BLUNT CARDIAC TRAUMA

SUMMARY

Blunt cardiac injury (BCI) is uncommon and varies in clinical significance. When clinically significant, it carries substantial morbidity and mortality. Screening with electrocardiogram (EKG) and troponin I levels should occur in those with blunt thoracic trauma (BTT) and those with negative screening can be safely discharged home in the absence of other injuries. When either screening test is positive, the next intervention should be an echocardiogram (ECHO) in those with new arrhythmias, hypotension, or heart failure with appropriate surgical treatment for any structural abnormalities. Those with normal ECHO or no indication for ECHO should undergo at least 24 hours of surveillance in the intensive care unit or a telemetry floor following traumatic injury.

RECOMMENDATIONS

- **Level 1**
  - **All patients with blunt thoracic trauma should receive an electrocardiogram and troponin I level to screen for blunt cardiac injury**
- **Level 2**
  - **Patients with normal electrocardiogram and troponin I after 8 hours can safely be discharged in the absence of other injuries requiring admission.**
  - **Echocardiogram should not be used as a screening test for blunt cardiac injury.**
- **Level 3**
  - **Patients with abnormal electrocardiogram or troponin I should undergo echocardiogram only in the presence of hypotension, new arrhythmia, or heart failure.**
  - **Patients with blunt cardiac injury and a normal echocardiogram or no indication for echocardiogram should be monitored for at least 24 hours in the intensive care unit or on a telemetry floor.**

INTRODUCTION

Blunt cardiac injury (BCI) occurs in 2.3-4.6% of trauma patients (1,2). It is often identified as the cause of death at the scene. Overall mortality from BCI is 11.4-24.5% (3-5). Attempts have been made to streamline and simplify the work-up of BCI, but no diagnostic gold-standard exists. Appropriate treatment for clinical manifestations should be initiated once a diagnosis of BCI is made. The management of those with BCI without a clinically significant manifestation involves is sparse in the literature

LITERATURE REVIEW

Definition

There is no uniform definition for BCI. Studies incorporate patient factors, EKG, chemical analysis, and imaging findings in their definition. Manifestations of BCI include dysrhythmias, conduction abnormalities, myocardial contusions, and anatomic abnormalities. BCIs are noted to be clinically significant if they

EVIDENCE DEFINITIONS

- **Class I:** Prospective randomized controlled trial.
- **Class II:** Prospective clinical study or retrospective analysis of reliable data. Includes observational, cohort, prevalence, or case control studies.
- **Class III:** Retrospective study. Includes database or registry reviews, large series of case reports, expert opinion.
- **Technology assessment:** A technology study which does not lend itself to classification in the above-mentioned format. Devices are evaluated in terms of their accuracy, reliability, therapeutic potential, or cost effectiveness.

LEVEL OF RECOMMENDATION DEFINITIONS

- **Level 1:** Convincingly justifiable based on available scientific information alone. Usually based on Class I data or strong Class II evidence if randomized testing is inappropriate. Conversely, low quality or contradictory Class I data may be insufficient to support a Level I recommendation.
- **Level 2:** Reasonably justifiable based on available scientific evidence and strongly supported by expert opinion. Usually supported by Class II data or a preponderance of Class III evidence.
- **Level 3:** Supported by available data, but scientific evidence is lacking. Generally supported by Class III data. Useful for educational purposes and in guiding future clinical research.

manifest in the following ways: hypotension in the absence of bleeding or neurogenic cause requiring vasopressors, cardiogenic shock requiring inotropes, EKG changes (conduction abnormalities, ST segment changes, T wave inversion, arrhythmias other than sinus tachycardia), structural or functional abnormality on ECHO (3,4).

Risk factors and predictors of mortality

Patients with blunt thoracic trauma should be screened for BCI (6). The most common mechanisms of injury are motor vehicle crash (60-80%), pedestrian struck by vehicle (10-23%), and fall from heights (5-23%) (4,7,8). Clinical risk factors associated with BCI include higher ISS (>25), associated skeletal, head (GCS<13), abdominal injuries, rib fractures, hemothorax and pulmonary contusion (3-5,8,9). Risk factors for mortality in those with BCI include hemothorax, hypotension on presentation, and elevated lactate (5). These injury patterns should raise suspicion for clinically significant BCI.

