Original Article

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Optimal Follow-up Duration for Traumatic Multiple Rib Fractures

Travmatik Multipl Kot Kırıklarının Optimal Takip Süresi

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ABSTRACT

Objective: The rib fracture, which is one of the most common consequences of chest trauma, can cause respiratory distress, and even mortality if not properly treated. There's still limited data on the length and frequency of follow-ups in terms of the challenges that may arise after an uneventful follow-up. The focus of this research is to standardize the optimal follow-up time in patients with rib fracture.

Methods: Patients with isolated chest trauma who were admitted to the Emergency Department or were referred to the Thoracic Surgery Clinic from other hospitals within a year were included in our study. The study did not include any patients who needed thoracic intervention. Rib fracture complications were observed both during and after hospitalization.

Results: Complications did not develop in the majority of patients during hospital follow-up and discharge, but haemothorax was the most prevalent (21.4-12.2%) within the first 72 hours and at discharge.

Conclusion: Patients with rib fractures who are followed up and discharged may develop fatal consequences. When patients with recent rib fracture present to the emergency department, the emergency room physician should be alert about long-term problems.

Keywords: Rib fracture, chest trauma, follow-up, emergency room

ÖZ

Amaç: Göğüs travmasının en sık görülen sonuçlarından biri olan kaburga kırığı, uygun şekilde tedavi edilmediği takdirde solunum sıkıntısına ve hatta ölüme neden olabilir. Sorunsuz bir takipten sonra ortaya çıkabilecek zorluklar açısından takiplerin uzunluğu ve sıklığı hakkında hala sınırlı veri vardır. Bu araştırmadaki amacımız; kaburga kırığı olan hastaların optimal takip süresini standardize etmeye çalışmaktır.

Yöntemler: Çalışmamıza; bir yıllık süre içinde acil servise başvuran ve diğer hastanelerden göğüs cerrahisi kliniğine sevk edilen izole göğüs travmalı hastalar dahil edilmiştir. Toraks cerrahisine ihtiyaç duyan hiçbir hasta çalışmaya dahil edilmemiştir. Hastanedeki yatışları sırasında ve taburculuk sonrası takiplerinde hastaların kaburga kırığı komplikasyonları değerlendirilmiştir.

Bulgular: Hastaların çoğunda hastane takipleri ve taburculuk sırasında komplikasyon gelişmedi ancak ilk 72 saat içinde ve taburcu olurken en sık (%21,4-12,2) hemotoraks tespit edildi.

Sonuç: Kaburga kırığı olan hastalarda, hastane takipleri sırasında ve taburcu edildikten sonra ölümcül komplikasyonlar gelişebilir. Özgeçmişinde kaburga kırığı hikayesi olan hastalar, acil servise başvurduğunda, acil servis doktoru uzun vadede gelişebilecek komplikasyonlar konusunda uyanık olmalıdır.

Anahtar Sözcükler: Kaburga kırığı, göğüs travması, takip, acil servis

Introduction

Thoracic trauma counts up to 15% of all trauma cases consulted in emergency departments (1). Rib fractures, as the most frequent complication of blunt thoracic injuries, do not require hospitalization or further treatment at an approximate rate of 75% but may constitute the risk of developing delayed complications

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such as pneumothorax, haemothorax, or atelectasis (2-4). Mortality rates up to 30% have been reported for multiple rib fractures resulting in a flail chest and associated extra-thoracic organ injuries (5-7). Although the principle of management for a great majority of rib fractures involves analgesia and delicate observation of patients, the follow-up of outpatients is crucial to notice the potentially delayed complications.

The aim of this single-centred study was to assess the complications of multiple rib fractures in order to estimate the optimal duration of hospital stay and follow-up examinations.

