Bull attack causing complex blunt thoracic aortic injury requiring total arch replacement

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Ethical statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All procedures performed in this study were in accordance with the ethical standards of Mayo Clinic and with the Helsinki Declaration (as revised in 2013).

IRB statement: At Mayo Clinic, single subject case studies or a case series with multiple subjects that are prepared and disseminated for educational purposes, are not systematic investigations and, therefore, are not considered research.

Informed consent: The patient could not be reached for an informed consent discussion. We anonymized the case report to the best of our abilities.

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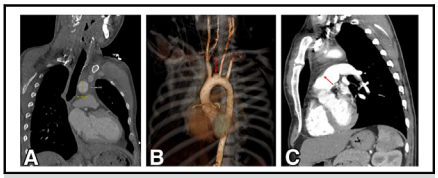

Pseudoaneurysm measurements (A), 3D reconstruction (B), and intramural hematoma (C).

CENTRAL MESSAGE

A 2000-lb bull attack caused an aortic pseudoaneurysm, intimal tear, and intramural hematoma, resulted in total aortic arch, proximal innominate artery, and left common carotid artery reconstruction.

Blunt thoracic aortic injury (BTAI) results from rapid deceleration, commonly motor vehicle accidents or falls. The pathophysiology involves the isthmus stretching between the mobile ascending aorta and the fixed descending aorta, predisposing to intimal tears that may progress to rupture. The Society of Vascular Surgery classification for BTAI is as follows: I = intimal tear, II = intramural hematoma, III = pseudoaneurysm, and IV = rupture.[1] Prompt diagnosis and management is critical because approximately 20% of patients with BTAI who reach the hospital alive die within 30 hours.[2] Treatment involves endovascular stenting or anatomic grafting repairs. Institutional review board approval was not required. The patient could not be reached for an informed consent discussion. We anonymized the case report to the best of our abilities.

CASE PRESENTATION

A 34-year-old man developed aortic arch pseudoaneurysm, intramural hematoma, and intimal tear after a cattle attack. He worked as a hoof-trimmer when a 2000-lb bull struck his back and pinned his chest against a metal bar, causing loss of consciousness. He presented to a local emergency department with severe chest pain, dyspnea, and dysphonia. Chest radiograph demonstrated widened mediastinum, prompting emergency computed tomography angiography (CTA). This revealed an aortic arch pseudoaneurysm involving the origin of the left common carotid artery. Also noted was a mid-to-distal ascending aorta intramural hematoma and an acute left second rib fracture. Given the complexity of his injury, he was transferred to our facility for an escalation of care (Figure 1).

Cardiovascular surgery recommended managing systolic blood pressure <110 mm Hg and heart rate <80, echocardiogram, repeat CTA, and admission to the intensive care unit. Transthoracic echocardiogram revealed no abnormalities with normal left ventricle function, normal aortic valve, and left ventricle ejection fraction of 65%. Repeat CTA highlighted the pseudoaneurysm measuring 31 × 25 mm, intramural hematoma involving the entire arch and proximal innominate and left common carotid arteries, and intimal tear posteriorly between the innominate and left common carotid arteries (Figure 2).

We proceeded with median sternotomy, exposing significant upper mediastinal hematoma upon entry. We dissected around the innominate artery past the common carotid and subclavian arteries, finding hematoma involving the entire intrathoracic left common carotid artery. Pericardium was incised, revealing a bloody pericardial effusion that was evacuated. The mid-ascending aorta was cannulated over a wire guided by transesophageal echocardiogram, and the superior vena cava and right atrium were cannulated in the usual fashion. We utilized cardiopulmonary bypass with retrograde cerebral perfusion strategy during circulatory arrest; we used both antegrade and retrograde cold-

