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Blunt Abdominal Aortic Injury and Multiple Traumatic Abdominal Wall Hernias: A case of Rare Concomitant Injuries

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Abstract

Blunt force trauma resulting in a combination of serious injuries is a significant cause of morbidity and mortality. We present a successfully managed case of blunt force trauma from a motor vehicular collision resulting in concomitant blunt abdominal aortic injury (BAAI) and multiple traumatic abdominal wall hernias (TAWH) that required emergency surgery. Lack of current literature and guidelines for the management of concomitant BAAI and TAWH makes these injuries a challenge for the trauma, vascular and general surgeons. Although minimally invasive techniques (laparoscopic and endovascular) exist to manage these injuries, in the setting of trauma open repair is favored by many surgeons. In conclusion, the management of concomitant BAAI and TAWH is challenging and the decision to treat will depend on a multitude of factors including but not limited to patient condition, available technology and physician preference.

Keywords: Traumatic, Hernia, Aortic, Abdominal

Introduction

Blunt abdominal aortic injury (BAAI) and traumatic abdominal wall hernia (TAWH) occurring concomitantly are very uncommon and have been previously reported in only rare case reports. Most common aortic injuries after blunt trauma affect the thoracic aorta, in close proximity to the isthmus where a relatively fixed arch transitions into a mobile descending aorta resulting in the highest shear forces from deceleration at the isthmus [1]. The incidence of abdominal aortic injuries after blunt trauma, however, is reported to be less than 0.1% in patients that reach the hospital [2]. The reported incidence of traumatic abdominal wall hernias is less than 0.2% [3]. This rare combination of injuries poses a significant management challenge for the surgeons given the lack of management guidelines. Management options include observation, open versus endovascular interventions for BAAI and open or minimally invasive repair with or without the use of mesh for TAWH [1,4-6]. We report a case of successful surgical management of a patient with concomitant BAAI and three TAWH.

Case Presentation

We present a case of a 22-year-old male who was a restrained back-seat passenger in a high-speed head-on motor vehicle collision. He was the lone survivor out of four passengers in the vehicle. On arrival, his primary survey was significant for abdominal contour deformity and presence of a "seat belt sign". His vital signs included heart rate of 150/min, systolic blood pressure of 70 mmHg, respiratory rate of 20/min and Glasgow coma scale of 14/15 (E3M5V6). After resuscitation he was stabilized to a blood pressure of 120/70 mmHg and a heart rate of 110/min. His chest and pelvic x-rays were negative. He underwent imaging with computerized tomography (CT) after stabilization of hemodynamics with initial resuscitation. His CT scan findings were significant for traumatic disruption of the anterior abdominal wall in three sites with bowel herniating through the fascial defect, acute aortic dissection with external contour deformity of the infrarenal aorta and free fluid in the abdomen (Figure 1A). Based on the CT scan findings and labile hemodynamic status, he was taken to the operating room and underwent an exploratory laparotomy. Operative findings were significant for two lateral abdominal wall defects as well as rectus sheath disruption in the midline. A small bowel perforation was identified in a segment within the midline TAWH, with no significant spillage of enteric contents. He also had a segment of sigmoid with questionable viability with an associated mesocolon laceration in the lateral abdominal wall hernia. There was a traumatic aortic dissection caudal to the inferior mesenteric artery and a pseudoaneurysm with a contained rupture (Figure 1B). The initial surgery consisted of repair of the BAAI with a 14 mm interposition Dacron tube graft followed by closure

of the retroperitoneum, small bowel resection with primary anastomosis, segmental sigmoid resection with stapled ends and a temporary closure of the abdomen with a negative pressure dressing. Although the BAAI was amenable to endovascular repair, we chose to utilize open repair of the aorta because of several reasons. Firstly, patient was hemodynamically labile and required an exploratory laparotomy for other associated injuries. Secondly, the aortic diameter below the renal arteries was 14 mm, making it unsuitable for any commercially available aortic endografts. His hemodynamics stabilized over the course of next two days. He remained intubated and in intensive care unit. During the subsequent planned second look laparotomy, three days later, he had a rectosigmoid anastomosis and a transverse colon loop colostomy placed. His abdominal wall hernias and altered anatomy made a diverting loop ileostomy not feasible. Additionally, he underwent primary repair of the lateral TAWHs using 0 PDS suture without the use of mesh. Five days from his index surgery he underwent closure of midline wound with a biological mesh placed as a bridging mesh and skin advancement flaps to approximate the skin. His hospital course was complicated with development of an enterocutaneous fistula that was managed non-operatively initially and required total parenteral nutrition for 2 weeks till oral intake was tolerated. Five weeks later, he was discharged to the rehabilitation unit. Six months later, he had exploratory laparotomy with excision of fistula tract, small bowel resection and the reversal of the transverse loop colostomy. Her recovered well and was discharged in a stable and ambulatory condition. His hernia repair with mesh and aortic tube graft remain intact with no associated infection on serial CT scan done two years after his index procedure (Figure 2).

