Original Article

Did the introduction of high-sensitivity Troponin T for the assessment of suspected acute coronary syndrome in Malta result in reduction of hospitalization time? A retrospective review

Ahmed Chilmeran, Yahya Alwatari, Stuart Zintilis, Robert Xuereb

Abstract

Aims: Troponins I and T are biomarkers used for diagnosing myocardial infarction. The recently developed high-sensitivity Troponin T assay can detect levels as low as 3 ng/L which gives the advantage of rapid diagnosis of acute coronary syndrome (ACS) allowing earlier intervention and theoretically earlier discharge. The aim of the study was to audit the hospital practice and its adherence to international guidelines in using Troponin for diagnosing ACS, and to assess the average hospital admission length when using Troponin T compared to the older Troponin I.

Methodology: A retrospective study that included all patients who had Troponin T taken between January 1st and January 31st, 2016 at Mater Dei Hospital (MDH), comparing them to patients who had Troponin I taken between November 1st and November 30th, 2015.

Results: Data collection yielded a total of 1,032 patients in the Troponin T group and 1,004 patients in the Troponin I group. The average length of stay when using Troponin T was 6.42 days whereas the average length of stay when using Troponin I was 7.16 days. Data analysis of those patients also showed that the average time interval between the first and second Troponin was in the region of 9 hours, which is not what the current guidelines recommend.

Conclusion: The use of the new highly sensitive Troponin T resulted in an average reduction in hospitalization time of 0.75 days per patient at MDH. Adherence to the "0/3 hours" guideline of the second Troponin is highly recommended.

Keywords

Acute coronary syndromes, High sensitivity cardiac markers, Malta, Troponin T, Myocardial infarction

Introduction

Myocardial infarction (MI) is a leading cause of death and disability worldwide. Patients presenting with chest pain account for the second most common reason for emergency department visits in the United States, although only 20% of them are eventually found to suffer from acute coronary event.[1] Cardiac Troponin T (cTnT) and troponin I (cTnI) are enzymes used to confirm or rule out a diagnosis of myocardial infarction (MI) alongside a history of typical chest pain and ECG abnormalities. They are coded by specific genes and are deemed to be unique to the myocardium.[2]

The recent development of high sensitivity

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cardiac troponin T (hs-cTnT) permits the detection of very low levels in the blood, which allows for a higher diagnostic accuracy in patients with suspected MI.[3] In addition, the early identification of individuals at risk for MI is vital because patients benefit the most from early and aggressive treatment.[4] In the past there were no set criteria on what a high sensitivity assay included, but this was resolved in 2012 after experts agreed on a definition: "high-sensitivity assays should have a coefficient of variance (CV) of <10% at the 99th percentile value in the population of interest. To be classified as high-sensitivity assays, concentrations below the 99th percentile should be detectable above the assay's limit of detection for >50% of healthy individuals in the population of interest".[5] Hs-cTnT is an extremely sensitive blood test for the diagnosis of MI but not as specific; several other conditions can cause a false positive result. This could create a challenge when trying to correlate a raised level of hs-cTnT and clinical findings, as illustrated in (Figure 1).[5] A meta-analysis involving 9 studies and 9186 patients estimated a sensitivity of 0.94 (95% confidence interval [CI] 0.89-0.97) and a specificity of 0.73 (95% CI 0.64-0.81) for hs-cTnT in diagnosing acute MI presentation to the emergency department.[6]

Figure 1: Illustrates causes of Troponin rise
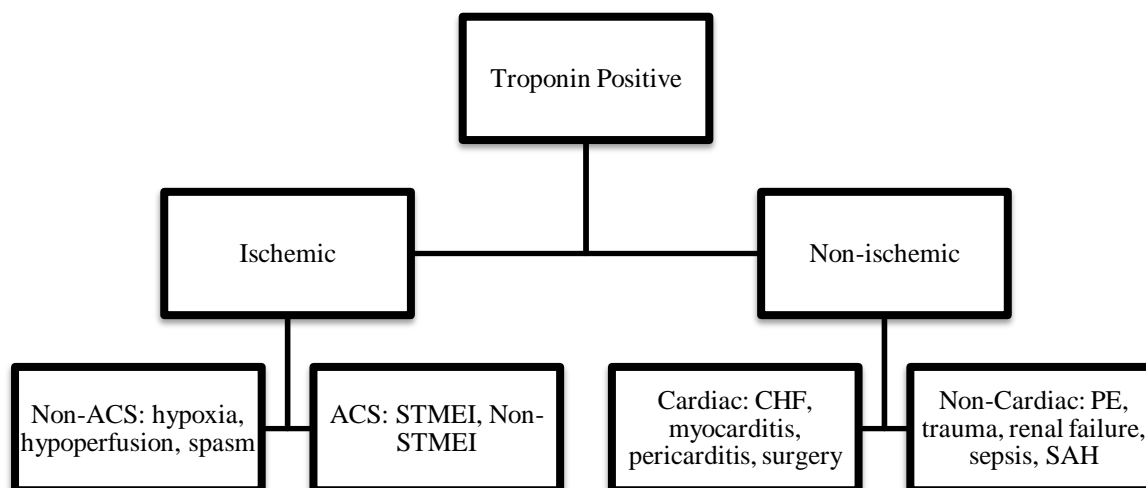
It is vital that a blood sample is drawn for cardiac troponin from all patients presenting with acute chest pain to the Emergency Department. According to the 2013 ESC guidelines for the management of non-ST elevation MI (NSTEMI), if hs-cTn is being used for the assessment of these patients, the time span between the first hs-cTn and the re-test hs-cTn should be 3 hours rather than the previously adhered to 6 hour time span. This facilitates an earlier rule in and rule out of ACS which leads to earlier intervention if necessary, or earlier discharge.[7]

