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Troponin Testing in the Emergency Setting: How Good are we?

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Abstract

Objectives: The purpose of this audit was to ascertain whether troponin tests are requested appropriately for acute admissions via A&E and EAU at the John Radcliffe Hospital, Oxford. Troponin tests are not 100% specific, and commencing the ACS protocol is not without risks. Inappropriate tests could result in minimally positive levels, and starting antiplatelets in these situations could lead to unnecessary complications.

Methods: Data was collected on two 24-hour periods for all admissions to A&E and EAU (Emergency Assessment Unit). Admissions were monitored on the electronic whiteboard and follow-up was through a combination of reading notes and using 'Case Notes'. The primary outcome was whether troponin tests were requested appropriately. Criteria for appropriateness of requests were decided after meeting with cardiologists. The secondary outcome was whether the troponin tests were requested within an appropriate time frame, i.e. at admission and at 12 hours.

Results: A total of 55 patients had troponin tests. Mean age was 72.3 years. Nine requests came via EAU and the majority through A&E. Of these 55 patients, 40% had a troponin requested inappropriately, the majority of which were requested by the nursing staff. Mean time for the first troponin test was 63.5 minutes. Repeat troponins were requested at a range (5 hours to 13 hours). Three patients were actually started on ACS protocol inappropriately. The cost of inappropriate tests totaled £320.

Conclusion: Although there were no adverse events in the patients that were sampled during this audit, the ACS protocol was started inappropriately in three patients. Cutting down inappropriate troponin tests in the acute setting could, by extrapolation, amount to savings of £58,400 per annum. We presented this audit at several local and regional meetings, and came up with recommendations to put in place within our hospital. Our intervention in the form of checklists, posters and widespread teaching, improved results considerably, with only 5% inappropriate tests requested in the second audit cycle.

Keyword: Accidents and emergency; Troponin; Acute coronary syndrome

Abbreviations: A&E: Accidents and Emergency; ACS: Acute Coronary Syndrome; EAU: Emergency Assessment Unit; NHS: National Health System; NICE: National Institute of Clinical Excellence

Introduction

Troponins are selective biomarkers for damage to the myocardium that have truly revolutionalized the field of emergency medicine, with rapid laboratory tests enabling health care providers to make a quick diagnosis and provide efficient care pathway for patients. However, these results should be interpreted with caution. Although raised troponin levels are indicative of cardiac damage, they are not always associated with acute myocardial infarction. Troponin levels can be raised in myocarditis, drugs causing coronary artery spasm e.g. cocaine, cardiac trauma (surgery or road traffic accidents), severe cardiac failure, pulmonary embolus and even chronic renal impairment. Initiating the full ACS (Acute coronary syndrome) protocol in patients presenting with a positive troponin, is not without its risks. Indeed, the combination of aspirin 300mg, clopidogrel 300 mg and dalteparin can cause potentially lethal bleeding in certain populations deemed at risk, namely the elderly population who a) are at greater risks of falls and b) are more likely to have higher bleeding times due to poor nutrition and poor synthetic function. This stresses the importance of using the troponin test with discernment so as to make informed choices on treatment that we administer to patients [1].

Furthermore, there are also financial implications of inappropriate troponin tests. Each troponin test processed in the laboratory actually costs £10. In this age of austerity, this is definitely something we should be mindful of troponin test. The appropriateness of troponin tests will no doubt become even more pertinent in the future, with the development of new technology enabling more rapid bedside tests, for example the 'Instant-View' Troponin I Whole Blood/Serum Test' (Alfa scientific designs inc.) [1].

Aims

The purpose of this audit was to ascertain the incidence of Troponin-I blood tests that are requested inappropriately for acute admissions via A&E and EAU at the John Radcliffe Hospital, a large teaching hospital in Oxford. Secondary aims were to look at whether the timings of the test were appropriate.

NICE guidelines suggest time 0 and time=12 hours post admission [2]. We also analysed the number of patients started on troponin inappropriately, and whether this caused any adverse outcomes.

Methods

We compared current practice in the two above-named departments at the John Radcliffe hospital against NICE guidelines

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(National Institute of Clinical Excellence) as well as the local cardiac directorate guidelines. The criteria for deciding whether requesting a Troponin-I test was appropriate, and demonstrated in Table 1.

Data Collection

Data was collected on two 24-hour periods for all admissions to A&E (Accident and Emergency) and EA (Emergency Assessment Unit). For the first audit cycle, the sampling periods were:

- 08:00 on 15th May 2011 till 0800 16th May 2011 and
- 08:00 on 26th June 2011 until 0800 27th June 2011.

For the second audit cycle, the sampling periods were:

- 08:00 on 25th October 2011 till 0800 26th October 2011 and
- 08:00 on 16th November 2011 till 0800 17th November 2011.

One investigator was resident on level 1 of the John Radcliffe Hospital in 12-hour shifts. Admissions were monitored on the electronic whiteboard and follow up was through a combination of reading notes and using 'Case Notes'. Data were collected using a proforma shown below (Table 2). The test that was being looked at was Troponin-I for all patients admitted.

Results

For the first cycle, a total of 55 acute admissions had one or more troponin tests sent to the laboratory over the 48-hour period. The total number of troponin tests requested was 80.

The average patient age was 72.3 years. Overall, approximately 68% of patients were male, and 32% female. Of the 55 patients, 9 were admitted through EAU and the majority through A&E.

Over this two-day period, we found 48 appropriate troponin-I tests. The remaining requests were deemed inappropriate as per the criteria outlined earlier. This means that 32 tests, i.e. 40% of the troponin-I tests requested for consecutive admissions over a 24-hour audit period were requested inappropriately. The cost of the inappropriate troponin-I tests totaled £320 (including repeat troponin tests).