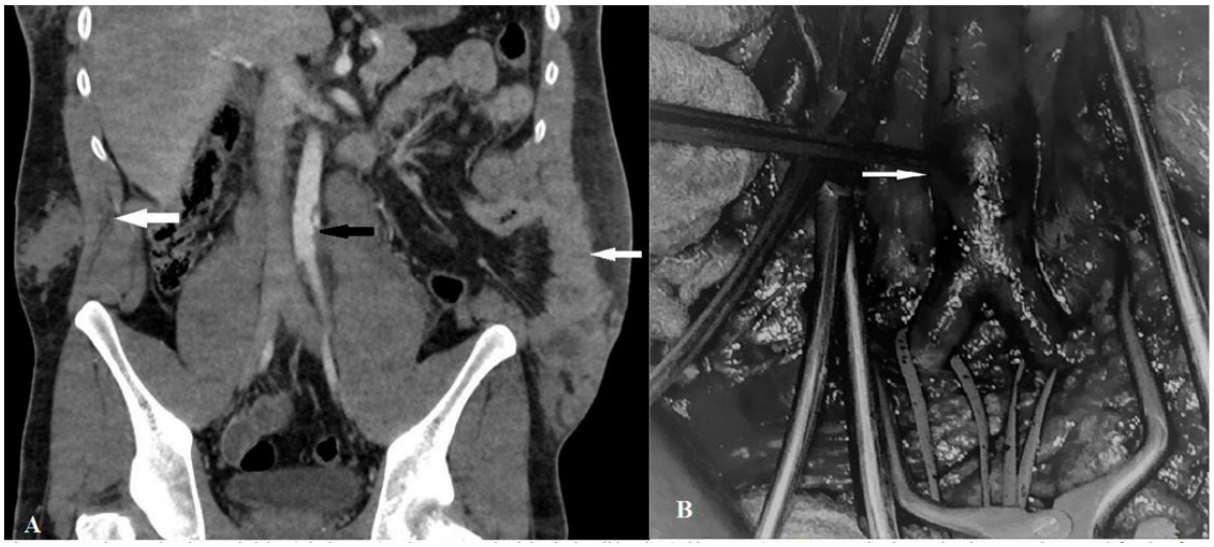

Figure 1: A CT images showing aortic injury (Black arrow) and two traumatic abdominal wall hernias (White Arrow). B. Intraoperative image showing external contour deformity of infrarenal aorta in zone III (White Arrow)

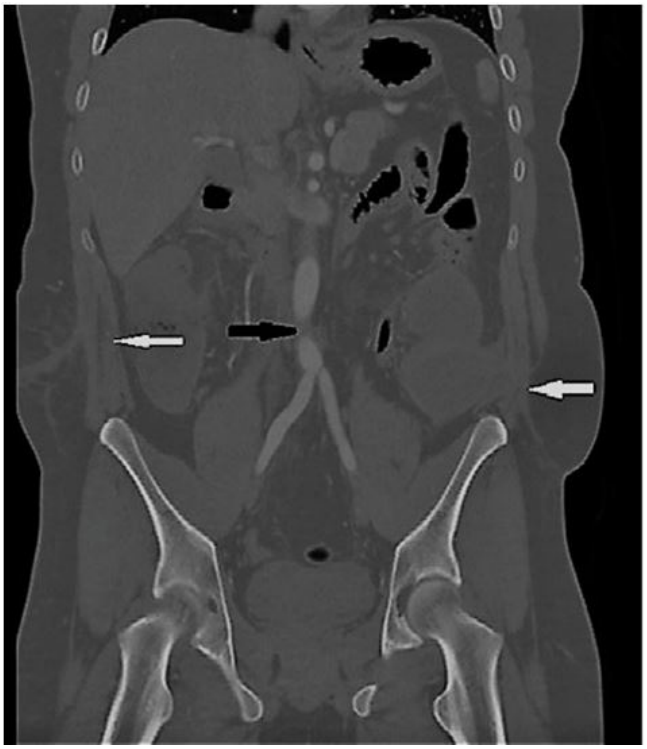

Figure 2: Post operative CT Scan two years after repair showing normal aortic graft (Black Arrow) and hernia repair without recurrence (White Arrows)

Discussion

Traumatic injury to abdominal aorta after blunt trauma (BAAI) is extremely rare, comprising of less than 0.1% of all aortic injuries [2]. BAAI may be caused by shear force from rapid deceleration, seen largely in high speed motor vehicle crashes. Other mechanisms include crushing of the aorta from compression between the vertebral bodies and abdominal wall, the so called "seat belt aorta" and direct injury to the aorta by bone fragments from fractures [7,8]. TAWH are caused by increased abdominal pressure or sheer forces with acceleration/deceleration in blunt abdominal trauma seen with motor vehicle accidents in adults and handlebar injuries in children [9].