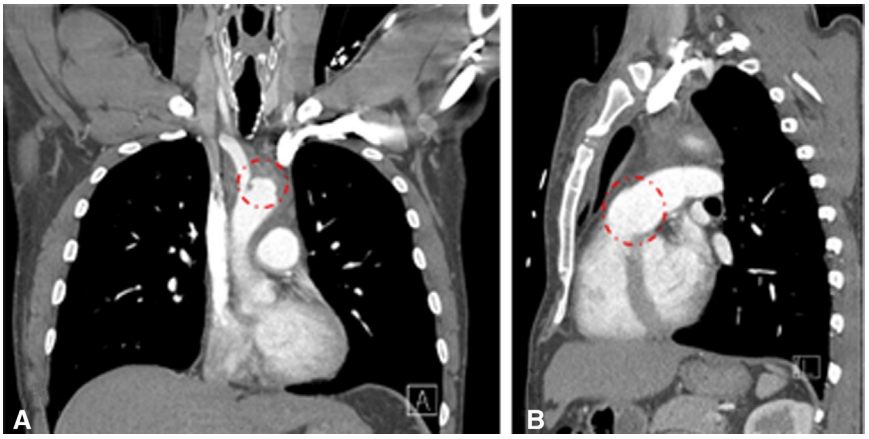

FIGURE 1. Initial computed tomography angiography demonstrating the ascending aortic pseudoaneurysm (*dashed circle*) in the coronal (A) and sagittal (B) views.

blood cardioplegia for myocardium protection. Circulatory arrest started after achieving adequate cooling with flat line electroencephalogram and subsequently, the aortic arch was opened to find a 3 × 5 cm posterior intimal full thickness defect (Figure E1) with intramural hematoma circumferentially at the midascending aorta extending into the proximal innominate and left common carotid arteries. The aortic arch was resected diagonally from the origin to the ligamentum arteriosum inferiorly and the left subclavian artery superiorly. Once debrided to normal aorta, polytetrafluoroethylene graft with 2 presewn branches was sewn, connecting the 24-mm limb to the sinotubular junction, 10-mm limb to the innominate artery, and 8-mm limb to the left common carotid (Figure E2). The ascending aorta was replaced to treat the intramural hematoma that extended from the sinotubular junction. Once the left common carotid artery was secured, retrograde cerebral perfusion was interrupted and antegrade cerebral perfusion was initiated. After 39 minutes of hypothermic circulatory arrest, there was preserved biventricular function with a well-functioning native aortic valve. Electroencephalogram returned to baseline and no diaphragmatic pathology was found. The patient was weaned from cardiopulmonary bypass and returned to the intensive care unit with pacing wires and bilateral mediastinal chest tubes in stable condition.

Metoprolol and aspirin were initiated postprocedurally. On postoperative day (POD) 1, the patient no longer required intensive care unit-level care and the mediastinal chest tubes were removed on POD2. Repeat CTA on POD3 (Figure E3) demonstrated expected postoperative changes with no concerning finding. The patient was discharged on POD4 with aspirin. Five years later, he

