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Cardiac pseudoaneurysm following non-operative management after penetrating thoracoabdominal trauma and pericardial window

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A 46-year-old man presented with a single gunshot wound to the left lower quadrant of the abdomen. He arrived hypotensive with systolic blood pressure 86 mm Hg, which normalized after initial crystalloid fluid bolus, Glasgow Coma Scale 15, and with generalized peritonitis. Chest radiograph revealed a bullet in the left chest with associated hemothorax. Cardiac FAST was negative for pericardial fluid. A left tube thoracostomy was placed with 500 mL of blood evacuated. He was taken to the operating room with stable vital signs where exploratory laparotomy identified multiple injuries that required jejunal and transverse colonic resections and primary repair of through-and-through gastric injuries. An injury to the left hemidiaphragm was noted and repaired, confirming a trajectory from the left lower quadrant into the left chest. Because of the proximity of the diaphragm injury to the central tendon of the diaphragm and heart, a subxiphoid pericardial window (SPW) was performed in which a small amount of pericardial blood and clot was noted. Subsequent pericardial irrigation via red rubber catheter was clear. The pericardiotomy was left open and a damage control approach with temporary abdominal closure was performed. Postoperative CT angiography revealed the bullet lodged between the left pulmonary hilum and pericardium, without evidence of cardiac injury (Fig. 1). On postoperative day (POD) 2, the patient returned to the operating room for bowel anastomoses and abdominal closure. On POD 5, the patient underwent video assisted thoracoscopic surgery (VATS) for evacuation of retained hemothorax and the bullet tract was noted to terminate in the left pulmonary hilum, without evidence of cardiac injury, pericardial violation, pulmonary hemorrhage, or air leak. Post-VATS, chest tube management was unremarkable and the patient was discharged home on POD 17. He was seen in clinic 2, 3, and 6 weeks after discharge for follow-up and was without complaints. Eleven months later, he returned desiring repair of a ventral incisional hernia. During evaluation, he reported 2 months of symptoms consistent with recurrent syncopal events. A transthoracic echocardiogram and CT angiogram of the chest were obtained to interrogate for cardiovascular complications associated with the retained hilar bullet, which demonstrated a 5.5 x 3.4 cm left ventricular pseudoaneurysm with a 5-mm neck (Fig. 2A, B).

WHAT YOU WOULD DO

- A. Admit the patient from clinic and perform emergent median sternotomy and cardiac exploration.
- B. Plan elective surgery after consultation with cardiothoracic surgery for cardiac pseudoaneurysm repair with cardiopulmonary bypass.
- C. Consult Cardiology to evaluate the pseudoaneurysm and cardiopulmonary vasculature with cardiac catheterization.
- D. Perform no intervention unless symptoms progress.

WHAT WE DID AND WHY

B. Plan elective surgery after consultation with cardiothoracic surgery for cardiac pseudoaneurysm repair with cardiopulmonary bypass.

Because of the duration and stability of the symptoms, we pursued a carefully planned, multidisciplinary surgical approach to cardiac pseudoaneurysm repair. The patient underwent expedited outpatient consultation with cardiothoracic surgery with agreement that this injury would be most definitively managed with a median sternotomy approach with cardiopulmonary bypass. At operation, the pericardium was carefully dissected, the left ventricular pseudoaneurysm sac was excised, and a bolstered primary repair was performed with pledgeted sutures (Fig. 3). The patient was discharged home after an uncomplicated postoperative course.

Historically, when a pericardial window demonstrated hemopericardium, exploratory sternotomy was considered the standard of care. Subsequent literature has shown that sternotomy following a positive SPW after penetrating trauma is often non-therapeutic, particularly among patients who remain hemodynamically stable and for whom pericardial irrigation fluid remains clear after initial evacuation of blood. For appropriately selected patients, this approach has been shown to be safe and less morbid than routine sternotomy. However, the optimal postoperative surveillance strategy remains unclear because of a lack of published long-term outcomes after use of this management strategy.

Traumatic ventricular pseudoaneurysm occurs when cardiac rupture or ischemic necrosis is contained by clot and pericardial tissue. Symptoms of chest pain, dyspnea, and heart failure suggest pseudo-aneurysm formation, but may be absent at the time of diagnosis, underscoring the importance of surveillance with both clinical and radiographic assessment. Our patient did not have any cardiac symptoms until 9 months postoperatively, and even then symptoms were elicited only during outpatient assessment of an abdominal wall hernia. It was only after symptom-focused imaging that he was noted to have a large left ventricular pseudoaneurysm, which possibly would have led to a fatal rupture if left untreated. For small pseudo-aneurysm defects with fibrotic wound edges, primary excision and repair with pledgeted sutures is appropriate. For larger defects, a dacron, bovine pericardial, or autologous pericardial patch is preferred. When a patch is placed, the pseudoaneurysm capsule may be preserved and closed over the patch to reinforce the repair.

Based on this experience, we developed and implemented a surveillance protocol with focused clinical assessment for cardiovascular symptoms and transthoracic echocardiography before discharge, and at 1 and 6 months after non-operative management of hemodynamically stable, SPW-positive penetrating injuries. By standardizing postoperative surveillance for patients with a positive SPW after penetrating chest trauma who are managed without sternotomy, data on the natural history and risk factors for development of complications may be collected and analyzed, promoting the development of evidence-based guidelines for this rare injury.

DISCLOSURE

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Figure 1.
Initial chest CT findings with bullet localization to hilar/cardiac interface.

Figure 2.
CT angiography of a bilobed left ventricular pseudoaneurysm. (A) Axial view, (B) coronal view.

Figure 3.
Intraoperative exposure of left ventricular pseudoaneurysm. Arrow points to pseudoaneurysm neck.