Patients with BAAI may be asymptomatic from the injury with incidental injury identified on the imaging. When symptomatic, most patients are hemodynamically unstable with an acute abdomen, neurological deficit and end organ or limb ischemia [4,7]. Presence of a distended abdomen and "seat belt sign" should raise the suspicion for aortic injury. TAWH is clinically evident on physical exam with a palpable mass and tenderness. They may, however, be missed or misdiagnosed as other traumatic injuries like rectus sheath hematoma or Morel-Lavallee lesion. Imaging with CT scan is very sensitive for TAWH and BAAI and helps identify other intraabdominal injuries [10].

Azizzadeh *et al.* classified the traumatic aortic injuries into four grades based on angiography finding which included grade 1, intimal tear; grade 2, intramural hematoma; grade 3, pseudoaneurysm; grade 4, rupture [1]. This classification was modified by Starnes *et al.* based on the presence or absence of aortic contour deformity into four categories; two with external aortic contour abnormality and two without. Intimal tear with intimal defect and/or thrombus of less than 10mm in length or width and large intimal flap (LIF) with intimal defect and/or thrombus of more than 10 mm in length or width are without any external contour abnormality. Pseudoaneurysm with contained rupture and rupture with free contrast extravasation are associated with aortic external contour abnormality. They also found a statistically significant association of a higher injury severity score with higher grade of aortic injury [11].

Several factors play a role in the selection of therapeutic modality. Patients needing an exploratory laparotomy for other injuries may be managed by open repair of the aorta with a prosthetic tube or bifurcated graft. However, gross contamination of peritoneal cavity increases the infection risk after open aortic repair with prosthetic material. Our patient did not have gross spillage or contamination of the peritoneal cavity. There is a trend to treat blunt aortic injury with endovascular repair when feasible [1,11]. The largest series of patients with blunt abdominal aortic injury (BAAI) included 28 patients and the injuries were described based on the abdominal aorta zones of injury. Zone I included diaphragmatic hiatus to superior mesenteric artery, zone II included superior mesenteric artery to renal arteries and zone III renal arteries to aortic bifurcation. Zones I and III were deemed amenable to endovascular repair with particular benefit in the setting of concurrent gross contamination [4]. Our case was a grade 3 injury in zone III which was between the renal arteries and the aortic bifurcation. We chose to utilize open repair of the aorta for the following reasons. Patient was hemodynamically labile and required an exploratory laparotomy for other associated injuries. The aortic diameter below the renal arteries was 14 mm, making it unsuitable for any commercially available aortic endografts. Although the patient had blunt small bowel and colon injury, there was no gross contamination or spillage of bowel contents in the peritoneal cavity.

Repair of a TAWH requires considerable experience and may utilize laparoscopic or open approach if isolated [5]. The timing of repair is controversial but delaying repair results in muscle atrophy and enlarging defect over the time making delayed repair technically challenging. A multi-disciplinary approach comprising plastic surgery, trauma surgery and occupational therapist may be the key to the optimum outcome. Tension free repair is the goal, and this may not be possible without utilizing a mesh [6]. In the setting of gross contamination from concomitant bowel injury, the use of a mesh is controversial. The introduction of biologic mesh has changed treatment paradigms in a contaminated abdomen. We managed the patient with primary repair of TAWHs and closure of midline laparotomy with advancement skin flaps and biologic mesh.

As the technology and equipment improve, there is an increasing trend to treat isolated BAAI with endovascular techniques and TAWHs with minimally invasive techniques, when feasible.

Conclusion

No management guidelines exist for the treatment of blunt abdominal aortic injury combined with traumatic abdominal wall hernias. Most patients with these injuries have multiple intrabdominal injuries that require exploration. Aortic injuries require operative intervention in grade 3 and 4 injuries or when imaging reveals external contour deformity while all TAWHs require treatment with the timing of repair, use of prosthetic mesh or the use of minimally invasive techniques still under debate. Our case describes a successful open surgical approach for these two rare concomitant injuries.

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