ELSEVIER

Clinical Research

Outcome after Thoracic Aortic Injury: Experience in a Level-1 Trauma Center

Yazan Duwayri, Jihad Abbas, Gregory Cerilli, Edwin Chan, and Munier Nazzal, Toledo, Ohio

Traumatic rupture of the thoracic aorta is a potentially fatal injury that leads to death in 75-90% of cases at the time of injury. In this report, we present our experience with traumatic thoracic aortic injury and compare the outcome in patients with respect to their hemodynamic stability at presentation and the timing of surgical repair. We performed a retrospective data analysis of the medical records of 30 patients who had sustained a traumatic rupture of the thoracic aorta during the period from January 1, 2000 to October 30, 2005. The demographic data, mechanism of injury, modality of diagnosis, location of injury, other associated injuries, hemodynamic stability at presentation, response to resuscitation, timing of aortic repair, as well as the resultant morbidities and mortalities were reviewed. Traumatic rupture of the thoracic aorta was diagnosed in 30 patients. The injury was located in the ascending aorta in two patients, in the aortic isthmus in 25 patients, and in the descending aorta (distal to the isthmus) in three patients. Associated injuries included head injury (50%), C spine (23.3%), lung injury (80%), and visceral (63%) and extremity (60%) injury. Seven patients (23%) were pronounced dead on arrival to the emergency room, 14 patients (47%) were hemodynamically unstable upon arrival, and nine patients (30%) were hemodynamically stable. In the unstable group, two patients (14%) expired before operative repair, 11 patients (79%) underwent emergent repair of the thoracic aorta resulting in 46% mortality, and one patient (7%) underwent delayed repair after initial stabilization with a splenectomy for a splenic laceration. In the stable group, three patients (33%) underwent early (within 24 hr) aortic surgery, while repair was delayed in six (67%). The mean duration of time spent prior to delayed repair was 20.85 days (range 2-53, median = 25). There was no mortality in this group. Acute traumatic thoracic aortic rupture remains a highly fatal condition. Hemodynamic instability remains the main mortality risk factor. Delayed repair is safe and is not associated with increased risk of aortic rupture in hemodynamically stable patients.

INTRODUCTION

Traumatic tear of the thoracic aorta is usually an injury of deceleration accidents such as high-speed motor vehicle collisions. It is a highly fatal condition, resulting in immediate death in as high as 75-90% of cases.[1] Patients with a ruptured thoracic aorta often have other severe traumatic injuries that add to their mortality and morbidity risks. Due to the high immediate mortality rate, this injury had been considered an absolute surgical emergency until the emergence of delayed repair.[2,3] Delayed repair of traumatic aortic tears would allow patients to recover from their associated injuries and optimize their status in preparation for surgical repair.

The present report is a retrospective study on 30 consecutive patients brought to our level-1 trauma center with traumatic injuries of the thoracic aorta. We review our experience and analyze factors contributing to the outcome of management.

Division of Vascular and Endovascular Surgery, Department of Surgery, University of Toledo Medical Center, Toledo, OH.

Correspondence to: Munier Nazzal, MD, Division of Vascular and Endovascular Surgery, Department of Surgery, University of Toledo Medical Center, 3064 Arlington Avenue, Dowling Hall 2nd Floor, Toledo, OH 43614, USA, E-mail: munier.nazzal@utoledo.edu

Ann Vasc Surg 2008; 22: 309-313
DOI: 10.1016/j.avsg.2007.09.012

Published online: April 14, 2008

MATERIALS AND METHODS

All patients who presented with traumatic tears of the thoracic aorta to the University of Toledo Medical Center from January 1, 2000, to October 30, 2005, were identified through the institution's trauma registry. The medical records of those patients were retrospectively reviewed for demographic data, mechanism of injury, modality of diagnosis, location of injury, other associated injuries, hemodynamic stability at presentation, response to resuscitation, and timing of repair. ''Immediate surgical repair'' was defined as repair within 24 hr of the time of presentation. ''Delayed repair'' was defined as repair after 24 hr from the time of presentation. ''Hemodynamic instability'' was defined as persistent hypotension (systolic blood pressure $<$ 90) and tachycardia unresponsive to rapid infusion of 2 L of crystalloid fluid boluses and requiring blood transfusion in the trauma bay. Outcomes of management and factors contributing to outcome were reviewed. Surgical repair was done via a left-sided thoracotomy in all cases. Left heart bypass was utilized in all operative repairs, and repair was performed using a Dacron (Dupont, Wilmington, DE) graft.

