Changes in the patterns, presentation and management of penetrating chest trauma patients at a level II trauma centre in Southern Pakistan over the last two decades

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Abstract

Penetrating chest trauma can be used as an indicator of violence in the country. We aimed to look at the changes in its incidence and management at a major trauma centre in the country. We also wanted to look at any effect of prehospital time on surgical intervention and outcome of the victim. In this retrospective descriptive study, we observed the presentation and management of 191 penetrating chest injury patients at a level II trauma hospital in Pakistan in the last 20 years. The study sample was divided into two groups: Group 1, 1988–1998 and Group 2, 1999–2009. No significant change in incidence of trauma was observed between the two groups. The delay in the time between event and arrival showed an increase in the number of surgical procedures performed. Also the number of thoracotomies performed went up significantly in the second decade from 5.7 to 16.5% with a P<0.05. Six (3.1%) mortality cases were observed in 20 years. It was seen that the greater the prehospital time, the greater the chances of surgery. Also seen was the increase in mortality as critical cases could make it to the hospital alive in recent times due to improved transportation services.

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Keywords: Chest trauma; Penetrating injury; Injury severity score; Thoracotomy

1. Introduction

Thoracic injury is a common cause of mortality and major disability, and the leading cause of death from physical trauma after head and spinal cord injury [1]. Thoracic injuries account for 20–25% of deaths due to trauma. Penetrating thoracic trauma accounts for almost 33% of total chest traumas [2]. The Pakistani population has suffered more due to trauma in recent times because of the ever increasing violence and political instability.

Penetrating chest trauma is mostly attributed to violence and has a higher mortality than blunt trauma [3]. It is more common in men and the mechanism of injury is usually a gunshot or stab wound. Early recognition and timely treatment of various life-threatening injuries; better resuscitative measures, preoperative care and effective surgical procedures can significantly alter the outcome of these patients [4]. Moreover, the key to improved outcome lies in rapid transportation to adequate emergency care providing centers [5]. Gunshot wound of the heart has been found to have the highest mortality [6]. Studies have shown chest tube thoracostomy to be the primary modality for managing non-mediastinal/peripheral chest injury with a very low incidence of thoracotomy [7, 8].

It has also been noted that cases of violence are associated with injuries to other parts of the body. Therefore, we have also included injury severity scores (ISSs) in our study to quantify the trauma and use it to see the patterns of polytrauma in our cases. Our study aims to review the changes in the characteristics of penetrating thoracic injuries; its management and prehospital time (time between event of trauma and arrival at the hospital). We also aimed to look at the effect of prehospital time on the management with emphasis on the number of surgeries performed. Chest trauma being a cause of major disability needs to be taken very seriously; the efficiency of the paramedic staff, prompt management in emergency care and other time saving measures are crucial in saving lives.

Violence and terrorism have been a major problem in Pakistan. Terrorism and crime has increased remarkably and the health care services have improved with time and so it was essential to compare the victims of penetrating chest trauma from two decades at a leading level II private hospital in the heart of the city.

2. Materials and methods

The hospital records of a total of 191 patients identified with penetrating chest trauma between September 1988 and October 2009 were reviewed retrospectively. Our study included patients with penetrating chest trauma only,
excluding blunt chest injuries. We also recorded details of other injuries sustained along with penetrating chest trauma and ISSs were calculated for individuals. Relevant clinical data were acquired from the patients’ files. Self-referral cases were included as they were on the victims choice and could be treated like the primary cases. In order to draw comparison between the presentation and management of chest trauma, we divided our study period into Group 1 (1988–1998) and Group 2 (1999–2009). Data were analyzed using SPSS version 17 (SPSS Inc., Chicago, IL, USA). Mean and standard deviation was used for continuous, while frequency and percentages were used for discrete variables. The difference in proportion was estimated by the $\chi^2$ and Fisher exact-test, while the difference in means was calculated by the t-test at $P<0.05$.

