Chest Wall Injury Society

Title of Presentation NONOPERATIVE MANAGEMENT OF MULTIPLE RIB FRACTURES RESULTS IN A HIGH INCIDENCE OF NONUNION AND MALUNION

Background

The true rate of nonunion (NU) and malunion (MU) after traumatic rib fractures is underexplored in current literature, as are contributory patient and injury factors.

Methods

We conducted a retrospective cohort study of hospitalized patients with multiple traumatic rib fractures managed nonoperatively between August 2014 and April 2025 at a level I trauma center. Patients were included if they had documented computed tomography (CT) imaging of the chest obtained six months or later from the date of injury. Three independent reviewers assessed follow-up CT imaging for the presence of NU, defined as a persistent fracture gap, and MU, defined as abnormal angulation with cortical irregularity. Multivariate logistic regression was used to evaluate the effects of fracture characteristics on the likelihood of developing NU/MU.

Results

NU/MU was present in 40 of 219 patients (18.3%) and in 96 of 1229 individual fractures (7.8%). Cohorts were similar regarding demographic factors and injury mechanisms. Regression analysis showed bicortical displacement and flail rib predisposed to NU/MU with respective odds ratios of 21.8 (95% CI 10.7–44.9, $p<0.001$) and 5.71 (95% CI 2.77–12.0). Posterior and offset fractures were also significantly more likely to develop NU/MU. Fracture comminution and rib height on the chest wall (high, middle, or low) were not significant predictors. Patients with NU/MU initially presented with more rib fractures (median 6 vs. 4, $p < 0.001$) and concomitant clavicular fractures (20.0% vs. 8.4%, $p = 0.043$). Of 19 comorbidities, only cigarette smoking was associated with NU/MU (67.5% vs. 46.9%, $p = 0.019$).

Conclusion

NU/MU was common after severe chest wall trauma and was associated with cigarette smoking. Posterior fracture location, flail rib, and degree of rib displacement were also associated with NU/MU. Whether surgical stabilization can reduce the incidence in these settings is unclear.

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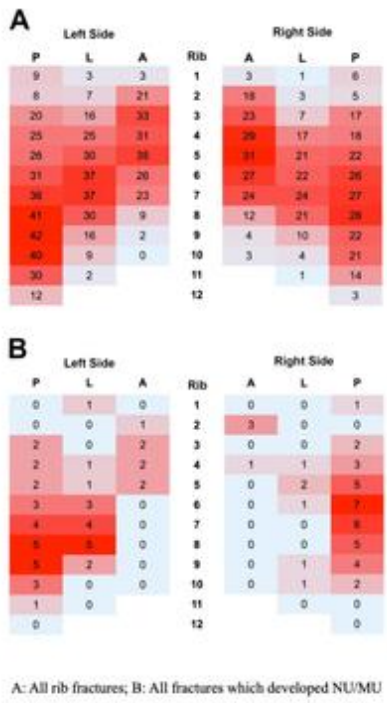
Figure 1: Fracture Heat Maps



A: All rib fractures; B: All fractures which developed NU/MU

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Table 4: Multivariate Logistic Regression

Parameter	β	OR	95% CI	p	VIF
Intercept	-2.88	0.05	0.03 – 0.09	**< 0.001**	-
Anterior	-1.54	0.21	0.10 – 0.42	**< 0.001**	1.46
Lateral	-1.24	0.29	0.15 – 0.54	**< 0.001**	1.45
High (Ribs 1 – 4)	-0.136	0.87	0.48 – 1.55	0.649	1.16
Low (Ribs 9 – 12)	-0.355	0.70	0.37 – 1.29	0.259	1.30
Offset	1.61	4.99	2.88 – 8.93	**< 0.001**	1.14
Displaced	3.08	21.8	10.7 – 44.9	**< 0.001**	1.04
Complex	0.112	1.12	0.49 – 2.33	0.777	1.05
Flail	1.74	5.71	2.77 – 12.0	**< 0.001**	1.21

β = Parameter estimate; CI: Confidence interval; OR: Odds ratio; VIF: Variance inflation factor.