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Acute Thoracic Aortic Occlusion with Diffuse Mesenteric Ischemia and Death due to Vertebral Fracture Dislocation after Motorcycle Crash: Case Report and Review of the Literature

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Abstract

Acute traumatic thoracic aortic occlusion, related to thoracic vertebral body fractures, is an emergent, but rare vascular event. These patients have to be identified and managed in an efficient manner to achieve the best outcomes. We present the case of a 16 year old male who was involved in a motorcycle versus truck crash. He was transferred from an outside hospital. He subsequently developed global mesenteric ischemia with complete bowel necrosis secondary to traumatic thoracic aortic occlusion following this high energy trauma. On-table angiography *via* both femoral and brachial cut down approaches showed truncation of contrast in the aorta at the level of the fracture. The decision was made to perform an axillo-bifemoral bypass anastomosis to restore flow to the mesentery and lower extremities due to inability to pass a catheter and stent open the lesion. However, the bowel was re-inspected and noted to be dark and dusky, consistent with mesenteric infarction. Spy angiography was used to confirm there was no arterial supply to the viscera. Thus, the decision was made to abort surgical revascularization as the injury was deemed to be catastrophic and restoration of perfusion was deemed futile. In conclusion, the case highlights a rare clinical condition of traumatic thoracic aortic occlusion associated with acute mesenteric ischemia due to vertebral spondylolisthesis/fracture dislocation.

Significance of this study

What is already known about this subject?

- Acute aortic occlusion after blunt trauma is a rare but catastrophic vascular event, with high mortality rate of 75%.
- The reported incidence of aortic trauma ranges from approximately 1% to 9% of all major arterial injuries.
- Only by ensuring expeditious surgical management can mortality rates be expected to be decreased to less than 50 percent.
- Of the 10% to 15% of the patients with thoracic aortic injuries who initially survive and arrive at hospital alive, 1 out of 5 will die in the hospital prior to surgery.

What are the new findings?

- Early vascular and spinal surgery consultation with the timely reduction of the vertebral subluxation and distal revascularization could potentially be lifesaving in this situation.
- Endovascular options are becoming more and more prevalent, although not a viable option in the case of complete aortic occlusion.
- ECMO may provide more time for other interventions with patients suffering from traumatic aortic injuries with mesenteric ischemia due to aortic tethering and other acute traumatic aortic pathologies.
- Earlier restoration of blood flow by performing an axillary-bifemoral bypass graph should

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be considered and may be a potentially life-saving intervention.

How might these results change the focus of research or clinical practice?

- The finding of this report highlights the value and importance of early diagnosis and intervention to restore blood flow after acute traumatic aortic occlusion.
- Hybrid operating rooms with interventional vascular capabilities could improve the efficiency of care for this subset of critically ill patients.
- Clinical diagnosis via physical examination should be used to expedite the treatment of patients with evidence of acute aortic occlusion after thoracic vertebral fracture dislocation injuries.

Introduction

Acute aortic occlusion is a rare and emergent vascular event [1-4]. Patients who present with this disorder typically have a classical history and physical examination with findings consistent with occlusion of the distal aorta and resultant ischemia of the distal tissues. These patients have to be managed in an efficient manner to achieve the best outcomes. Aortography has been shown to be important in determining whether the renal arteries are involved and has traditionally been recommended to be completed prior to surgery [4]. Complete acute aortic occlusion after blunt chest trauma is an even more exceedingly rare event, which warrants a high degree of clinical suspicion to diagnose and treat effectively [4-5]. If the patient is clinically unable to tolerate a major vascular intervention, a viable option is to perform axillo-bifemoral bypass under local anesthesia [4]. Even with aggressive surgical management and postoperative care, these patients tend to have uncertain, complicated postoperative courses. It is of primary importance that physicians realize that time is a critical factor and these patients should be promptly referred for vascular surgery or the appropriate care center [4]. Only by ensuring expeditious surgical management can mortality rates be expected to be decreased to less than 50 percent [4].

