ORIGINAL ARTICLE

HIGH SENSITIVITY TROPONIN T: AN AUDIT OF IMPLEMENTATION OF ITS PROTOCOL IN A DISTRICT GENERAL HOSPITAL

Shahid Kalim, Shaista Nazir*, Zia Ullah Khan**

Department of Cardiology, *General Medicine and Endocrinology, **General Medicine, Alexandra Hospital, Worcestershire Acute Hospitals NHS trust, Redditch, Worcestershire, United Kingdom

Background: Protocols based on newer high sensitivity Troponin T (hsTropT) assays can rule in a suspected Acute Myocardial Infarction (AMI) as early as 3 hours. We conducted this study to audit adherence to our Trust's newly introduced AMI diagnostic protocol based on paired hsTropT testing at 0 and 3 hours. **Methods:** We retrospectively reviewed data of all patients who had hsTropT test done between 1st and 7th May 2012. Patient's demographics, utility of single or paired samples, time interval between paired samples, patient's presenting symptoms and ECG findings were noted and their means, medians, Standard deviations and proportions were calculated. **Results:** A total of 66 patients had hsTropT test done during this period. Mean age was 63.30±17.46 years and 38 (57.57%) were males. Twenty-four (36.36%) patients had only single, rather than protocol recommended paired hsTropT samples, taken. Among the 42 (63.63%) patients with paired samples, the mean time interval was found to be 4.41±5.7 hours. Contrary to the recommendations, 15 (22.73%) had a very long whereas 2 (3.03%) had a very short time interval between two samples. A subgroup analysis of patients with single samples, found only 2 (3.03%) patient with ST-segment elevation, appropriate for single testing. **Conclusion:** Our study confirmed that in a large number of patients the protocol for paired sampling or a recommended time interval of 3 hours between 2 samples was not being followed.

Keywords: Myocardial Infarction, Troponin T, chest pain, Arrhythmias, Cardiac

J Ayub Med Coll Abbottabad 2013;25(3-4):9–11

INTRODUCTION

Diagnosis of Acute Myocardial Infarction (AMI) has been a challenge to the clinicians and an on-going effort has been devoted to diagnose it in the early stages to prevent myocardial damage. Initially Creatinine Kinase-MB (CK-MB) was used as a cardiac biomarker for the detection of AMI.[1] Later on it was replaced by Troponin T because of its high sensitivity and specificity resulting in widespread use of its different isotopes in the form of Troponin T and I for the last several years.[2]

Old troponin T has a generic fault of needing 6 and 12 hours levels to diagnose an AMI, which means patients practically need to stay in-hospital for 12 hours, before discharging them confidently as low risk for AMI.[2] This resulted in an effort to develop a quicker mean of diagnosing AMI, which culminated in the form of development and utility of high sensitivity Troponin T.[3] This high sensitivity troponin T has the ability to detect Troponin rise within 3 hours and patients who are negative for troponin T can be safely discharged as low risk for AMI because of its high negative predictive values.[4]

Our Trust and Hospital also wanted to join this move of rapidly diagnosing AMI via hsTropT based AMI protocol. So, they developed and introduced a new local hsTropT based AMI diagnostic protocol (Figure-1). This protocol was derived from various studies[3,5] and its magnitude of difference in paired samples, for labelling patients as AMI, was determined by local community survey. An extensive education of junior and senior doctors regarding this new diagnostic approach was arranged for several months prior to implementation of this protocol on 4th April 2012.

However, after several months of it implementation it was generally being felt that this protocol is not being followed properly. We decided to test whether there had been any real adherence issues to this protocol in the past in our setting. Therefore, we planned this retrospective compliance study with the main aim to look at the frequency of adherence to this protocol.

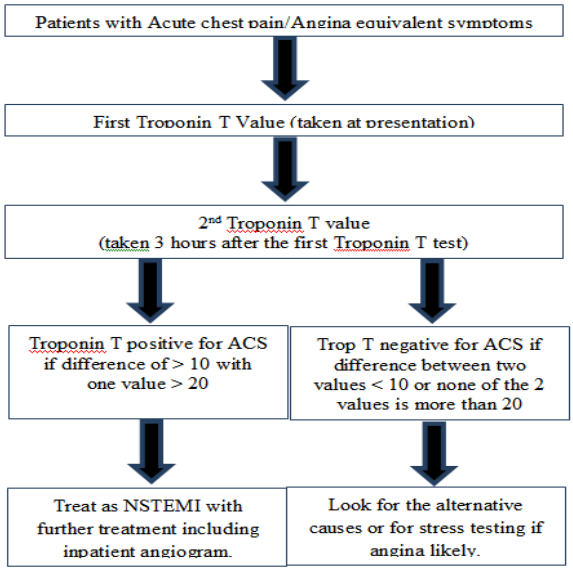

Figure-1: Protocol being used at our hospital for the diagnosis of AMI

MATERIAL AND METHODS

This retrospective study was undertaken in Alexandra Hospital Redditch, a District General Hospital (DGH) in the United Kingdom. We checked records to determine the practices four weeks after implementation of this protocol, giving an addition four weeks' time for adaptation, with a view that all the information must had been well conveyed till that time and a good compliance should be present.

