



Evaluation of Rib Fractures due to Trauma

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Authors' contributions

This work was carried out in collaboration among all authors. Author SA designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors SA, AD and AG managed the analyses of the study. Authors AD and AG managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Introduction and Aim: We aimed to evaluate the one-year mortality rates and the effect of comorbid diseases on mortality in patients with trauma and isolated rib fractures.

Materials and Methods: Ninety patients who had trauma, isolated rib fracture between January 2016 and December 2016 and could be reached after one year after the trauma were included in the study. The files of the patients were scanned retrospectively. Age, gender, and length of hospital stay were recorded. After one-year follow-up, they were contacted by phone to evaluate the rates of additional disease and mortality.

Results: 27 of the patients were female (30%), 63 of them were male (70%). Regarding the causes of injury, there were falls in 42 patients at most and in-vehicle traffic accidents in 35 patients. The mean age was 56.85 ± 16.33 , the mean hospital stay was 4.04 ± 4.55 days. The most common comorbidities were diabetes mellitus in 13 patients and hypertension in 11 patients. The least detected additional diseases are; Ulcerative colitis, epilepsy, arrhythmia, gastroesophageal reflux, gastrointestinal bleeding, rheumatism, Alzheimer and Familial Mediterranean Fever in 1 patient each. One patient died who had gastrointestinal bleeding. Mortality rate was 1.11%.

Conclusions: Post-traumatic rib fractures disrupt people's quality of life and cause morbidity and mortality. Although the risk of comorbid mortality increases, close follow-up is important in preventing or reducing mortality rates.

Keywords: Rib fracture; comorbidity; mortality; trauma.

1. INTRODUCTION

Ribs play an important role in respiratory function. While it plays a role in inspiration through the internal intercostal muscles, it also plays a role in expiration through the external intercostal muscles [1]. Ribs are an essential component of the thorax; Injury can be seen in rib fractures, lung, mediastinum and other vital organs. Ribs are frequently affected by blunt and penetrating injuries to the thorax. In addition, pathological rib fractures due to bending, dislocation, stress and tumor are also encountered. Rib fracture is the most common form of blunt thoracic injury, and ribs are frequently affected [2].

Thoracic trauma ranks third among all trauma cases [3]. Rib fractures are the most common finding in thoracic trauma [4]. Thoracic traumas, which constitute 1/3 of all trauma emergencies, constitute approximately 25% of trauma-related deaths worldwide [5]. Rib fractures in patients presenting due to severe trauma are seen as minor compared to other injuries [6]. Traffic accidents are the most common cause of deaths in adults under 40 years of age [7]. It has been reported that 93.5% of those using seat belts in serious injuries have rib fractures [8]. Clinical symptoms of rib fractures are respiratory distress caused by pain and pain. Ventilation and vital capacity decrease with pain, decrease in clearance of secretions may cause an increase in carbon dioxide [9]. The incidence of intrathoracic injury increases by approximately 10% with each rib fracture [10]. While young people are more resistant to rib fractures and thoracic injuries, they become more susceptible with age [11].

Young people have higher pain thresholds and greater oxygen exchange in the blood, causing them to be resistant to rib fractures. Accordingly, they tolerate lung parenchymal injuries and rib fractures better. With aging, muscle mass in the thorax decreases. This causes insufficient coughing power and secretions not being cleared effectively. In addition, with aging, the tendency against respiratory system diseases increases [6]. The incidence of rib fracture due to thoracic trauma ranges between 10-40% in all trauma cases [12]. Rib fracture is detected in 40-80% of blunt thoracic trauma [13]. The danger of breaking ribs is significant. Mortality rate due to rib fractures was determined as 4.4% and it was

reported that 55% of deaths occurred in the first 24 hours [14].

2. MATERIALS AND METHODS

Approval was obtained from Afyonkarahisar Health Sciences University Ethics Committee with 2019/1 date and number. Files of 167 patients who had thoracic trauma and isolated rib fractures between January 2016 and December 2016 were retrospectively reviewed. Age, gender, and length of hospital stay were recorded.

