Isolated Rupture of Bicuspid Aortic Valve Following Blunt Chest Trauma: A Case Report and Systematic Review of Literature

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Abstract
Blunt trauma to chest cause injury to various cardiac structures. Isolated rupture of aortic valve without aortic dissection is rare complication of blunt chest trauma and can be caused by a tear or avulsion of the valve. We report a case of a 35-year-old male who presented with severe aortic insufficiency due to rupture of a non-infected congenital bicuspid aortic valve following non-penetrating chest trauma. The diagnosis was suggested by echocardiography and was confirmed by intra-operative and histological findings. The patient was successfully treated with surgical valve replacement with uneventful postoperative course and recovery.

Keywords: Bicuspid aortic valve; Traumatic rupture; Blunt chest trauma; Aortic insufficiency

Case Presentation

Introduction
Non penetrating trauma to the chest can cause life-threatening injuries involving airway, lungs and heart [1]. Acute aortic insufficiency following blunt chest trauma is usually caused by aortic dissection with or without involvement of aortic valve. We describe a case of 35-year-old male who presented after falling from a height of 25 feet and was found to have rupture of his congenital bicuspid aortic valve without aortic dissection. He underwent surgical valve replacement with uneventful post op and follow up course.

Case Presentation
35-year-old male with significant medical history of bipolar disorder and schizophrenia was admitted after he Jumped from a height of 25 feet. He landed on his anterior chest and sustained multiple internal and external organ traumas. His initial blood pressure was 92/24 mm hg and pulse was 79/min. On clinical examination he was noted to have grade 3/6 early diastolic decrescendo murmur in aortic area. Patient did not have any reported cardiac history in past. The CT scan of chest showed bilateral hemo-pneumothoraces, pulmonary contusions, multiple rib fractures, hepatic and renal laceration. Aortic dissection was also suspected however CT angiogram of chest was non-conclusive. An aortic angiogram was then performed which showed wide-open aortic insufficiency without any dissection. Transthoracic echocardiogram which was done on day 1 of admission revealed a bicuspid aortic valve with severe aortic insufficiency (Figure 1a, 1b).

Cardiothoracic surgery consult was obtained for severe aortic insufficiency and plan was made for elective surgical valve replacement once patient was more stable clinically. However, patient was noted to have worsening heart failure and he could not wait for clinical stabilization. Consequently, he underwent surgical intervention on day 6 of admission.

Figure 1: Transthoracic echocardiography (TTE): Parasternal long axis view showing severe aortic insufficiency (a), parasternal short axis view showing bicuspid aortic valve with aortic insufficiency (b).

Figure 2: Trans-esophageal echocardiography (TEE): Three chamber view showing 2cm freely mobile mass on anterior aortic valve leaflet (a), magnified view of the aortic valve with freely movable mass (b).

Figure 3: Intra-operative findings showing bicuspid aortic valve with completely torn right leaflet.
not be weaned from ventilator. This led to a repeat trans-thoracic echocardiogram on day 12th of admission which showed a new 2cm freely mobile structure on one of leaflet of the aortic valve, which was suspicious for a vegetation. This freely mobile structure was not visualized on initial echocardiogram possibly due to suboptimal and limited picture because of hemo-pneumothorax. This finding was confirmed on trans-esophageal echocardiogram (Figure 2a, 2b). Patient was subsequently taken to operating room for suspected endocarditis with worsening heart failure. Intraoperative findings were remarkable for a congenital bicuspid aortic valve with one of the leaflet completely hearing of one of the leaflet completely sheared off from annulus (Figure 3). This torn leaflet gave an appearance of a vegetation on echocardiogram. The valve was then excised and replaced with 29mm mosaic ultra-bio prosthesis. Histological examination of the valve confirmed absence of any inflammation or infection. Patient had an uneventful post-operative course. He was successfully weaned off from ventilator and was ultimately discharged to a rehab facility in stable condition on day 6th post-operative. He was doing well on his follow up appointment in office 2 weeks and 6 weeks post discharge.

Discussion/Conclusion

Traumatic rupture of bicuspid aortic valve without involvement of thoracic aorta is rare cause of acute aortic insufficiency. We performed a systematic review of literature for similar cases through PubMed and Cochrane from database inception to September 20, 2015. The MeSH, Emtree and keyword search terms used in combination were: bicuspid aortic valve, traumatic rupture, and blunt chest trauma. There was no restriction for the type of study and all PubMed indexed studies were included. The comparison of three case reports [2-4] which met inclusion criteria is described in Table 1. It is well known that individuals with bicuspid aortic valve are more to develop valvulopathy and ascending aortopathies [5]. There is a possibility that bicuspid aortic valves are structurally more susceptible to disruption from trauma as compared to normal tri-leaflet valves. A high index of suspicion in such patients who presents after trauma can lead to early diagnosis and intervention with significant effect on clinical outcome.

Table 1: The demographic comparison of previously reported cases of traumatic bicuspid aortic valve rupture.

<table>
<thead>
<tr>
<th>Reference</th>
<th>Age of patient (Years)</th>
<th>Gender</th>
<th>Source of trauma</th>
<th>Aortic dissection</th>
<th>Ruptured leaflet</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tokizawa et al.</td>
<td>64</td>
<td>Female</td>
<td>Traffic Accident</td>
<td>Absent</td>
<td>Anterior</td>
<td>Surgical Replacement</td>
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<tr>
<td>Fujimoto et al.</td>
<td>27</td>
<td>Male</td>
<td>Motocross game</td>
<td>Absent</td>
<td>Anterior</td>
<td>Surgical replacement</td>
</tr>
<tr>
<td>Anselmino et al.</td>
<td>60</td>
<td>Male</td>
<td>Motor vehicle accident</td>
<td>Absent</td>
<td>Anterior</td>
<td>Surgical replacement</td>
</tr>
<tr>
<td>Current case</td>
<td>35</td>
<td>Male</td>
<td>Falling from height</td>
<td>Absent</td>
<td>Right</td>
<td>Surgical replacement</td>
</tr>
</tbody>
</table>

References