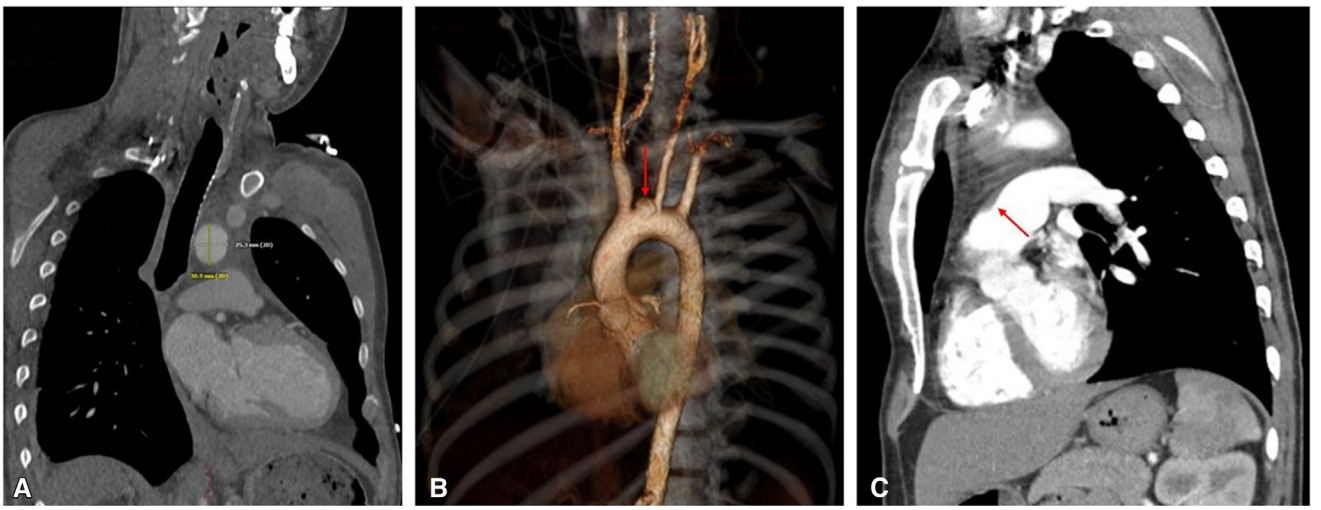

FIGURE 2. Repeat computed tomography angiography measurements (A) and 3-dimensional reconstructions (B) *red arrow* is demonstrating the ascending aortic pseudoaneurysm and the presence of the intramural hematoma (C).

continues to receive annual CTAs that have demonstrated stable postsurgical changes.

DISCUSSION

The incidence of BTAI is 0.3% to 2%, accounting for 7000 to 7500 trauma-related deaths annually.[3] Patients experience severe chest pain and mediastinal hematoma compressing intrathoracic structures, producing dysphagia, dysphonia, and dyspnea.[3] Commonly associated injuries are rib fractures (86%), hemothorax (86%), intra-abdominal injury (74%), and cardiac injury (44%).[3] Prompt diagnosis is critical to maximizing survival. Chest radiograph is commonly initially pursued and displays a widened mediastinum, but this is not sensitive or specific. CTA and echocardiogram should be obtained with high suspicion. Treatment depends on the severity and extent of injury. For grade I and II BTAI, medical management (antihypertensive and anti-impulse therapy) is appropriate with repeat imaging and possible intervention with clinical deterioration. Grade III and IV injuries warrant operative intervention in an urgent and emergency manner, respectively.[3] Grade III BTAI has conflicting recommendations regarding operative timing, but recent evidence suggests improved stroke, paraplegia, mortality, and survival rates in delaying surgery >24 hours.[3,4] When anatomically feasible, endovascular repair is preferred due to improved perioperative outcomes identified on retrospective reviews.[4] Although open repair has associated increased mortality and complications, our patient recovered uneventfully and lives an unrestricted life years later.[5]

CONCLUSIONS

A 34-year-old man who developed aortic arch pseudoaneurysm, intimal tear, and intramural hematoma after being pinned by a 2000-lb bull. The patient underwent total aortic arch reconstruction of the proximal innominate and left common carotid arteries, which continues to provide robust repair 5 years postoperatively.

Conflict of Interest Statement

The authors reported no conflicts of interest.

The *Journal* policy requires editors and reviewers to disclose conflicts of interest and to decline handing or reviewing manuscripts for which they may have a conflict of interest. The editors and reviewers of this article have no conflicts of interest.

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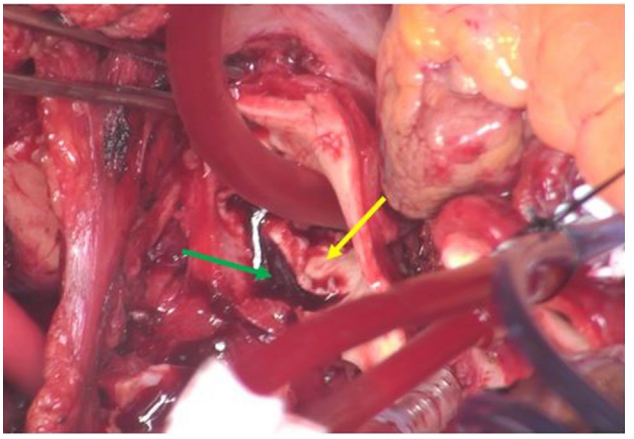

FIGURE E1. Our visualization upon incising the aorta to find the posterior intimal tear (*yellow arrow*) and intramural hematoma (*green arrow*).

