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Electrophysiologic changes related to blunt cardiac injury: Clinical practice pearls

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Introduction

Blunt chest trauma resulting in blunt cardiac injury (BCI) can precipitate myocardial damage, leading to electrocardiographic (ECG) changes and elevated cardiac enzyme levels, and—if left untreated—can be life threatening, contributing to ventricular injuries, valvular tear or rupture, septal tears, coronary artery thrombosis or laceration, or fatal cardiac rupture.[1] Rapid deceleration, traumatic blow to the precordium, and direct injury from rib fracture/fragments account for most cases of BCI; thus, any patient who presents after a motor vehicle collision or who sustains significant chest trauma should be thoroughly evaluated.[1] This case report demonstrates an interesting variant of ECG changes correlating with cardiac troponin I (cTnI) levels that occurred following a level 3 trauma event. Understanding diagnostic standards post blunt chest trauma is an important tool for the clinician in making the diagnosis of BCI.

Case report

The patient is a 31-year-old man admitted to a large quaternary care center after sustaining multiple injuries from a stone grinder explosion. He sustained open deformity to his left upper extremity, a right pneumothorax, a right pulmonary contusion, and multiple closed right costal fractures. The patient had no significant past medical history. Upon assessment, the patient complained of constant, dull, precordial chest pain. A baseline ECG (Figure 1, upper panel) was obtained and revealed sinus rhythm, an incomplete right bundle branch pattern, and poor r-wave progression. Initially, this was believed to be a normal variant. Given complaints of precordial pain, cardiac biomarkers were ordered. A cTnI level was drawn and was elevated at 6.16 ng/mL (a cTnI level >0.10 indicates myocardial injury). A bedside transthoracic echocardiogram was obtained and demonstrated normal left ventricle and right ventricle structure and function, no significant valvular abnormalities, no significant wall motion abnormalities, and a trace pericardial effusion without concern for tamponade physiology. Serial ECGs were then obtained every 6 hours and the patient's hemodynamic status was monitored via telemetry cardiac monitoring. Serial ECG morphologic changes correlated with down-trending troponins (2.10 ng/mL at 24 hours), with complete improvement in complaints of precordial chest pain, r-wave progression, and resolution of incomplete right bundle branch pattern after 48 hours (Figure 1, lower panel).

Discussion

Initial work-up for blunt chest trauma should always include a thorough past medical history and review of existing baseline data, as well as obtaining an ECG, cardiac enzymes, and an echocardiogram, depending on the severity of the clinical presentation.[1] Utilization of appropriate diagnostic testing can be critical to a timely diagnosis (Supplemental Table 1).[1–3] Once a diagnosis of BCI is established, continuous ECG and troponin monitoring is essential for surveillance and to guide clinical decision making. In this case study as the troponin levels decreased, the ECG abnormalities resolved. BCI most often involves injury to the right heart, likely owing to orientation to the anterior chest wall,[1–3] which likely precipitated the ECG findings in this case. It is important to note that initial clinical manifestations of cardiac trauma can be mistaken for primary cardiac conditions; thus a thorough review of past medical history is crucial. Furthermore, if baseline troponin levels are negative upon admission and the blunt chest trauma occurred immediately prior to presentation, the cardiac troponin levels should be reevaluated 4–6 hours later.[2]

