Intracardiac pneumatic nails

Jason G Andrade MD¹, Mohammad I Amin MBBCh¹, Stephen Chow MD¹,
Calvin Wan MD², Kenneth Gin MD¹, John Jue MD¹

A 54-year-old man presented to the hospital with severe epigastric pain approximately 10 h after sustaining self-inflicted traumatic chest and head injuries. On examination, he was hemodynamically stable but in obvious discomfort. Two puncture wounds were noted on the left mid chest just lateral of the midline. There was widened splitting of the second heart sound and decreased breath sounds across the left chest, but otherwise, his cardiopulmonary examination was unremarkable. A pericardial friction rub was not detected. Electrocardiography demonstrated normal sinus rhythm with a right bundle branch block of undetermined age as well as ST elevation in the lateral precordial leads. Portable chest radiographs showed an enlarged cardiothoracic ratio, left-sided pleural effusion ($\wedge$) and two linear radiopaque densities (white arrows) over the left chest in anteroposterior (Figure 1A) and lateral (Figure 1B) projections. Transthoracic echocardiography demonstrated the presence of a mobile linear echodensity (large arrow) in the left ventricular (LV) cavity protruding through the inferolateral LV wall into the pleural space in parasternal long-axis (Figure 1C; LA refers to the left atrium) and apical (Figure 1D) four-chamber views. A second echodense linearity was noted within the anterior chest wall protruding through the right ventricular (RV) free wall (small arrow), with the tip lodged in the interventricular septum seen in the apical four-chamber view (Figure 1D). Computed tomography of the chest confirmed the presence of two intracardiac nails (white arrows), a pericardial effusion (*) and left-sided hemothorax ($\wedge$) in a sagittal reformat (Figure 1E). On contrast-enhanced computed tomography, there was

active extravasation of contrast (+) from the RV into the pericardial space in an axial reformat (Figure 1F).

The patient was taken urgently to the operative suite where a mid-line sternotomy and a cardiotomy were performed. An 18-gauge pneumatically delivered 4.5 cm finishing nail was visualized penetrating through the RV free wall into the interventricular septum. The head of the nail resided within the anterior mediastinum approximately 1.5 cm from the left lateral sternal border. The nail was cut in half and extracted in a controlled fashion (Figure 1G; small arrow). The RV free wall was repaired using a figure-eight 4-0 Prolene suture (Ethicon Inc, USA). A second nail was visualized exiting through the posterolateral LV wall in close proximity to the large obtuse marginal branch. Using anterior digital counter pressure, the nail was removed from the back of the heart (Figure 1G; large arrow). The exit site in the posterolateral LV wall was oversewn using a figure-eight 4-0 Prolene suture. An entry site in the anterolateral left ventricle had spontaneously sealed. Associated with the exit of the LV nail was a longitudinal tear in the posterior pericardium. There was communication between the pleural space and the left pleura, where approximately 1.5 L of blood and clot were removed. The sternum was closed with wires in the usual manner. Two mediastinal drains and one left pleural drain were left in place. Intraoperative transesophageal echocardiography before and following repair demonstrated normal biventricular function without associated valvular abnormalities. The patient's postoperative recovery was uneventful and he was discharged after seven days.

Figure 1

¹Division of Cardiology; ²Division of Cardiac Surgery, University of British Columbia, Vancouver General Hospital, Vancouver, British Columbia
Correspondence: Dr Jason G Andrade, University of British Columbia, 9th Floor Cardiology, 2775 Laurel Street, Vancouver, British Columbia V5Z 1M9.

Telephone 604-320-3715, fax 604-875-5361, e-mail jasonandrade@me.com

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DISCUSSION

Penetrating pneumatic nail injuries to the heart are a relatively uncommon phenomenon (1-3). Fortunately, there is a relatively low mortality rate associated with these types of injuries (approximately 20%) (3). This is most likely due to a combination of the relatively small impact force generated by pneumatic nail guns, as well as the fact that these types of injuries tend to create a self-sealing puncture wound. Although hemodynamic instability requiring urgent intervention is the most common presentation, the spectrum of clinical presentation can vary significantly from hemodynamic stability to cardiovascular collapse (3). Although most injuries can be diagnosed rapidly and accurately by physical examination and plain radiography, the use of multimodality imaging in hemodynamically stable patients allows for accurate foreign body localization and facilitates the development of

a therapeutic strategy. In the present case, the use of these imaging modalities was invaluable for delineating the accurate position of the intracavitary nails, determining the complications of injury and guiding the operative approach for removal – a process that was achieved safely without the use of cardiopulmonary bypass.

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