A Study of the Determinants of Laboratory Turnaround time in Tertiary Care Teaching Hospital in Bihar

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ABSTRACT

Introduction: The laboratory turnaround time can be commonly defined as the time from when a test is ordered until the result is reported. 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. Studies have highlighted that outcomes in certain situations such as operation theatres and in emergency departments have been affected by timely reporting of laboratory test results. These parameters can directly influence clinical outcomes and patient satisfaction.

Materials and Methodology: This was a cross-sectional study done in the Biochemistry department of a 600 bed tertiary care multi-speciality teaching hospital in Bihar. 2600 samples from patients admitted over a period of 6 months from 1st April 2019 to 30th October 2019 were analysed using descriptive statistics.

Results: The average TAT from test advise by physician to report despatch is 10.68 hours (± 4.16 Standard Deviation) while the average TAT from receipt of samples in the laboratory to report despatch was 7.54 hours (± 2.28 Standard Deviation)

Discussion: This study did a detailed analysis looking into the reasons for delay and bringing forth feasible recommendations towards rectification. This study also looked into the "Critical tests" and the "Critical results" TAT and the reasons for delay therein which was not highlighted in many studies done in Indian settings earlier.

Conclusion: Pre analytical phase and post analytical phase delays contribute to delayed TAT in hospital settings. Recommendations with an aim to reduce the delays with active involvement of the management can be fruitful.

Key Words: Turnaround time (TAT), Critical tests, Critical results, Delay

INTRODUCTION

The laboratory turnaround time can be commonly 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 have highlighted that outcomes in certain situations such as operation theatres and in emergency departments have been affected by timely reporting of laboratory test results. These parameters can directly influence clinical outcomes and patient satisfaction.²

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.³

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The total TAT for laboratory assays includes the entire interval from ordering of the test to the result intimation to the clinician. It takes into consideration the intervals from order requisition to specimen collection, the time required for transport to the laboratory, accessioning in the laboratory, sample processing and additional pre-analytic steps if necessary, sample analysis time, the time from completion of analysis until result verification, and the time it takes for the clinical team to be informed of the result.⁴

TAT may depend on various factors like the type of test performed, priority of the test and clinical status of the patients for which the tests are ordered.⁵

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.⁶

The Joint Commission International (JCI), an independent not-for-profit organization endeavoured to improve patient safety and quality of health care, defines a critical test as "a test that requires immediate communication of result irrespective of whether it is normal, significantly abnormal or critical".

This definition is also used by many organizations such as the Clinical and Laboratory Standards Institute (CLSI) and the Royal College of Pathologists (RCP).

A critical result on the other hand as defined by the JCI is "a test result that is significantly outside the normal range and may represent life-threatening values and thus requires immediate notification to the physician to start medical intervention"⁷

Communication of Critical results is now an integral part of many National and International accreditation procedures for medical laboratories like the International Organization for Standardization (ISO) 15189:2012, the Joint Commission International, 6th Edition Standards effective from 1st July 2017 and the National Accreditation Board for Testing and Calibration Laboratories Standards. Timely notification of critical results is endorsed as one of the leading quality indicators of the post-analytical phase by the Working Group "Laboratory Errors and Patient Safety" (WG-LEPS) of the International Federation of Clinical Chemistry and Laboratory Medicine (IFCC).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 ad-

dressed 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 teaching medical college in Bihar.

MATERIALS AND METHODOLOGY

This was a cross-sectional study done in the Biochemistry department of a 600 bed tertiary care multi-speciality teaching hospital in Bihar. 2600 samples from patients admitted over a period of 6 months from 1st April 2019 to 30th October 2019 were analysed using descriptive statistics. The study was approved by the Institutional Ethics Committee. We collected the date which was entered in an excel spreadsheet. The data was analysed using the statistical software SPSS (Version 21).

All the routine tests having standard turnaround time and advised by the physicians of the Medical College and performed in the Biochemistry department during the said time period were considered. Rare tests which do not have standard turnaround time and are not done in the Biochemistry department or done through outsourced laboratory services were not considered.

The routine tests included hematology, plasma total calcium, glucose, uric acid, cholesterol, protein, albumin, AST, ALT, ALP, total bilirubin, direct bilirubin, phosphorous, magnesium, urea, creatinine, gamma-glutamyl transferase, sodium, potassium, chloride, total CO₂, amylase, lipase, lactate dehydrogenase, triglyceride, HDL cholesterol, LDL-cholesterol, C-reactive protein, CPK, CPK-MB, iron, and TIBC.

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).

The process flow from test advice by the physician to reporting the results is depicted in **Figure 1**.

RESULTS

There were a total of 2876 samples from 1st April 2019 to 30th October 2019 in the Sample Entry Master Register of the Department of Biochemistry of which 2600 samples (90.43%) were included in the study. 276 samples (9.57%) were not included in the study as those were rare tests or were outsourced. 1370 (52.7%) of the samples were from female patients while 1230 (47.3%) of the samples were from male patients. This is depicted in **Figure 2**. The average age of the patients whose samples were included in the study were 42.36 years ($\pm$ 12.24 Standard Deviation) and range from 1

month to 80 years.

