

# Successful endovascular management of a traumatic aortic rupture in a pediatric patient: case report and literature review

Pediyatrik bir hastada travmatik aort rüptürünün başarılı endovasküler tedavisi:  
Olgu sunumu ve literatür taraması

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We report herein an 11-year-old pedestrian struck by a motorcycle, who suffered subdural hematoma and aortic rupture and developed traumatic pseudoaneurysm. He was treated conservatively for the first 24 hours and submitted to stent placement occluding the aneurysm neck. There were no recurrences in the post-procedure period and the child was discharged after 21 days without sequelae. This report also reviews trauma mechanisms and management of such threatening lesions in the pediatric population.

**Key Words:** Blunt trauma; pediatric trauma; traumatic aortic rupture.

Bu yazıda, motosiklet çarpması sonucu subdural hematoma, aort rüptürü ve travmatik psödoanevrizma gelişen 11 yaşındaki olgu sunuldu. Hasta ilk 24 saat süreyle konservatif olarak tedavi edildi ve daha sonra anevrizma boynunun tıkanıklığını gidermeye yönelik stent yerleştirme işlemi için gönderildi. İşlem sonrası dönemde nüks oluşmadı ve hasta 21 gün sonra sekelsiz olarak taburcu edildi. Bu yazı, aynı zamanda pediyatrik hasta grubunun bu ciddi lezyonlarının tedavisi ve travma mekanizmalarını da irdelemektedir.

**Anahtar Sözcükler:** Künt travma; pediyatrik travma; travmatik aortik rüptür.

Traumatic aortic rupture due to blunt injuries is commonly associated with anterior-posterior motor vehicle accidents. Traumatic aortic rupture accounts for up to 10-20% of fatalities in high-speed deceleration road accidents and carries an estimated immediate fatality rate of 80-90%. Untreated survivors of acute trauma (10-20%) have poor prognosis, with 30% of them dying within six hours, 40-50% within 24 hours, and 90% within four months. Few cases arrive in the emergency room alive, and when they do, it is either because the rupture has tamponaded into a hematoma or a pseudoaneurysm has developed.

The pediatric population has a minimal rate of traumatic aortic rupture, with a mortality rate ranging from 0 to 2%.<sup>[1]</sup> Motor vehicle accidents are the leading cause related to this lesion in this population.

Therapeutic advances were relevant after the introduction of endovascular (EV) stents for the closure of leakages or pseudoaneurysm formed by traumatic dissection in 5% of cases.<sup>[1]</sup>

Herein, we describe the case of an 11-year-old male victim of a blunt trauma who was successfully treated with an endoprosthesis.

## CASE REPORT

An 11-year-old boy, weighting 30 kg, was struck by a motorcycle with a posterior direct trauma and arrived in the emergency room with Glasgow Coma Scale of 9, pulse rate of 120, arterial blood pressure of 110/70 mmHg, and closed left leg fracture. Initial assessment was performed with orotracheal intubation, venous lines and fluid replacement with lactated ringer at 20 ml/kg. Rapid response was achieved. Initial cranial and thorax plain films showed occipital fracture and widened mediastinum. Whole body computed tomography (CT) showed subdural hematoma, occipital fracture and an aortic flap into the descending aorta (Fig. 1a), corresponding to a pseudoaneurysm in sagittal (Fig. 1b) and coronal (Fig. 1c) reconstructions.

The child was maintained on mechanical ventilation and blood pressure control for about 24 hours,

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**Fig. 1.** (a) Aortic flap (double lumen) in thoracic CT scan. (b) Thoracic aortic pseudoaneurysm (sagittal view). (c) Thoracic aortic pseudoaneurysm (coronal view). (d) Aortogram confirming thoracic pseudoaneurysm.

when it was possible to perform an arteriogram that confirmed the pseudoaneurysm (Fig. 1d). A stent was placed occluding the aneurysmatic neck (Fig. 2).

