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Traumatic aortic injuries in the pediatric population

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Abstract

Background/Purpose: Blunt trauma is the leading cause of pediatric injury, but pediatric aortic injuries are rare. We undertook this study to investigate the demographics, treatment, and outcomes of children with blunt aortic injuries and report our experience over a 10-year period.

Methods: After Institutional Review Board approval, a 10-year retrospective review of all pediatric patients admitted with blunt aortic injury was performed. Patient demographics, injury details and severity score (Injury Severity Score), treatment, and outcomes were recorded.

Results: There were 11 children, with ages ranging from 7 to 19 years. The most common mechanism of injury was motor vehicle crashes (8). Initial computed tomography demonstrated all 11 injuries: 7 thoracic aortic (TA) and 4 abdominal aortic (AA) injuries. Associated injuries were common. The TA injuries included 4 transections, 2 intimal flaps, and 1 pseudoaneurysm. Three of these were managed nonoperatively. The AA injuries included 3 intimal flaps and 1 dissection. Three of these were also managed nonoperatively. There were no complications in the 4 children with AA or in the 3 children with TA managed nonoperatively. Complications in the 4 children undergoing operative repair of the TA included paraplegia, renal failure, recurrent laryngeal nerve injury, and pulmonary embolus. The mean hospital stay was 8 days. All children survived, with all but one discharged directly to home.

Conclusions: Blunt aortic injury in children is uncommon and is primarily associated with motor vehicle crashes. Injuries to the abdominal aorta were seen with restrained children vs those to the thoracic aorta that were seen in children who were unrestrained.

Traumatic injury remains the most common cause of death and disability in the pediatric population. It is estimated that 20,000 children die each year from traumatic injuries [1]. Despite increases in the incidence of penetrating trauma, blunt trauma remains the most common mechanism of injury in children, including motor vehicle crashes, falls, and vehicle vs pedestrian crashes.

Traumatic aortic injuries result in significant morbidity and mortality. The management of aortic injuries in adult trauma patients has been well established, based upon both military and civilian experiences. In fact, the Eastern Association for the Surgery of Trauma has published best practice guidelines for the diagnosis and treatment of traumatic thoracic aortic injuries in adults that are available on the Internet [2]. Vascular injuries in children are much less common and are primarily iatrogenic injuries sustained during catheterization procedures or traumatic injuries to the vasculature of the extremities. Most reports of aortic injuries in children are limited to case reports or small series [3-5],

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Table 1 Hemodynamics, hemoglobin, and GCS at presentation

Patient	Systolic BP (mm Hg)	Mean arterial pressure	Heart rate (beats/min)	Hgb (g/dL)	GCS
1	115	83.7	116	12.1	15
2	147	106.3	136	12	15
3	101	71	96	14	15
4	124	86	77	12	12
5	137	82.3	95	11.6	15
6	110	78.7	130	15.2	12
7	157	94	119	13	15
8	134	94	96	15	13
9	128	92	114	14.1	15
10	130	92	116	12.6	15
11	110	69.3	105	11	15

Hgb indicates hemoglobin.

and there is an even greater paucity of data available pertaining to the injury of the abdominal aorta in children.

The purpose of this report is to investigate the patient demographics, mechanisms of injury, associated injuries, treatment of aortic injuries, and outcome of pediatric patients with these injuries cared for at a single institution.

1. Methods

Approval for this study was obtained from the Institutional Review Board at the University of Florida. Both the hospital and pediatric surgery databases were queried for all pediatric patients seen at our institution who were younger than 20 years and had sustained traumatic injury to either the thoracic or abdominal aorta, including *The International Classification of Diseases, Ninth Revision, Clinical Modification* (*Sixth Edition*), codes 901.0 to 901.0, over a 10-year period from January 1996 to July 2006. A retrospective review of the hospital and clinic charts of these children was performed. Children with injuries limited to a major branch of the aorta, such as the carotid, mesenteric, renal, or iliac arteries, were excluded from review. All children were evaluated by the Pediatric Surgery or Trauma Surgery services at the University of Florida.

Data regarding patient demographics, mechanism of injury, hemodynamic status at presentation, diagnostic modalities, specific vascular diagnostic modalities, associated injuries, therapy, complications, and outcomes were gathered. Where appropriate, data are reported as mean ± standard error of the mean.

2. Results

The results are presented in tabular form in Tables 1-3.

2.1. Patient demographics and mechanism of injury

There were 11 patients who met the aforementioned criteria. The mean age of the patients was 14.3 ± 1.2 years (range, 7-19 years). The youngest patient was 7 years, and only 3 of the patients were older than 16 years. Most of the children were male (n = 8, 72%), and most were injured as occupants of a motor vehicle crash (n = 8, 72%). The other

Table 2 Traumatic thoracic aortic injuries

Patient	Age (y)	Sex	Mechanism of Injury	Restraint	Diagnosis	Repair	Associated injuries	Complications
1	13	M	BCA, no helmet	–	CT, TEE	No	Rib fx, pulmonary contusion, pneumothorax, femur fx, acromion fx, liver laceration, kidney contusion	None
2	16	M	MVC	No	CT, aortogram	Yes, graft	Femur and bilateral tibia fx, radius fx	Renal failure, paraplegia, sepsis, pneumonia
3	13	M	ATV, no helmet	–	CT	No	Radius fx, spleen laceration	None
4	19	F	MVC	No	CT	Yes, graft	Rib fx, pulmonary contusion, pneumothorax, hip dislocation, liver and spleen laceration, kidney contusion	Pulmonary embolus
5	15	M	MVC	No	CT	No	Rib fx, spine fx, scalp laceration	None
6	17	F	MVC	No	CT	Yes, graft	Humerus fx, pelvic fx, maxilla and orbit fx, liver contusion	Recurrent laryngeal nerve injury
7	18	M	Fall	–	CT, aortogram	Yes, graft	Rib fx, bilateral radius fx	None

BCA indicates bicycle accident; MVC motor vehicle crash; ATV, all-terrain vehicle crash; CT computed tomography; TEE, transesophageal echocardiography; fx, fracture.