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Monitoring of Turnaround time (TAT) in Biochemistry Laboratory of a tertiary care hospital in Punjab

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Abstract: *Turnaround time (TAT) is commonly defined as the time from when a test is ordered until the result is reported which includes the pre- analytical, analytical and post-analytical time. Increased attention to patient's needs is demonstrated by efforts to improve the quality of the entire service provided, e. g reduction of laboratory turnaround time (TAT). The availability of the results from a laboratory in defined time increases the patient's satisfaction and also proves the clinician's efficiency. A total of 300 samples were taken for analysis of TAT, out of which 150 were from outdoor patients and 150 from indoor patients. The contribution of the analytical time to the total turnaround time was found to be less than the contribution of pre and post-analytical time in both OPD and IPD patients. In addition, 38 samples (25.3%) in OPD and 37 samples (24.7%) in IPD were reported outside the defined TAT. The various reasons responsible for more time consumed in pre and post-analytical phases as compared with the analytical phase are time taken to transport the samples from phlebotomy area to the laboratory which increases pre-analytical time and the manual delivery of reports which increases post-analytical time. So, by streamlining the pre and post-analytical processes, the TAT of the lab can be reduced.*

Keywords*: Inpatient department (IPD), outpatient department (OPD), turnaround time (TAT)*

I. Introduction

World class service industries are characterized by their efforts towards reducing the total time required for reporting the results of investigations, also called timeliness. In contrast, timeliness of results reporting has not been a major focus in clinical laboratories (1-3). Timeliness which is expressed as the turnaround time (TAT) is often used by the clinicians as the benchmark for laboratory performance. A faster TAT helps the clinicians in diagnosing the disease and starting the treatment of the patient in a single meeting which increases the patient satisfaction. Patient outcomes are definitely affected by delays in diagnosis (4).

TAT has been described in a number of ways by the researchers. The "total testing cycle" describes TAT as consortium of nine steps: ordering, collection, identification, transport, preparation, analysis, reporting, interpretation and action (5). Clinicians consider TAT from the time the test is ordered to results reporting, whereas laboratory professionals usually use specimen receipt to reporting of results as TAT (6). TAT has also been classified as pre-analytical, analytical and post-analytical depending on the different phases of sample processing (7).

The aim of the present study is to determine the turnaround time (TAT) of the biochemistry laboratory, to evaluate the contribution of pre-analytical and post-analytical phases as compared to analytical phase to the total turnaround time (TAT) and to see the number of samples being reported outside the defined TAT. Various steps were also evaluated by which the total turnaround time can be reduced.

II. Materials And Methods

The present study has been conducted on samples received in the clinical biochemistry laboratory of a tertiary care hospital catering to a large population of Punjab. The lab is equipped with the latest instruments like fully automated biochemistry analyzer BS-480 (Mindray) for routine chemistries, fully automated Liasion Chemiluminescence for hormone assays, fully automated AIA-360 for hormones and tumour marker assay, Sensacore electrolyte analyser and arterial blood gas analyser (Radiometer-ABL).

The samples from outdoor patients were collected in the sample collection area by trained phlebotomists whereas the samples from indoor patients were drawn by the staff nurses of their respective wards. The samples were transported to the laboratory from both outdoor and indoor patients by their respective attendants.

The samples received in the laboratory were first screened for any pre-analytical errors followed by their processing. Quality control samples were run daily in the laboratory for all the analytes to identify any intra-assay variation.

The samples received in the laboratory were processed in the order in which they were received with the exception of samples received from emergency which were run on stat mode as soon as they were received including ABG samples.

After the sample was analyzed for all requested parameters and the reports were validated in the software which were then dispatched and manually distributed by the laboratory attendant to the respective outdoor departments and wards. The samples were run in batches and the reports were also dispatched in batches after complete analysis.

The present study does not include the results of investigations like ACCP, ANA which are reported weekly and the samples of special hormone assays received in the evening.

In this study, we are presenting the TAT of 300 samples out of which 150 were received from outdoor patients and 150 from indoor patients in the clinical biochemistry laboratory of our hospital.

Statistical analysis

The normality of the quantitative data was checked by measures of Kolmogorov-Smirnov tests of normality. As our data was normally distributed, it was written as its mean and standard deviation. For time related variables, paired t test was applied. Different timings were also given the form of its median and interquartile range. 75th percentile was taken as the optimal cut-off value for defining TAT. How many tests needed value more than 75th percentile was given as discrete categorical data and were presented as n %. All calculations were two sided and were performed using SPSS version 17. A p value of < 0.05 was considered to be statistically significant.

