Exercises in EBM

Myocardial Contusion

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ABSTRACT

Objective: To utilise an evidence-based strategy to answer two clinical questions regarding myocardial contusion – How is the diagnosis made and how long does a patient require cardiac monitoring?

Methods: Pubmed search using appropriate MeSH terminology then selection of abstracts using predetermined criteria.

Results: One meta-analysis, five descriptive reviews and thirty-two other articles were selected for detailed review.

Conclusion: Myocardial contusion is an ill-defined term for traumatic cardiac injury. "Significant blunt chest trauma" appears to be a more useful term. Normal serially performed electrocardiograms and troponin I assays over 8 hours appear to exclude this condition. When complications occur, the onset is usually within 48 hours of injury. Monitoring of patients with abnormal ECG's or troponins for at least 48 hours post injury would therefore be prudent. (**Critical Care and Resuscitation 2005; 7: 29-31**)

Key words: Contusion, Myocardial

OBJECTIVE

To answer the clinical questions:

1. How is the diagnosis of myocardial contusion made?
2. How long does a patient with a diagnosed myocardial contusion require monitoring?

METHODS

A pubmed MeSH database search was performed and the term "contusion, myocardial" was identified. A pubmed clinical query for systematic reviews regarding "contusion, myocardial" in addition to a term search was performed, including articles published in the last twenty years.

Abstracts were selected for further review if they met one or more of the following predetermined criteria:

1. They evaluated blunt chest trauma in adult patients
2. They evaluated one or more modalities for diagnosing myocardial contusion
3. They preferably described clinically significant outcomes of myocardial contusion

RESULTS

One meta-analysis, five descriptive reviews and thirty two other articles (prioritising prospective studies, but including evidence of all levels including case reports) were selected for detailed review, based on their perceived capacity to help answer the clinical questions. The following information was derived from the exercise.

Question 1

How is the diagnosis of myocardial contusion made?

The gold standard for diagnosing myocardial contusion is autopsy. This is clearly not a useful method for the clinician involved in managing live trauma patients.

No consistent definition of myocardial contusion appears to be in use in the literature. A number of methods of diagnosing myocardial injury and thus defining it have been described. These can be grouped as clinical features, ECG abnormalities, cardiac enzyme elevations (CK-MB, troponin I and T), echocardiographic (both

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transthoracic and transoesophageal) and radionuclide imaging abnormalities.

It is apparent that many studies don't correlate abnormal investigations with clinically significant clinical outcomes (eg. malignant arrhythmias, death). For example Garcia-Fernandez and colleagues examined the role of transoesphageal echocardiography in the assessment of 66 patients with blunt chest trauma.[1] All subjects had serial ECG, CK-MB and transoesophageal echocardiography. They found that there was no association between an abnormal echocardiogram and results of other tests, but there was no correlation attempted between any of the investigations and complications of myocardial contusion.

Of more relevance, a meta-analysis of 41 published studies between 1967 and 1994 correlated "complications", defined as any new onset cardiac problem that required treatment, with a range of investigations.[2] Three separate meta-analyses were performed, one of 16 retrospective studies (2471 patients with 112 complications), a second of 25 prospective studies (2210 patients with 58 complications) and a third including all studies. Results of all three were similar. An abnormal ECG and CK-MB were each found to correlate with complications. Radionuclide scans correlated poorly. The results for echocardiography were not congruent between the studies, with benefit seen in the retrospective and combined analysis only. Unfortunately the studies were of heterogeneous groups of patients ranging from those with isolated blunt chest injuries, to victims of severe multiple trauma. Some studies also required at least one abnormal test result to qualify for inclusion, while others involved all patients presenting with blunt chest trauma.

Since 1994 there have been a number of better quality prospective studies. Seventy-one patients with blunt chest trauma, not requiring intensive care unit (ICU) admission for other injuries, and no past cardiac history, had 48 hours of continuous cardiac monitoring, baseline and daily CK-MB and troponin T assays, and 12 lead ECG's.[3] Abnormal results were correlated with ECG rhythm disturbances. These included bundle branch blocks, supraventricular tachycardia, junctional tachycardia, atrial fibrillation and flutter, sinus arrest, ventricular tachycardia or fibrillation and acute ischaemic changes. Initial ECG abnormalities and an elevated troponin T were the only variables found to predict clinically significant ECG events. Of note although significant findings were found for 26 patients, intervention was needed for only six patients.

