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RESEARCH ARTICLE

STRATEGIES FOR IMPROVING OPERATIONAL EFFECTIVENESS IN THE CLINICAL LABORATORYAT KING FAHD ARMED FORCES HOSPITAL (KFAFH)

Badr Almuafa, Ohood Saleh Almalki, Dareen Abdullah Alqrni, Fayza Omar Albarnawi, Abdullah Abdulrahman Alshahrani, Abdullah Alhadhrami, Adil Soliman Alsharif, Qusai Shoaib, Fadi Alshaikh, Ibrahim Rajab, Mohammed Alqarni, Awaad Helal Almalki, Mohammed Abdulhade Alshehri, Bander K. Al-Amari and Ammar Al-Roqy

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Abstract

Background: Laboratory turnaround time is considered one of the most important indicators of work efficiency in hospitals. Physicians always need timely results to make effective clinical decisions, especially in the emergency department. These results can guide physicians to admit patients to the hospital, discharge them home, or do further investigations.
Objectives: To reduce troponin turnaround time (TAT) to less than 60min using coordinated process improvement methods
Methods: A retrospective study in the ED Laboratory at King Fahd Armed Forces Hospital (KFAFH). A team of lab specialists conducted a Root cause analysis with the Fishbone diagram and applied Focus PDCA to the process. The time taken from receiving the test to the release of results in minutes was considered the Turnaround time (TAT) for the Trop I test.
Results: The average TAT time was brought down from 101 minutes to consistently less than 35 minutes by September 2019.
Conclusion: With an interdisciplinary team of healthcare professionals, the Turnaround time for troponin Iwas successfully reduced in our Emergency Department by 70% in 2019.

Introduction:-

Troponin T is a critical cardiac biomarker for ACS (Acute Coronary Syndrome). [1] A timely diagnosis depends on an efficient testing process. The turnaround time of this test is, therefore very, vital for the diagnosis and subsequent intervention.

TAT (turnaround time) may be defined in different contexts according to the settings. Literature has seen TAT classified by test (e.g., Troponin), priority (e.g., urgent or routine), population served (e.g., inpatient, outpatient, ED), and the activities included. This last area is the greatest source of variation in reporting of TAT. [2–5]

The steps in performing a laboratory test were outlined by Lundberg, who described the brain-to-brain TAT or "total testing cycle" as a series of nine steps: ordering, collection, identification, transportation, preparation, analysis, reporting, interpretation, and action. [2,6]The term "therapeutic TAT" is sometimes used to describe the interval between when a test is requested to the time a treatment decision is made. Although the laboratory can and perhaps

Corresponding Author:- Badr Almuafa

should be involved in all these steps, many laboratories restrict their definition of TAT to intra-laboratory activities, arguing that other factors are outside their direct control and that timing data for extra-laboratory activities are not readily available. Such an approach will necessarily underestimate TAT since non-analytical delays may be responsible for up to 96% of total TAT. In the ED, delay in the review of results by clinicians is the greatest component of perceived TAT.

Intra-laboratory TAT can also vary in its definition with possible start points of sample receipt time, registration time, or analytical sampling time and end points of analytical completion time, result verification time, result transfer to electronic medical record time and report printing time.Another classification of time periods separates the steps into the pre-analytical (order to preparation), analytical (analysis) and post-analytical (reporting to action) phases. These divisions have often been used when classifying errors and delays and are sometimes used for description of TAT.

In particular, hsTnI test is a powerful tool in the diagnosis and management of acute myocardial infarction (AMI) and the delay of delivering results has its impact on a long waiting time in ER department. The purpose of this study was to reduce TAT for Troponin test to 35 minutes although the lab department policy and procedure guidelines for stat troponin is 60 minutes from time of receiving the specimen in lab reception

Methodology:-

The study was performed in the Laboratory department at King Fahd Armed Forces Hospital (KFAFH). The lab was facing a serious issue of long waiting time to obtain STAT Troponin test results in 2017. Receiving 14485 high sensitivity Troponin I (hsTnI) stat samples per year from Emergency Department, the TAT was an average of 101 minutes in 2017.

For better understanding of our shortcomings, all current practices, processes, and systems at the laboratory were analyzed initiallyby brainstorming and using fish-bone diagram to identify the related root cause to problem (figure 1).

Further, a FOCUS PDCA method of quality improvement was applied to this project(figure 2) after brain storming and fishbone analysis were carried out. Baseline assessment included a review of the patient's turnaround time from receiving sample until release. The project was conducted from with ongoing performance measures monitoring weekly, followed by interventions and action plans accordingly.