The reported incidence of aortic trauma ranges from approximately 1% to 9% of all major arterial injuries [1-5]. Acute abdominal aortic occlusion due to blunt trauma is a much rarer condition with only a few scattered reports in the literature. Although injury to the abdominal aorta associated with blunt abdominal trauma is a relatively infrequent event, trauma to the thoracic aorta after blunt chest trauma is an even more infrequent occurrence [6]. The resulting contusion, occlusion, intimal disruption, dissection, or rupture of the involved aortic segment often has catastrophic clinical consequences, particularly if not treated efficiently. The thoracic aorta is relatively fixed by both the intercostals and great vessels and the spine and a direct blow typically results in a tear at the ligament arteriosum just below the arch of the aorta [6]. The aortic wall is stretched and compressed against a high pressure column of blood. Any mechanism of blunt vascular trauma that results in aortic contusion, intimal laceration, compression or dissection can lead to luminal stenosis, thrombosis, and ultimate occlusion of this large caliber vessel. Intimal disruption may lead to distal dissection and progress to complete aortic thrombosis. In the absence of underlying occlusive disease, acute abdominal aortic occlusion usually results in marked acute distal ischemia and progressive neurologic and motor impairment [2,3]. The clinical sequelae of acute traumatic thoracic aortic occlusion is significantly determined by the location of injury and extent of the occlusion or thrombosis, the presence of a sufficient collateral vascular network before the time of trauma, and the time between injury and revascularization [5].

Although posttraumatic neurologic impairment without direct spinal cord injury is rare, it is, however, common in the setting of acute aortic thrombosis, particularly after cases of blunt traumatic injury to the abdominal aorta. When a vertebral fracture is present, it increases the risk of spinal cord injury and paralysis. Thoracic fracture dislocations reportedly lead to complete paraplegia in up to 80% of cases. It is rare for these dislocations not to cause neurological deficits, as evidenced by a paucity of documented neurologically intact cases in the English-language literature. Nevertheless, Blunt Aortic Injury (BAI) is known to be a life-threatening complication of chest trauma. In a study of 387 blunt trauma deaths, it was noted to be the second most common cause of death after head injury [3]. BAI is an injury of rapid deceleration and is strongly associated with motor vehicle collisions, and to a lesser extent motorcycle accidents.

It has been estimated that 85% of patients die at the scene of the accident, and of the 10% to 15% of the patients who initially survive and arrive at hospital alive, 1 out of 5 will die of subsequent aortic rupture in the hospital prior to surgery [4,5]. The key to successful management of these patients is early recognition that neurologic deficits arising in the setting of significant blunt thoracic or abdominal trauma may be due to aortic occlusion. Although full neurologic recovery may be unlikely, dramatic improvement in neurologic function can occur if a high index of suspicion is maintained, angiographic confirmation is rapidly obtained, and immediate revascularization is achieved. The clinical and radiographic findings dictate the most suitable operative approach. If the extent of aortic trauma requires replacement by a prosthetic graft, hypotension should be instinctively avoided and any unnecessary dissection and collateral interruption should be kept to a minimum. We present the case of a young male who sustained a blunt thoracic injury after a motorcycle collision with the bed of a truck with complete thoracic aortic occlusion and global mesenteric ischemia and bowel infarction.

Presentation of Case

Acute thoracic aortic occlusion from vertebral subluxation is a very rare phenomenon and there are no other cases in the literature that we could identify. Patient was a 16 year old male who was involved in a motorcycle versus truck crash with acute mesenteric ischemia with complete bowel necrosis due to traumatic proximal aortic occlusion from thoracic vertebral subluxation following this high energy trauma. The patient presented with multiple injuries to the thorax and abdomen, including a right traumatic hemopneumothorax and became progressively hemo dynamically unstable (Figure 1).

