

Infrarenal aortic dissection in a child after blunt trauma

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ABSTRACT

We present a 4-year-old who suffered blunt abdominal trauma leading to Chance fractures to the lumbar spine, bucket-handle injuries to the ileum and descending colon, and an aortic intimal injury leading to occlusion of the infrarenal aorta with extension to the bifurcation. Her vascular injuries were managed by endarterectomy of the intimal injury, thrombectomy of the distal aorta and bilateral iliac arteries using a Fogarty catheter, and patch angioplasty of the infrarenal aorta using bovine pericardium secured by a combination of interrupted and running sutures to optimize elasticity and operative time. (*J Vasc Surg Cases Innov Tech* 2022;8:129-31.)

Keywords: Aortic dissection; Bucket handle bowel injury; Chance fracture; Pediatric; Seat-belt; Trauma

The percentage of blunt vs penetrating injury is higher in the pediatric population when compared with adults. Because of their devastating nature, abdominal vascular injuries remain a significant source of morbidity and mortality among trauma patients.¹ An estimated 95%-99% of all aortic disruptions are in the thoracic region. Nevertheless, the mortality rate of abdominal aortic injuries has been reported to be between 18% and 37%.² Blunt vascular trauma, occurring in patients with seat belt fastened, has been attributed to the action of direct and indirect mechanical and hydraulic forces.^{3,4} Several cases of pediatric aortic injuries after blunt trauma have been presented in the literature including a 14-year-old with partial aortic transection repaired with Dacron graft,⁵ a 10-year-old with aortic and common iliac injuries,⁶ and a 6-year-old with acute bilateral lower extremity ischemia.⁷ Although most blunt aortic injuries manifest in the acute setting (<24 hours), some present days to years later including a 13-year-old who developed symptoms 10 years after a motor vehicle collision and required stenotic web excision and patch aortoplasty using bovine pericardium (BP).⁸ Our objective is to share our experience with a rare case of severe blunt aortic injury in a child.

CASE REPORT

A restrained 4-year-old girl sustained several injuries when a car collided with her utility terrain vehicle. Computed tomography (CT) scans at a local hospital were concerning for intra-abdominal fluid, L3/L4 fractures, and possible distal aortic injury prompting transfer to our level 1 trauma center (Fig 1). Primary and secondary trauma surveys on arrival almost 4 hours after her injury revealed tachycardia, rigid abdomen with seat belt sign across lower abdomen, and step-off lumbar deformity. Extremities had palpable distal pulses with intact motor and sensory functions. She was taken for emergent damage control surgery. After packing the abdomen, 56 cm of ileum and 8 cm of descending colon were resected for three bucket-handle injuries. With palpable aortic and iliac pulses and no expanding hematoma, the retroperitoneum was not explored. On arrival in the pediatric intensive care unit pedal and femoral pulses became weak and absent 20 minutes later with mottling (approximately 6 hours after trauma). CT angiogram showed complete occlusion of infrarenal aorta (Fig 2) and vascular surgery was consulted. On return to operating room, saphenous veins were evaluated as possible conduit, but deemed too small to accommodate the aorta (approximately 1 cm diameter). The retroperitoneal hematoma was evacuated, intravenous heparin administered, and infrarenal aorta and common iliac arteries were clamped. A 3-cm longitudinal aortic arteriotomy revealed a 2-cm intimal transection. The injured intima was endarterectomized with a freer elevator and the distal intimal flap tacked down just above the aortic bifurcation with simple interrupted 7-0 prolene. The anterior and posterior walls of the aorta appeared intact without further injury. Once the area was cleared of debris, a 2F Fogarty catheter was passed down the common iliac arteries and balloon deployed as the catheter was withdrawn. A significant clot burden was delivered.