III. Results

The turnaround time (TAT) has been monitored in 150 samples taken from patients in OPD and 150 samples from IPD patients. Table 1 shows the time taken to complete pre-analytical, analytical and post-analytical phases in both OPD and IPD samples. The average turnaround time in OPD and IPD was 163.9± 35.8 and 162.4 ± 52.6 minutes respectively. The time taken for pre-analytical phase was 50.4 ± 11.9 minutes in OPD (17.4 ± 5.5 minutes for phlebotomy and 33.0 ± 11.1 minutes for transport of sample from phlebotomy area to the laboratory) and 50.9 ± 25.9 minutes in IPD (which includes only transport of sample). The time taken to complete the analytical phase was 79.2± 22.4 and 77.7 ± 32.4 minutes in OPD and IPD respectively. The time taken to complete the post-analytical phase which includes the time taken for manually distributing the reports was 34.3 ± 21.4 minutes in OPD and 33.7

± 18.9 minutes in IPD (Table 1). The time taken for completing the analytical phase in both OPD and IPD was significantly less (p= 0.027 in OPD, p= 0.047 in IPD) than the combined pre and post-analytical time in both OPD (84.6 ± 24.1 minutes) and in IPD (84.6 ± 35.0 minutes).

Also, the contribution of analytical time to the total TAT in OPD (48.2%) and in IPD (48.3%) is less than the contribution of combined pre and post-analytical time in OPD (51.8%) and in IPD (51.7%) (Table2).

Table 1
Analysis of turn around time (TAT) by subdividing into 3 phases

	Pre-analytical phase	Analytical phase	Post-analytical phase	Combined pre and post-analytical phase	TAT(minutes) (mean±SD)
OPD	50.4 ± 11.9	79.2 ± 22.4	34.3 ± 21.4	84.6±24.1	163.9 ± 35.8
IPD	50.9 ± 25.9	77.7 ± 32.4	33.7 ± 18.9	84.6±35	162.4 ± 52.6

TABLE 2
Contribution of pre and post-analytical time(AT) to total TAT

	Total TAT %	Pre and post AT %	Analytical time to TAT %
OPD	100	51.8	48.2
IPD	100	51.7	48.3

Out of 150 samples each from both OPD and IPD, 38 samples (25.3%) in OPD and 37 samples (24.7%) in IPD have been found to be reported outside the defined cut-off value of TAT which is 187 minutes in OPD and 185 minutes in IPD (Table 3).

Analysis of time taken to report 150 samples in OPD shows that 17 samples have been reported between 61-120 minutes, 86 samples have been reported between 121-180 minutes and 47 samples have taken time more than 180 minutes (Table 4).

Out of 150 samples in IPD, 01sample has been reported in less than 60 minutes, 31 samples have been reported between 61-120 minutes, 77 samples have been reported between 121-180 minutes and 41 samples have taken time more than 180 minutes (Table 4) which means that maximum number of samples have been analyzed between 120-180 minutes in both OPD and IPD.

In the present study, situations in the laboratory when TAT was prolonged due to machine breakdowns and lack of uninterrupted electricity have not been included.

TABLE 3
Number and percentage of samples crossing the cut-off value of TAT

	Defined TAT(minutes)	Number of samples crossing threshold	% samples
OPD	187	38	25.3
IPD	185	37	24.7

TABLE 4
Analysis of reporting of samples in OPD and IPD

Time(MIN)	No. of samples	%	No. of samples	%
<= 60	Zero	zero	1	0.7
61-120	17	11.3	31	20.7
121-180	86	57.3	77	51.3
> 180	47	31.3	41	27.3

IV. Discussion

One of the most visible and talked about areas of laboratory service is how fast a test result is returned to a caregiver (8). If the results from the laboratory are available in less time, it helps the clinician to start the treatment in a single visit thus proving the clinician's efficiency and increases patient satisfaction. On the other hand, there are many processes which are not under the control of laboratory professionals which influence TAT and are responsible for a number of delays(9). Our study demonstrates that the pre and post-analytical phases are contributing 51.8% in OPD and 51.7% in IPD to the total turnaround time. This means that if the time consumed for pre and post-analytical phases is reduced, than TAT can also be reduced.

In case of pre-analytical phase, adoption of ideal phlebotomy practices, bar-coding of samples, use of computer generated requisition slips, use of plasma and serum separator tubes will reduce the delays occurring as a result of illegible slips and wrong sample collection techniques. Also, the time taken to transport the specimen from phlebotomy area to the laboratory can be reduced with the help of pneumatic system. McQueen (10) found that inclusion of a pneumatic tubing system led to a significant reduction of TAT.

The pneumatic system is a path breaking innovation that has revolutionized sample transport and many studies have proven the efficiency of this mechanism in reducing the inadvertent delays as a result of human courier (11).

The analytical phase can be reduced by using fully automated machines with higher throughput, adoption of efficient quality control procedures, training of technical staff to handle urgent samples with priority, use of plasma or whole blood samples, automatic dilutions when results are above linearity and prompt validation of reports once tests are completed.

The post-analytical phase can be reduced by adoption of lab information system. The manual dispatch of reports to the respective wards should stop, rather, the clinicians and staff nurses should be able to see the report on the computer and take their print-outs. This will reduce the post-analytical time which in present study is contributing to the turnaround time.

V. Conclusion

The results of our present study show that a lot can be done to improve the turnaround time of our laboratory. The results of this study were discussed with the management of the institute following which the print-outs of reports of OPD patients are now taken in the sample collection area when the patient comes to collect the report. This has reduced the post-analytical time taken for manual delivery of reports in OPD patients. The biggest impediment for prompt TAT in our setting is the lack of automated facilities for sample transport as we are dependent on manual courier for sample transport which is a pre-analytical cause.

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