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Research Article

EXTENSIVE EPIDEMIOLOGICAL STUDY OF TRAUMATIC PNEUMOTHORAX IN SAUDI ARABIA'S POPULATION

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ABSTRACT

Objectives: Traumatic pneumothorax is one of the causes of trauma mortality and morbidity. It is a problem for developing countries as many accidents can be avoided and there are few epidemiological data to support programs injury prevention. The main objective of the current study was to determine demographic characteristics, patterns, and severity of the injury, thoracic, and extra-thoracic related injuries in a Level 1 trauma center, Riyadh, Saudi Arabia (SA).

Methods: This retrospective observational study used the King Abdulaziz Medical City Trauma Center's trauma registry to review the data of traumatic pneumothorax patients admitted to the hospital from January 2001 to December 2018. Demographic characteristics, admission date and time, type and mechanism of injury, involved body area, and severity rates were analyzed.

Results: A total of 708 patients of whom 92.3% were males. Blunt trauma (75.8%) is the most common cause of injury. Motor Vehicle Accidents (MVA) were the most common cause (57%) of traumatic pneumothorax. Rib fractures (36.5%), lung contusions (31.5%), and hemothorax (23.5%) were the most common clinical forms of chest injury associated with traumatic pneumothorax. On the other hand, the head injury (34.8%) was the most common extra thoracic part associated. The mean Injury Severity Score in the current study was found to be 20.1.

Conclusion: This study showed the trends of traumatic pneumothorax injuries in a Level 1 trauma center, Riyadh, SA, showing MVA are the leading cause of traumatic pneumothorax in our region. These demographic data will be crucial for local health-care systems to be optimally resourced.

Keywords: Traumatic pneumothorax, Motor vehicle accidents, Head injury, Saudi Arabia.

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INTRODUCTION

Trauma is the leading cause of disability-adjusted life-years suffered in Saudi Arabia (SA), according to the Global Burden of Disease [1]. In 2013, trauma was the most common cause of death in the SA. According to the Ministry of Health of SA, 18.5% of death in the SA involved injury, and Motor vehicle accidents (MVA's) account for more than 80% of all trauma admissions in SA [2].

SA's population is relatively young, where 40% of the population is 19 years of age and younger, and trauma has a significant impact on the health and prosperity of the country. In any type of accident, the most often affected body part is the chest. Trauma to the chest can result in damaging the internal organs such as the heart, lungs, and other chest tissues, which are threatening and endangering the injured person's life [3,4].

Traumatic pneumothorax is pleural air caused by trauma and can be a partial or complete collapse of the lung. Traumatic pneumothorax can result from penetrating or blunt lung injuries [5]. Thoracic injury accounts for 25% of all mortal injuries and is the commonest intra-thoracic blunt chest injury manifestation, which occurs in 40–50% of patients with thoracic injury [6]. Therefore, patients with acute traumatic pneumothorax require appropriate diagnosis and treatment.

In SA, there is no studies investigate details of traumatic pneumothorax and few studies discuss this issue worldwide (based on author knowledge). Therefore, this study aims to identify demographic characteristics, patterns, and severity of the injury, thoracic, and extra-thoracic-related injuries in a Level 1 trauma center in Riyadh, SA.

METHODS

King Abdulaziz Medical City (KAMC) performed this retrospective observational study and is located in Riyadh, which represents SA's largest hospital. KAMC's Emergency Care Center (ECC) is Riyadh's biggest center with 192 beds. Those belong to National Guards employees and their families are the only patients who could access treatment at this facility. In the emergency department; however, any person can be seen and offered the proper intervention. The KAMC is considered a specialized trauma center as it offers 24-h care to trauma, offering access to care plans to different departments. Besides, the KAMC is one of few SA medical institutions approved by the American College of Surgeons to provide specialized emergency life support training. The KAMC has about 200 pediatric patient beds, 60 of which are in the pediatric ECC, and 900 adult-patient beds, 132 of which are in the adult ECC.

Study population

The dataset used in this analysis was derived from the database of KAMC trauma. The database has provided detailed information on all acute traumatic patients seen since its establishment in 2001. To identify trauma-related admissions, an official director reviews all of the daily admissions. The director collects the patient data from the moment of admission to discharge from the hospital. The study included all traumatic patients with pneumothorax who were hospitalized for at least 1 day between January 2001 and December 2018. The database collects detailed trauma patient information including several variables, such as age, sex, method of transportation, activation of trauma code, surgery, and admission to the intensive care unit. The severity scale used in this study is the Injury Severity Score (ISS).