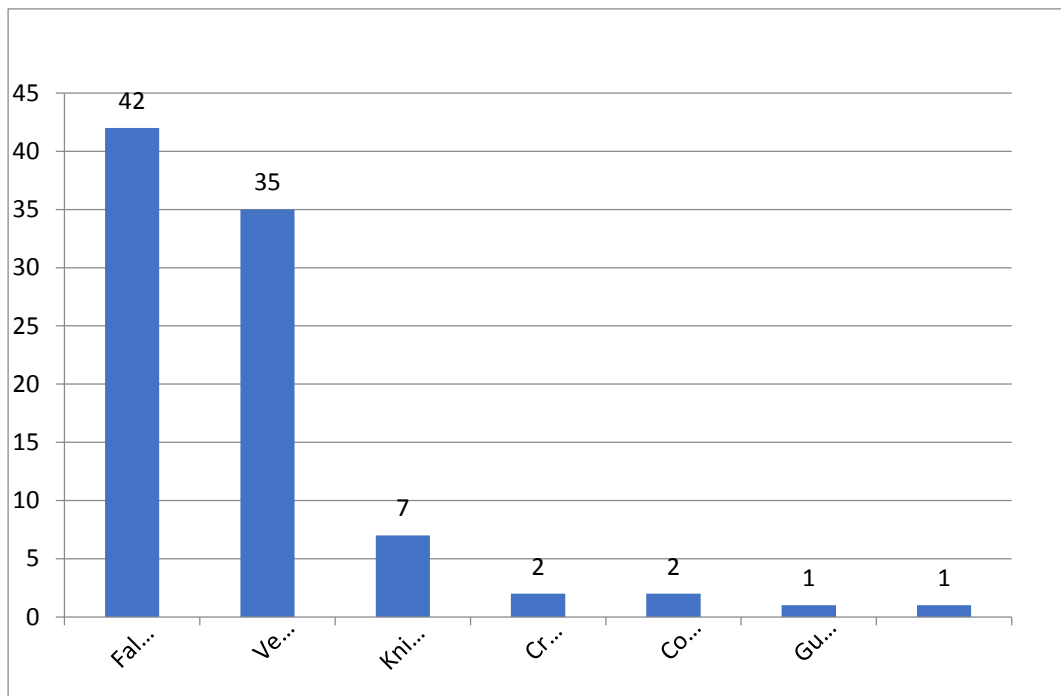
After a year of follow-up, a study was conducted by contacting the phone. A total of 90 patients could be reached. 77 patients could not be reached, possibly due to the phone off, address change, number cancellation or number change. One year after the trauma, additional disease and mortality conditions were evaluated.

3. RESULTS

27(30%) of the patients were female and 63(70%) were male. The mean age was 56.85 ± 16.33 . The average age of women was 65.67 and the average age of men was 53.27. Conditions that cause rib fractures; falling in 42(46.67%) patients, in vehicle traffic accident in 35(38.89%) patients, knife injury in 7(7.78%) patients, crushed by a heavy object in 2(2.22%) patients, compression between two objects in 2(2.22%) patients, 1(1.1%) motorcycle accident, 1(1.1%) gunshot injury was detected (Graphic 1).

The minimum number of hospitalization days was 0 and the maximum was 28 days. Average number of days of hospitalization was 4.04 ± 4.55 . The average hospitalization days for women were 2.73 and 4.57 for men.

Considering the additional disease conditions; diabetes mellitus in 13(14.44%) patients, hypertension in 11(12.22%) patients, chronic obstructive pulmonary disease in 7(7.78%) patients, hyperlipidemia in 3(3.33%) patients, heart failure in 3(3.33%) patients, 2(2.22%) cerebrovascular disease in 2(2.22%) patients, depression in 2(2.22%) patients, ulcerative colitis in 1(1.11%) patient, epilepsy in 1(1.11%), cardiac arrhythmia in 1(1.11%) patient, 1(1.11%) patient, gastroesophageal reflux in 1(1.11%) patient, rheumatic joint disease in 1(1.11%) patient, Alzheimer, 1(1.11%) patient had Familial



Graphic 1. Factors causing trauma

Table 1. Comorbid conditions of the patients

Additional diseases	Number (n)	%
Diabetes mellitus	13	14,44
Hypertension	11	12,22
Heart failure	3	3,33
Cerebrovascular disease	2	2,22
Ulcerative colitis	1	1,11
Osteoporosis	2	2,22
Epilepsy	1	1,11
Cardiac arrhythmia	1	1,11
Chronic obstructive pulmonary disease	7	7,78
Hyperlipidemia	3	3,33
Gastroesophageal reflux	1	1,11
Joint rheumatism	1	1,11
Alzheimer's disease	1	1,11
Familial mediterranean fever	1	1,11
Depression	2	2,22
Gastrointestinal bleeding	1	1,11

Mediterranean Fever, and 1(1.11%) patient had gastrointestinal bleeding. No additional disease was found in 39 patients. Additional diseases of the patients are shown in table 1. 1(1.11%) patient who developed gastrointestinal bleeding died.

