Penetrating Nail-Gun Injury of the Heart

Managed by Adenosine-Induced
Asystole in the Absence of a Heart-Lung Machine

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During his work, an 18-year-old carpenter-in-training overbalanced and shot himself in the left median thorax with a nail gun. The patient was delivered to our thoracic surgery unit with a tentative diagnosis of penetrating lung trauma. An emergent computed tomogram showed a heart-penetrating nail injury. The patient was taken to the operating room, where he underwent emergency surgery that included sternotomy, pericardiotomy, extraction of the nail, and trauma treatment of the heart injury. The surgery was performed in a unit without a heart-lung machine. For that reason, asystole was chemically induced by the intravenous administration of adenosine. The surgery was successful, and the patient was discharged from the hospital on the 10th postoperative day.

In cases of penetrating injuries of the heart, especially those with a foreign body retained in situ, we believe that the intravenous administration of adenosine is an elegant solution for the rapid provocation of asystole. In contrast to other methods, adenosine-induced asystole enables relatively safe myocardial manipulation in the absence of a cardiac surgical unit and a heart-lung machine. (Tex Heart Inst J 2014;41(4):429-32)

Pneumatic nail-gun injuries occur fairly often and usually involve the hands and the limbs.^{1,2} Penetrating injuries of the heart are rare, often performed with suicidal intention.³⁻⁶ We present a case of accidental self injury and discuss the appropriate sequence of evaluation and treatment in the absence of a cardiac surgery unit and a heart-lung machine.

Key words: Accidents, occupational; adenosine/ administration & dosage; asystole, induced; cardiac tamponade/therapy; emergency medical services/ standards; foreign bodies; heart arrest, induced; heart injuries/surgery; heart-lung machine; heart ventricles/ injuries; wounds, penetrating/surgery

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Case Report

During his work in May 2007, an 18-year-old carpenter-in-training overbalanced and shot himself with a nail gun, in the left median thorax. The injury, in appearance, was a small, lightly bleeding inframammary wound (Fig. 1). Because he collapsed, the patient received emergency treatment (perfusion, intubation, and ventilation) by the physician who arrived by ambulance. He was then delivered by helicopter to our thoracic surgery unit with the tentative diagnosis of “penetrating lung trauma.”

The patient was in stable condition at admission to the emergency ward. This enabled a clarifying computed tomographic scan (Figs. 2 and 3), which showed a penetrating heart injury and cardiac retention of the fired nail. Further, left-sided hemopneumothorax was diagnosed. The abdominal scan showed no injuries. Sudden circulatory failure set in with hypotension, progressive bradycardia, and jugular congestion, so the patient was taken immediately to the operating room.

After sternotomy, a pericardiotomy released a massive amount of blood from the pericardial sac. As a consequence of this maneuver, the circulatory failure was overcome, but sinus tachycardia began. Inspection of the operative site showed a left-sided medial pleural injury and a barbed nail deeply penetrated in the left ventricle (Fig. 4). The computed tomographic scan had not revealed the barbs, because of their small size.

In preparation for extraction of the barbed nail, we induced chemical asystole through intravenous injection of adenosine (12 mg) over a central venous catheter. During this short-term asystole (10–15 s), we removed the nail by carefully twisting it. Simply pulling the nail out of the myocardium could have ruptured the wound margins of the ventricular wall. Inspection of the posterior wall of the heart showed no injury; the entry wound on the anterior ventricular wall was then closed with non-resorbable, felt-sheathed sutures.