Blunt Thoracic Aortic Injury in Case of a 15-Year-Old Boy: Difficulties and Possibilities of the Endovascular Approach

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Background: Blunt thoracic aortic injuries (BTAIs) are rare but life threatening. Most BTAI are caused by high-energy trauma. Among children with blunt trauma, the incidence of BTAI is below 1 percent. The present case deals with covered thoracic aortic rupture of a 15-year-old boy. Emphasizing the value and the difficulties of endovascular surgery in children is the motivation for this case report.

Case report: We are presenting the case of a 15-year-old boy, who suffered multiple traumata after accident. Beneath multiple fractures and a liver laceration, a thoracic aortic rupture with pseudoaneurysm of the aortic wall was diagnosed. Owing to the comorbidities, an endovascular therapy in combination with a transposition of the left subclavian artery to the common carotid artery was performed. The chronological line-up of the events and the endovascular treatment as well as the in-hospital follow-up are described.

Discussion: Injury-induced BTAI in pubescent children rarely occurs. Only few cases can be found in literature, none of which were associated with the presented pattern of injury.

Conclusions: The optimal treatment for childhood BTAI is a case-by-case decision. We critically discuss the value of endovascular therapy in the present case.

Blunt thoracic aortic injury (BTAI) is rare in pediatric patients. Although trauma could be named as main cause of death, BTAI induce only 2.1% of all pediatric deaths.[1]

Only few cases of victims younger than 20 years suffering from BTAI can be found in literature. Clinical manifestation of BTAI can be absent among children, who may demonstrate minimal, if any evidence of chest wall trauma. Thus, evaluation of all pediatric patients who are suspected of significant thoracic trauma is essential. Mortality after thoracic aortic rupture amounts to 85%.[2] Further 50% of the surviving patients will die within the first 24 hours. Within the first 3 months, mortality among all patients will rose up to 90%.[3]

In adults, recent studies have shown a better perioperative (30-day) outcome after endovascular repair compared with open surgery.

Aortic injuries can be graded based on computed tomography (CT) findings as follows:

- Type I with an intimal tear or flap
- Type II with an intramural hematoma
- Type III with pseudoaneurysm of the aortic wall
- Type IV with open rupture[4]

Type I and II of blunt traumatic aortic injury show slow progression of the injury and a nonsurgical therapy could be discussed.[4] Some publications describe medical treatment without further

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Table I. Chronological list of the injuries

Time of detection	Injury	Treatment
First treatment	Pelvic fracture (Os pubis)	Transfixation of sacroiliac joint via banjo screw
First treatment	Epiphyseolysis distal, right femur	Crossed wire osteosynthesis of the distal right femur
University Hospital	Liver laceration segment IV	Conservatively
University Hospital	Splenic infarction	Conservatively
University Hospital	Dissection of the celiac trunc	Conservatively
University Hospital	Back pain	Conservatively
University Hospital	BTAI III°	Transposition of the LSA and TEVAR

TEVAR, thoracic aortic endovascular aneurysm repair.

intervention as therapeutic option, others prefer open repair with the use of an intraoperative partial left heart bypass.[5] The need of immediate surgical therapy of BTAI type III or IV remains undisputed.[6] Prospective, multicenter trials emphasized the value of endovascular therapy in case of traumatic thoracic aortic rupture.[7,8] The purpose of this case report is to describe a rare pattern of injury leading to BTAI.

CASE REPORT

A 15-year-old boy was brought to a rural hospital with thoracic pain and inability to walk due to pain of the leg and the pelvis. Interviewed by an emergency physician, he reported himself crashing into a tree using his bicycle. Later, he admitted the collision happened while he was using his Kettcar, which was tied to a 30 miles/hr driving car.

The medical history includes nothing but obesity (body mass index, 42.2). During the hospital stay, a manifest hypothyreosis could be detected.

Radiography performed after admission revealed a pelvic fracture and a right distal femoral epiphyseolysis. The patient was transferred to our institution in hemodynamically stable situation. A CT scan confirmed the multifragmented, unstable pelvic fracture and the epiphyseolysis. Furthermore, it showed a clinical mute liver laceration of segment IV, a small splenic infarction of the upper pole, and obstruction of the celiac trunk with accompanying intramural hematoma.

First line of treatment included transfixation of the sacroiliac joint via banjo screw and crossed wire osteosynthesis of the right distal femur. The liver laceration and the splenic infarction were treated conservatively. The boy stayed on the children intensive care unit. Despite continuous application of intravenous analgesics thoracic pain remained unchanged. An overview of all injuries and the performed treatment can be found in Table I.

A CT scan of the entire aorta was performed because of the celiac trunk dissection and the perivascular hematoma in the viscera renal segment of the aorta. It revealed a covered rupture of the thoracic aorta in the junction of the distal aortic arch and descending thoracic aorta (Figs. 1 and 2). Moreover, an anatomic variation of the left vertebral artery was seen, having its origin directly in the descending aorta.

We considered the aortic lesion an indication for repair. The main arguments to decide for endovascular instead open repair were

1. that heparinization is necessary during clamping of the aorta, which means a significant elevated risk for bleeding.
2. that the liver laceration with requirement of blood transfusion is a relative contraindication for open surgical repair.

The surgery has been performed under general anesthesia with neuromonitoring techniques to detect cerebral function including neurologic monitoring with electroencephalography and transcranial doppler sonography. Both stated a physiological and noncompromised cerebrovascular perfusion during the whole procedure.

Vascular Surgical Treatment

(1) All anastomoses were done with a slowly absorbable 5.0 PDS suture (Ethicon®) l, which would guarantee a maximum flexibility in case of further growth and development of the vessels. In addition, single-button suture instead of running suture was performed.

(2) Transposition of the left subclavian artery (LSA) to the left common carotid artery instead of performing a carotid subclavian bypass to avoid implantation of a foreign material and reduce the