

Isolated Abdominal Injury of Blunt Aortic Trauma: Two Case Reports and Review of the Literature

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Background: Injury to the abdominal aorta as part of a blunt injury is a rare event and is normally associated with other abdominal injuries. The management of these injuries can be non-operative, open repair or endovascular repair.

Methods: We present two cases of blunt abdominal aortic injury (BAAI) in which the aorta was the only abdominal injury. This is followed by a review of the current literature.

Results: Both these cases were treated endovascularly with good results.

Conclusions: BAAIs are rare and can occur in isolation, i.e. without any accompanying abdominal injuries. Despite historically being treated mostly by open repair, endovascular repair offers many advantages and can be safely managed.

Keywords: Aorta; Abdominal; Trauma; Endovascular Procedure

Received: 27 July 2018; Accepted: 20 August 2018

INTRODUCTION

Injury to the abdominal aorta as part of a blunt injury is a rare event. A Western Trauma Association study reviewed 392,315 blunt injury cases and found blunt abdominal aortic injury (BAAI) in only 113 (0.3%) cases [1]. In many of these cases, the aortic injury is associated with other abdominal injuries, such as solid organ injury, small bowel injury, mesenteric hematoma, colon injury, etc. [2]. The increasing use of multi-detector computed tomography (CT) scans has led to an increase in the detection of injuries to the abdominal aorta [3].

Blunt injuries to the aorta are classified by type and by location. The types of aortic injury include free rupture and pseudoaneurysm, in which the external contour of the aorta is abnormal, as well as intimal tears and large intimal flaps, in which the external contour of the aorta is unchanged. The classification of the zones of injury are based on possible endovascular approaches: Zone I injuries range from the diaphragmatic hiatus to the origin of the superior mesenteric artery (SMA); Zone II encompasses the SMA, inferior mesenteric artery (IMA), and renal arteries; and Zone III includes injuries below the renal arteries [1].

The management of blunt abdominal injury ranges from non-operative management to open aortic repair. In the past few decades, endovascular techniques have emerged. As more experience is gained with aortic aneurysm repair in elective and urgent settings, the endovascular management of thoracic and abdominal aortic repair in trauma is rapidly becoming more common.

We present two cases where injury to the abdominal aorta was the sole abdominal injury. Details on the management and outcome are described and a review of the available literature is presented.

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Author contributions: All authors have substantially contributed to the manuscript writing.

Conflicts of interest: None.

Funding: None.

Presentation: A presentation on the topic presented here was given as part of the EVTMM 2018 symposium.

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Case Report 1

A 52-year-old cyclist presented to the trauma bay after falling from his bicycle at a high speed of 80 kph (approx.



Figure 1 Computed tomography images of the patient in case 1. (a) Coronal, (b) sagittal, and (c) axial views with enlarged images in the inserts.

50 mph) during a cross-country ride. He was alert, conscious and ambulating at the scene, though his helmet had fractured. His vital signs were normal and stable at the scene and during transfer. Primary survey in the trauma bay was normal, and secondary survey revealed substantial subcutaneous emphysema in his right chest and torso, as well as a deformity of the right clavicle. Pedal pulses were normal. A chest X-ray in the trauma bay revealed subcutaneous emphysema with no pneumothorax, and FAST examination was negative.

The patient proceeded to the CT scanner for a “whole-body” scan (see Figure 1). The CT revealed substantial subcutaneous emphysema, extending from the cranium to the scrotum, as well as minimal right-sided pneumothorax, minor pneumomediastinum, and air in the spinal column. There was a right-sided clavicular fracture and a fracture to his right 6th rib. Additionally, there was a large intimal flap in the infra-renal aorta, with partial thrombosis. No other head, chest or abdominal injury was noted.

The patient continued to be stable and with normal vital signs. He was admitted to the intensive care unit, and gastro-esophagoscopy and bronchoscopy were performed to rule out airway and/or esophageal leak. Both studies were normal. After other injuries were ruled out, the patient was taken to the operating room for angiography and endovascular repair of the aortic injury.

