Management of Advanced Aged Patients with Rib Fractures

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Rib fractures are painful and disabling injuries found in chest trauma patients. Elderly patients (age > 60 years old) represent the majority of the victims of major trauma, and rib fractures account for 10% of all trauma admissions. Rib fracture management includes operative and non-operative approaches. Conservative treatment generally consists of satisfactory pain control, respiratory assistance, cough strategies, and deep breathing exercises. Surgical fixation in elderly patients seems to result in better outcomes than conservative treatment in terms of shorter hospitalization time, more favorable pain feedback and reduced associated morbidity.

conservative treatment ribs fractures flail chest elderly population rib fixation

1. Introduction

Rib fractures are painful and disabling injuries found in chest trauma patients. Simple rib fractures typically heal with minimal intervention or consequence, but as the number of fractured ribs increases, the morbidity and mortality rates increase exponentially, particularly among elderly patients ^{[1][2]}.

Rib fracture management includes operative and non-operative approaches. Conservative treatment generally consists of satisfactory pain control, respiratory assistance, cough strategies, and deep breathing exercises ^[3]. Patients receiving conservative treatment have fewer complications, a more significant length of hospital stay, and worse functional status after hospitalization ^[4].

Despite the favorable results emerging from multiple studies reported in the literature, surgical fixation of rib fractures and fluctuating chest injuries has not been used to its full potential ^{[5][6]}. Furthermore, it is controversial whether older age patients benefit from surgical fixation.

2. Management of Advanced Aged Patients with Rib Fractures

The data concerning the mortality rate, as reported in **Table 1**, showed a lower overall weighted mean in the operatively-treated group (3%) compared to conservative-treated patients (8.3%).

Table 1. Studies comparing conservative and operative treatment of rib fractures.

	Authors (Year, Country)							
Outcomes		Fitzgerald et al. (2017, USA) ^[7]	Ali- Osman et al. (2018, USA) ^[7]	Kane et al. (2018, USA) ^[8]	Chen Zhu et al. (2020, USA) ^[9]	Pieracci et al. (2021, USA) ^[<u>10</u>]	Cooper et al. (2021, Australia) [<u>11</u>]	Christie et al. (2021, USA) ^[12]
Subjects (number)	СТ	50	135	392	758	227	280	172
	ОТ	23	64	43	758	133	15	85
Male (%)	СТ	nr	73 (54)	nr	518 (68)	116 (51)	† 185 (63)	nr
	ОТ	nr	41 (61)	nr	530 (70)	81 (61)		nr
Age (IQR/SD)	СТ	75 (65–97)	72 (66– 81)	75.4 ± 6.8	72 (68– 79)	86 (80– 90)	77 (73–84)	75 (65– 100)
	ОТ	68 (63–89)	69 (63– 74)	71.3 ± 6.0	72 (68– 78)	84 (80– 100)	78 (75–83)	74 (65– 69)
Rib fractures (IQR/SD)	СТ	nr	5 (3–7)	nr	nr	5 (1–7)	4 (3–6)	nr
	ОТ	nr	7 (5–9)	nr	nr	9 (1–30)	8 (6–12)	nr
Flail chest (IQR/SD)	СТ	nr	nr	nr	348 (46)	36 (16)	42 (15)	nr
	ОТ	nr	nr	nr	345 (46)	76 (57)	7 (50)	nr
ISS (IQR/SD)	СТ	19 (14–23)	14 (8– 24)	14.1 ± 10.3	nr	13 (4–34)	14 (10–19)	13 (1–38)
	ОТ	21 (16–26)	17.5 (9– 25)	20.1 ± 8.5	nr	14 (4–57)	17 (13–29)	20 (9–59)
Mortality (%)	СТ	2 (4)	13 (10)	33 (8)	55 (7)	21 (9)	27 (10)	18 (10)
	ОТ	0 (0)	1 (2)	1 (2)	32 (4)	10 (8)	0 (0)	4 (5)
(IQR/SD) Mortality (%) Pneumonia (%)	СТ	7 (14)	16 (12)	54 (14)	8 (1)	9 (4)	25 (10)	20 (12)
	ОТ	0 (0)	5 (8)	2 (5)	23 (3)	16 (12)	2 (13)	0 (0)
MVL (IQR/SD)	СТ	nr	4 (1–10)	nr	7 (3–14)	nr	5 (2–12)	nr
	ОТ	nr	3 (1–15)	nr	6 (2–13)	nr	12 (3–30)	nr
ICU-LOS	СТ	12 (7–17)	4 (3–7)	0 (0–3)	4 (2–8)	0	3 (1–6)	10 (1–32)
(IQR/SD)	ОТ	8 (5–11)	6 (3–10)	5 (0-8)	7 (4–13)	4.5	6 (2–13)	8 (1–11)

