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, more than 70% of errors occur in the pre-analytical phase. Most of the errors occur in this phase and it is difficult to control and maintain because a lot of professionals are involved in this phase. 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. 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. 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.

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

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 |

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.
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 present 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 %.

In the recent study, hemolysis was the most common reason for sample rejection. It was reported by Gokhan C. Similar findings were found by Goswami et al. Arul et al. ‘Incidence of hemolysis was reported to be 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. It also leads to increased turnaround time as fresh sampling is required, mostly.

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. Incorrect phlebotomy practices due to ignorance or increased workload could be another reason.

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. 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 reported incidence of clotted samples to be 45.6% in hematology laboratory. Arul et al. 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.

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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