Variables and statistical analysis

In this study, the analysis will be based on the following variables: Demographic data, type of injury, injury mechanism, thoracic organ associations, extrathoracic part associations, and ISS. Meanwhile, the patients will be divided into male and female. Furthermore, the types of injuries were classified as blunt, penetrating, and gunshot injury. The mechanisms of injury were allocated to MVA, pedestrian, homicide, or injury intentionally caused by another person, fall motorcycle, suicide and self-inflicted injury, and injuries not mentioned above. The traumatic associated injuries were also classified into either thoracic parts which are hemothorax, rib fracture, lung contusion, and cardiac contusion, or extrathoracic associated injuries involving head injury, abdominal injury, and musculoskeletal (MSK) injury. The ISS was included as well.

All analyses of the data were performed using SPSS Statistics (version 22; IBM Corp., Armonk, NY, USA).

RESULTS

The study is discussing the patients who were diagnosed with a traumatic pneumothorax based on a dataset obtained from KAMC. The descriptive characteristics of traumatic pneumothorax patients in KAMC are shown in Table 1.

The total number of patients considered in this study is 708 patients. We have found that 653 cases (92.3%) are male and 54 (7.7%) are female patients while the average age group is 28 years old (range 2–95 years of age). In terms of mode of injury-causing traumatic pneumothorax, the blunt thoracic injury was detected in 536 (75.8%) followed by thoracic stab injury in 153 (21.6%) and thoracic gunshot injury in 14 (1.9%) patients. MVA is the most common accident mechanism causing traumatic pneumothorax in 403 (57%), followed by pedestrian injury in 80 (11.3%), homicide and death intentionally caused by other persons in 168 (23.8%), fall from heights in 34 (4.8%), suicide and self-inflicted injury in 1 (0.1%), motorcycle injury in 7 (1%), and other injuries not mentioned above in 13 (1.9%) patients.

Table 1: Descriptive characteristics of traumatic pneumothorax patients at King Abdulaziz Medical City

Variables	Number	Percentage
Age		
Age mean (year)	28	
Gender		
Male	653	92.3
Female	54	7.7
Type of injuries		
Blunt	536	75.8
Penetrating stab	153	21.6
Penetrating gunshot	14	1.9
Mechanism of injury		
MVA	403	57
Pedestrian	80	11.3
Homicide	168	23.8
Fall	34	4.8
Self-inflicted injury	1	0.1
Motorcycle	7	1
Others	13	1.9
Thoracic injury		
Pneumothorax side		
Bilateral	126	17.7
Right	261	37
Left	320	45.3
Thoracic injuries		
Hemothorax	166	23.5
Lung contusion	223	31.5
Cardiac contusion	2	0.3
Ribs fracture	258	36.5
Extra-thoracic injuries		
Abdominal injury	123	17.4
Head injury	246	34.8
MSK injury	108	15.3
Mean of ISS	20.1	

ISS: Injury severity score, MSK: Musculoskeletal, MVA: Motor vehicle accidents

Pneumothorax was registered in 261 (37%) patients on the right side of the lung, 320 (45.3%) patients on the left side, while 126 (17.7%) patients on the bilateral side of the lungs. Injury to thoracic components associated with traumatic pneumothorax cases consists of rib fractures in 258 (36.5%), lung contusions in 223 (31.5%), hemothorax in 166 (23.5%), and cardiac contusions in 2 (0.3%). Besides, head injury was the most common injured system other than thoracic cage associated with traumatic pneumothorax with 246 (34.8%) cases. The abdominal injuries were also found in 123 (17.4%) of traumatic pneumothorax patients while the MSK in 108 (15.3%) patients. Furthermore, the severity of trauma uses the ISS system to assess the trauma and its mean in this study was determined to be 20.1.

DISCUSSION

With rapid urban industrialization, urbanization, and exponential growth in high-speed traffic flow, trauma in general and chest trauma, in particular, are growing. This leads to intensified the need for improved treatment, trained staff, and sophisticated equipment to save trauma patients' lives [3].