	Authors (Year, Country)										
IH-LOS (IQR/SD)	СТ	17 (10–23)	4.8 (3–8)	5 (3–9)	7 (4–12)	6	6.5 (3–13)	8 (1–39)			
	ОТ	18 (14–23)	12 (9– 16)	12 (10– 16)	13 (9– 18)	11	12 (9–15)	15 (3–49)			

† Overall male distribution; IQR: interquartile range; SD: standard deviation; nr: not reported; CT: conservative treatment; OT: operative treatment; ISS: Injury Severity Score; MVL: mechanical ventilation length; ICU-LOS: intensive care unit-length of stay; IH-LOS: in hospital-length of stay.

Secondary outcomes, such as pneumonia, were reported at a reasonably higher rate in the non-operative patients' group (9.6% vs. 5.8%).

Historically, the standard of care for rib fractures has been nonoperative management. The choice of nonoperative management may have resulted from a lack of knowledge about fracture fixation techniques among those managing the chest wall injuries in this set of patients. As rib fracture fixation has gained popularity and fixation techniques and implant devices have been refined, the clinical results are encouraging ^[13]. Operative techniques for rib fixation include rigid devices such as plates, struts, intramedullary nails, malleable Kirschner wires, and sutures. These surgical approaches differ in their safety and efficacy, and the optimal approach has not been determined so far ^[14]. The evidence supporting rib fracture fixation to improve patient survival statistics and accelerate patient's recovery to a normal functional state is increasing. Several studies have shown that rib fracture fixation results in reductions in narcotic use, avoidance of tracheostomy, and better quality of life ^{[7][15][16]}.

Rib fractures are a known threat to the survival of geriatric trauma patients and can adversely affect the recovery and rehabilitation of other injuries. Functional and lifestyle limitations relative to the patient's baseline are crucial endpoints after chest wall trauma in the elderly population. Along with the age-associated deterioration in global pulmonary function, pain from rib fractures, and subsequent respiratory impairment, rib fractures can alter the survival potential and quality of recovery. Rib plating procedures appear to enhance these outcome measures and should be strongly considered as an adjunct, if not a first-line therapeutic alternative for rib fractures in the geriatric patient population ^[17].

Elderly trauma patients with rib fractures are currently understudied with few published studies and data defining best practices. With the evolution of plating systems for fixation and chest wall stabilization, the practical paradigm for rib fracture management is shifting as a viable operative intervention now exists ^{[12][17][18][19][20]}. The clinical outcomes in this group of patients may be ameliorated by the systematic use of thoracic trauma protocols, anesthetic techniques, and rib-stabilization interventions. A tailored rehabilitation nursing care program has also significantly improved the functional status and quality of life in patients with severe rib fractures at discharge and six-month follow-up, improving the quality of nursing care itself ^[21]. However, few of these studies have included elderly subjects to date. Therefore, it is unclear whether the results of these studies can be extrapolated to the geriatric trauma population ^[22].

Considering the available results, surgical fixation in elderly patients seems to result in better outcomes than conservative treatment in terms of shorter hospitalization time, more favorable pain feedback and reduced associated morbidity.

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