4. DISCUSSION

Talbot et al. examined rib fractures in three groups in their study, including 1-4 ribs as the

upper region. Vascular or brachial plexus injuries are seen in rib fractures in this area.

They included 5-9 ribs as the middle zone and noted that pulmonary rupture, pulmonary crush, extrapleural hematoma, hemmothorax and pneumothorax are more common in fractures of this region. They included 10-12 ribs as the lower rib area and they found that liver and spleen injuries are more common in fractures of this region [2].

Thoracic trauma ranks third among trauma cases [3]. It accounts for approximately 25% of trauma-related deaths worldwide [4]. Motor vehicle accidents are the leading cause of rib fractures and are more common in males [15]. Rib fractures are the most common finding in thoracic trauma [4]. The incidence of rib fractures in all trauma cases has been reported in the range of 10-40 % [12,16].

Patients with rib fractures may require intensive care support or a ventilator [13,16]. Blunt thoracic trauma is an important cause of mortality and morbidity in developing countries. Blunt thoracic trauma accounts for approximately 75% of chest trauma [17]. Rib fractures usually cause pneumothorax and hemothorax, and its incidence has been reported to be 35% [17]. Traffic accidents, which are the main cause of rib fractures, have been reported with a rate of 47.5% to 70.9% in different studies [17]. In the study by Özdil et al., They reported the rate of motor vehicle accidents that cause elevation fracture as 37.0%. Besides, they reported that it was 74.6%, with the addition of motorcycle and pedestrian accidents [17]. Sirmali et al. reported the rate of bilateral rib fractures in trauma as 22.7 % [16]. In the study of Frank Cheau-Feng Lin et al., they found a rib fracture as 31.8 % [5]. In our study, traffic accidents causing rib fractures were found to be 38.89%, consistent with the literature.

Post-traumatic rib fractures can cause symptoms such as hemothorax, pneumotorx pain and dyspnea [17]. Multiple rib fractures accompanying multitrauma have been shown to be a prognostic factor on mortality and morbidity [18]. Sirmali et al. reported that the highest morbidity rates in patients with rib fractures developed above 60 years of age [16].

Although the duration of hospitalization of the patients varies according to the nature of the trauma, Frank Cheau-Feng Lin et al. Found that the average length of stay was 7 days [5], Yücel O. et al. 6.97 days [19], Yetim TD. et al. they determined it as 10 days [20]. In our study, the mean hospitalization period of the patients was 4.04 ± 5.55 days.

In our study, we found the rates of comorbidity between 14.44% and 1.1%. Diabetes mellitus in 13(14.44%) patients, hypertension in 11(12.22%) patients, chronic obstructive pulmonary disease in 7(7.78%) patients, hyperlipdemia in 3(3.33%) patients, heart failure in 3(3.33%) patients,

2(2.22%) osteoporosis in 2(2.22%) patients, cerebrovascular disease in 2(2.22%) patients, depression in 1(1.11%) patient, ulcerative colitis in 1(1.11%) patient, epilepsy in 1(1.11%), cardiac arrhythmia in 1(1.11%) patient, 1(1.11%) patient, gastroesophageal reflux in 1(1.11%) patient, rheumatic disease in 1(1.11%) patient, Alzheimer in 1(1.11%) patient, Familial Mediterranean Fever in 1(1.11%) patient, and gastrointestinal bleeding in 1(1.11%) patient.

Different rates are reported for mortality due to rib fractures. According to the Taiwan National Health Research database, rib fractures cause 4.4% of patient deaths and 55% occur within the first 24 hours [14]. The mortality rate was reported as 4% in the study by Brasel KJ et al. [21]. They reported the mortality rate as 6.9% in the study conducted by Frank Cheau-Feng Lin et al. [5]. Yücel O. et al. found the mortality rate as 0.014% in his study [19]. Yetim TD. et al. reported mortality as 1% in their study [20]. In our study, 1 patient who developed gastrointestinal bleeding died and we found the mortality rate as 1.1%. The reason for the low rates in our study may be that patients were evaluated 1 year after discharge and not all patients could be reached.

5. CONCLUSION

As a result, rib fractures that occur after trauma disrupt people's lives and cause morbidity and mortality. Morbidity and mortality are more risky in patients with old age and multitrauma patients with a high number of rib fractures. Emergency service team should pay attention to complications in the follow-up of patients with old age and rib fractures, especially for multitrauma patients.

CONSENT

As per international standard or university standard, patients' written consent has been collected and preserved by the authors.

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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