A flow chart was drafted to determine the steps of the process. Manual entering order, log book and spinning time of samples were the main suggested causes of delaying results, followed by other less important causes such as, equipment, supplies and lack of trained staff (figure3).

A team was assembled consisting of Lab specialists in order to execute the proposed action plan. The team was headed by the Supervisor of ED LAB. The first action taken was to implement laboratory information system (LIS). This system includes the elimination of (log book, entering order and labeling).

This was followed by decreasing the spinning time (centrifuge) by using rapid tube tests (from 10 to 3 minutes). Thirdly, a series of staff training and education for action plan was conducted. And lastly, the flow chart process was redesigned.

Data collection and analysis was done on a weekly basis to make sure not exceed target. Monthly meetings for the team were conducted to study the data.Assessment of the current flow chart processes were done. The outcome measuresselected were patient satisfaction and length of stay.

The process measure was taken as time calculated by the following equation:

(Test released time – Test received time)*60

All data was extracted from oasis system by using business object program, andall statistical analysis were performed by using software Microsoft Excel.No conflict of interest or confidentiality issues pertains to patients

Results:-

The first step in the process improvement project was the brainstorming and fishbone analysis. The most common manpower issues turned out to be a lack of lab technician or phlebotomist, and absence of physician order. In methods, it was noticed that the lab was not following Extended Coagulation Profile (PPG), many unnecessary steps were being followed and that the handling was not proper. Difficulty in transportation of the samples, distance and rounding constituted the environmental factors. In materials and machines, the shortage in lab supply, types of tubes, labeling and barcode generation, stat equipment, system training and communication were causative of long TAT.

What / Intervention	Who	When
Transfer manual paper request to electronic ordering (LIS)	IT & Lab Dep	March 2018
Training & orientation on a new software (LIS)	ED physicians	April 2018
Training ED nurses to collect blood new tube	Lab & ED Dep	Jan 2018
Training ED lab staff	ED lab Dep	September 2018
New SOP creation, flowcharts for workflow	ED lab Dep	November 2018
Continues improvement by PDCA (simple & effective approach for solving problem and managing change)	ED lab & ED dep	2019 TO 2021

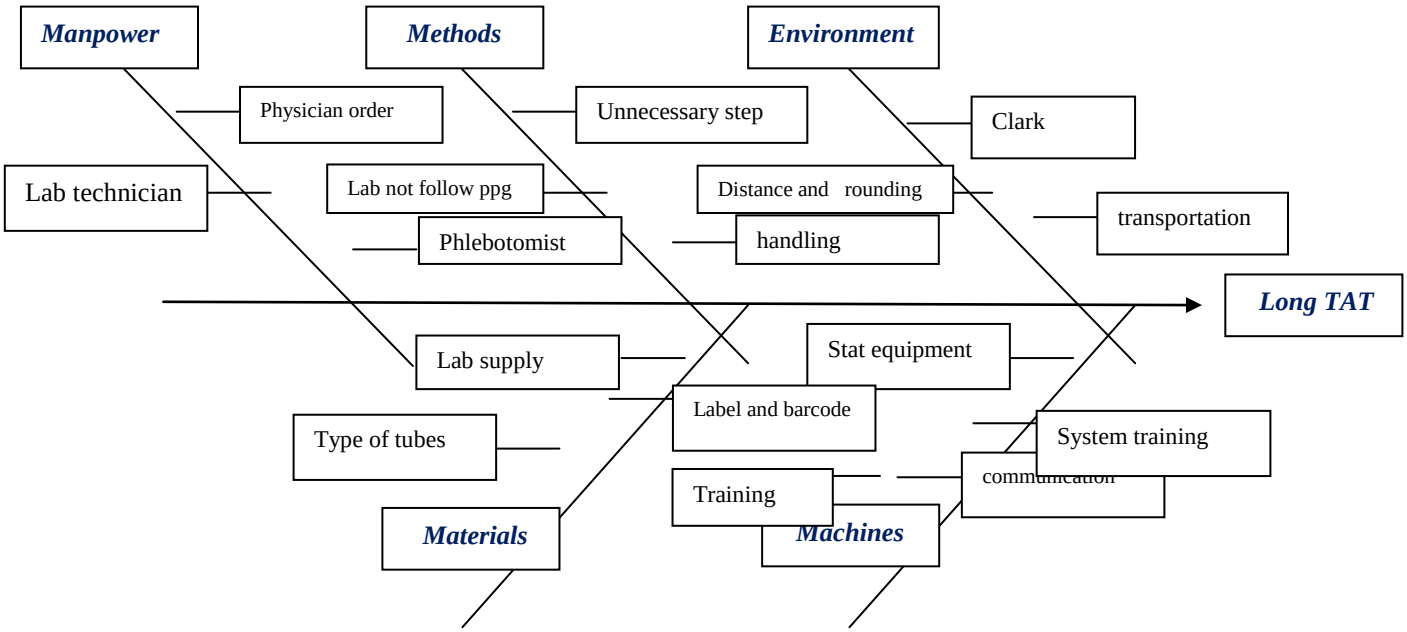

Figure 1:- Fishbone Tool.

