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ORIGINAL ARTICLE

Turn Around Time (TAT) as a Benchmark of Laboratory Performance

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Abstract Laboratory analytical turnaround time is a reliable indicator of laboratory effectiveness. Our study aimed to evaluate laboratory analytical turnaround time in our laboratory and appraise the contribution of the different phases of analysis towards the same. The turn around time (TAT) for all the samples (both routine and emergency) for the outpatient and hospitalized patients were evaluated for one year. TAT was calculated from sample reception to report dispatch. The average TAT for the clinical biochemistry samples was 5.5 h for routine inpatient samples while the TAT for the outpatient samples was 24 h. The turnaround time for stat samples was 1 h. Pre- and Post-analytical phases were found to contribute approximately 75% to the total TAT. The TAT demonstrates the need for improvement in the pre- and post-analytical periods. We need to tread the middle path to perform optimally according to clinician expectations.

Keywords Turn around time · Pre analytical · Analytical · Post analytical · Laboratory

Introduction

Accuracy, precision, timeliness, and authenticity are the four pillars of efficient laboratory services. We, clinical biochemists sometimes overlook timeliness as an important attribute and instead concentrate on improving the analytical intricacies of sample processing. However, timeliness which is expressed as the turnaround time (TAT) is often used by the clinicians as the benchmark for laboratory performance. Clinicians depend on fast TATs to achieve early diagnosis and treatment of their patients and to achieve early patient discharge from emergency departments or hospital in-patient services. Hence faster TATs have a role in curtailing general expenditure incurred by the exchequer. Delayed TATs also increases the frequency of duplicate samples sent to the laboratory. This further increases the workload on the laboratory. Assessment and improvement of turnaround times is essential for laboratory quality management as well as ensuring patient satisfaction.

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 the TAT [1]. There are many factors which are beyond the jurisdiction of the laboratory which influence TAT. Such non-analytical delays may be responsible for up to 96% of total TAT [2]. The present study was undertaken to evaluate the current turnaround times for our inpatient, outpatient and emergency samples. The study also attempts to evaluate the contribution of analytical versus the pre- and post-analytical phases of processing towards the turn around time.

Materials and Methods

Govind Ballabh Pant Hospital (GBPH) is a tertiary care super specialty center in Delhi specializing in cardiology, cardiothoracic surgery, neurology, neurosurgery, gastroenterology, gastro surgery and psychiatry. It is a 600 bedded hospital offering specialized medical and surgical treatment to about 300,000 patients in the OPD and 19,000

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patients in the general and private wards every year. The clinical biochemistry department is equipped with state of the art autoanalyser with ISE—Olympus AU 400(Hamburg, Germany), electrolyte analyzer-Ecolyte (Ecshweiler, Germany), automated coagulometer-ACL 7000 (Instrumentation Laboratory, USA) and other ancillaries for sample processing. Inpatient phlebotomies are performed by clinical department staff, whereas blood specimens from outpatients are collected on site at a centralized collection center by laboratory personnel. The samples (both routine and stat) are delivered to the lab by the paramedical 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 center for 3 h 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. However, the (Prothrombin time) PT OPD samples are analyzed and the reports are handed over to the patients the same day. The stat samples are processed promptly and run on stat mode to deliver the reports at the earliest.

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 QC is run after a batch of every 50 samples to identify any intra assay fluctuations (bracketed QC). 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. This is strictly on first come first serve basis. The samples are numbered at the reception counter accordingly. The time when these are loaded in the autoanalyser to the time when they are finally validated are also documented in the TAT logbook. As the reports are dispatched single handedly by our employee so the report distribution is commenced after the entire reporting process is completed. We are presenting the data of TAT of routine, stat and OPD samples received by our laboratory during a period of August 2008–July 2009.

Results

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 Prothrombin time samples is 30 min and for the electrolyte samples is approximately 1 h. The TAT for stat samples is 1 h as the samples are run on stat mode and the reports are collected by the patient attendants. 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.

Discussion

The clinicians are dependent on laboratory services for the initiation and evaluation of treatment modalities. It is hence our prerogative to ensure timeliness. It is evident from the results of our study that there is a lot of scope for the improvement of turnaround time in our setting. The perception of us, clinical biochemists regarding laboratory efficiency has undergone tremendous change over the last couple of years. We understand that the pre- and post-analytical phases are equally important for the laboratories more so where TAT is concerned.

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 [3]. The term therapeutic TAT is describes the interval when a test is requested to the time some therapeutic decision is taken [4]. TAT can be classified as pre-analytical, analytical and post-analytical depending on the different phases of sample processing [5].

Our study demonstrates that the average TAT for the emergency and the outpatient PT samples is being maintained at 1 h. The analytical and the pre- and post-analytical phases confer equally towards the TAT in this case. On the contrary, reporting of the stable in patients as well as the patients attending OPD services takes 4.5–5 h on an

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

		TAT (Total, h)	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
	Prothrombin time	4.5–5.5	30 min	15	85
	Routine chemistries	4.5–5.5	1.5–2 h	35	65
OPD	Prothrombin time	1	30 min	50	50
	Rest of the chemistries	24	2.5–3 h	15	85
EMERGEN.	All parameters	1–1.5	45 min	50	50

average; when the pre- and the post-analytical phases contribute up to 76.25% as compared to 50% in the above situation. This suggests that when the pre- and the post-analytical phases are streamlined, then TAT can be controlled in a better way as compared to the present scenario where the analytical phase is bestowed with the responsibility of ensuring speedier reporting.

There are different ways in which each of the phases—pre, analytical and post-analytical phases can be expedited in order to achieve optimum turnaround time. The pneumatic system is a path breaking innovation that has revolutionized sample transport. Many studies have proven the efficiency of this mechanism in reducing inadvertent delays as a result of human courier [6]. One study found that inclusion of a pneumatic tubing system led to a significant reduction of TATs [7]. The other means of minimizing pre-analytical delays are adoption of ideal phlebotomy practices, bar coding of samples and computer generated requisition slips. All these practices will reduce the delays that are incurred as a result of illegible slips and faulty sample collection techniques. Use of gel vacutainers can reduce the delays that are caused during centrifugation. The analytical phase can be streamlined by complete automation of laboratories, use of machines with higher throughputs, use of plasma or whole blood samples, primary tube sampling, ensuring minimal downtime and adequacy of backup, adoption of efficient quality control procedures, automatic dilutions in case of results exceeding linearity, prompt validation of reports etc. It is also essential to ensure effective division of labor 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 [8–10]. The post analytical phase can be dramatically improved with the adoption of laboratory information services (LIS). This will abolish transcriptional errors and delays caused in report dispatch to the respective wards. In situation like ours, the report delivery can be speeded up by the deployment of additional personnel for this task [11]. The other strategies that may be adopted are prompt information to the wards regarding critical values and pre-analytical errors so that repeat samples are processed without much ado. There is a pertinent need to devise transparent and effective communication system between the clinicians and laboratorians [12].

It is clear from our critical self-appraisal of our laboratory services that we have improvised the analytical phase by automation, elaborate documentation and communication of critical values and recruitment of trained laboratory personnel. There is a scope of further improvement in our turn around time by initiating administrative machinery for acquiring state of the art pneumatic tube delivery system and LIS.

Conclusions

Despite rapid improvements in sample delivery, processing and report dispatch as a result of technological advancements, TAT continues to be a bone of contention between the clinicians and laboratorians. 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. We need to adopt a pragmatic approach for reducing the hindrances for optimum TAT. At the same the clinicians need to accept and recognize the inherent complexities of sample processing and give us the necessary breathing space.

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