In the current study, the highest rate of traumatic pneumothorax was found in those with an average age of 28 years, and the majority are male injured with 92.4% of the total population. The study's demographic finding is close to other reports [3,4] indicating that males are likely to have more traumatic pneumothorax because they are more involved and mobile; thus, increasing trauma risk. However, in other populations such as Murat *et al*. study's targeting group, no major difference in the injured gender [5]. The reason is that in the SA, the males are eligible for driving. This percentage may vary after mid-2018 when females are permitted to drive [7].

Blunt trauma was the most common mode of injury, accounting for 75.8% of all cases, and a trend of male predominance among all forms of injury was observed. The other injury modes are penetrated stab injury 21.6% and penetrate gunshot injury 1.9%. These are similar results of international studies, such as the study in Ref. [5].

In the present study, MVA was the most common cause of blunt trauma in 57% of the study population, followed by homicide and death intentionally caused by other persons in 23.8%, pedestrian injury in 11.3%, height fall 4.8%, suicide and self-inflicted injury 0.1%, motorcycle injury 1%, and other injuries not listed 1.9%. This result is consistent with the trend found in an earlier study of adult patients, where the most common cause of blunt trauma was traffic-related injuries [1,8,9].

The left side of the lung was found to be the most affected side by the injury among the considered population. Trauma-related pneumothorax was found 45.3% on the left side of the lung, 37% on the right side of the lung, and 17.7% on the bilateral side of the lung. These results are similar to studies in Refs. [5,10].

In the current study, the ribs fractures were considered the most common associated thoracic injury in patients with traumatic pneumothorax with 36.5% of the study population. In the Sharma *et al*. study, the ribs fractures represent the most frequent chest injuries in 71% of their population [4]. Saaiq *et al*., furthermore, found that the most common chest injuries were fracture ribs with 74% compared to other injured chest parts [11]. Atri *et al*. [12] also found rib fracture to be the most prevalent injury in 60% of the patients.

Our study associated thoracic injury result is similar to the aforementioned reports as it considered the most common chest injury is the ribs fractures. However, ribs fractures did not consider as the

dominant associated thoracic injuries since other thoracic cage injuries include lung contusions 31.5%, hemothorax 23.5%, and cardiac contusions 0.3% have presented in high parentage results.

A significant determinant of outcome in patients with traumatic pneumothorax is the presence of related extra-thoracic injuries as it increases the risk of complications. It is essential to early detect and care for these injuries to reduce mortality and morbidity associated with traumatic pneumothorax. Head trauma has been reported in the present study as the most frequent 34.8% extra-thoracic injury. Many research, however, recorded MSK injury as the most prevalent extra-thoracic injury 50% [3,13-15], whereas in the current study it was the third most common 15.3% and the second common was abdominal injury 17.4%.

ISS system is usually used to predict poly-trauma injury associated with traumatic pneumothorax injury as specified by the ISS to be >15 as a poly-trauma. In the current study, the mean of ISS was found to be 20.1, which is considered as a poly-trauma and also close to Battaglia *et al*. report that had an ISS score of 20.7 [16,17].

CONCLUSION

It is possible to prevent and predict multiple diseases even before they can occur. The same principle applies to trauma as well. This discretionary study provides details on the epidemiology of pneumothorax trauma patients admitted to a KAMC Trauma Center in Riyadh, SA. Males were more affected by trauma than females in general. The findings also revealed that the most common form of injury was blunt trauma, with MVA being the most common cause of blunt trauma. The findings of this study illustrate the need for an effective multidisciplinary program to address the causes of trauma and to develop a strategy to reduce the burden of this problem, especially in SA. In line with these findings and as a part of the solution to trauma issues, practitioners are also expected to provide anticipatory advice to their patients.

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CONFLICT OF INTEREST

The author declares that he has no conflict of interest.

AUTHOR CONTRIBUTIONS

Nasser Alrashidi: Conceptualization; Data curation; Formal analysis; Methodology; Supervision; Validation; Writing—Original draft.

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ETHICAL APPROVAL AND CONSENT TO PARTICIPATE

The study was done with the permission of the Qassim University, SA, Ethics Review Committee. Hospital officials were notified about the study and its goals. All information was ensured of privacy and confidentiality.

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