Focus PDCA was planned and the actions implemented (Figure 2). The team of Lab specialists collaborated with IT and ED physicians along with the Central and ED Lab staff. It was construed that all paper orders would be transferred to electronic ordering, training and orientation would be given on the new software use and ordering, ED phlebotomists would be trained to collect in the new tubes while ED lab staff would be trained on how to use the new machines. New SOPs were created and flowcharts for workflow reset (Figure 3).

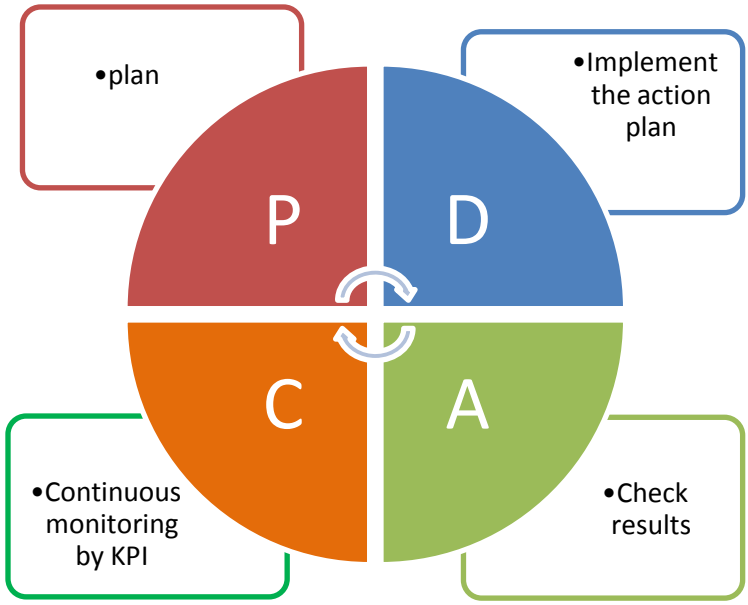

Figure 2:- PDCA cycle.

The new flowchart directed the blood collection by phlebotomist following physician manual order. The porter would transport this in batches and the lab would receive the samples with a mandatory request form. This was noted in the log book in the reception and the order entered into the system. Once labeling was completed, the sample would be centrifuged for 10 minutes an analyzed. If the results were abnormal, they were immediately informed to the physician and then report released.

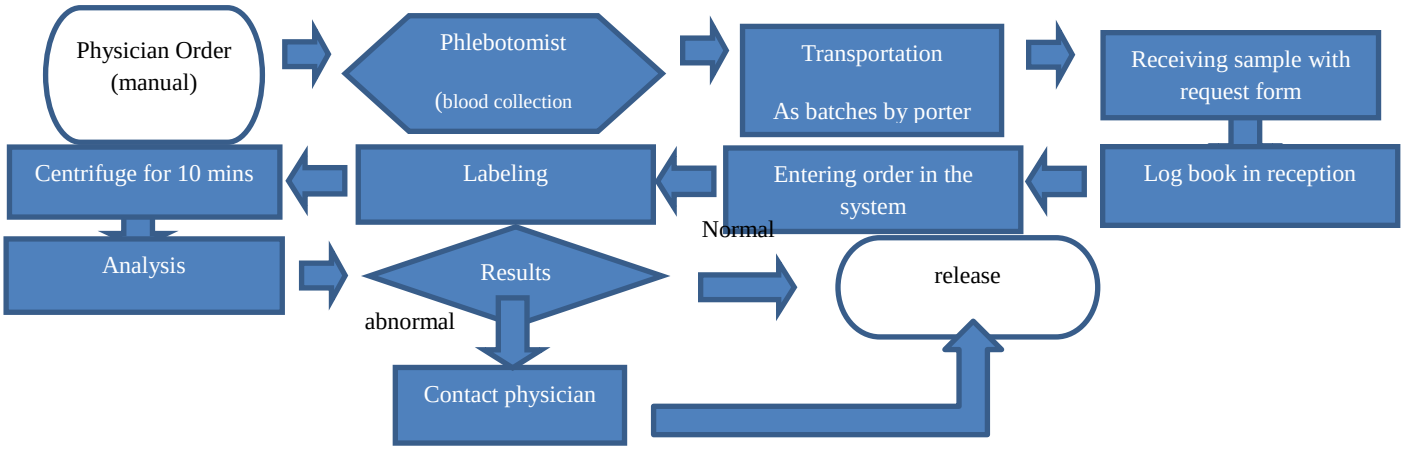

Figure 3:- Flow chart.