The data were recorded and analyzed using Microsoft (Redmond, WA) Excel, and statistical analysis was done using Fisher's exact test.

RESULTS

During the study period, 30 cases with thoracic aortic injury presented to the University of Toledo Medical Center.

The mean age was 40.6 years (range 16-89). There were seven (23%) female and 23 (77%) male patients. Twenty-nine (97%) of these patients sustained the injury as a result of a motor vehicle collision, while one patient sustained a crush injury by a forklift resulting in thoracic aortic injury.

Seven patients arrived without vital signs and were pronounced dead shortly after arrival; the diagnosis was later made in these patients by postmortem autopsy. The initial diagnosis of thoracic aortic injury was suggested by chest X-ray in 19 out of the remaining 23 patients (83%). Of those, 16 (84%) underwent computed tomography angiography (CTA) of the chest to confirm the diagnosis, one (5%) had a transesophageal echocardiogram, and two (11%) were taken emergently to the operating room, where the diagnosis was confirmed intraoperatively. Of the four patients who had an essentially negative chest X-ray, a CTA of the chest was done and revealed the traumatic aortic rupture (TAR) in three (75%).

Table I. Injuries associated with traumatic tears of the thoracic aorta

	Stable patients ($n = 9$)	Unstable patients ($n = 14$)	p
Closed head injury	4 (44%)	7 (50%)	1
Cervical spine injury	0 (0%)	4 (29%)	0.1273
Lung contusions	7 (78%)	12 (86%)	1
Chest wall injuries	3 (33%)	7 (50%)	0.6693
Abdominal visceral injuries	5 (56%)	10 (71%)	0.6570
Extremity injuries	6 (67%)	9 (64%)	1

The fourth patient did not survive the initial resuscitation to undergo further tests, and the diagnosis of thoracic aortic injury was made by postmortem autopsy. Aortography was utilized as a confirmatory study in 11 patients.

The injury was located in the ascending aorta in two patients (7%), in the aortic isthmus in 25 patients (83%), and in the descending aorta (distal to the isthmus) in three patients (10%).

Associated injuries included closed head injury in 15 patients (50%), cervical spine injury in seven patients (23.3%), lung contusions in 24 patients (80%), chest wall injuries in 16 patients (53%), abdominal visceral injuries in 19 patients (63%), and extremity injury in 18 patients (60%). There was no significant statistical difference in the pattern of associated injuries between the stable and the unstable groups (Table I).

Seven patients (23%) were pronounced dead on arrival to the emergency room, with the diagnosis of thoracic aortic rupture made only by autopsy. The remaining patients were divided into two groups according to their hemodynamic stability upon presentation and in the trauma bay.

Fourteen patients (47%) were hemodynamically unstable upon arrival. Of those, two (14%) expired shortly after arrival during resuscitation attempts, 11 (79%) underwent emergent repair of the thoracic aorta, and one (7%) underwent delayed repair after initial stabilization with a splenectomy for a splenic laceration. Among the 11 patients who underwent emergent repair secondary to hemodynamic instability, five (45.5%) expired intraoperatively during attempted repair, one (9%) developed acute renal failure and paraplegia postoperatively, and five (45.5%) survived without postoperative complications and were later discharged. Blood transfusion requirements during initial resuscitation in the emergency room ranged between one and seven units of packed red blood cells. An increased initial transfusion requirement seems to correlate with poor outcome (Table II).