Sternal Fracture

Historically, sternal fractures were thought to predict BCI. The true association between sternal fracture and BCI is not well defined in the literature. A recent review quoted the incidence of sternal fracture and BCI from 0-60% (10). It is unclear if the presence of sternal fracture should prompt a work-up for BCI (2,5).

Diagnosis

EKG and troponin I are widely used as screening and diagnostic tests for BCI. Positive EKG findings in BCI include conduction abnormalities, ST segment changes, T wave inversion, and arrhythmias other than sinus tachycardia. The utility of these tests is their negative predictive value (NPV). Drawn in combination on admission and 8 hours after injury, they have a NPV of 100%. In the absence of other injuries, these patients are safe to discharge home (3). The interval of repeat testing varies in the literature. Changes have been seen in up to 8 hours after presentation, arguing that the minimum interval should be 8 hours (3). ECHO should not be used for screening for BCI (5-8). Recent expert opinion and small retrospective studies recommend ECHO should only be ordered in BCI patients with hypotension, heart failure, or new arrhythmias (6,10).

Management

Initial treatment should be guided by the clinical manifestation of BCI whether that be hypotension, cardiac shock, arrhythmia, or structural abnormality. Any structural cardiac abnormality should result in a cardiothoracic surgery consult and appropriate management. No consensus exists for management of BCI in the absence of treatable clinical manifestations. They should be observed because the risk of developing an arrhythmia is 3-39% (11). All BCI should be observed as degree of injury does not always correlate to the severity of the resultant arrhythmia (2,11). Fortunately, most EKG abnormalities tend to be transient, intermittent, and clinically irrelevant (12). Length of observation is not well defined. Expert opinion recommends at least 24 hours of monitoring (4,7). Many patients with BCI often have concomitant injuries and high ISS values that determine their placement and result in hospital stays >24 hours, eliminating the dilemma of duration and level of observation (4).

REFERENCES

1. Marcolini EG, Keegan J. Blunt Cardiac Injury. Emerg Med Clin North Am. 2015; 33(3):519-527.
2. Hanschen M, Kanz KG, Kirchhoff C, et al. Blunt cardiac injury in the severely injured - A retrospective multicentre study. PLoS One. 2015; 10(7):1-13.
3. Velmahos GC, Karaiskakis M, Salim A, et al. Normal electrocardiography and serum troponin I levels preclude the presence of clinically significant blunt cardiac injury. J Trauma. 2003; 54(1):45-50-51.
4. Salim A, Velmahos GC, Jindal A, et al. Clinically significant blunt cardiac trauma: role of serum troponin levels combined with electrocardiographic findings. J Trauma. 2001; 50(2):237-243.
5. Joseph B, Jokar TO, Khalil M, et al. Identifying the broken heart: Predictors of mortality and morbidity in suspected blunt cardiac injury. American Journal of Surgery. 2015.
6. Clancy K, Velopulos C, Bilaniuk JW, et al. Screening for blunt cardiac injury. J Trauma Acute Care Surg. 2012; 73(5):S301-S306.

7. Nagy KK, Krosner SM, Roberts RR, Joseph KT, Smith RF, Barrett J. Determining which patients require evaluation for blunt cardiac injury following blunt chest trauma. World J Surg. 2001; 25(1):108-111.
8. Emet M, Akoz A, Aslan S, Saritas A, Cakir Z, Acemoglu H. Assessment of cardiac injury in patients with blunt chest trauma. Eur J Trauma Emerg Surg. 2010; 36(5):441-447.
9. Lancey RA, Monahan TS. Correlation of clinical characteristics and outcomes with injury scoring in blunt cardiac trauma. J Trauma. 2003; 54(3):509-515.
10. El-Menyar A, Al Thani H, Zarour A, Latifi R. Understanding traumatic blunt cardiac injury. Ann Card Anaesth. 2012; 15(4):287.
11. Frazee RC, Mucha Jr. P, Farnell MB, Miller Jr. FA. Objective evaluation of blunt cardiac trauma. J Trauma-Injury Infect Crit Care. 1986; 26(6):510-520.
12. Yousef R, Carr JA. Blunt cardiac trauma: A review of the current knowledge and management. Ann Thorac Surg. 2014;98(3):1134-1140.

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