In Malta, hs-cTnT was introduced to Mater Dei Hospital in December 2015. Prior to this date, cTnI was the cardiac enzyme used to diagnose or rule out MI.

Methods

This study had two aims: the first was to compare hospitalization time between patients admitted with suspected MI before and after the introduction of hs-cTnT, and the second was to audit the time span between the first cardiac Troponin and the follow up Troponin, and whether the ESC guidelines were being adhered to in Malta's main public hospital.

This research was conducted as a retrospective study with inclusion criteria encompassing all patients attending Mater Dei Hospital between November 1st 2015 and November 30th 2015 who had two or more cTnI samples taken. These were subsequently compared with patients attending between January 1st 2016 and January 31st 2016 who had two or more hs-cTnT samples taken. Patients who only had one troponin taken were excluded from this study.

The data was gathered from the Mater Dei Hospital medical computer records system (iSoft).

Exclusion criteria were applied manually by the authors during data analysis.

Results

In the cohort of patients between 1st November and 30th November 2015 there were 1005 patients. 566 were male (age range 10-95 years) and 439 were female (age range 16-100 years). In the cohort of patients between 1st January and 31st January 2016 there were 1031 patients. 571 were male (age range 14-97 year) and 460 were female (age range 18-98 years). Figure 2 compares the gender differences between both populations, while figures 3 and 4 compare the age differences.

The average time span between Troponin I tests that were taken was 9.26 hours (approximately 9 hours and 15 minutes) while the average time span between Troponin T tests that were taken was 9.14 hours (approximately 9 hours and 8 minutes). This resulted in an average reduction of 7 minutes (*P value 0.0001*).

The average length of stay for patients being investigated for suspected Acute Coronary Syndrome whilst using the Troponin I assay was 7.16 days, with a median length of 3 days, and this was reduced to 6.42 days with a median length of 2 days after the introduction of the new high-sensitivity Troponin T assay. This was an average reduction in length of stay of 0.74 days per hospital patient admission (18 hours approximately).
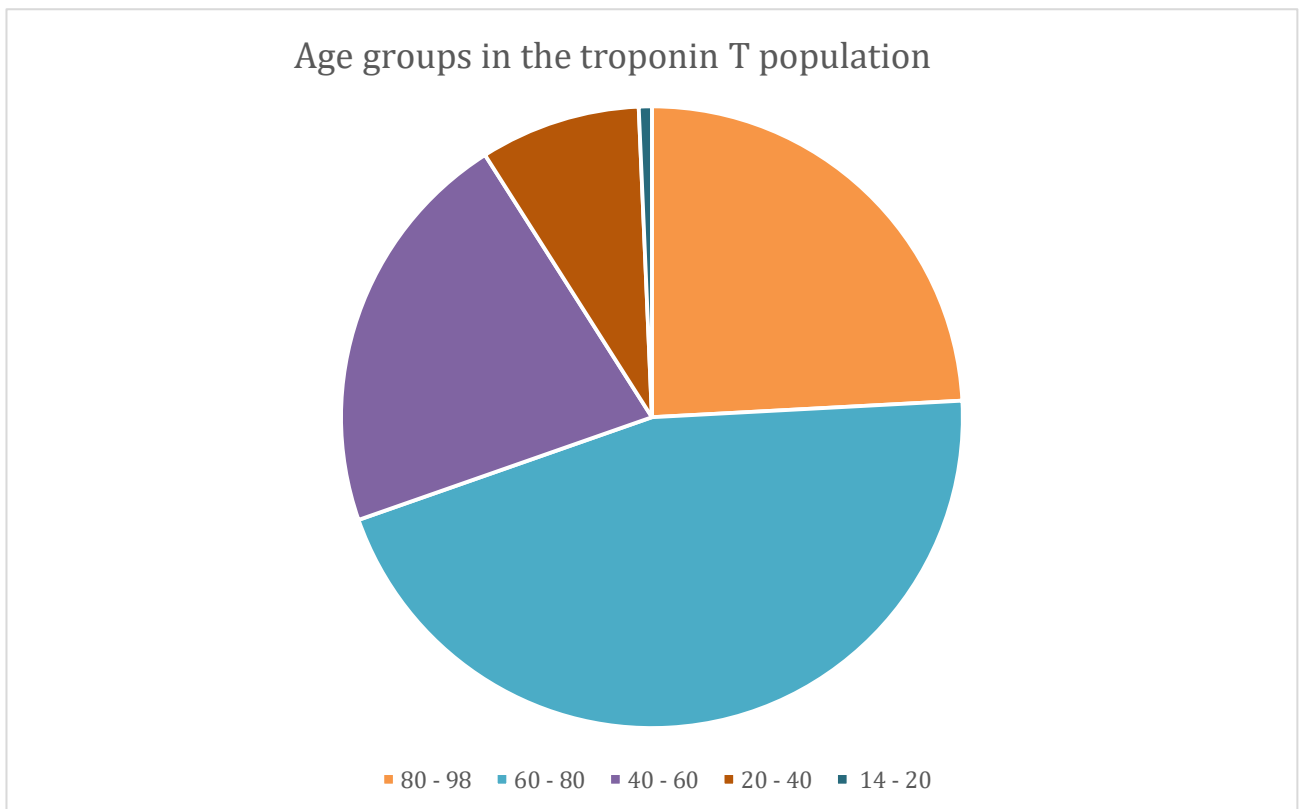
Figure 2: Illustrates the gender differences between both populations

