Cardiac Trauma During Teenage Years

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KEYWORDS

• Cardiac injury • Teenagers • Epidemiology • Diagnosis • Treatment • Outcomes

KEY POINTS

- Blunt cardiac trauma includes a wide spectrum of conditions, ranging from asymptomatic myocardial contusion to fatal cardiac arrhythmias and/or cardiac rupture.
- Blunt cardiac rupture is a common cause of instant death in traffic injuries.
- The role of cardiac biomarkers remains controversial; however, normal electrocardiogram and troponin levels may rule out a significant blunt cardiac trauma in most cases.
- Significant chest trauma, especially in the presence of multiple rib or sternal fractures or lung contusions, is associated with a high incidence of cardiac involvement.
- Insignificant blunt cardiac injury during sports may cause fatal arrhythmia in teens.
- The diagnosis of penetrating cardiac injury is usually clinical. The Focused Assessment with Sonography in Trauma examination is the most useful and reliable bedside investigation.
- Patients with penetrating cardiac trauma or blunt cardiac rupture presenting with cardiac arrest or imminent cardiac arrest should be managed with an emergency-room resuscitative thoracotomy.
- Survivors of penetrating cardiac injuries should be evaluated with early and late echocardiography to detect anatomic or functional cardiac sequelae.

INTRODUCTION

Trauma is overall the fourth most common cause of death and the leading cause of death in individuals younger than 40 years, accounting for 5 million fatalities worldwide on an annual basis.[1] Thoracic trauma is directly responsible for 25% of trauma deaths, and contributes indirectly to another 25% of trauma-related mortalities.[2]

Thoracic trauma may result in a wide spectrum of cardiac lesions, ranging from an asymptomatic myocardial contusion to a rapidly fatal cardiac tamponade or exsanguination caused by a transmural laceration. The reported incidence of cardiac injuries

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varies widely, with 15% to 76% of patients sustaining major chest injury depending on whether the diagnosis has been made clinically or on autopsy.[3–7] Nevertheless, in penetrating trauma and in victims who die at the scene of the injury, the incidence of cardiac involvement is much higher.[8,9]

Cardiac trauma is uncommon in the pediatric population in the United States. Kaptein and colleagues,[10] in a National Trauma Data Bank (NTDB) review, reported that only 0.03% of all pediatric trauma cases (age <8 years) had a documented cardiac injury. The vast majority of cardiac lesions in this population, however, occurred in teenagers (73%). The American Association for the Surgery of Trauma (AAST) has defined the severity of cardiac injuries in their organ injury scale for standardization purposes (**Table 1**).[11] This article reviews the management of cardiac trauma under the following categories:

1. Blunt cardiac injury (BCI)
2. Penetrating cardiac injury (PCI)

BLUNT CARDIAC INJURY

Background

Borch described the very first myocardial contusion in 1676, and Akenside elucidated the first autopsy-verified BCI in 1764.[12,13] Since the Borch and Akenside reports BCI

Table 1
American Association for the Surgery of Trauma organ injury scale: heart

Grade	Description of Injury
I	Blunt injury with minor electrographic abnormalities Blunt or penetrating pericardial wound without cardiac injury, tamponade, or herniation
II	Blunt cardiac injury with heart block or ischemic changes without heart failure Penetrating tangential myocardial wound up to, but not extending through, endocardium without tamponade
III	Blunt cardiac injury with sustained (≥6 beats/min) or multifocal ventricular contractions Blunt or penetrating injury with septal rupture, pulmonary or tricuspid valvular incompetence, papillary muscle dysfunction, or distal coronary artery occlusion without cardiac failure Blunt pericardial laceration with cardiac herniation Blunt cardiac injury with cardiac failure Penetrating tangential myocardial wound up to, but not extending through, endocardium, with tamponade
IV	Blunt or penetrating injury with septal rupture, pulmonary or tricuspid valve incompetence, papillary muscle dysfunction, or distal coronary artery arterial occlusion with cardiac failure Blunt or penetrating injury with aortic or mitral valve incompetence Blunt or penetrating injury of the right ventricle, right atrium, or left atrium
V	Blunt or penetrating injury with proximal coronary artery occlusion Blunt or penetrating injury of the left ventricle Stellate wound with <50% tissue loss of the right ventricle, right atrium, or left atrium
VI	Blunt avulsion of the heart; penetrating wound producing >50% tissue loss of a chamber

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