Physical examination revealed decreased breath sounds on the right side, weak femoral pulses with no pedal pulses bilaterally, pale feet, and a loss of motor function and sensation below T10 with a palpable step-off fracture at that level. His Focused Assessment Sonogram for Trauma (FAST) was positive in the RUQ above the liver/based of the right lung. Chest X-ray revealed left lateral subluxation of

Figure 1: This is a chest x-ray with findings suggestive of a large pulmonary contusion involving the left hemithorax versus a left hemothorax.Left lateral subluxation of the thoracic spine at the T10 level in relation to T9 is demonstrated, with an obliquely oriented lower thoracic and imaged lumbar spine. Collectively, these findings are highly concerning for an acute thoracic spinal injury, including ligamentous injury.

the thoracic vertebral body of T10 on T11 with an obliquely angulated lower thoracic spine. A right chest tube was placed to decompress the hemopneumothorax. CT scan was not able to be obtained due to his hemodynamic instability. Therefore, a vascular surgery consult was requested as the patient was being emergently taken up to the operating room for exploratory laparotomy and right thoracotomy in an attempt to achieve hemodynamic optimization.

An intraoperative orthopedic surgery consultation was obtained, but they were unable to intervene due to lack of proper CT imaging or adequate radiographic assessment. After bleeding in the thoracic cavity was controlled, abdominal laparotomy revealed no evidence of hemoperitoneum but also showed no pulses in the aorta. The vascular surgery team subsequently intervened and performed a femoral cut down and aortogram, which showed a truncation of contrast in the aorta at the level of T10 (Figure 2). Therefore, a left brachial cut down was undertaken and a repeat aortogram was then performed from a superior left brachial artery cut-down approach, which demonstrated the same findings.

The decision was made to perform an axillo-bifemoral bypass anastomosis to restore flow to the mesentery and lower extremities. However, at this point, the bowel was re-inspected and noted to be dark and dusky consistent with mesenteric infarction. Spy angiography confirmed there was no arterial supply to the viscera. Thus, the decision was made to abort any attempt at surgical revascularization by the vascular surgery team as the injury was deemed to be catastrophic and vascular intervention at this time would be futile. The family was informed of the clinical situation and comfort care measures were instituted.

Discussion

Acute aortic occlusion is a rare but catastrophic disease, with high mortality rate of 75%, especially if there are delays in diagnosis and treatment [7]. It often results from aortic saddle embolus or the development of acute occlusive thrombosis overlying atherosclerotic abdominal aorta or damaged aortic intima from blunt trauma [7]. Traumatic aortic occlusion is even more rare of a phenomenon to encounter and can easily delay diagnosis of an injury that is very time sensitive. Fatalities from traumatic aortic injury have been quoted as high as 30% and the mechanisms are secondary to high-speed deceleration in the anterior-posterior and lateral position that leads to torsion, bending, shearing and increase in intravascular pressure [8,9].

In the case presented, the aorta was tethered from the displaced thoracic vertebral fracture. Due to this mechanism of injury, the catheter from the aortogram was unable to be passed through the thoracic aorta at the level of occlusion from below or above. Secondary to the high risk nature of this presentation, early vascular surgery consultation and intervention along with the timely reduction of the vertebral subluxation could potentially be lifesaving in this situation. Once such an injury is suspected or identified, a timely confirmatory diagnosis should ensue along with aggressive intravenous therapy with vasodilators, and beta-blocking drugs to limit aortic wall stress and the risk of lethal aortic rupture [10]. The majority of the treatments for centuries involved open procedures. More recently, endovascular options are becoming more and more prevalent. Observational multicenter studies from the American Association for the Surgery of Trauma (AAST) comparing the two modalities have shown a reduction in the overall mortality along with a significant reduction of procedure-related paraplegia (from 8.7% to 1.6%) when using endovascular techniques. It also may obviate the need for a thoracotomy and the use of heparin that is contraindicated in a subset of trauma patients [10].

However, endovascular treatment requires that specific anatomic conditions with adequate peripheral vascular access [8]. The most important anatomic characteristic for endovascular treatment of a posttraumatic lesion is the presence of an adequate proximal neck, the absence of mural thrombus, calcifications, or hemorrhage in the aortic wall at the neck site [8]. In this current case, it is unlikely our patient would have benefitted given the aortic luminal occlusion preventing stent graft placement.