Figure 3: Illustrates the age groups in the first group (Troponin I population)

Age groups in the troponin I population

80 - 100   60 - 80   40 - 60   20 - 40   10 - 20
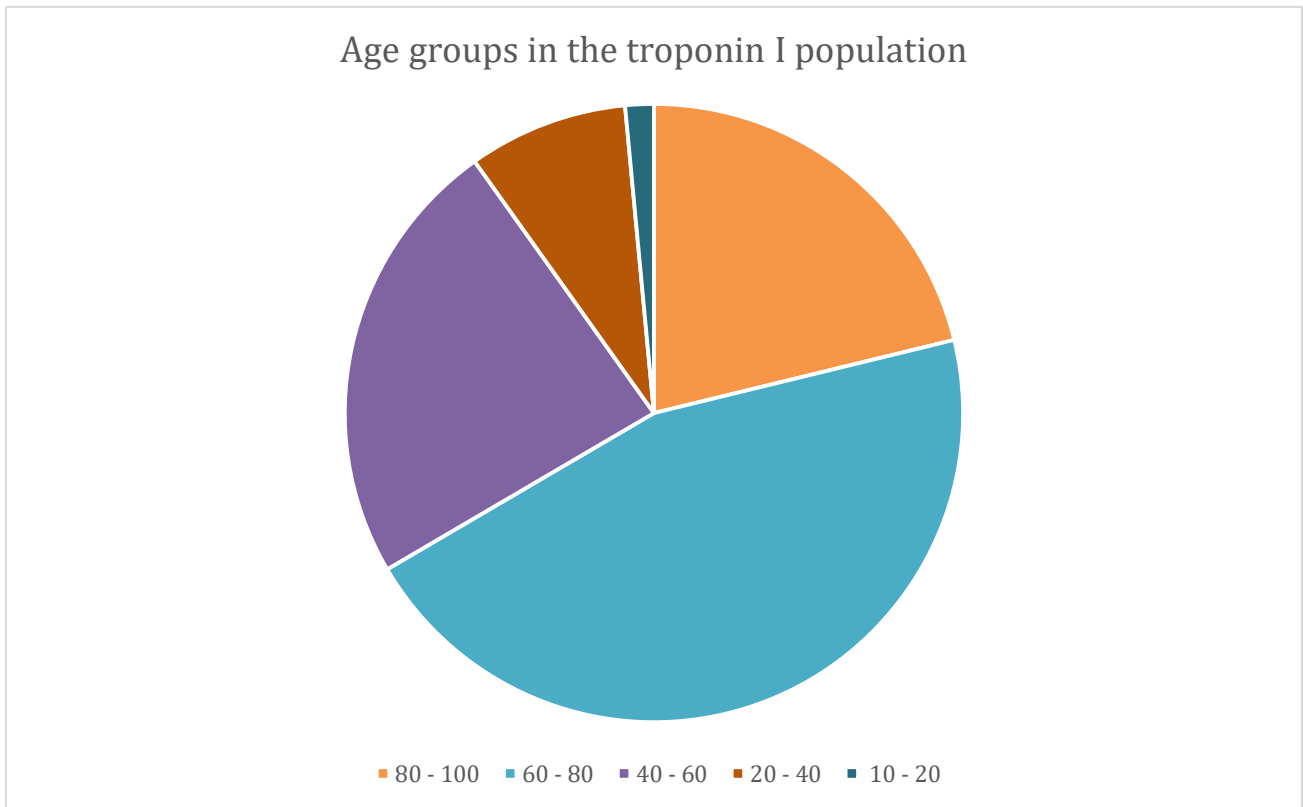
Figure 4: Illustrates the age groups in the second group (Troponin T population)