Methods

A total of 68 trauma patients aged over 18 years who were admitted to the emergency unit and were thereafter referred to a thoracic surgery clinic between April 2021 and January 2022 were retrospectively analyzed. The main inclusion criteria were unilateral 3 or more rib fractures diagnosed via computerized tomography at first admission, hospitalization for at least 3 days, and attending follow-up examination 10 to 15 days after discharge. Ongoing anticoagulant therapy, development of flail chest or any extra-thoracic injuries and receiving thoracic interventions such as chest tube or pleural catheter insertion at the initial admission or surgical chest wall stabilization during the course were the main exclusion criteria. This research was approved by Kırklareli University Ethics Committee (protocol no: P20220005, date: 17.02.2022) and conducted in accordance with the Helsinki Declaration of Principles. A whole group of patients received exactly the same medication, including pantoprazole sodium, paracetamol and tramadol hydrochloride. In order to notice potential complications, vital signs were closely observed in addition to daily performed physical examinations, blood tests and chest X-rays. Discharged patients were also assessed by physical and radiological examinations at the specified periods.

Acquired data were analyzed in terms of patients' gender and age; type and side of trauma; the number of broken ribs grouped as 3-5, 6-9, and 10-12; type of complications including pneumothorax, haemothorax, pneumohemothorax, atelectasis, and subcutaneous emphysema; and elapsed time until complication listed as 0-24, 24-48, 48-72 and over 72 hours. The same complications were noted if they existed at the follow-up examinations.

Statistical Analysis

The SPSS (IBM SPSS for Windows, ver.24) statistical package program was used for calculations. Descriptive statistics for continuous variables in the study were expressed as mean and standard deviation; categorical variables were expressed as number (n) and percentage (%). Independent samples t-test was used to compare the averages of measurements and chi-square test was employed to reveal the relationship between categorical variables. P-value <0.05 was used to indicate the statistical significance.

Results

Mean age was 56.2 years among a total of 34 male (81%) and 8 female (19%) patients. A more frequent cause of injury was fall from heights whereas both hemithorax were affected evenly. A number of fractured ribs were between 3 and 5 in over half of the cases. Twenty-two patients developed distinctive complications inside of the first 72 hours. Following discharge, 2 patients developed pneumothorax and 5 haemothorax while 34 cases did not develop any complications. Related data and images of complications are detailed in Table 1 and Figure 1.

In the course of hospitalization, only one elderly patient (2.4%) died due to atelectasis and hyperacute respiratory insufficiency. Tube thoracostomy was performed in 12, pleural catheter drainage in 2 patients, whereas the other complications emerging in this period did not necessitate any additional interventions. Follow-up examination of discharged cases revealed pneumothorax in 2 and haemothorax in 5 patients who were thereafter scheduled for re-inspection since they were all asymptomatic. Complications and outcomes are summarized in Table 2.

Statistical studies showed that the development of complications during or after the hospitalization period was not related to age, gender, type and side of trauma, or the number of fractured ribs (Table 3). Besides, patients develop almost most of the complications in the first 72 hours following the traumatic event.

Discussion

The findings of this study clearly showed that majority of the complications due to traumatic rib fractures occurred in the first 72 hours and one-fifth of the patients presented with delayed complications at the follow-up examination.

Recent studies have reported mortality rates in patients with multiple rib fractures as high as 22% (8-11). Advanced age, the severity of the injury, admittance to lower levels of hospitals, and the presence of comorbid diseases were announced with elevated rates of in-hospital mortality (9-13). The mortality rate was 2.4% in this study, which might be related to the relatively lower average of patient age when compared to the ones reported in the literature.

Table 1. Clinical features of patients with traumatic rib fractures

Variables		n	%
Gender	Male	34	81
	Female	8	19
Cause of trauma	Fall from height	25	59.5
	Car accident	13	31
	Hit/crush	4	9.5
Side of trauma	Right	22	52.4
	Left	20	47.6
Number of rib fractures	3-5	24	57.1
	6-9	15	35.8
	10-12	3	7.1
Total		42	100