Therefore, charts of all of the patients who had their hsTropT test done during 1st to 7th May 2012 were included in this study. Data collected included demographic profile, total number of hsTropT samples, time interval between paired samples, symptoms and ECG findings. Data was then divided into three subsets: 1. Good compliance with Protocol: Time interval of 3–5½ hours in between 1st and 2nd hsTropT tests, 2. Too Early: Time interval between 2 tests <3 hours, and 3. Too Late: Time interval between 2 tests >5½ hours.

The value of 5½ hours was provisionally selected, as hsTropT value at 6 hours would lose its advantage over standard Troponin T for diagnosing AMI early. Data were analysed using IBM-SPSS-20.

RESULTS

Troponin T assays were requested in 66 patients. A Mean age was 63.30±17.46 years and 38 (57.57%) were males. In 24 (36.36%) patients, only single rather than protocol recommended paired hsTropT assay was requested showing a non-compliance with this protocol.

Among those 42 (63.63%) patients with paired hsTropT assays, a mean time interval between 1st and 2nd troponin T was found to be 4.41±5.7 hours with median of 3.11 hours. However, in 17 (25.76%) the recommendation time interval of 3 hours was not followed with 2 (3.03%) having it too soon and 15 (22.73%) had it too late (Table-1).

In order to identify possible causes of non-compliance to the protocol in patients with single samples, further analysis of the presenting symptoms and ECG findings were made and shown in Figure-2. In 16 (24.24%) the nature of their chest/abdominal pain was atypical for cardiac pain and their ECG was either normal 13(19.7%), or showed an arrhythmia 2(3.03%), or an ST-segment elevation 1(1.52%). In an addition 1(1.52%), ECG showed an ST-segment elevation and symptoms were typical for cardiac chest pain. However, except for 2 (3.03%) of the ST-segment elevation patients where use of single sample seemed appropriate, in rest of 15 (22.73%) patients use of this single assay was inappropriate.

In the remaining 7(10.61%) patients with single troponin values, no reason for this inappropriate testing could be deduced from the data. This included 4 (6.06%) where data could not be retrieved and another 3 (4.54%), where pain was found to be typical and ECG was either normal 1 (1.52%), or showed ST-segment depression 1(1.52%), or arrhythmia 1(1.52%), which would have otherwise culminated into sending a second hsTropT sample to confirm a diagnosis of AMI due to high index of suspicion in these patients.

Additionally, in 17 (25.76%) patients with paired samples but inappropriate time interval between two samples, it was not possible to determine any reason for sending them either too early or too late, although in some of the later cases it may be secondary to high work load in the hospital.

Table-1: showing baseline characteristics, hsTropT test numbers and their interval differences

Variable	values
Total Number of patients (n)	66
Mean Age (years)	63.30±17.46
Gender [(n (%))	
Male	38 (57.57%)
Female	28 (42.43%)
Trop T per patients (number and percentage)	
1	24 (36.36%)
2	42 (63.63%)
3	4 (6.06%)
NSTEMI diagnosis after 2 Troponin T values (in patients with 2 hsTropT values)	
ACS positive	9 (13.63%)
ACS negative	33 (50%)
Time interval between 1st and 2nd troponin (hours)	
Mean±SD	4.41±5.7
Median	3.11
Time Interval Between 2nd and 3rd Troponin (hours)	
Mean±SD)	9.52±8.31
Median	8.73
Inappropriate Requests*	
Single value	24 (36.36%)
Too Soon	2 (3.03%)
Too Late	15 (22.73%)

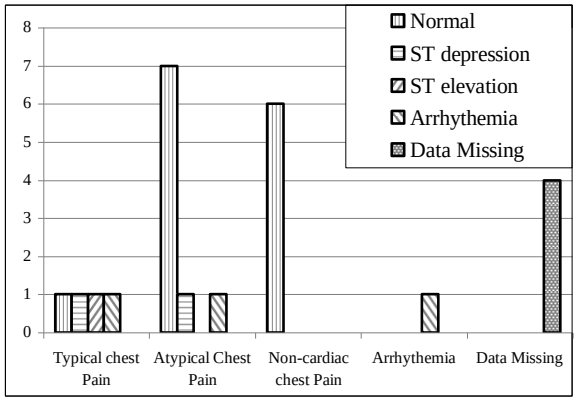

Figure-2: Symptoms and ECG changes in patients not having 2nd troponin T test done (n=24)

DISCUSSION

Our study has shown a definite non-compliance to hsTropT based protocol in our hospital. It included

almost one fourth of the patients with inappropriate single sample and almost the same percentage of patients with paired samples which were noncompliant to time interval recommendations. The possible reasons behind this trend of using single hsTropT test were being non-cardiac nature of the chest pain with normal ECG, an arrhythmia or an ST-segment elevation. Although ST segment elevation does not need second troponin T, in rest of the patients these ECG findings should have prompted a 2nd sample in accordance to the protocol.