Afterwards, the patient presented pulmonary contusion and remained on mechanical ventilation for four days. He was then discharged on post-operative day 21 with full recovery. He has been followed up twice a month for the last six months, showing no neurological, respiratory or hemodynamic damage.

### DISCUSSION

Post-traumatic aortic rupture occurs mainly in motor vehicle frontal crashes with driver ejection.<sup>[2,3]</sup> Other kinetic energy directions can cause disruption

of aortic layers due to dis-acceleration of fixed areas, such as the arterious (pulmonary) ligament.<sup>[4]</sup> It is an uncommon lesion in children.<sup>[5]</sup>

Most children presenting this injury are motor vehicle crash victims.<sup>[6-8]</sup> The direction of trauma is rarely mentioned, despite its importance in raising suspicion for the diagnosis of this kind of lesion. This concern is more often in motorcycle frontal collision but should also be remembered in cases like ours. There is no previous report in the literature of a posterior direct trauma as mechanism for this injury, as happened with the patient reported herein.

The diagnostic approach starts with classic findings in plain thoracic films, with high sensitivity but low specificity.<sup>[9,10]</sup> Spouge et al.<sup>[11]</sup> studied two groups concerning radiological findings and subsequent investigation was performed in only one of them. All children with confirmed aortic rupture in angiogram<sup>[12]</sup> or angiotomography<sup>[13-16]</sup> had widened mediastinum and blurred aortic arch. On the other hand, 50% of children who had negative results during investigation had the same abnormalities on plain films, making clinical findings and high level of suspicion essential for diagnosis. Striffeler<sup>[6]</sup> confirmed abnormal plain film findings with aortogram as well as with helicoidal tomography. Transesophageal echocardiography and intravascular ultrasound are possibilities in the evaluation of blunt chest trauma patients, but their applications are yet to be confirmed.<sup>[17-20]</sup>

Associated systemic injuries are quite common in pediatric patients with traumatic aortic rupture.<sup>[10]</sup>



**Fig. 2.** Pseudoaneurysm occlusion by stent placement.

Karmy-Jones et al.<sup>[7]</sup> observed in a retrospective series a high frequency of blunt head trauma (33%), pulmonary contusion (100%), long bones or pelvic fractures (50%), and myocardial contusion (17%), but no rib fractures. This only confirms that a high suspicion of vascular rupture should be taken into account in multi-traumatized children.

Surgical treatment for these lesions in pediatric patients requires a cardiac surgeon and extracorporeal circulation or bypass, as in the adult population.

Emergency operations were performed in nine adult patients in a Kawada et al. study.<sup>[21]</sup> Simple aortic cross-clamping and left heart bypass without heparin with the BioPump were performed for spinal cord protection in two recent patients without complication of embolization. Use of the BioPump as an adjunct in the repair of traumatic aortic rupture appears to be promising.

Delayed management approach with aggressive blood pressure control and serial radiological monitoring is a safe and recommended option for those with severe concomitant injuries or other medical comorbidities.<sup>[5]</sup> EV stenting offers a minimally invasive method of treatment but the long-term durability of the EV stent remains unknown. The greater feasibility of EV repair in the acute phase of the thoracic injury is an advantage over open surgery and should be the treatment of choice in patients with severe concomitant injuries.<sup>[16,22]</sup>

Ott et al.<sup>[23]</sup> analyzed prospectively the outcomes for open versus EV treatment of traumatic aortic rupture. There were no significant differences in demographics, injury or crash statistics between groups. The open group had an early mortality rate of 17% (n=2), a paraplegia rate of 16% (n=2), and a recurrent laryngeal nerve injury rate of 8.3% (n=1). This is in contrast to a 0% rate of mortality, paraplegia, and recurrent laryngeal nerve injury in the EV group. A definite trend toward decreased morbidity, mortality, intensive care unit length of stay, and number of ventilator-dependent days was seen with EV repair. EV repair is emerging as the preferred method of repairing blunt thoracic aortic injuries in trauma patients with multiple injuries.

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