Following these methods, the average time taken for the Troponin I test to be released came down from an average of 35minutes to 30.6 minutes in September gradually. (Figure 4) Although the lab department policy and procedure guidelines for stat troponin has always been 60 minutes from time of receiving the specimen in lab reception, the target was set at 35 minutes and the best achieved time was an average of 30 minutes.

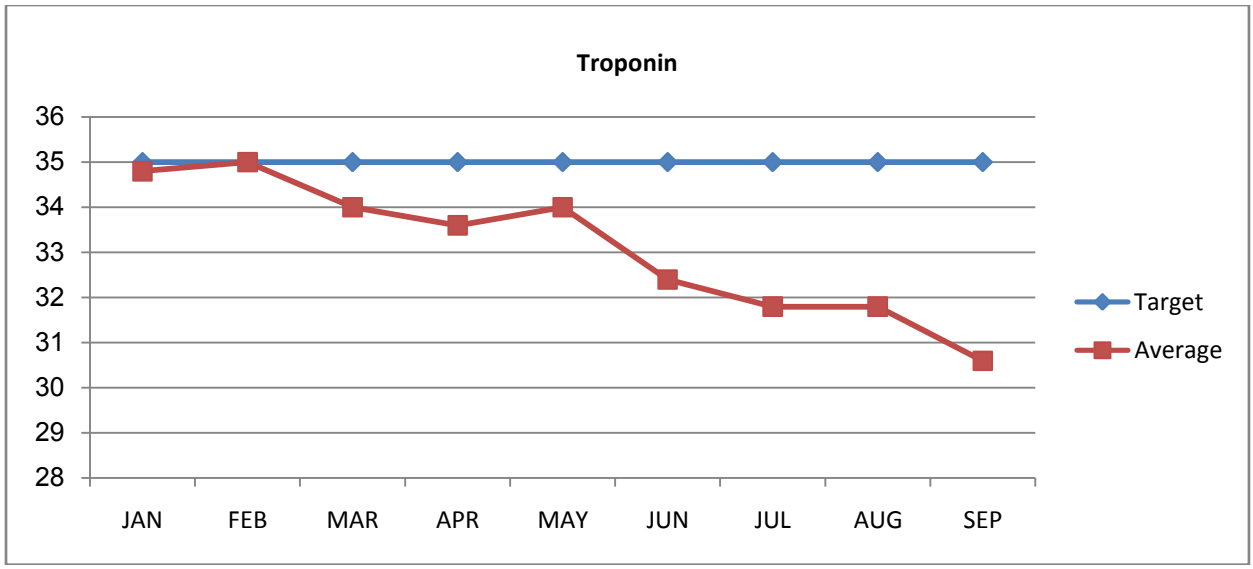

Figure 4:- Average time taken for Trop T test from January to September 2019.

Earlier, from 2017, the average TAT was 101 minutes. Comparison shows a very positive impact on the ED lab. The improvement project brought the TAT time down to 30 minutes by September 2019, which was a reduction by 70%. A significant impact on the length of patient stay in ER department was also seen because of the reduction in TAT time as there was early diagnosis and prompt intervention. This was a big change and a commendable achievement by the quality team. (Figure 5)