The incidence of spinal fractures in overall trauma population is 3% to 6%, with high-energy trauma accounting for the majority of the injuries [11]. As considerable violence is necessary to produce a fracture or dislocation of the thoracic spine, the narrower spinal canal in this region makes it almost inevitable that patients with these injuries also sustain a severe neurological injury. Some of the neurologic lesions seen associated with thoracic fractures include complete paraplegia, anterior cord syndrome, central cord syndrome, and rarely Brown-Sequard syndrome. Patients with incomplete cord injury have good potential for recovery unless there is no motor sparing after the injury. Treatment strategies are based off stability of the fracture and the neurological lesion that is present [12].

The exact mechanism of the spinal injury of this patient is difficult to definitively determine due to limited imaging. It is likely that the patient had a traumatic thoracic spondylolisthesis, based on findings on physical examination. Some authors have considered traumatic spondylolisthesis of the axis to be a flexion injury while others have considered it to be primarily a hyperextension-axial loading injury [13]. This lesion is commonly associated with a fall or a motor vehicle accident such as in this case [13]. It was noted that the displaced thoracic vertebral fracture occurred at the level of the aortic injury. Aortic occlusion was able to be confirmed by way of angiography, but the true and exact mechanism is also uncertain. There is a possibility that the aortic constriction could have been due to the vertebral fracture dislocation causing compression of the aorta or from the blunt injury to vessel with acute thrombosis related to the accident. If vertebral tethering of the aorta could have been confirmed,

vertebral reduction might have possibly been an appropriate surgical intervention. Treatment of this type of injury would most likely require surgical reduction. Unfortunately, our patient remained too unstable for proper workup as well to undergo such a procedure.

Extracorporeal Life Membrane Oxygenation (ECMO) is another temporizing intervention which could provide a possible option to patients who present with similar injuries as the patient presented in this report. In 2004, Masroor et al., [14] reported a case of a young man involved in a MVC who subsequently presented with injuries including a contained rupture of the descending aorta and developed what appeared to be a fat embolism leading to Adult Respiratory Distress Syndrome (ARDS) ECMO was initiated early while aggressive non-operative management of the aortic injury was continued and the patient had a positive outcome. There are multiple cases in the literature where ECMO has been used in response to respiratory and/or cardio failure in the trauma patient. Lee et al. also presented a case of a young man involved in a motorcycle crash that presented with abdominal hemorrhaging and aortic injury. Damage-control thoracic surgery and rescue ECMO were successfully utilized with a favorable outcome. Both of these patients were able to be stabilized enough to obtain imaging and further clarification of their injuries unlike our patient that we are presenting. ECMO has been shown to be advantages in traumatic aortic injuries and possibly could provide more time for other interventions with patients suffering from mesenteric ischemia due to aortic tethering and other acute traumatic aortic pathologies [14,15]. There has been no literature on the use of ECMO for the prevention of mesenteric ischemia in aortic injury, but this is the type of novel ideas we must consider and further investigate to find an appropriate intervention to a rare lesion.

Even with several treatment options, complications such as Acute Mesenteric Ischemia (AMI) must be considered and monitored. Acute Mesenteric Ischemia (AMI) is a life-threatening condition that occurs when an abrupt decrease in blood flow results in inadequate supply to the intestines, leading to bowel infarction [13]. The abrupt decrease in blood flow secondary to traumatic aortic injury that resulted in inadequate supply to the intestines led to eventual bowel infarction. When acute mesenteric ischemia is suspected, a diagnostic aortogram should be obtained to investigate the perfusion of the mesenteric circulation. At that point, endovascular measures can be taken to attempt to re-establish flow to the mesenteric bowel before frank necrosis occurs. The key to successful treatment of acute mesenteric ischemia involves early clinical recognition and early intervention to correct the underlying abnormality (Stone). This can become very challenging in the unstable polytrauma patient with a rare presentation of AMI. The patient we presented was unable to have an aortic stent graft placed due to the high grade occlusion secondary to the aortic injury. As catheter-based angiography with stent placement was not a feasible option to prevent the development of AMI, restoration of blood flow by performing an axillary-bifemoral bypass graph should be considered and may be a potentially life-saving intervention in the treatment of such cases, if performed proficiently.