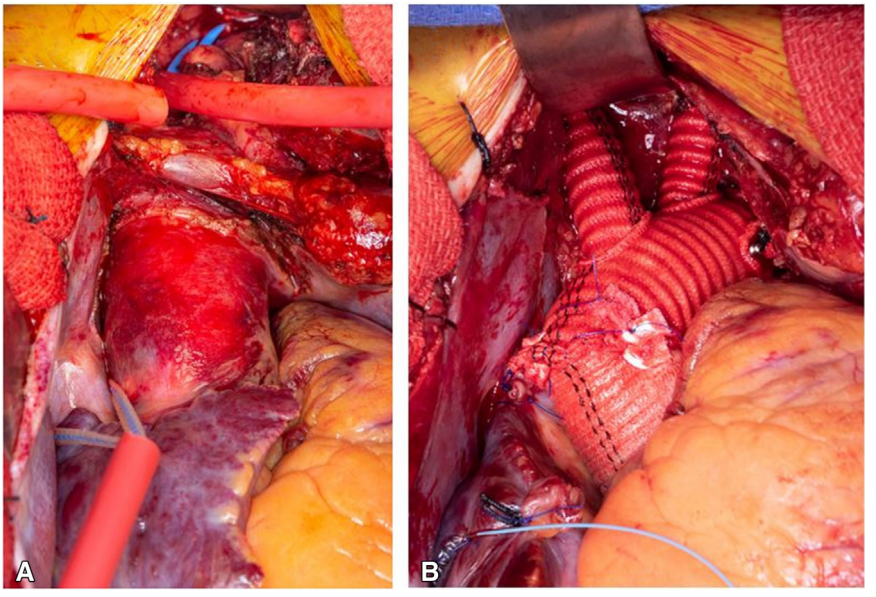

FIGURE E2. Intraoperative images demonstrating the ascending aorta before (A) and after repair (B).

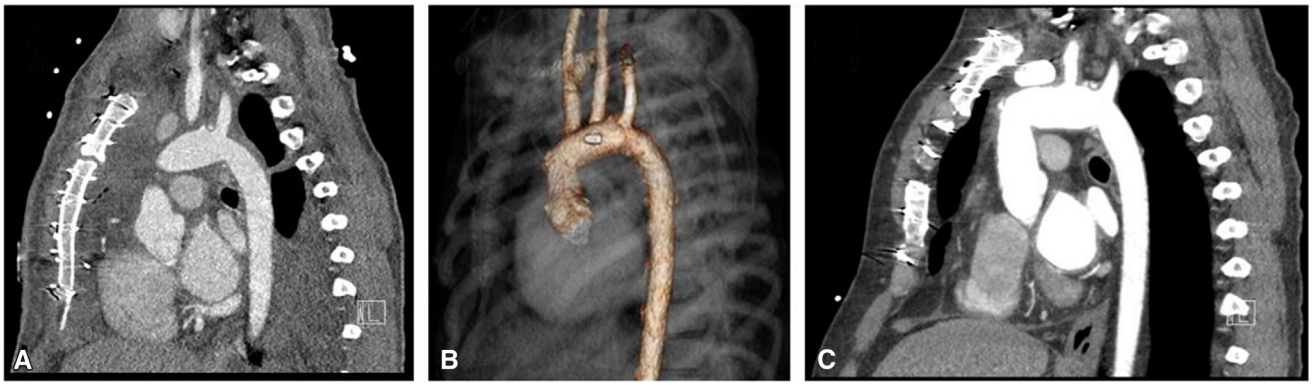

FIGURE E3. Follow-up computed tomography (*CT*) angiography on postoperative day 3 highlighting the repair (A) and its 3-dimensional reconstruction (B). Repeat CT angiography 4 years postoperatively highlighting the robust repair (C).