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A Study of the Determinants of Turnaround time in Clinical Biochemistry Laboratory

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INTRODUCTION

Medical Laboratory Turnaround Time (TAT) is one of the key quality indicators to measure performance of the laboratory. It is usually defined as the time from when a test is ordered until the result is reported (1). One of the parameters to measure performance of any laboratory is the Turnaround time (TAT). Turnaround time of laboratories is equally important as accuracy and precision of the tests performed by the laboratories when considering their quality of service. Clinicians prefer faster Turnaround times which help them arrive at the diagnosis and start treatment early which can lead to earlier patient discharge, reduced length of stay and is beneficial to the physicians, patients and the hospital management. Studies indicated that up to 80% of medical decisions rely on laboratory test results (2) These parameters can directly influence clinical outcomes and patient satisfaction (3). Clinicians and laboratory personnel define TAT differently. For laboratory personnel, TAT includes the time from the receipt of sample in laboratory to generation of report while to the clinicians TAT means the time of test requisition till the receipt of report. (4) The ultimate aim of the laboratory services is to provide accurate results to the physician at the earliest in order to facilitate treatment. Turnaround time being a complex interplay of factors, brings out the very important concept of critical tests and critical test results. Lundberg more than 40 years ago was one of the pioneers in this issue which has then been reiterated and refined by many international and national organizations down the years (5). As stated by the ISO 15189:2012, "in consultation with its users based on setting, staffing, workload, equipment, material and supplies, the laboratory shall establish appropriate turnaround times for each of its test to determine whether or not it is meeting the established target with regular assessment of the laboratory quality result with TAT"(6). The total laboratory results TAT is influenced due to incompetency of phlebotomy, high workloads, inappropriate workflow, machine breakdown, delay in the maintenance of analysers and computer shutdown. In addition, most laboratories do not stress enough the significance of TAT and give more importance to the accuracy of results. In summary, poor specimen transportation, shortage of resources, lack of knowledge and skills, power supply interruption, poor infrastructure and shortage of supplies are major factors that affect condition of quality laboratory services and TAT (7, 8). Monitoring of the Turnaround time is thus of paramount importance so far as the quality parameters of a laboratory are concerned. Improving TAT is a continuous process. The causes of delayed TAT should be identified and duly addressed on a routine basis with an aim towards a holistic approach for reducing the obstacles to optimise TAT (9). The study was conducted to evaluate the delay and reasons of delay of turnaround time (TAT) of tests in the Biochemistry department of a medical college & hospital in Aurangabad.

MATERIALS AND METHODOLOGY

This was a cross-sectional study done in the Clinical Laboratory Biochemistry department of Government Medical college, tertiary care multi-speciality hospital in Aurangabad, Maharashtra. 57448 samples were received from patients admitted and out patients, over a period of one year from 1st Jan 2020 to 31 st December 2020 were analysed using descriptive statistics. All the routine tests having standard turnaround time, advised by the physicians were performed during the said time period were considered. The routine tests included glucose, uric acid, cholesterol, protein, albumin, AST, ALT, ALP, total bilirubin, direct bilirubin, urea, creatinine, sodium, potassium, chloride, lactate dehydrogenase, triglyceride, HLD cholesterol, LDL-cholesterol, CPK, and Troponin t.

In this study, the total TAT was classified into 3 phases i.e., pre-analytical phase (specimen collection, transport and processing), analytical phase (testing), and post-analytical phase (testing result interpretation to reporting). Inpatient phlebotomies are performed by ward staff, whereas blood specimens from outpatients are collected on site at a centralized collection centre by laboratory personnel. The samples are delivered to the lab by the staff from the wards and laboratory support staff from the OPD, respectively. The ward reports are dispatched to the respective wards after appropriate validation by our laboratory staff. The routine OPD samples are collected in the centralized collection canter for 3 hrs till Noon. The samples are subsequently transported to our laboratory within 1 h by 1PM. These samples are processed and the reports are dispatched the following day to the centralized collection center. The reports are thereafter distributed to the different outpatient departments. The routine ward samples are received by our technical staff in the morning and processed subsequently. After screening of the samples for any pre-analytical errors, the analytical process is commenced. This is preceded by routine maintenance and quality control evaluation. The sample run is initiated after satisfactory quality control results. The same protocol is followed for the OPD samples too. The laboratory staff that is recruited for sample receipt makes entry regarding the time of sample reception by the lab. The samples are numbered

at the reception counter accordingly. The time when these are loaded in the auto analyser to the time when they are finally validated are also documented in the TAT logbook. As the reports are dispatched single handed by our employee so the report distribution is commenced after the entire reporting process is completed. We are presenting the data of TAT of emergency, routine and OPD samples received by our laboratory during a period of one year from 1st Jan 2020 to 31 st December 2020.

RESULTS

There were a total of 57448 samples received from 1st Jan 2021 to 30th Dec 2021 in the Sample Entry Master Register of the Department of Biochemistry were included in the study.

Table 1 shows the distribution of turnaround times for different parameters observed during the period of 1 year. We have not included those instances when the TAT was prolonged due to machine breakdowns or other unforeseen problems like lack of uninterrupted electricity and water supply. The average turnaround time for clinical biochemistry samples from the wards ranges from 4.5 to 5.5 h from the time the samples are received by us to the time the reports are dispatched.