A 1 cm × 6 cm BP patch was chosen given that it was readily available and thought to be superior to Dacron in amount of give with child growth, although this has not been investigated. The patch was cut to accommodate the defect. BP patch angioplasty was performed with interrupted 6-0 prolens down both sides of the patch in the cranial to caudal direction. Of note, we

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Fig 1. Computed tomography (CT) abdomen and pelvis taken at the outside hospital about an hour after the accident. Axial and coronal views show the aortic injury whose extent was not fully appreciated before the patient was emergently taken to the operating room for damage control surgery. The bone window in the sagittal view demonstrates part of the Chance fracture at L4 (arrow) that was repaired 5 days after the accident.



Fig 2. Computed tomography (CT) angiogram of the abdomen and pelvis taken after the first operation and approximately 6.5 hours after the accident showing the occlusion of the infrarenal aorta.

had to convert from interrupted to continuous running suture on the inferior aspect of the patch to expedite the repair given the lengthy operative time (122 minutes, approximately 20 minutes aortic clamp time) and anesthesia alerting us to progressive hypotension (with approximately 150 mL estimated blood loss) and hypothermia.

Postoperatively, femoral pulses palpable, lower extremity compartments soft, mottling resolved, and pedal signals present. On postoperative day 5, she underwent posterior approach open reduction internal fixation Chance fracture L3 to L4. CT angiography performed before discharge showed the vascular repair intact without stenosis or obstruction. The patient was ambulating when discharged on postoperative day 20. She was sent home on 3 months of therapeutic enoxaparin given the aortic injury and concomitant thrombus. Her father signed informed consent authorizing the authors to discuss her case in meetings

and publications. Institutional review board review was not requested because this was a retrospective analysis of a single case with no impact on the patient's care. The patient was seen at 2 months after injury, doing well. We will follow up at the end of the year with an aortic duplex and then decide on subsequent monitoring.

DISCUSSION

Blunt aortic injury in children is rare and often fatal presenting the vascular surgeon with a complex problem with little guidance or evidence-based protocols. This case demonstrated the triad of injuries seen in association with seat belt use: lumbar Chance fractures, bowel injury, and aortic injury.⁵ However, it was particularly unique and challenging as this patient was 4 years old. Based on a PubMed literature review, this is one of the youngest patients to be reported with this constellation of injuries.

During the initial exploration, the retroperitoneum was not entered given no expanding hematoma and readily palpable aortic and iliac pulses. The aortic injury seen on imaging by the pediatric trauma attending was to be managed nonoperatively. This rapidly changed with loss of pulses in the pediatric intensive care unit. This may serve as a guide to future management where the extent of injury at initial operation is uncertain and watchful waiting is entertained as in prior cases.⁶ To date, there are no long-term data supporting or refuting watchful waiting, and this remains a gray zone.

Patch repair was chosen given the long segment of transected intima requiring a 3-cm incision along the aorta for adequate exposure. Primary repair was not feasible as it would cause unacceptable flow-limiting stenosis given the small aortic size. Concern for growth of the child with a fixed size patch guided the suture technique, using interrupted sutures for much of the repair to allow for slightly more give, vs the running suture. Again, running suture was used on the inferior aspect to expedite the repair given the lengthy operative time and the patient's overall condition. BP was chosen given that it was available and thought to be superior to Dacron in amount of give as the child grows, although

this has not been investigated. A study comparing BP vs Dacron was performed for patch angioplasty of the carotid artery after endarterectomy and demonstrated decreased suture line bleeding in the BP group as well as superior handling as judged by the surgeons in the study.⁹

CONCLUSIONS

Severe aortic injuries in blunt abdominal trauma are rare but should be in the differential when a child presents with a seat belt sign along with possible bowel and vertebral injuries.⁵ Although nonoperative management has been reported,⁶ our case underscores the importance of a high level of suspicion with frequent neurovascular checks. Our case also highlights advantages of using BP over primary repair⁷ or Dacron patch⁵ to reduce tension, decrease suture line bleeding, and improve handling.⁹ Biannual follow-ups are recommended for several years including outpatient ultrasound examinations when warranted by clinical examination since some missed aortic injuries have been reported up to a decade later.^{5,8}

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