

Penetrating Injury of Ascending Aorta With Arrow In Situ

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Penetrating injuries of the aorta are rare and highly lethal; very few patients are able to reach the hospital alive. We report a case of penetrating injury into the ascending aorta with the arrow still in situ, shot by a bow in a tribal region of India. The wound of entry into the aorta was sealed by the arrow itself. The patient came to us walking and supporting the arrow with his left hand. He was operated on, and the arrow was successfully removed from the aorta.

(Ann Thorac Surg 2012;93:e85-7)

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Penetrating injuries of aorta are highly lethal and rare; very few patients are able to reach the hospital alive. Most patients who reach the hospital after such injuries are hemodynamically very unstable and need emergency procedures to repair the wound but with very high mortality. It is very rare to encounter a patient with such an injury walking into the emergency department with stable hemodynamics and the weapon still in situ.

The patient, a 22-year-old man, presented to us approximately 12 hours after an arrow injury sustained during fighting in his village. The arrow was shot from a bow at a distance of around 5 meters. Such bows and arrows are home-made weapons often used by tribal individuals for hunting. The patient's only presenting complaint was pain at the site of arrow entry. He was conscious, oriented, and hemodynamically stable on arrival (Fig 1). There was no history of hemoptysis, melena, or hematemesis, and the arrow was supported by his left hand. No surgical emphysema was noted, and his bilateral chest movements and all peripheral pulses were normal. His hemoglobin level was 12.9 g dL. Roentgenograms of the chest (Figs 2 and 3) were taken. The direction of the arrow and its depth inside the patient on these images strongly raised the suspicion of great vessel injury, and because there were no external or internal signs of ongoing bleeding, it raised a possibility that the entry wound in a great vessel was sealed by the arrow itself. In view of this, it was decided not to mobilize the patient for computed tomography.

The patient was taken into the operating room. A double-lumen endotracheal tube was placed so that we could collapse the right lung for a better view if needed. A median sternotomy was done, and a sternal retractor was applied at the lower end of the sternum, which was opened gently. Again the idea was to cause minimal mobility of the arrow and its in situ part. The right pleural



Fig 1. Patient at presentation with arrow approximately 3 feet long in the right parasternal area, in the first intercostal space just lateral to the sternum. The arrow was directed medially.

cavity was opened. No blood was found there. The arrow could now be felt penetrating the right first intercostal space just lateral to sternal border through the thymus and deeper through the innominate vein. There was hematoma in the thymic region. Part of the right lobe of the thymus was removed. The pericardium was then opened from below, and the incision was gradually extended upward. The area around the upper part of the ascending aorta and the left innominate vein was filled with a hematoma. The hematoma was carefully dissected out, and the anesthetist was asked to lower the systolic blood pressure to 80 mm Hg. The left innominate vein was pierced through and through. The tip of the arrow could now be felt going inside the ascending aorta, sealing the wound of entry. As we were dissecting the hematoma the arrow came loose, thus causing hemorrhage from the aorta. Digital pressure was used to control the hemorrhage. A side-biting aortic clamp, was applied and the arrow was removed from inside the aorta. The aorta was sutured with Prolene 3-0 and 4-0 in two layers, and the clamp was removed. The torn innominate vein was sutured and ligated. The anesthetist was asked to bring the blood pressure back. After hemostasis was achieved, the chest was closed and the patient was taken to the intensive care unit in stable condition. After a smooth postoperative recovery, the patient was discharged on the fifth postoperative day.

Comment

In spite of such a lethal injury, the patient was saved, first because the arrow was snugly fitted in the chest wall with

Accepted for publication Nov 7, 2011.

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Fig 2. Posteroanterior roentgenogram of the chest showing a sharp metallic foreign body piercing through the right parasternal region, around 7 to 8 cm in depth; the bilateral lung fields were clear. There was slight superior mediastinal widening.

strong musculature and well-built bony cage, thus minimizing the movement of the arrow inside the chest, which minimized the enlargement of the entry wound in the aorta; second because the patient made no attempt to pull the arrow out; and third because the decision to avoid computed tomography also minimized any further possible movement of the arrow.

The incidence of aortic trauma is very low among all trauma patients. The majority of these injuries are blunt trauma caused by road traffic accidents. Penetrating injuries are mainly due to gunshot wounds. In a study in Scotland [1], 0.3 % of all trauma patients had trauma to the thoracic or abdominal aorta between 1992 and 2002. Of these, 79% patients had an injury of the thoracic aorta, 20% had an injury of the abdominal aorta, and 1% had injuries of both. Blunt trauma was responsible for 73% of injuries. In this study, the overall mortality was reported to be 86%.

