Traumatic Rupture Of The Thoracic Aorta: An Endoluminal Approach

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Citation

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Abstract

Acute rupture of the thoracic aorta following blunt chest trauma is associated with an 80 - 85 % pre-hospital mortality rate.(1) In up to 20 % of survivors, the surrounding adventitia and mediastinal structures provide stabilization to the site of transection - creating a pseudoaneurysm. Given that undiagnosed aortic tears have a 50 % mortality rate within the first 48 hours, these injuries require early diagnosis and effective management.(2) In nearly 90 % of cases, the site of rupture is at the aortic isthmus - just distal to the left subclavian artery.(3) Mechanisms leading to rupture are threefold: (1) shear forces in relation to the mobile segments of the aortic arch and descending thoracic aorta [i.e., point fixation at the ligamentum arteriosum]; (2) compression of the aorta and great vessels over the underlying vertebral column; and (3) profound intraluminal hyperextension during the moment of impact.(4-6) In these critically-injured, multi-system trauma patients, surgical therapy is often considered - though the timing and approach are controversial. Presented is the successful endoluminal management of a traumatic aortic rupture.

INTRODUCTION

Acute rupture of the thoracic aorta following blunt chest trauma is associated with an 80 - 85 % pre-hospital mortality rate.([1]) In up to 20 % of survivors, the surrounding adventitia and mediastinal structures provide stabilization to the site of transection - creating a pseudoaneurysm. Given that undiagnosed aortic tears have a 50 % mortality rate within the first 48 hours, these injuries require early diagnosis and effective management.([2]) In nearly 90 % of cases, the site of rupture is at the aortic isthmus - just distal to the left subclavian artery.([3]) Mechanisms leading to rupture are threefold: (1) shear forces in relation to the mobile segments of the aortic arch and descending thoracic aorta [i.e., point fixation at the ligamentum arteriosum]; (2) compression of the aorta and great vessels over the underlying vertebral column; and (3) profound intraluminal hyperextension during the moment of impact.([4],[5],[6]) In these critically-injured, multi-system trauma patients, surgical therapy is often considered - though the timing and approach are controversial. Presented is the successful endoluminal management of a traumatic aortic rupture.

CASE REPORT

A 39 year old male was the unrestrained driver involved in a “t-bone” motor vehicle accident. He was struck on the passenger side when the second driver failed to stop for a red light; according to police reports the approximate rate of speed for each vehicle was 38 and 46 mph respectively. The patient was found by witnesses to be unconscious and trapped within the steel frame. When EMS personnel arrived, he had regained some level of consciousness but was extremely combative - trying to fight his way out of the wreckage. Paramedics extracted him from the vehicle, noting that he was “wildly moving” all extremities; the patient was intubated to establish control. Upon arrival to a Level I Trauma Center, he was hemodynamically stable (BP 120/86, P 126, 94 % saturation on 100 % FiO2). Initial survey revealed decreased left-sided breath sounds and a GCS score of 7t (E2 M4 V1t). Diagnostic studies revealed multiple left-sided rib fractures, a left hemo-pneumothorax, a left iliac wing fracture, and a left open humeral fracture. Following placement of a thoracostomy tube, a deep peritoneal lavage revealed gross blood and the patient was taken emergently to the operating theatre. A grade II splenic laceration was identified and conservatively managed. A large right-sided perinephric hematoma was also identified though an on-table IVP demonstrated normal renal integrity and function. Without further findings, the abdomen was closed and the patient was transferred to radiology. Computed tomography of the brain identified a right-sided subarachnoid hemorrhage and a left temporal-parietal contusion. Review of the patient’s chest radiograph, demonstrated loss of the aortic knob with mediastinal widening; a subsequent aortogram identified a traumatic rupture of the descending thoracic aorta. The patient remained stable and was urgently transferred to our center for definitive treatment. Upon arrival, spiral computed tomography clearly demonstrated the site of transection. He was then taken to the endoluminal suite.

Following cannulation of the left common femoral artery, a 9 fr. sheath was introduced. Through this, intravascular ultrasound was used to measure the exact dimensions of the aortic injury. A 35 mm x 10 cm endoluminal graft [AHI Device] was then introduced to selectively isolate and exclude the site of transection. Post-deployment aortography revealed appropriate positioning of the graft just distal to the left subclavian artery with complete exclusion. The procedure was conducted in 22 minutes and without systemic heparinization. The patient tolerated our intervention well and was transferred back to the trauma center on post-operative day one; his neurological exam remained a G.C.S. 7t - he was moving all extremities without any evidence of paraplegia. Twelve month follow-up revealed a fully-recovered, neurologically-intact young male. He had returned to work in the construction field. Computed tomography, at that time, demonstrated a well-aligned graft without evidence of an endoleak or pseudoaneurysm.

CONCLUSION

Endovascular exclusion of a traumatic pseudoaneurysm of the thoracic aorta is not only possible but effective. This patient serves to exemplify the dramatic role that such technology can serve in the setting of multi-system trauma. However, well-designed studies with long-term results will be required before appropriate comparisons can be drawn between the standard, open-approaches and endovascular techniques.

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