A Bentley 16×59 mm² covered stent graft was deployed in the infra-renal aorta through a 6 Fr sheath in the right groin, and a second (16×59 mm²) stent-graft was deployed with some overlap to provide an extension for the stent (see Figure 2). During deployment, thrombus material lodged in the left leg resulting in acute leg ischemia. Immediate thrombectomy was successfully performed. The patient had no history of hypertension, and his blood pressure was in the normal range during his hospital stay, so no effort was made to lower his blood pressure further. The patient was discharged 5 days later after the subcutaneous emphysema had resolved and remained well at follow-up 6 months

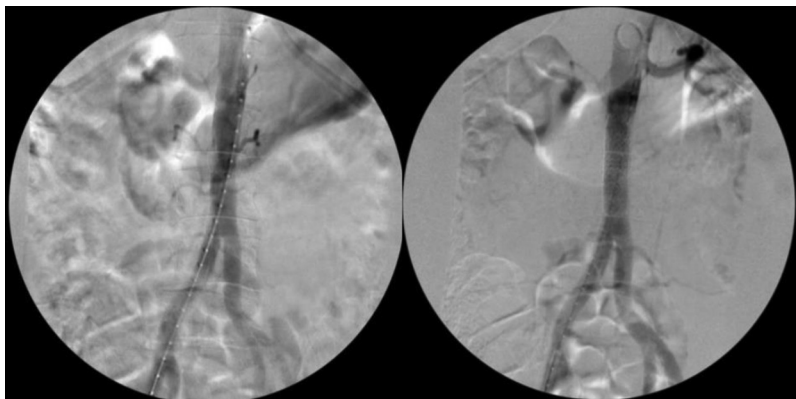


Figure 2 Intra-operative images of the patient in case 1, before (left) and after (right) deployment of the stent-graft.

later. He was treated with enoxaparin (LMWH) for 3 months after surgery, as well as aspirin which we have recommended that he continue to take indefinitely.

Case Report 2

A 57-year-old patient was referred to the ER 15 weeks after sustaining an open fracture of his right tibia and fibula. While repairing his minivan, the vehicle rolled onto him, compressing his leg and abdomen, resulting in an open leg fracture. The patient initially downplayed the severity of his abdominal pain due to his leg injury,

thus, no work-up on the abdomen was performed. His leg was repaired, and the patient was referred to a rehabilitation center.

Three months after his injury, the patient was referred to the ER due to acute ischemia of his left leg. Duplex ultrasonography was performed and revealed thrombosis of the left popliteal artery. An additional CT angiography of the chest and abdomen revealed a large mural and “floating” thrombus in the abdominal aorta (see Figure 3). After further questioning, it seems he had sustained a significant abdominal blunt trauma at the time of the accident. We speculated that the findings in the aorta were a result of an intimal tear which occurred at the time of the initial trauma.

The patient underwent endovascular repair with a (Bentley 16×59 mm²) covered stent graft with a satisfying technical result (see Figure 4). Some of the fresh thrombus dislodged distally and a femoral thrombectomy was successfully performed, with the pallor resolving and flow restored on the doppler.

The patient had no history of hypertension, and his blood pressure was in a normal range during his hospital stay, therefore no effort was made to lower his blood pressure further. The patient experienced an uneventful post-operative course and was alive and well on follow-up 6 months later. We recommended lifelong aspirin.

DISCUSSION

Isolated blunt injury to the abdominal aorta is rare. We present two such cases, as well as details of the management and outcomes. In patients where abdominal exploration is unwarranted, the advantages of endovascular approaches are even more significant. Suspicion of blunt abdominal trauma should be raised in patients presenting with a seat belt sign, abdominal wall disruption, lumbar spine fracture, hollow viscus injury, or abnormal peripheral pulses [4]. However, both patients we have presented demonstrated none of these signs. There should be a high index of suspicion for blunt abdominal