Figure 1. Radiological views of complications

Table 2. Complications of rib fractures, applied treatments and results

Variables		n	%
Complications for hospitalized patients	None	20	47.6
	Pneumothorax	4	9.5
	Haemothorax	9	21.4
	Haemopneumothorax	4	9.5
	Atelectasis	4	9.5
	Subcutaneous emphysema	1	2.5
Total		42	100
Elapsed time until complication (hours)	0-24	6	27.3
	24-48	7	31.8
	48-72	7	31.8
	>72	2	9.1
Total		22	100
Complication at follow-up examination	None	34	82.9
	Pneumothorax	2	4.9
	Haemothorax	5	12.2
Total		41	100

Table 3. Factors related to the development of complications

Variables		Complications during hospital stay (standard deviation)		p	Complication after discharge (standard deviation)		p
		None	Present		None	Present	
Age (mean ± standard deviation, years)		57.5±19.3	55±18.5	0.361	54.8±18.4	63.1±19.9	0.455
Gender (n)	Male	15	19	0.365	28	6	0.733
	Female	5	3		7	1	
Type of trauma (n)	Fall from height	12	13	0.651	19	6	0.125
	Car accident	7	6		12	1	
	Hit/crush	1	3		4	0	
Side of trauma (n)	Right	12	10	0.358	18	4	0.789
	Left	8	12		17	3	
Number of fractured ribs(n)	3-5	15	9	0.050	18	6	0.103
	6-9	4	11		14	6	
	10-12	1	2		3	0	

Chien et al. (10) reported that 3 or more rib fractures or any displaced fractures were good predictors of the development of complications, whereas Shulzhenko et al. (11) showed that 5 or more rib fractures were associated with increased intensive care unit admission and longer duration of stay at hospital and that 8 or more rib fractures were associated with elevated levels of complications and mortality. However, Whitson et al. (14) showed that the total number of rib fractures was not an independent predictor of in-hospital morbidity and that increased age, obesity, and accompanying traumas were the leading causes of worse outcomes. Likewise, this study revealed no connection between the number of rib fractures and the development of complications during the hospital stay or following discharge.

Several treatment strategies have been declared for rib fractures regarding the complicity and severity of pulmonary complications which are potentially evident to develop. Appropriate analgesia including catheter-based pain therapy, administration of intravenous ibuprofen or ketorolac, and also respiratory therapies featuring incentive spirometry, deep breathing, and coughing practices are recently approved as the mainstay to avoid the adverse consequences (15,16). Patients encountering life-threatening complications such as pneumothorax, and haemothorax should be instantly noticed and treated accurately. Despite the minor contradictions in timing, patient selection, and extent of surgical management of rib fractures; evidence-based data show that chest wall stabilization aids to ease the pain, reduce the incidence of pneumonia and shorten all of the durations of mechanical ventilation, hospitalization, and intensive care unit stay (17,18).

Suggestions concerning the length of follow-up differentiated between the recent studies varying from 3 to 12 months (19). This paper focused mainly on the acute and potentially fatal complications so should be extended with further long-term research to investigate the evidence of chronic complaints and disorders related to traumatic rib fractures.

Study Limitations

The principal limitation of this present study was that it was a single-center research, including a small group of cases. However, the findings support valuable and basic details for managing trauma patients with rib fractures.

Conclusion

Chest traumas lead to a high risk of mortality and morbidity. Observing patients with 3 or more traumatic rib fractures for at least 72 hours at the hospital and scheduling cases for follow-up examination between 10 to 15 days after discharge may aid to diagnose potentially life-threatening complications. Additionally, when patients with a recent rib fracture present to the emergency room, the clinician should be alert to potential complications.

Ethics

Ethics Committee Approval: This research was approved by Kırklareli University Ethics Committee (protocol no: P20220005, date: 17.02.2022) and conducted in accordance with the Helsinki Declaration of Principles.

Informed Consent: Retrospective study.

Peer-review: Externally peer reviewed.

Authorship Contributions

Surgical and Medical Practices: M.S., Concept: O.G.,Design: O.G., Data Collection or Processing: O.G., Analysis or Interpretation: M.S., Literature Search: M.S., Writing: M.S.

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