More recent studies have focussed on the end-point of "clinically significant blunt cardiac trauma (sigBCT)", defined as pericardial effusion, cardiogenic shock, arrhythmias needing treatment, structural cardiac defects related to trauma or unexplained hypotension needing intervention. A prospective study of 115 patients with blunt chest trauma, involving both ward and ICU patients with variable injury severity scores, had ECG's (baseline and repeated at 8 hours) and troponin I measurements (baseline and after 4 and 8 hours).[4] All patients who developed sigBCT were admitted to ICU before they developed complications and had a higher injury severity score than individuals treated in an unmonitored ward environment (29 vs. 14). Independent risk factors for sigBCT, were an abnormal troponin I, an abnormal baseline ECG as well as the presence of spinal or head injuries or a previous cardiac history. Fifty eight patients had abnormal ECG's which were all present at presentation. Twenty seven developed abnormal troponin measurements with 22 having the elevation at baseline. The 5 patients with the delayed troponin elevation all had an abnormal baseline ECG. Normal ECG's and troponins were associated with a 0% risk of sigBCT and an abnormal ECG or troponin carried a 62% of sigBCT.

A similar study involving 333 patients involved 44 with sigBCT[5]. Independent risk factors for sigBCT were an age over 50 years, injury severity score >15, systolic blood pressure <90mmHg, haemothorax, abdominal injuries, skeletal and head injuries. Normal serial ECG and troponin measurements (over 8 hours) were associated with a 100% negative predictive value. An abnormal ECG and troponin carried a 34% positive predictive value while an abnormal ECG, troponin, injury severity score >15, skeletal trauma and past cardiac history had a 75% positive predictive value.

Question 2

How long does a patient with a diagnosed myocardial contusion require monitoring?

No paper could be identified that addressed this question directly. Indirect evidence was sought in the form of studies describing the time course for occurrence of complications. Regrettably the time course of onset and the patients' location (ICU or elsewhere) when they developed the complication were inconsistently reported.

In a study by Salim *et al*,[4] 19/115 patients had sigBCT. Eighteen out of nineteen complications occurred within 24 hours of admission, but one developed a significant haemopericardium on day 6 while still in ICU for management of other injuries. In a prospective study of 280 patients, nine developed a complication, all within 12 hours.[6] In a retrospective review of 3010 patients with blunt chest trauma, four developed arrhythmias needing treatment.[7] The maximal interval between the trauma and event was 48 hours. A retrospective review of 88 patients documented two

patients who developed ventricular fibrillation between 24 and 36 hours post injury.[8] A similar review of 71 patients involved 13 complications (arrhythmias or pump failure needing treatment and 2 deaths) which all evolved within eight hours after injury.[9] A case report by Sakka *et al*,[10] described a 23 year old male multiple trauma patient who died on day six while in an ICU with SIRS and MODS. Death was attributed to myocardial contusion with evidence of necrosis of the interventricular septum at post-mortem.

CONCLUSIONS

Myocardial contusion is an ill-defined term for traumatic cardiac injury. SigBCT appears to be a more clinically useful term. ECG and troponin have been the most adequately studied predictors of complications after blunt cardiac trauma. A normal ECG and troponin I performed serially over 8 hours appears to exclude sigBCT. Not all patients with abnormalities of these tests develop complications. Imaging studies appear less useful, and echocardiography has not been as extensively studied, other than to delineate the nature of complications.

The appropriate duration needed for cardiac monitoring of patients after blunt cardiac trauma is unclear from the literature. Most complications appear to occur early, within 48 hours of injury. Late complications can occur but this seems to occur in severely injured patients still requiring intensive care. Monitoring of patients with abnormal ECG's or troponins for 48 hours after significant blunt chest trauma would therefore be prudent. Patients with normal ECG's and troponin measurements repeated serially for 8 hours are at low risk of complications and may be treated based on the needs of other injuries.

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