The average TAT from test advise by physician to report despatch is 10.68 hours(± 4.16 Standard Deviation) while the average TAT from receipt of samples in the laboratory to report despatch was 7.54 hours (± 2.28 Standard Deviation)

Out of 2600 samples, 2295 samples (88.27%) complied with the standard TAT while 305 samples (11.73%) did not comply with the standard TAT. This is depicted in **Figure 3**.

Of the 305 samples which did not comply to the TAT, pre-analytical phase delay was the reason for failure to comply with the TAT in 164 (53.77%) samples, post analytical delay was the reason for failure to comply with the TAT in 122 (40.0%) samples while both pre-analytical and post analytical phase delay was the reason of failure to comply with the TAT in 19 (6.23%) samples. The same is depicted in **Figure 4**.

The average TAT for Critical results were 24.28 mins (± 2.26 Standard Deviation).

DISCUSSION

One of the most discussed areas of laboratory service is how fast a test result is returned to a caregiver.¹⁰ 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.¹¹ This could be due to the stringent process of Quality control and Inventory management or attributed to the short study period of six months. Moreover, this study did a detailed analysis looking into the reasons for delay and bringing forth feasible recommendations towards rectification. This study also looked into the “Critical tests” and the “Critical results” TAT and the reasons for delay therein which was not highlighted in many studies done in Indian settings earlier.

The reasons for delay were as follows:

1. Pre-analytical phase

- Communication delay between the treating team and the nursing team
- Errors in sample collection by the nursing staff or trainee doctors mostly
- Delay in samples reaching the laboratory
- Delay in screening samples in the laboratory for feasibility of further analysis

2. Analytical phase

No noted delays

3. Post-analytical phase

- Shortage of Typist specially in the peak morning hours.
- Delay in abnormal reports verification by Bio-chemists
- Failure by laboratory staffs to intimate “Critical tests” and “Critical results” to the treating team as per hospital protocol.
- Difficulty by the laboratory staffs to reach out to the treating team to intimate “Critical tests” and “Critical results” to the treating team as per hospital protocol.

Recommendations with an aim to reduce delays in different phases:

1. Pre-analytical phase

- Incorporation of the allocated staff nurse during physician rounds and starting physician handoff forms to strengthen physician communication between shift changes. To continue with the existing process of bed-side shift handover for the nursing staffs. An extra column for investigations advised by the treating team with their pending status was added in the display board in every ward.
- Training imparted to the staff nurses and the trainee doctors on the use of appropriate vials for sample collection and reference document made available in the work stations.
- The concept of ward rounds by the phlebotomists was initiated at 6 AM, 10 AM, 2 PM and 6 PM to improve on the sample collection process.
- A red coloured “URGENT” sticker was introduced and the staff nurses, the trainee doctors, the runner boys and the laboratory staffs were trained on the use and the implications of the sticker which needed to be processed on an urgent basis.
- During peak morning hours, the nursing in-charges of the respective patient care units were asked to liaison with the Housekeeping supervisors of the respective floors to ensure rapid and smooth sample transportation to the laboratory.
- The hospital management took proactive steps to increase the number of sample carrier boxes with an aim towards infection control practices for carrying blood, urine and stool samples separately.
- 24X7 sample receiving area with appropriate manning was ensured by the hospital management 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 analysis.

2. Analytical Phase

No delays were reported in the analytical phase.

The hospital has a good system of Internal and External Quality Control and maintains its inventory of reagents meticulously which is being monitored by

the hospital management on a monthly basis. Commonly used indispensable machines have backups. Preventive Maintenance of the Machines as a part of the Comprehensive Maintenance Contract is under direct supervision of a dedicated in-house Biomedical Engineer appointed for the Laboratory equipment.

3. Post-analytical Phase

- Shortage of typists were duly addressed by recruitment of a typist in the morning hours.
- The on call night duty roster for Post Graduate students and the faculty was enforced to ensure that there is atleast one competent authority to verify and abnormal reports even at night.
- The clinical and the laboratory staffs were trained on the "Critical tests" and the "Critical results" and the hospital policy on reporting the same to the treating team together. The list of "Critical tests" and "Critical results" were made available in the computers in the Nursing stations and the Laboratory for ready reference of the involved staffs.
- Laboratory staffs were retrained on the documentation of result reporting to treating team for the "Critical tests" and the "Critical results".
- The nursing staffs and the trainee doctors were trained on the hospital protocol of acting upon a "Critical test" and a "Critical result" once intimated from the laboratory.

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 handing. The recommendation to link up the "Critical test" and the "Critical results" reporting with the Short Message Service (SMS) alert of the departmental service mobiles is also under consideration for further improvement.

The study brought out the problems in the process which were affecting the TAT of the samples handled by the Biochemistry laboratory.

CONCLUSION

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.

Limitations of the study

The study looked into the Turnaround Time for the samples handled by the Biochemistry department only and rare and outsourced tests were excluded.

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 three months 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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Figure 1: Process flow of samples from advice to reporting.

Figure 2: Sex Distribution of the Samples.

Figure 3: Percentage of Standard TAT Compliance.

Figure 4: Types of Delay in failure to comply with the Standard Turnaround Time.