



Original Article

Morbidity, mortality, associated injuries, and management of traumatic rib fractures

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Abstract

Background: Thoracic trauma is responsible for approximately 25% of trauma deaths, and rib fractures are present in as many as 40–80% of patients, and intensive care and/or ventilator support are frequently required for these patients. To identify their risk factors would improve treatment strategies for these patients.

Methods: Between March 2005 and December 2013, consecutive patients with blunt thoracic trauma, who were admitted to the Department of Thoracic Surgery at Tungs' Taichung Metro Harbor Hospital (Taichung, Taiwan), were reviewed in this retrospective cohort study with the approval of the Institutional Review Board. The duration of hospital stay, ventilator support, injury severity score (ISS), type of injury, associated injuries, treatments, and mortality were analyzed statistically.

Results: A total of 1621 thoracic trauma patients were included in this study, with a male majority and an age range of 18–95 years (mean age, 51.2 years). Approximately 11.7% of these patients had an ISS ≥ 16 and a mortality rate of 6.9%. Among them, 78.5% had rib fractures; 31.8%, traumatic hemothorax; 15.6%, pneumothorax; 9.6%, hemopneumothorax; and 4.6%, lung contusion. The most common associated injury was extremity fracture, followed by head injury and clavicle fracture. Surgery on the extremities (20.6% of patients) and chest tube placement (22.7% of patients) were the most common treatments. The number of rib fractures was associated with prolonged hospital and intensive care unit (ICU) stays (≥ 7 days), an ISS ≥ 16 , and pulmonary complications of hemothorax, pneumothorax, and hemopneumothorax, but not with mechanical ventilator use. Furthermore, old age was significantly associated with rib fractures in patients with thoracic trauma.

Conclusion: The severity of traumatic rib fractures was identified in this study. Therefore, a trauma team needs better preparation to provide effective treatment strategies when encountering thoracic trauma patients, especially patients who are older and have rib fractures.

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Keywords: associated injury; rib fracture; thoracic trauma

1. Introduction

Trauma is the leading cause of death in Taiwan in the adult population aged < 50 years.¹ Occurring almost always as an unexpected affliction with very high mortality and morbidity, thoracic trauma is responsible for approximately 25% of trauma deaths. Thoracic trauma is also a contributing factor

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towards an additional 25% of trauma deaths worldwide.^{2–6} The incidence of rib fractures owing to thoracic trauma is in the range of 10–40% among all trauma cases.^{2,7,8} In studies focusing on blunt thoracic trauma, rib fractures were present in as many as 40–80% of thoracic trauma patients, who frequently require the care of an intensive care unit (ICU) and/or ventilator support.^{8–10} Contrary to the previous conception that most chest wall injuries are benign, rib fractures exist in 4.4% of patient mortality within 30 days and 55% of patient mortality within 24 hours because of their precarious nature, based on a nationwide population-based study using pooled data from the Taiwan's National Health Insurance Research Database.¹¹

In the present study, our aims were to understand the clinical course following traumatic rib fractures and identify risk factors for mortality and morbidity. These results may help to prepare a trauma team with better treatment strategies in the initial encounter with patients with thoracic trauma at clinical presentation, especially elderly patients with rib fractures.

2. Methods

2.1. Study population

This retrospective cohort study included consecutive patients with blunt thoracic trauma who were admitted to the Department of Thoracic Surgery at Tungs' Taichung Metro Harbor Hospital (Taichung, Taiwan, R.O.C.; a Level I trauma center) between March 1, 2005 and December 31, 2013. All data were obtained from electronic medical records. The exclusion criteria included: (1) patients treated only in an outpatient setting or transferred to another institution; (2) patients aged < 18 years; (3) patients admitted to the Department of Cardiovascular Surgery with cardiac or great vessel involvement whose care did not involve the Department of Thoracic Surgery; and (4) patients for whom the medical chart parameters under study could not be well determined.

Data such as sex, age, admission, and discharge dates, duration of hospital and ICU stay, ventilator support, injury severity score (ISS), type of injury (rib fractures were specifically identified by two independent licensed thoracic surgeons), associated injuries, treatments received, and mortality were collected from the medical records. Surgery and associated injuries were classified according to the body part involved, namely head injury, facial bone fracture, spine injury, clavicle fracture, extremity fracture, or abdomen injury. Soft tissue injuries were not included in this study.

The study protocol was approved by the Institutional Review Board of Tungs' Taichung Metro Harbor Hospital, Taichung, Taiwan, R.O.C. (Approval Number, #102039).

2.2. Statistical analysis

We retrospectively performed statistical analysis on the database of all thoracic trauma patients admitted to the hospital. The χ^2 test was employed for the statistical analysis of

the variables. The relationships between the total number of rib fractures and various associated injuries were statistically analyzed using χ^2 for trend and the *t* test for comparison. The Pearson correlation was calculated to determine the relationships between the total number of rib fractures in patients with thoracic trauma and prolonged hospital stay of ≥ 7 days, ICU stay, mechanical ventilator use, or mortality. Multivariate logistic regression was also performed to explore the relationship between rib fractures and patients' age, sex, and comorbidities. All statistical results were significant when $p < 0.05$. Statistical analysis was performed using the SPSS statistical package (Version 17.0; SPSS, Inc., Chicago, IL, USA).

3. Results

During the 9-year study period, there were 1621 thoracic trauma patients, excluding eight patients who were younger than 18 years old. The majority (72.5%) of thoracic trauma patients were male (Table 1). The patients' age ranged from

Table 1
Demographic and clinical characteristics of 1621 thoracic trauma patients.

	No. or mean no.	SD or %
Total	1621	100
Sex/male	1176	72.5
Patient age (y)	51.2	17.1
18–44	589	36.3
45–64	613	37.8
65–74	251	15.5
≥ 75	168	10.4
Injury type		
Thoracic		
Rib fracture	1272	78.5
Sternum fracture	14	0.9
Lung contusion	75	4.6
Hemothorax	515	31.8
Pneumothorax	253	15.6
Hemopneumothorax	156	9.6
Associated injury		
Head injury	425	26.2
Facial bone fracture	53	3.3
Spine injury	111	6.8
Clavicle fracture	349	21.5
Extremity fracture	432	26.7
Abdomen injury	205	12.6
Treatments		
Surgery		
Thoracic surgery	38	2.3
Head surgery	98	6.0
Facial bone surgery	36	2.2
Spine surgery	51	3.1
Clavicle surgery	193	11.9
Extremity surgery	334	20.6
Abdomen surgery	83	5.1
Chest drain		
Chest tube	368	22.7
Pig tail	52	3.2
ISS ≥ 16	190	11.7
Death	112	6.9

ISS = injury severity score; SD = standard deviation.

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