Breaks, Plates and Fewer Aches: Infection Rates and Hardware Removal in Intrathoracic vs. Extrathoracic Rib Fixation

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Introduction

- Rib fractures occur in approximately 20% of patients with thoracic trauma.
- Surgical stabilization of rib fractures (**SSRF**) involves open reduction and internal fixation with plates and screws to restore rib alignment.
- SSRF is now widely used, offering **better outcomes** and shorter ICU/hospital stays compared to non-operative management.[1]
- Two main techniques:
  - Extrathoracic (**external**) – older, more common.
  - Intrathoracic (**internal**) – newer, minimally invasive via video-assisted thoracoscopic surgery (VATS).[2]
- VATS-based intrathoracic SSRF offers:
  - Smaller incisions
  - Improved visualization
  - Access to pleural space
  - Better nerve block guidance
- Despite benefits, surgical site infection (**SSI**) remains a concern, especially with implanted hardware.
- Reported infection rates are low (**<5%**), but hardware infection can lead to significant **morbidity**.[3]
- Most **current literature** focuses on extrathoracic SSRF, with limited data comparing infection rates between techniques.[4]
- The intrathoracic approach may **reduce infection risk**, but has not been widely studied.

Aim

To compare postoperative infection rates and hardware removal between internal (intrathoracic) and external (extrathoracic) SSRF approaches, and to identify clinical and procedural predictors of SSI.

Methods

- A single-center, **retrospective**, cohort study was conducted involving **174 patients** who underwent SSRF from 2021–2024 at a Level 1 Trauma Center.
- Patients with previous chest hardware or infection prior to fixation were **excluded** from the study.
- **Primary** outcomes:
  - SSI following SSRF procedure
  - Post-operative hardware removal required
- **Secondary** outcomes:
  - Patient demographics (age, ISS)
  - Comorbidities (COPD, diabetes, ischemia, immunosuppression, smoking status, albumin, BMI)
  - Post-operative outcomes, length of hospital stay, transfusion requirement, days on ventilator
- Patients were grouped by plating type. Categorical variables were compared using chi-square or Fisher's exact tests. Continuous variables were analyzed using Mann–Whitney U tests. Multivariable logistic regression was used to identify
- independent predictors of SSI. Analyses were performed using JASP.

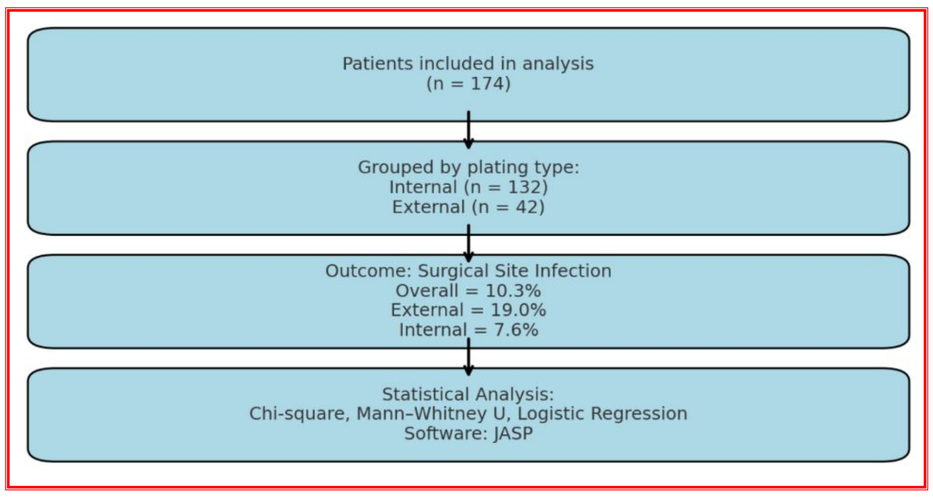

Figure 1. Flowchart of patient selection and analytic steps. Final sample included 174 patients undergoing SSRF between 2021–2024, stratified by plating technique.