These findings mean that our hsTropT based diagnostic protocol was not being implemented properly and we had been either over-utilising it by using it in patients who actually didn't need it or had been running a risk of missing an AMI by improperly ruling it out by single hsTropT values during this period.

Various recognised protocols for the diagnosis of AMI have shown that AMI can be safely excluded if 2 values are used over 12 hours for the standard[2] and over 3 hours for the new hsTropT assays.[3,4] In our study, almost one third of patients does not have second hsTropT test done, which could be justified in few of those patients where an ST-segment elevation MI (STEMI) was diagnosed on the ECG. However, in majority of these patients its single use was inappropriate. This inappropriate use can be explained by either of the two possibilities. Firstly, as described before, these tests were not required at first place because of the nature of the symptoms or alternatively, the single test results were misinterpreted as negative due to lack of knowledge of protocol. A similar, but in larger proportions, trend towards non-adherence with standard troponin T test protocol was noted in an audit performed in Australia by Davey.[6] This again re-enforces the findings that a lot of non-adherence does exist for these protocols for the diagnosis of AMI, and makes our study much more relevant.

The implications of our study are both local and general. Locally, our hospital will require a further dissemination of information about hsTropT based AMI protocol via education of our medical staff in order to increase compliance and avoid any inappropriate under-diagnoses of AMI. This can be also be implied to a wider scale in general which would mean that whenever different protocols are in place for certain diagnostic procedures, there is always a need for on-going education of the medical staff in order to fulfil its goals.

Limitations of our study included its audit design, a smaller sample size, and lack of data in the case of few of our patients. However, the trends seen in our study were enough to draw conclusion of non-adherence to protocol and make suggestions about need for further arrangements of education of medical staff. A further audit is being planned after implementation of these suggestions to look at its effects on the compliance.

CONCLUSION

In conclusion, our study has shown that non-compliance to implementation of hsTropT has happened in a large proportion of our patients, both in the form of use of single hsTropT samples and a shorter time interval between two samples. Similarly, another issue highlighted was, that in a quite large number of patients second sample was sent later than recommended timings and therefore reduced the advantage of its usefulness in early diagnosis of AMI. A best approach to reduce this non-adherence with the protocol would be to start a continuous education process of the medical staff about appropriate use of this protocol.

ACKNOWLEDGMENT

We are highly indebted to Dr. Dzifa Wosornu Abban, FRCP, Consultant Cardiologist at Alexandra Hospital Redditch, UK for her suggestions about this study.

REFERENCES

1. Young GP, Gibler WB, Hedges JR, Hoekstra JW, Slovis C, Aghababian R, *et al*. Serial Creatine Kinase-MB results are a sensitive indicator of acute myocardial infarction in chest pain patients with nondiagnostic electrocardiograms: The Second Emergency Medicine Cardiac Research Group Study. Acad Emerg Med 1997;4:869–77.
2. Alpert JS, Thygesen K, Antman E, Bassand JP. The Joint European Society of Cardiology/American College of Cardiology Committee. Myocardial Infarction redefined –a consensus document of the joint European Society of Cardiology/American College of Cardiology Committee for the redefinition of Myocardial Infarction. J Am Coll Cardiol 2000;36:959–69.
3. Aldous SJ, Richards MA, Cullen L, Troughton R, Than M. A new improved accelerated diagnostic protocol safely identifies low risk patients with chest pain in emergency department. Acad Emerg Med 2012;19:510–6.
4. Thygesen K, Mair J, Giannitsis E, Muller C, Lindahl B, Blankenberg S, *et al*. How to use high-sensitivity cardiac troponins in acute cardiac care. Eur Heart J 2012;33:2252–7.
5. Mueller M, Biener M, Vafaie M, Doerr S, Keller T, Blankenberg S, *et al*. Absolute and relative kinetic changes of high senstivity Troponin T in acute coronary syndrome and in patients with acute troponins in the absence of acute coronary syndrome. Clin Chem 2012;58(1):209–18.
6. Davey RX. Troponin testing: an audit in three metropolitan hospitals. Med J Aust 2003;179:81–3.

Address for Correspondence:

Dr. Shahid Kalim, Department of Cardiology, Alexandra Hospital, Woodrow Drive, Redditch, Worcestershire, B98 7UB, United Kingdom
Email: shahidkalim@gmail.com