Development of a Surgical Stabilization of Rib Fractures (SSRF) Program at a Rural Trauma Level 1 Trauma Center: Effects on Regional Transfer Practices and Clinical Management

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Introduction

Recent studies have focused on the clinical outcomes and operative aspects of surgical stabilization of rib fractures (SSRF). However, the effects of development of SSRF programs on trauma system transfers and management practices remains to be elucidated.

Objective

The objective of this study was to examine the effects of developing an SSRF program at a rural Level I Trauma Center specifically with regards to: transfer volume, incidence of SSRF performance and any alteration, or evolution, of SSRF technique.

Methods

A retrospective review was performed at a rural level 1 trauma center for patients ≥ 18 years of age, admitted with at least one rib fracture between January 2017- December 2023. Demographics, transfer status, injury severity score (ISS), max abbreviated injury severity (MAIS) score, SSRF procedure, and ICU and hospital length of stay (LOS) were collected. Percent change and McNemar test on paired proportions were calculated between 2017 and 2023 years only using MedCalc Software with P <0.05 level of significance.

Results

4,346 patients were evaluated with at least one rib fracture and 4,001 of these patients were admitted with an average age 64 years old ± SD 19. Forty-nine percent (49%) of patients were transferred in from outside facilities with a 1.7-fold increase in transfers with isolated rib fractures from 177 in 2017 to 304 in 2023. Overall, over the study period there was a 51% increase in rib fractures admitted. A 900% increase in SSRF procedures was seen for all patients and these patients had favorable hospital outcomes and 720% increase in those transferred in with isolated rib fractures. In 2017, 100% of SSRFs were performed in an open extrathoracic fashion, whereas in 2023, 81% were open extrathoracic, and 19% were performed in a minimally invasive intrathoracic fashion.

Tables

Year	Total # of admitted patients	Age, average ± SD, median	Female, n (%)	ISS, average ± SD, median	Max Chest AIS Score, average ± SD, median
2017	424	61 ± 19.6, 62.5	162(38%)	12 ± 8.2, 9	2.2 ± 0.7, 2
2018	469	64 ± 19, 65	184(39%)	13 ± 8, 10	2.5 ± 0.8, 3
2019	504	65 ± 18, 67	196(39%)	13.5 ± 9, 10	2.6 ± 0.8, 3
2020	598	63 ± 19.5, 65	228(38%)	14.5 ± 9, 13	2.7 ± 0.7, 3
2021	643	66 ± 18.8, 68	259(40%)	14 ± 8.3, 12	2.7 ± 0.7, 3
2022	722	64 ± 18, 66	260(36%)	15 ± 8.8, 13	2.8 ± 0.7, 3
2023	641	63 ± 19, 66	244(38%)	15 ± 8.6, 13	2.7 ± 0.7, 3
Total	4001	64 ± 19, 66	1533(38%)	14 ± 8.7, 11	2.6 ± 0.7, 3

Table 1: Demographics and Injury characteristics of all rib fracture patients by year.

Admitted Rib Fracture Patients	2017	2018	2019	2020	2021	2022	2023	Total	Change from 2017 & 2023
Total Patients Admitted w/RF	424	469	504	598	643	722	641	4001	51% P < 0.0001
Patients Transferred In w/ Rib Fractures	177	232	261	309	327	367	304	1977	72% P = 0.27
Patients Transferred In w/ Isolated Rib Fractures	61	105	103	110	151	169	126	825	107% P = 0.93
SSRF Cohort	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**Total**	**Change from 2017-2023**
Total SSRF Procedures	8	20	24	61	64	68	80	326	900% P = 0.027
SSRF in Patients Transferred in w/ RF	5	11	18	36	37	41	41	189	720% P = 0.01
SSRF in Patients Transferred In with Isolated RF	2	5	8	12	23	25	24	99	1100% P = 0.14

Table 2. Total number of patients admitted with rib fractures, transfer status and SSRF procedures.

Conclusion

A practice driven and institutionally supported effort to develop a SSRF program at a Rural Level I Trauma Center was associated with an increase patient transfers for rib fracture management, total SSRF procedures performed and advancement of SSRF technique in the form of both open extrathoracic and minimally invasive intrathoracic SSRF. Over this same time period a significant increase in admissions for rib fractures was observed, independent of transferred patients. Our group is pursuing evaluation of the effect of the SSRF program on transfer patterns, patient outcomes, resource utilization and hospital costs.

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