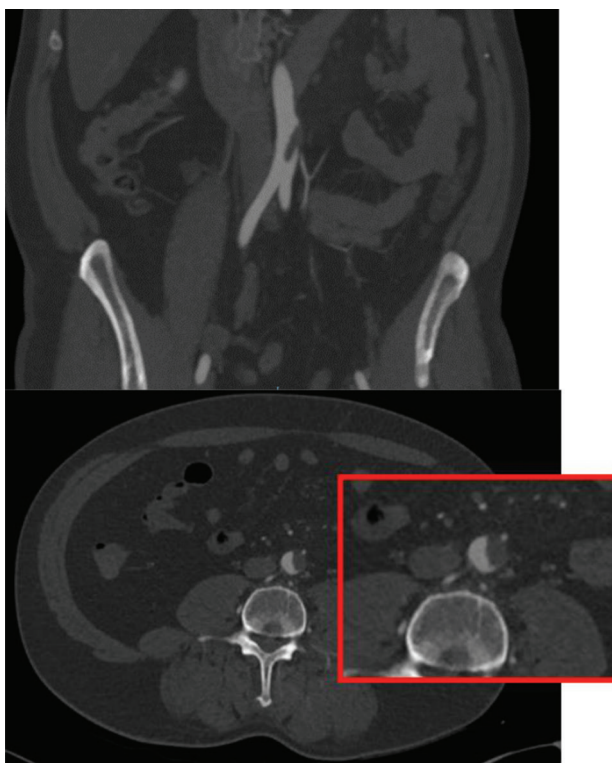


Figure 3 CT angiography images of the patient in case 2.

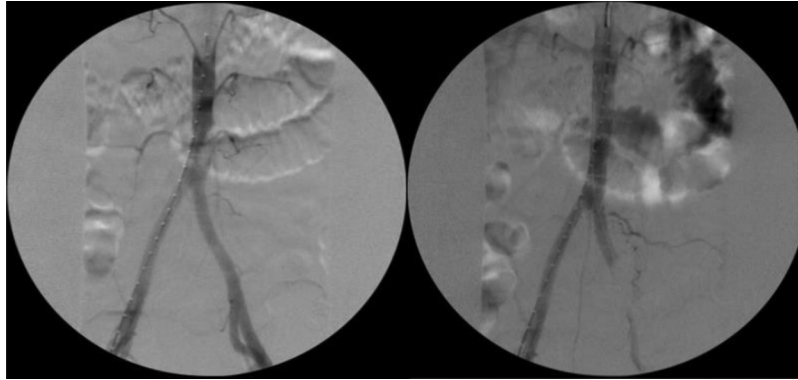


Figure 4 Intra-operative images of the patient in case 2, before (left) and after (right) deployment of the stent.

Table 1 Management of BAAI according to the zone of injury.

Zone of Injury	Management
Zone 1	Non-operative, endovascular, or open repair
Zone 2	Non-operative or open repair
Zone 3	Non-operative, endovascular, or open repair

injury in all patients who present no other abdominal or vascular injuries. As the frequency of CT scans in the evaluation of trauma patients continues to increase, more such asymptomatic injuries to the abdominal aorta are likely to be detected [3].

The Western Trauma Association conducted a review of over 392,315 blunt trauma patients from 1996–2011, 113 of which had a BAAI. The leading cause of injury was motor vehicle injury (60%). The review does not specify if patients presented with no other abdominal injury, as was the case in our two patients. However, the number of associated injuries: 50 cases of spine fractures, 45 of hemoperitoneum, 43 of solid organ injury, 39 of small bowel injury, 32 of colon injury, etc. suggests that the majority of cases involve injury to another abdominal organ. In a separate study of 414 patients from 180 centers, 119 patients (27%) sustained blunt injuries to the abdominal aorta without any other major injuries [2].

In the Western Trauma Association cohort, 17.7% of cases presented as intimal tears, 36% as large intimal flaps, 15.9% as pseudoaneurysms, and 31.9% as free ruptures. Forty cases (35.4%) were managed non-operatively, 49 cases (43.4%), including all of the aortic free ruptures, were managed with open surgical repair, and only 17 cases (15%) were managed mainly with endovascular therapy. The choice of the treatment was affected by the patient's condition, the type of injury and the zone of injury (see Table 1). Injuries without contour abnormalities were treated mostly with a non-operative or endovascular approach, whereas free rupture was exclusively treated with open repair. While injuries to

zones 1 and 3 were treated with all three approaches, injuries to zone 2 were never treated with an endovascular approach [1]. In a separate review of 436 patients with BAAI, only 42 patients (10%) underwent repair, and the majority of them (29 patient, 69%) underwent endovascular repair [2].

An endovascular approach to a BAAI offers several advantages. In cases where open abdominal exploration is not necessary, endovascular repair avoids the morbidity of an open abdominal or retroperitoneal approach. In patients in which exploration reveals gross contamination of the peritoneal cavity, an endovascular approach avoids contamination of major vessels and graft material [5].

CONCLUSION

BAAIs are rare and can occur in isolation, i.e. without any accompanying abdominal injuries. Despite historically being treated mostly by open repair, endovascular repair offers many advantages and can be safely managed. We expect endovascular treatment to become the mainstay of treatment in the near future.

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