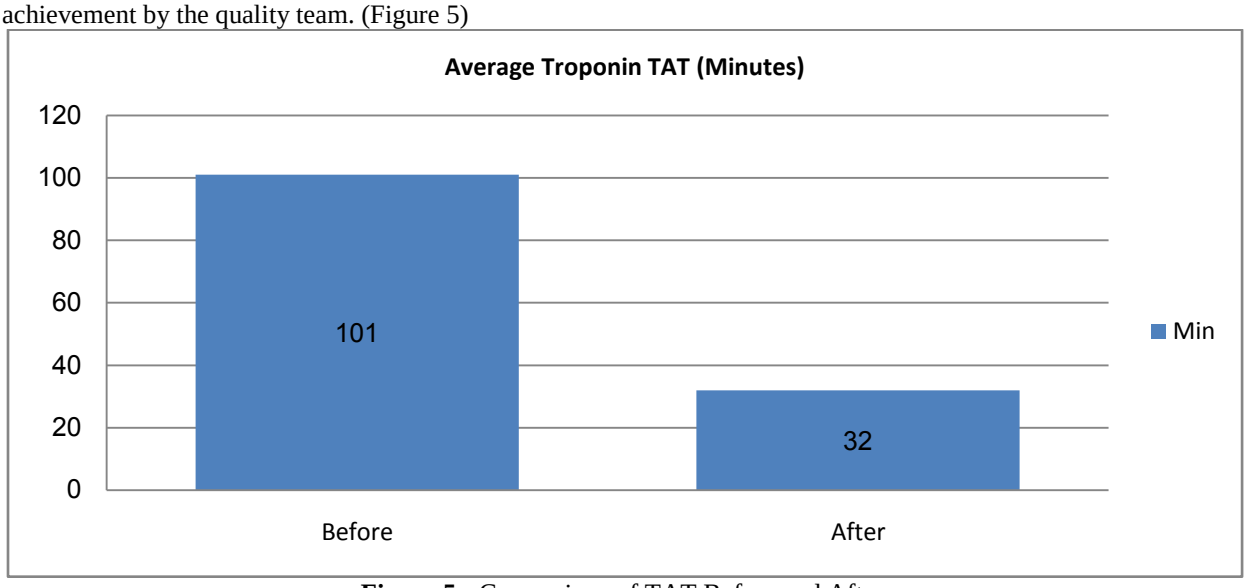

Figure 5:- Comparison of TAT Before and After.

Discussion:-

Decreasing the TAT time for troponins has long been explored in the healthcare scenario. Heart disease, being a critical condition causing nearly 25% deaths worldwide is one of the most common emergencies in any ED.[7]There lies a grave need to get these results on time and therein does TAT play a pivotal role, carrying the responsibility of decision-making and prompt intervention by its value.

Troponin cardiac biomarkers are a diagnostic test used in the detection of cardiac-specific cell injury in patients suspected of having cardiac conditions. Earlier work focussed on Troponin T. Recent studies have however shown that Troponin I is a better cardiac marker essentially and thus the TAT for this parameter is more crucial for the ED.[1,13–15]

Vasani et al, Sullivan et al and Benjamin et al used the lean six sigma methodology to bring down the TAT times for Troponin T. [8–10] They managed to see an increase in compliance rate from 86% to 95% in the first, reduced troponin T TAT by 33 minutes from 86 to 53 minutes in the second and brought it down to 33 minutes in the third. In our study a similar result was achieved by the simple techniques of Focus PDCA, which managed to put the issues into perspective. Where the RCA in Vasani's study mainly showed that Delay in stat troponin TAT because routine and stat tests are loaded at the same time on the analyzer, in the present study, lack of manpower training on the utilization of newer equipment was the main issue. Once the paperwork was converted to an electronic method and staff trained for the same, the overall TAT came down drastically. A similar effect was seen in a study by Jensen et al, where the barcoding system was initiated and staff trained for the same. [11]

Also a process shift was initiated, similar to the many studies involving the Laboratory TATs. Where most studies used a lean sigma methodology, our study seems to be unique in using a Focus PDCA as a tool for improving cardiac marker turnaround time. [8–10,12] With the increasing patient load in the ED, the load of patients also increases in the lab. This can cause prolonged laboratory TAT which may in turn delay the recognition of conditions in their acute phase, potentially affecting clinical decision-making and the prompt initiation of treatment. In our project, we were able to decreas the TAT times despite the increase in volume of samples received.

Limitations

All data was obtained from the IT department. However, other measures could have been used for better assessment of the effectiveness of our current system like time from registration in ED until diagnosis, which was not possible to be obtain from the IT department**.**

Conclusion:-

Our project showcased the importance of having an efficient system for testing critical lab values, such as Troponin I which is regularly sought in the ED for crucial cases such as myocardial infarction. Delay in the getting the value leads to delayed diagnosis and could even lead to death of the patient. Early diagnosis and prompt intervention is the protocol in such medical ailments.

With the collaborative effort of an interdisciplinary team of health care professionals, the Turnaround time for troponin I was reduced by 70% for patients in our Emergency Department in 2019. There was a consistentachievement of delivering laboratory results in less than 35 minutes. This was a major shift from 101 minutes and was achieved by using RCA and Focus PDCA, with a diligent charting of the process flow.

This project for quality improvement has also positively impacted other processes in the ED. The staff have discussed to extend the methodology for more lab parameters as well as radiological results.

Recommendations:-

Our project recommends a more intensive study of root causes of delay and management support to eliminate them. Other laboratory or radiological critical tests such as platelet levels for stroke patients, ECG in ACS, KUB for renal pain and so on may also be evaluated to bring down the turnaround times.

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