KEYWORDS Blunt chest injury; Troponin; Electrocardiography (ECG); Cardiac injury; Right bundle branch block
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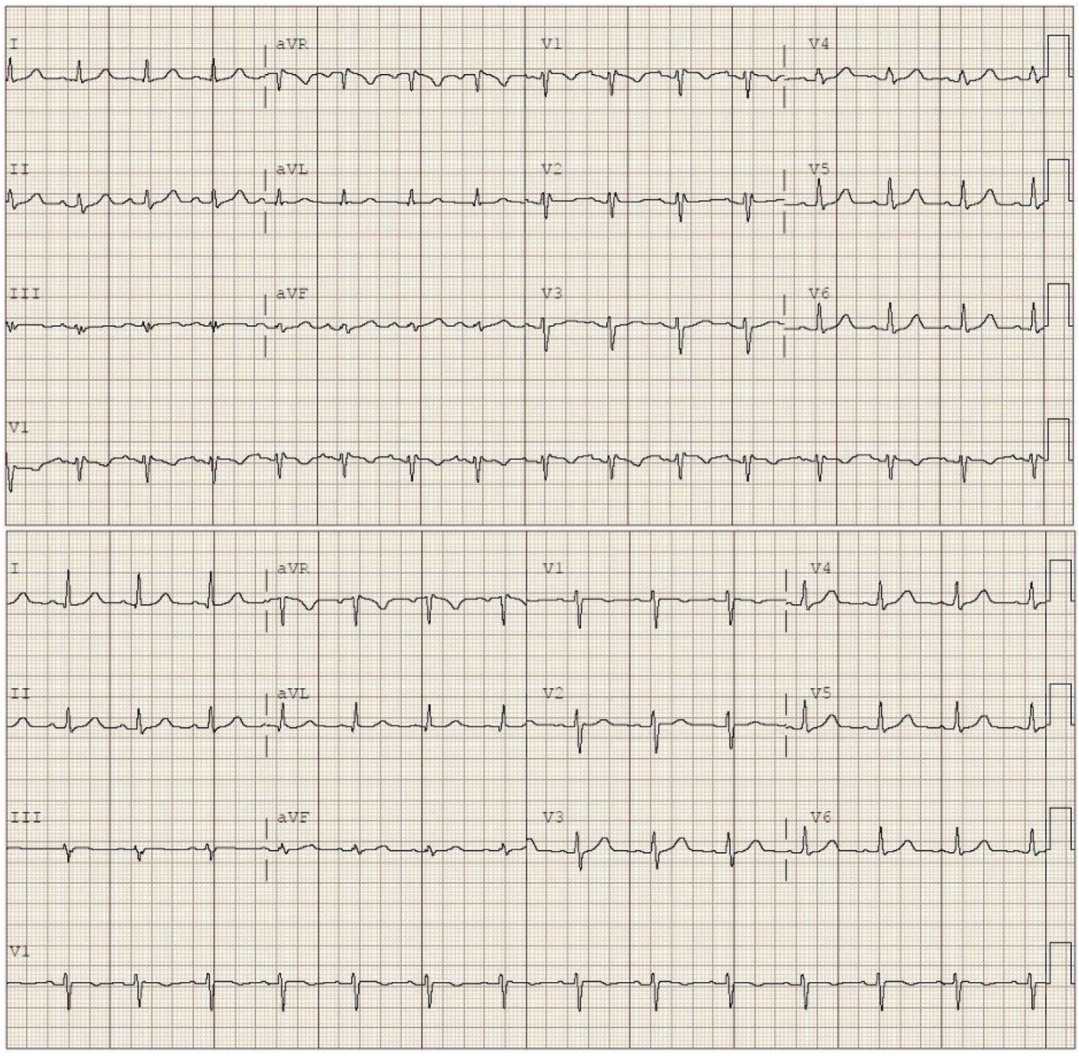

Figure 1 Serial electrocardiograms demonstrating changes in anteroseptal leads that resolve with a downtrend of myocardial injury.

Conclusion

This case study highlights the importance of obtaining appropriate diagnostic testing after blunt chest trauma, the relationship of diagnostic testing to diagnosis, and the connection between troponin and ECG abnormalities concerning myocardial injury. Blunt cardiac injuries themselves are a vague diagnosis and have no specific clinical signs or symptoms that correlate with the risk of cardiac complications. Furthermore, symptoms such as elevated troponin can be owing to reasons other than BCI. In this specific case, use of evidence-based diagnostic testing in a patient with a clinical suspicion for BCI, a thorough medical history, serial cardiac biomarkers, and continuous cardiac monitoring led to an accurate diagnosis and the delivery of safe cardiology care.

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Appendix

Supplementary Data

Supplementary data associated with this article can be found in the online version at https://doi.org/10.1016/j.hrcr.2024.01.005.

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