by Goswami et al[12] (81 % of total rejections). Arul et al[10] reported incidence of of hemolysis as 0.03%. There can be various causes of hemolysis including using a needle that is too small, pulling the syringe plunger too fast, shaking the tube vigorously, or centrifuging the sample before clot formation.[13] It also leads to increased turnaround time as fresh sampling is required, mostly.[10]

The second most common error was inadequate samples. 6570 samples were rejected due to this reason(22.73%). As per available literature, insufficient samples can be accounted from pediatric, neonatal and oncology wards, as peripheral vascular access is difficult.[14,15,16.] Incorrect phlebotomy practices due to ignorance or increased workload could be another reason.[14]

Incidence of misidentifications (including), labeling errors ,incorrect vials, sample contaminated, sample mix-ups were observed to be 6.31 %, 1.26 %, 2.52 % and 2.77 % respectively. This can be attributed to excessive work-load due to large number of patients or sampling done by untrained staff. [17] Incidence of test not done/available was 2.52%, which could be because of lack of information in the wards.

Incidence of clotted samples was found to be 1.2 %.The chief reason could be improper handling of blood samples including poor mixing , keeping at horizontal position. Gokhan C[11] reported incidence of clotted samples to be 45.6 % in hematology laboratory. Arul et al[10] reported that 0.12 % samples were clotted in biochemistry laboratory.

Pre-analytical errors can adversely affect treatment of patients. Most of the errors can be reduced by proper training of the staff and checking competency through by conduction of practical and theory assessment at frequent intervals.[10,18]

LIMITATIONS:

The limitations of this study include that only samples received in emergency were included and routine samples were not included in the study. Also, no comparison was made between day , evening and night shifts.

CONCLUSIONS:

In the current study, incidence of pre-analytical errors was found to be 10.58% in the emergency lab. Hemolysis of blood samples was the most common cause of rejection. Total Turnaround time (median value) was found to be 108 minutes and the time taken for analysis in the auto-analyzer was the main contributing factor towards TAT. It is recommended that to avoid these errors , adequate and continuous training of hospital staff including lab personnel should be ensured.

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