The average time for the first troponin test was 28 minutes. The average time for the repeat troponin test was 13.4 hours (NICE guidelines recommend repeat troponin testing at 12 hours).

Of the inappropriately requested troponin tests, only one was requested by EAU, the remainder by A&E.

We found that 86% of inappropriate troponin tests were requested by nursing staff (19/32), the remainder being requested by doctors in A&E (Senior House Officer, Specialty Registrar and Staff grade). However, this should be interpreted with caution as the majority of blood tests are requested by nursing staff anyway (82% of total troponin tests were requested by nurses (including one healthcare assistant).

From the total number of patients who had a troponin test, 17 were started on ACS protocol, three of whom were started inappropriately (Table 3). Of note, antiplatelet treatment in one of these patients was stopped immediately after the post take medical ward round, whereas two patients received 48 hours of antiplatelet therapy (ACS protocol) before it was reviewed by the medical team and ultimately stopped. Fortunately, none of these patients sustained any bleeding or other side effects.

Discussion

Our main conclusions after this first audit cycle was that there was a serious lack of awareness amongst the emergency department staff regarding the requesting of troponin in patients admitted acutely unwell. We were understandably concerned that there was potential for serious hazards secondary to these inappropriate troponin-I requests. Indeed, these three patients who were commenced on full ACS protocol could easily have suffered a major gastric bleed or intracranial bleed. More importantly, we noted that one patient presenting with collapse

Chest pain of any nature
Breathlessness and pulmonary oedema on CXR
Breathlessness and new ECG changes or abnormal admission ECG if no previous
Syncope with new ECG changes or abnormal admission ECG if no previous
Unexplained hypotension and new ECG changes or abnormal admission ECG if no previous
Stroke/TIA only if new ECG changes or abnormal admission ECG if no previous
New onset AF or atrial flutter
Sepsis only if new ECG changes or abnormal admission ECG if no previous
Congestive cardiac failure if new ECG changes or abnormal admission ECG

Table 1: Criteria for appropriateness of request.

Date of admission
Patient's Hospital Number
Age
Referred by (A&E/EAU) Presenting complaint
Appropriateness of troponin-I test
Requester grade
Timing of test (hours post admission)
Test result
Action taken as result

Table 2: Data collection.

Presenting complaint	1st troponin	2nd troponin	Final diagnosis	ACS started?
Abdominal pain	Negative	N/A	Gastroenteritis	NO
Right arm pain	Negative	N/A	Off legs	NO
Reduced mobility	Negative	N/A	Orthostatic hypotension	NO
Collapse	Negative	N/A	Postural hypotension	NO
Collapse	0.45	N/A	Subarachnoid haemorrhage	NO
Vomiting	Negative	N/A	Large intracranial bleed	NO
Headache	Negative	N/A	Headache	NO
Slurred speech	Negative	N/A	Renal failure	NO
Right sided weakness	Negative	N/A	Atrial fibrillation	NO
Fall	0.21	1.52	Mechanical fall	YES
Fall	Negative	N/A	Fractured left neck of femur	NO
Breathlessness	0.54	N/A	Chest infection	NO
Collapse	0.19	0.96	Dehydration	NO
Palpitations and dizziness	Negative	N/A	Palpitations	NO
Fall	Negative	N/A	Mechanical fall	NO
Collapse	0.39	0.54	Dehydration	YES
Collapse	0.07	0.12	Aortic dissection	NO
Epigastric pain	0.06	0.04	Urinary retention	YES
Breathlessness	Negative	N/A	Chronic bronchitis	NO
Collapse	0.37	0.4	Severe asthma	NO
Generally unwell	Negative	N/A	Alcohol withdrawal	NO
Epigastric pain	Negative	Negative	Biliary colic	NO

Table 3: Inappropriate troponin tests in 22 patients on two 24- audit days (First Cycle). A negative test corresponds to normal values i.e. Troponin< 0.04.

and subsequently found to have an aortic dissection, also had a raised serial troponins. Starting ACS protocol in that case could truly have devastating consequences.

Finally, we were very conscious of the huge financial resources taken up by inappropriate requests. As mentioned above, the total cost of inappropriate tests amounted to £320.00. This would mean an annual saving margin of £58,400, which in the long run would make a real difference within the NHS. In order to implement some change in the way troponin-I tests were requested in the emergency department, we devised a checklist in the form of large posters (Appendix 1) that we put up in the department. We also organized teaching for nurses, nursing students and junior doctors, to show our audit findings and the implications of our research. This was met with a great deal of enthusiasm by the heads of department and the audit was discussed at various local and regional meetings.

A few months down the road, we undertook a re-audit in order to find out whether our interventions had brought any change.

Results of re-Audit

As mentioned above, the second audit cycle data collection took place over two-24 hour shifts in October and November 2011. We found that over these 48 hours, 60 patients who were admitted had one or more troponin test requested. A total number of 92 troponin tests were requested during that period, of which 87 were appropriate. This means that 5 Troponin-I tests, i.e. 5.4% were inappropriate.

This time, none of the patients were stated on ACS treatment inappropriately.

Conclusion

Although there were still 5 inappropriate Troponin-I requests in the second audit cycle, our intervention brought a significant drop in the number of inappropriate troponin tests requested in the emergency department.

We have since extended our criteria checklist and teaching onto all the other medical and surgical wards in the John Radcliffe Hospital, and are planning to re-audit on a larger scale in 2013.

References

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2. NICE (2010) Chest pain of recent onset Assessment and diagnosis of recent onset chest pain or discomfort of suspected cardiac origin.