TAT for the OPD samples was 1 day since the reports are dispatched the next day. The patients receive the reports as and when they turn up for subsequent health check-ups.

We have also computed the intra laboratory turnaround time to evaluate our efficacy in generating reports in the laboratory. This will exclude the delays caused due to manual delivery of samples and reports. The turnaround time for the electrolyte samples is approximately 1 h. It is quite evident from the table that the delays caused in TAT are primarily due to the pre- and the post analytical phases. The biggest impediment for prompt TAT in our setting is the lack of automated facilities for sample transport and report dispatch. We are dependent on manual courier for sample transport as well as report dispatch.

Table 1: Contribution of the various phases of sample processing towards the final TAT

		TAT (Total, hrs)	Intra laboratory TAT	Contribution of analytical phase in TAT (approx., %)	Contribution of pre and post-analytical phase in TAT (approx., %)
Ward	Electrolytes	4.5–5.5	1–1.5 h	30	70
	Routine chemistries	4.5–5.5	1.5-2 h	35	65
OPD	Routine chemistries	24	2.5–3 h	15	85
Emergency	Emergency parameters	1–1.5	45 min	50	50

DISCUSSION

One of the most discussed areas of laboratory service is how fast a test result is returned to a caregiver (10). TAT has been described in various 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 [11]. Though studies have been done on the determination of laboratory turnaround time in tertiary care hospitals in India, there is a dearth of such studies in teaching hospitals where the reasons for delayed TAT can be different. Though the reasons for delayed TAT as highlighted in this study were similar to those highlighted in other studies, however, as depicted in other studies were did not note in delays due to instrumentation failure (12). This could be due to the stringent process of Quality control and Inventory management or attributed to the short study period of six months.

The reasons for delay were as follows:

1. Pre-analytical phase:

    a. Communication delay between the treating team and the nursing team

    b. Errors in sample collection by the nursing staff or trainee doctors mostly.

    c. Delay in samples reaching the laboratory.

    d. Delay in screening samples in the laboratory for feasibility of further analysis

2. Analytical phase: No noted delays

3. Post-analytical phase:

a. Shortage of data entry operator in the peak morning hours.

b. Delay in abnormal reports verification

c. Difficulty by the laboratory staffs to reach out to the treating doctors.

Recommendations with an aim to reduce delays in different phases:

1. Pre-analytical phase

a. Training to the trainee doctors on the use of appropriate vials for sample collection and reference document made available in the work stations to improve on the sample collection process.

b. During peak morning hours, the staff of the respective patient care wards were asked to ensure rapid and smooth sample transportation to the laboratory.

c. The hospital management took proactive steps to increase the number of sample carrier boxes with an aim towards infection control practices for carrying blood and urine samples separately.

d. 24X7 sample receiving area with appropriate manning was ensured and backup with adequate and trained staffs provided to ensure that technician shortage was also taken care of to reduce of the delay of screening and processing samples for run test analysis.

2. Analytical Phase

No delays were reported in the analytical phase. It was also essential to ensure effective division of labour among the technicians so that sample processing and reporting occurs smoothly. The staff should be trained to handle urgent samples with utmost care and expedite their processing (13,14,15). The clinical lab biochemistry has a good system of Internal and External Quality Control and maintains its inventory of reagents meticulously which is being monitored by the management on a monthly basis. Commonly used machines have backups. Preventive Maintenance of the Machines as a part of the Comprehensive Maintenance Contract is under supervision.

3. Post-analytical Phase

a. Shortage of clerk was duly addressed by allotting special staff in the morning hours. b. The on call night duty roster for staff and the faculty was enforced to ensure that there is at least one competent authority to verify and abnormal reports c. The hospital management together with active support from the Head of the Department, Biochemistry gave full support with an aim towards improving on the TAT.

Last but not the least, in the second phase the proposal to introduce the Bar coding system with scanner and printer was put forth to the hospital management with an aim to reduce errors and ensure faster sample handling. The recommendation to link up the results reporting with the Short Message Service (SMS) and WhatsApp on the mobiles also contributed for further improvement.

This study brought out the problems in the process which were affecting the TAT of the samples handled by Biochemistry laboratory, and continuous improvement strategies adapted to minimize TAT.

CONCLUSION

TAT has different interpretations for the clinicians and laboratory staff. Improving TAT is a continuous process and we need to have a wholesome approach for reducing the obstacles for optimum TAT.

Pre analytical phase and post analytical phase delays contribute to delayed TAT in hospital settings. Stringent Quality Control measures can avoid analytical phase delays. Recommendations with an aim to reduce the delays with active involvement of the management can be fruitful. We, as clinical biochemists feel disheartened by the demands for faster TATs without any consideration for the procedural demands. It is also an uphill task for us to control extra laboratory factors that affect TAT adversely.

Limitations of the study

The study looked into the Turnaround Time for the samples handled by the Biochemistry department. Though the study, meticulously looked into the reasons for delayed Turnaround time of the samples handled by the Biochemistry department in detail looking into every process step, however, the short span of the study for one year could be a deterrent in unmasking other potential problem areas. Further follow-up studies are needed to analyse the effects of the interventions on the Turnaround time of the samples handled by the Biochemistry department.

Conflict of Interest The authors declare that there is no conflict of interest.

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