Age groups in the troponin T population

80 - 98   60 - 80   40 - 60   20 - 40   14 - 20

Discussion

In Malta there is no single, consistent guideline to define the time period between taking serial Troponin T tests in the setting of a suspected Acute Coronary Syndrome. The current UK and European Guidelines state that the time period between Troponin 1 and 2 should be three hours. As can be seen from the results, before the introduction of the new high sensitivity Troponin T test the average time between Troponin I tests was 9.26 hours. After the introduction of the Troponin T tests, a small but significant impact on this time delay was observed, reducing it to 9.14. The reason why there wasn't a significant difference in the interval between the two tests could be attributed to the hospital policy at the time which still recommended a repeat test to be done after a six hour, rather than a three hour, window. We strongly recommended the implementation of change in this policy and repeating the 2nd hs-cTnT in three hours rather than six.

Prior to the introduction of the Troponin T high sensitivity assay, the average length of stay at hospital for patients being investigated for suspected Acute Coronary Syndrome was 7.16 days. With the introduction of the high sensitivity assay this length of stay reduced to 6.42 days. An average reduction of 0.74 days (18 hours approximately) was achieved with *P value less than 0.018*. Based on 2012 national figures published in the Times of Malta, the average cost of a bed in a Medical/Cardiac ward varied from 164.68 Euros to 278.87 (mean 221.78).[8] The reduction in time scale of 18 hours with regards to length of admission with the introduction of the Troponin T assay therefore equates to an average saving of 164.12 Euros per patient admission. Taking into account the fact that during January 2017 the number of patients admitted or already an in-patient but having serial Troponin tests taken was 32.23/day, if each of these patients spent an average 18 hours less as an in-patient, this equates to 23.85 days per month of bed-time saved. This would save an average of 5,289.50 Euros per day to the local health service; equating to 63,473.97 Euros per year. It is, however, too early to tell whether the introduction of hs-cTnT had an impact on mortality rates. This could be a potential aim for a future study.

Some randomized controlled trials have demonstrated the safety and the high efficacy of early patient discharge in accelerated 2-hour protocols when compared to standard care. If we are to standardize such protocols in the Malta health casualty service, the number of admissions will be expected to further decrease with significant economic benefits.[9]

Limitations

The design of our study does not come without a few limitations. The first of those was that other factors were noted to come into play when analyzing the length of stay of patients presenting with chest pain. Some patients in our cohort had a prolonged length of stay due to having multiple co-morbidities and having other diagnoses than ACS, making it necessary in their cases to prolong the length of their inpatient stays. In a few cases it was not possible to attribute differences in length of stay to the different Troponin assays. Another factor which might have confounded the interpretation of our results is the fact that overcrowding of hospital beds in January might have influenced an earlier discharge date for patients presenting the same way as those who presented in November, where less pressure for beds was present.

Another limitation was that in many cases a clear "clinical reason for request" was not adequately provided by the clinician requesting the Troponin blood test, in many cases sufficing with a simple "follow-up". For that reason it was not understood why a Troponin was taken in patients as young as 10 years, for example.

We did not include the diagnosis of patients included in this study or their outcomes as we did not deem it consistent with our scope and aims. We also did not look into time to intervention for patients who ended up being diagnosed with acute MI, although that could be a promising discussion point for another paper.

Conclusion

Based on our study, the introduction of high-sensitivity Troponin T for the assessment of acute coronary syndrome in Malta did result in a statistically significant reduction of hospitalization time and was thus cost effective. Further steps are advised to be taken to ensure adherence to the recent European guidelines of the second Troponin timing. We advise that patients presenting with symptoms suggestive of ACS have their first Troponin taken at the triage stage during the first encounter, which allows the second Troponin to be

taken 3 hours later. This will facilitate either earlier discharge and, if needed, earlier intervention.

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