Conclusion

The case highlights a rare case of traumatic thoracic aortic occlusion associated with thoracic vertebral fracture dislocation, lower extremity paralysis and subsequent acute mesenteric ischemia. Literature for similar cases is currently very scarce and optimal guidance for definitive treatment in the unstable trauma patient is difficult to ascertain. This accentuates the need for further research into more efficient diagnostic and possible treatment algorithms that could possibly prevent negative outcomes in patient who present to trauma centers and emergency rooms with this complicated post-traumatic injury complex. Clinicians should remain vigilant and recognize the subtle signs of paralysis, diminished pulses, and pallor. In particular, awareness of this unique clinical presentation can lead to earlier diagnosis and intervention to prevent its associated morbidity and mortality.

References

1. Welborn MB, Sawyers JL. Acute abdominal aortic occlusion due to non-penetrating trauma. Am J Surg. 1969;118(1):112-6.
2. Sumpio BE, Gusberg RJ. Aortic thrombosis with paraplegia: an unusual consequence of blunt abdominal trauma. J Vasc Surg. 1987;6(4):412-4.
3. Smith RS, Chang FC. Traumatic rupture of the aorta: still a lethal injury. Am J Surg. 1986;152(6):660-3.
4. Fabian TC, Richardson JD, Croce MA, Smith JS Jr, Rodman G Jr, Kearney PA, et al. Prospective study of blunt aortic injury: multicenter trial of the American Association for the Surgery of Trauma. J Trauma. 1997;42(3):374-83.
5. Parmley LF, Mattingly TW, Manion TW, Manion WC, Jahnke EJ Jr. Nonpenetrating traumatic injury of the aorta. Circulation. 1958;17(6):1086.
6. O'Connor JV, Byrne C, Scalea TM, Griffith BP, Neschis DG. Vascular injuries after blunt chest trauma: diagnosis and management. Scand J Trauma Resusc Emerg Med. 2009;17:42.
7. Ting JY, Dehdary A. Acute severe non-traumatic muscle injury following reperfusion surgery for acute aortic occlusion: Case report. Int J Emerg Med. 2011;4:20.
8. Fattori R, Napoli G, Lovato L, Russo V, Pacini D, Pierangeli A, et al. Indications for, timing of, and results of catheter-based treatment of traumatic injury to the aorta. AJR Am J Roentgenol. 2002;179(3):603-9.
9. Ergun O, Canyigit M, Hidiroglu M, Tatar IG, Birgi E, Küçüker A, et al. Endovascular treatment for acute traumatic thoracic aortic transection. Ulus Travma Acil Cerrahi Derg. 2015;21(4):285-90.
10. Fattori R, Russo V, Lovato L, Di Bartolomeo R. Optimal management of traumatic aortic injury. Eur J Vasc Endovasc Surg. 2009;37(1):8-14.
11. Postma IL, Oner FC, Bijlsma TS, Heetveld MJ, Goslings JC, Bloemers FW. Spinal injuries in an airplane crash: a description of incidence, morphology, and injury mechanism. Spine (Phila Pa 1976). 2015;40(8):530-6.
12. Bohlman HH. Current Concepts Review Treatment of Fractures and Dislocations of the Thoracic and Lumbar Spine. J Bone Joint Surg. 1985: 67;1:165-9.
13. Levine AM, Edwards CC. The management of traumatic spondylolisthesis of the axis. J Bone Joint Surg Am. 1985;67(2):217-26.
14. Masroor S, Hasan T, Pham Si, Neijman T, Ricardo M, McKenney M, et al. Extracorporeal life support in pulmonary failure after traumatic rupture of the thoracic aorta: A case report. The Journal of Trauma Injury, Infection, and Critical Care. 2004;57:389-91.
15. Stone JR, Wilkins LR. Acute Mesenteric Ischemia. Techniques in Vascular and Interventional Radiology. 2015:18(1):24-30.