3. Results

The study included 191 patients with penetrating chest trauma presenting to the Aga Khan University Hospital (AKUH) in the last 20 years from all over Pakistan. In our study, penetrating chest trauma was 22.5% of the total chest traumas. We divided our study population in two groups according to the decade of the presenting trauma. There were 179 males and 12 females in total. Table 1 shows the baseline presentations and management of these patients. The time between event of trauma and arrival at the AKUH for all patients was recorded as shown in Table 1. A rise in incidence from 88 to 103 cases was noted in the latter decade. Gunshot wounds were the most frequent mode of injury comprising 136 (71.2%) of the total. They comprised homicidal, suicidal and stray bullet wounds shown in Table 2. In the management, 126 (66%) had a tube thoracostomy and 22 (11.5%) underwent thoracotomy. The average length of hospital stay was 6.5 days. Polytrauma which can be defined as an ISS > 16, was seen in 76 (39.7%) cases. Long bone fractures were the most common associated injury seen in a total of 72 (37.7%) cases.

On comparison between the two groups, age, gender and other parameters were quite similar showing no significant change as depicted in Table 1. The number of thoracotomies, however, showed a significant rise in Group 2 with $P<0.05$. The frequency of stab wounds increased significantly in Group 2 with a $P<0.001$ as shown in Table 2. The time between event and arrival was $< 1$ h in 23 (26.1%) patients in Group 1 and 38 (36.9%) in Group 2, showing a 10.8% improvement in prehospital time. It was also noted that the greater the delay in transportation time, the greater the number of surgical interventions required, as shown in Fig. 1. This was most evident for thoracotomy.

The ISS showed no significant variation during the last two decades and long bone injury remained to be the most common associated injury. A total of 44 (23%) patients underwent surgical management which comprised of 22 cases of thoracotomy, four with thoracotomy and laparotomy both. Others included video-assisted thoracoscopic surgery (VATS) (4) and laparotomy (14). There were six cases of mortality in the last two decades, which accounted for in-hospital deaths, i.e. within 30 days of hospital stay as shown in Table 3.

4. Discussion

Our study depicts a holistic picture of a busy metropolitan city in the developing world with a weak health care system which still manages to avoid unfavorable outcomes in numerous cases of penetrating chest trauma. Penetrating chest trauma was 22.5% of the total chest trauma at the AKUH. These results differ from another study from the Northern areas of the country by Salim and Bilal which show a penetrating trauma incidence of 33%, which can be attributed to the higher rates of violence mostly due to tribal differences [9]. Males outnumbered females by a huge margin 15:1, because of their greater exposure to outdoor activities and rivalries etc. [10].

It was expected that cases of penetrating chest trauma would mainly be managed at other government hospitals due to cost and other issues and thus limiting our penetrating chest trauma load majorly as compared to other government centers. A study from a government hospital in the same city shows 67 cases per year compared to 9.6 at AKUH [11]. Therefore, self-referral cases were also included as they highlight the important role of our trauma centre in this part of the country.
The time of occurrence of trauma and arrival in a hospital is considered very critical in dealing with trauma, thus leading to the concept of the ‘Golden Hour’. It is defined as the first 60 min after the occurrence of a major multi-system trauma. It is widely believed that the victims’ chances of survival greatly increase when they receive specialized trauma care within the ‘Golden Hour’ [12]. Our results show a 10.8% improvement in prehospital time, within the ‘Golden Hour’ to a major trauma care hospital in Group 2 compared to Group 1. This improvement can be attributed to measures such as a greater number of efficient ambulance services and increased number of strategic placement of ambulance pick up points all over the city.

Our results show that among those managed with a surgical intervention, 80% were admitted after the crucial 1 h of trauma. Thus, reinforcing the fact that delay in transportation makes management more difficult, creating the need for surgical intervention. We also noticed that victims reaching the hospital in less than half an hour were least likely to undergo a surgical intervention as compared to those coming beyond that time, as shown in Fig. 1.

Gunshot wounds were the most frequent cause of injury, followed by stab wounds and bomb blasts. The number of victims of bomb blasts shows an increase in the latter decade mostly due to an increase in such events. We only included blast wounds with associated penetrating chest trauma, mainly due to penetrating shrapnel. Recent statistics from a government website reveals 140 cases of suicide bombings in Pakistan, since 2002.

The low mortality in our study highlights an important fact that penetrating trauma presenting to the hospital is mostly salvageable even when associated with polytrauma. This may, however, be masking the fatal trauma associated with massive hemorrhage, i.e. in cases of great vessel injury and cardiac injury which seldom make it to the hospital [6]. Results from other hospitals of the city show a mortality of <7%, while its even lower at our institution, i.e. 3% [11]. Reasons for mortality seen in our six cases included multiorgan failure, sepsis, excessive bleeding and cardiorespiratory failure as shown in Table 3.

