

Clinical Science

Rib fractures: comparison of associated injuries between pediatric and adult population



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Associated injuries;
Pattern of injury

Abstract

BACKGROUND: Rib fractures are considered a marker of exposure to significant traumatic energy. In children, because of high elasticity of the chest wall, higher energy levels are necessary for ribs to fracture. The purpose of this study was to analyze patterns of associated injuries in children as compared with adults, all of whom presented with rib fractures.

METHODS: A retrospective cohort study involving blunt trauma patients with rib fractures registered in the National Trauma Registry was conducted.

RESULTS: Of 6,995 trauma victims who were found to suffer from rib fractures, 328 were children and 6,627 were adults. Isolated rib fractures without associated injuries occurred in 19 children (5.8%) and 731 adults (11%). More adults had 4 or more fractured ribs compared with children ($P < .001$). Children suffered from higher rates of associated brain injuries ($P = .003$), hemothorax/pneumothorax ($P = .006$), spleen, and liver injury ($P < .001$). Mortality rate was 5% in both groups.

CONCLUSIONS: The incidence of associated head, thoracic, and abdominal solid organ injuries in children was significantly higher than in adults suffering from rib fractures. In spite of a higher Injury Severity Score and incidence of associated injuries, mortality rate was similar. Mortality of rib fracture patients was mostly affected by the presence of extrathoracic injuries.

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Rib fractures are common, occurring in 10% of all blunt trauma patients.^{1,2} Rib fractures are an indicator of considerable energy impact and frequently accompanied by various intra and extrathoracic injuries. In adult trauma victims with rib fractures following blunt trauma, the main predictor of mortality is the presence of associated injuries.³⁻⁵ Several studies in the adult population of patients revealed that apart from associated injuries, other independent factors that adversely affect mortality rate include older age and higher number of fractured ribs.^{2,6,7}

Table 1 Injury mechanism leading to rib fractures in children and adults

Age	0–14 years (n = 328)	15–64 years (n = 6,627)	P value
Mechanism			
MVA	53 (16.16%)	2,401 (36.23%)	<.0001
Motorcycle	1 (.3%)	663 (10%)	<.0001
PHBC	132 (40.24%)	642 (9.69%)	<.0001
Bicycle	25 (7.62%)	225 (3.4%)	.0001
Fall from height	68 (20.73%)	1,479 (22.32%)	.54
Fall (non-height)	12 (3.66%)	338 (5.1%)	.3
Assault	9 (2.74%)	242 (3.65%)	.48
Other	28 (8.54%)	637 (9.61%)	.58

MVA = driver or passenger in motor vehicle accident; PHBC = pedestrian hit by car.

The relationship of rib fractures with associated injuries and mortality rate seems to be different in children compared with adults. Several studies examining chest trauma in children show that a high incidence of significant intrathoracic injuries may occur without concomitant rib fractures.^{7,8} If rib fractures do occur, the rate of associated injuries and mortality increases significantly.^{9,10} It is assumed that higher energy is required to cause rib fractures in children, which in turn will lead to higher probability of multiorgan injury. Nevertheless, the real association between associated injuries and number of fractured ribs needs to be clarified.

The primary aim of this study was to compare differences of the concomitant injury patterns in adult and pediatric population of trauma victims suffering from rib fractures.

Methods

We performed a retrospective cohort study involving all blunt trauma patients suffering from concomitant rib

fractures, between the years 1998 and 2009. Data were obtained from the records of The Israeli National Trauma Registry maintained by Israel's National Center for Trauma and Emergency Medicine Research, in the Gertner Institute for Epidemiology and Health Policy Research. Records with information concerning trauma patients hospitalized in 11 hospitals, of which 6 are Level I trauma centers and 5 are Level II trauma centers, were included.

Data collected in the registry include age, sex, mechanism of injury, number of fractured ribs, severity of the splenic injury, Injury Severity Score (ISS), mortality, and associated injuries. This included presence of pneumothorax, hemothorax, lung contusion, and aortic injury. Data collected for extrathoracic injury included head injury, solid abdominal organ injury, pelvic fractures, and long-bone fractures. Trauma victims older than 65 years were excluded from this study because of higher prevalence of osteoporosis leading to fractures following minor injury. Patients included were divided into 2 groups: children aged 0 to 14 years and adults aged 15 to 64 years.

Statistical analysis was performed using SAS version 9.2 (SAS, Cary, NC) and GraphPad InStat version 3.10

Table 2 ISS and number of fractured ribs in children and adults by injury mechanism

Age	0–14 years (n = 328)			15–64 years (n = 6,627)			P value
	MVA	PHBC	FALL	MVA	PHBC	FALL	
ISS							
1–14	128 (39.02%)			3,218 (48.56%)			.0007
	7	33	43	1,036	183	827	
	2.1%	10%	13.1%	15.6%	2.7%	12.4%	
16+	200 (60.98%)			3,409 (51.44%)			
	46	99	25	1,365	459	652	
	14%	30.1%	7.6%	20.6%	6.9%	9.8%	
Number of broken ribs							
≤3 ribs	232 (70.73%)			3,890 (58.7%)			<.0001
	37	91	51	1,448	360	856	
	11.2%	27.7%	15.5%	21.8%	5.4%	12.9%	
>3 ribs	96 (29.27%)			2,737 (41.3%)			
	16	41	17	953	282	623	
	4.8%	12.5%	5.1%	14.3%	4.2%	9.4%	

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