Penetrating aortic injuries still have a very high mortality rate, with no improvement in survival despite improved trauma services. Injury to the thoracic aorta, gunshot wounds, unrecordable blood pressure on admission, and the need to perform thoracotomy in the emergency department are important predictors of high mortality. Demetriades and colleagues [2] reported the overall mortality in such cases to be 80.6%.

Acute cardiac failure, pulmonary edema, and ischemia of the brain, cord, and other structures pose special problems with trauma to the aortic arch and its branches [3].

Endovascular treatment may be a valuable and lifesaving option for patients sustaining penetrating aortic injury with contraindications to surgical operation [4].

Both the diagnosis and management of penetrating injuries to the heart and great vessels have evolved from more invasive to less invasive strategies, paralleling the advent of sophisticated imaging tools and the development of endovascular therapies [5].

During a 35-year period (1974–2009), Verdant [6] described 138 consecutive patients with acute traumatic rupture of the thoracic aorta who underwent repair with a Dacron graft interposition through a standard left thoracotomy. It was observed that conventional open surgical repair of acute traumatic rupture of the thoracic aorta performed with properly monitored circulatory support can be accomplished with a very low rate of mortality and spinal cord injury. In comparison with the Gott shunt, a bypass of the left side of the heart propelled with a centrifugal pump is a technically better method of perfusion.

Seitelberger and associates [7] described the surgical treatment of a 56-year-old patient with a single thoracic stab wound penetrating the left innominate vein and the aortic arch. Repair was successfully achieved by use of extracorporeal circulation and circulatory arrest during deep hypothermia.

Wall and colleagues [8] described the various exposure techniques and principles of managing penetrating thoracic vascular injuries. They advocated a median sternotomy for the ascending aorta and arch and a posterolateral thoracotomy for the thoracic aorta. Preoperative arteriography if feasible is extremely useful in managing penetrating injuries to the thoracic outlet because it

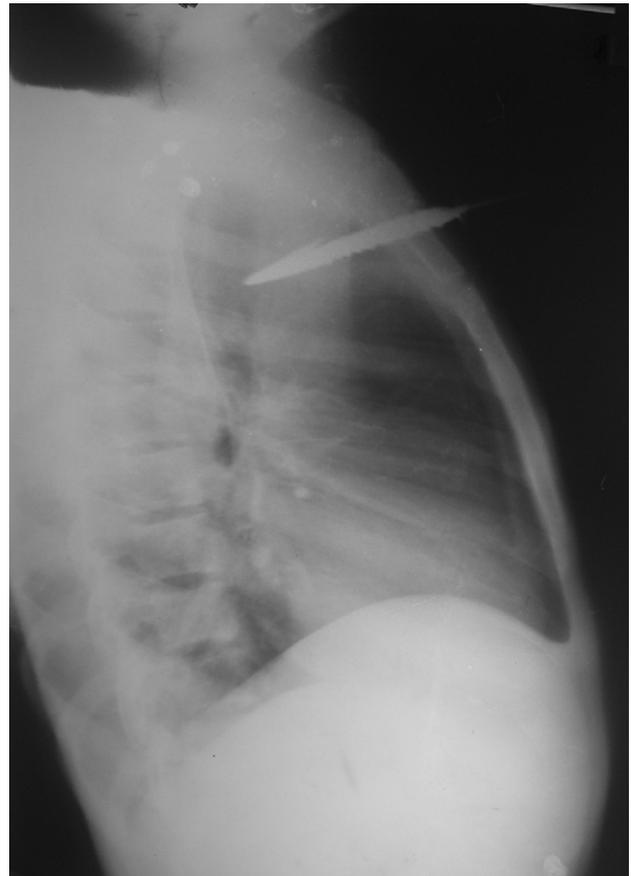


Fig 3. Right lateral roentgenogram of the chest showing the length of the metallic portion of the arrow.

allows the choice of appropriate incisions for exposure and control. Injuries to the innominate artery, the right common carotid or subclavian artery, and the left intrathoracic common carotid artery are best managed through a median sternotomy with appropriate extension. Injury to the left subclavian artery is managed with a high left anterolateral thoracotomy for proximal control, combined with a supraclavicular incision. The bypass principle is useful for managing injuries to the innominate or left carotid artery.

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