Despite better measures taken to manage trauma and frequent surgical intervention, mortality was still higher in the latter group as shown in Table 3. This can be attributed to the improvement in prehospital time that made it possible for critically injured patients to reach a hospital alive which was not possible in the previous decade [13]. Two of these patients had major chest and abdominal injuries requiring thoracotomy plus laparotomy. Two of the cases in the latter decade presented with excessive bleeding and a Glasgow Coma Scale <3. We did not have a significant number of reported in-hospital complications as the mean length of hospital stay was <7 days and there was a subsequent loss to follow-up as many patients from farther away areas of the country did not return.

Management of hemothorax-related trauma follows the basic protocol applied to both trauma and thoracic surgeons. Most of the patients require a non-operative approach with a tube thoracotomy as in 66% of our patients. Surgeries carried out at AKUH were for arteriogenous fistula repair, evacuation of hematoma, clotted hemothorax, chylothorax, diaphragmatic tear, empyema and decortication. The bullet often traversed vertically downward through the diaphragm in to the abdominal cavity to damage the abdominal viscera and so these laparotomies were also accounted for in the surgical interventions. Procedures were done to repair gastrointestinal tract lacerations, ruptured spleen, liver and blood in the peritoneum.

The number of thoracotomies has seen a significant rise in Group 2, mostly due to the low threshold in the latter decade to conduct a thoracotomy for chest exploration, especially after a gunshot wound as opposed to studies done in the US where the rates have declined in Class 1 patients [14]. This increase is also attributed to the transportation of critically injured patients in need of surgery.

### Table 2. Mode of injury of penetrating chest trauma patients during two decades (n=191)

<table>
<thead>
<tr>
<th>Cause of injury</th>
<th>1988-1998 (n=88)</th>
<th>1999-2009 (n=103)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gunshot wound</td>
<td>67 (76.1%)</td>
<td>69 (67.0%)</td>
<td></td>
</tr>
<tr>
<td>Stab wound</td>
<td>9 (10.2%)</td>
<td>21 (20.4%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Blast injury</td>
<td>2 (3.3%)</td>
<td>9 (8.7%)</td>
<td></td>
</tr>
<tr>
<td>Gunshot and stab wound</td>
<td>10 (11.4%)</td>
<td>4 (3.9%)</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>4 (2.1%)</td>
<td>4 (3.9%)</td>
<td></td>
</tr>
</tbody>
</table>

### Table 3. Mortality profile of subjects (n=191)

<table>
<thead>
<tr>
<th>Cause of death</th>
<th>&lt;24 h in hospital</th>
<th>&gt;24 h in hospital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expired</td>
<td>2 (33.3%)</td>
<td>4 (66.7%)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>2 (33.3%)</td>
<td>4 (66.7%)</td>
</tr>
<tr>
<td>Cause of death</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cardiorespiratory</td>
<td>2 (33.3%)</td>
<td></td>
</tr>
<tr>
<td>Sepsis</td>
<td>2 (33.3%)</td>
<td></td>
</tr>
<tr>
<td>Multiorgan failure with sepsis</td>
<td>2 (33.3%)</td>
<td></td>
</tr>
<tr>
<td>Surgical priority</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elective</td>
<td>1 (16.7%)</td>
<td></td>
</tr>
<tr>
<td>Urgent</td>
<td>1 (16.7%)</td>
<td>2 (33.3%)</td>
</tr>
</tbody>
</table>

Fig. 1. Relationship of surgical intervention and prehospital time of penetrating chest trauma patients in minutes (n=191). VATS, video assisted thoracoscopic surgery.
to the hospital in good time. Also, readily available resources such as VATS have made it much easier than in the last decade. VATS was found to be a good approach to the thorax in patients who were hemodynamically stable. It was especially useful in cases of clotted retained hemothorax. It was also found to be useful in identifying the location of bleeders inside the chest cavity [15].

The need for an efficient ambulance service still persists to avail of the precious ‘Golden Hour’, so patients suffering from fatal injuries can reach a hospital early. Also, the improvement in prehospital time has led to an increase in the number of critical cases reaching a hospital alive, hence increasing in-hospital mortality. It has been seen that delay in critical prehospital time has a direct relationship with requirement of surgical intervention. There is a dire need for a dedicated trauma centre given the rise in incidence of trauma in this part of the world.

References