Results

Overall SSI Rate: 10.3%

External Plating and SSI: 19.0% vs. 7.6% (internal), *p = 0.04*

Multivariable Regression:

- External plating independently associated with SSI
  - OR = 3.76, 95% CI: 1.25–2.40, *p = 0.016*
  - Sensitivity analysis (w/o cryoablation): OR = 3.17, *p = 0.031*

Non-significant predictors: BMI, albumin, diabetes, smoking

Key Trends:

- Higher ISS in external group (25.4 vs. 21.2, *p = 0.039*)
- Trends toward:
  - Higher BMI (30.9 vs. 28.7, p = 0.069)
  - Lower albumin (3.13 vs. 3.33, p = 0.84)
  - Longer hospital stays (20.7 vs. 21.0 days, p = 0.098)

Other Associations:

- Hardware removal more common in patients with SSI (*p = 0.002*)
- Cryoablation more common in internal group (*p = 0.009*)
- Blood transfusion more common in external group (*p = 0.036*), but not associated with SSI

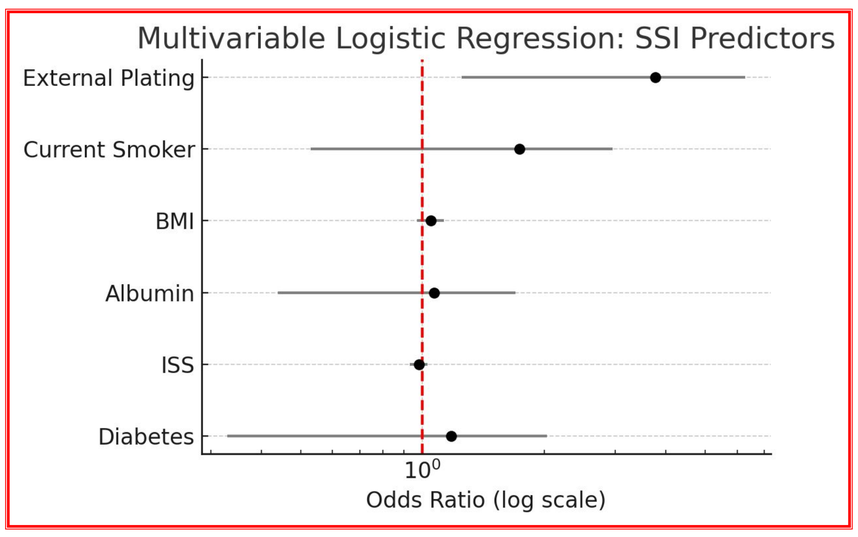

Figure 3. Adjusted odds ratios (ORs) for predictors of surgical site infection. External plating remained independently associated with increased SSI risk (OR = 3.76, 95% CI: 1.25–2.40, p = 0.016), even after sensitivity analysis excluding cryoablation.

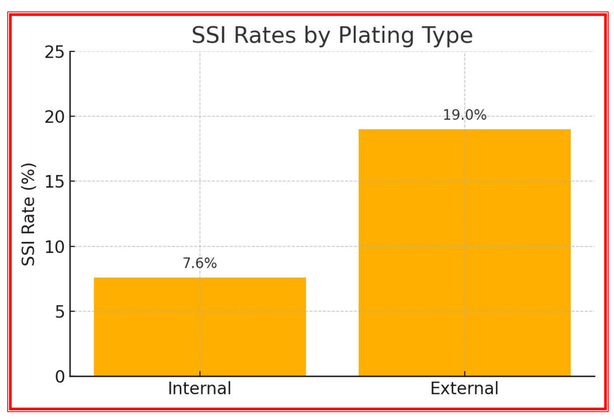

Figure 2. Surgical site infection (SSI) occurred significantly more frequently in patients who underwent external plating compared to internal plating (19.0% vs. 7.6%, p = 0.04).

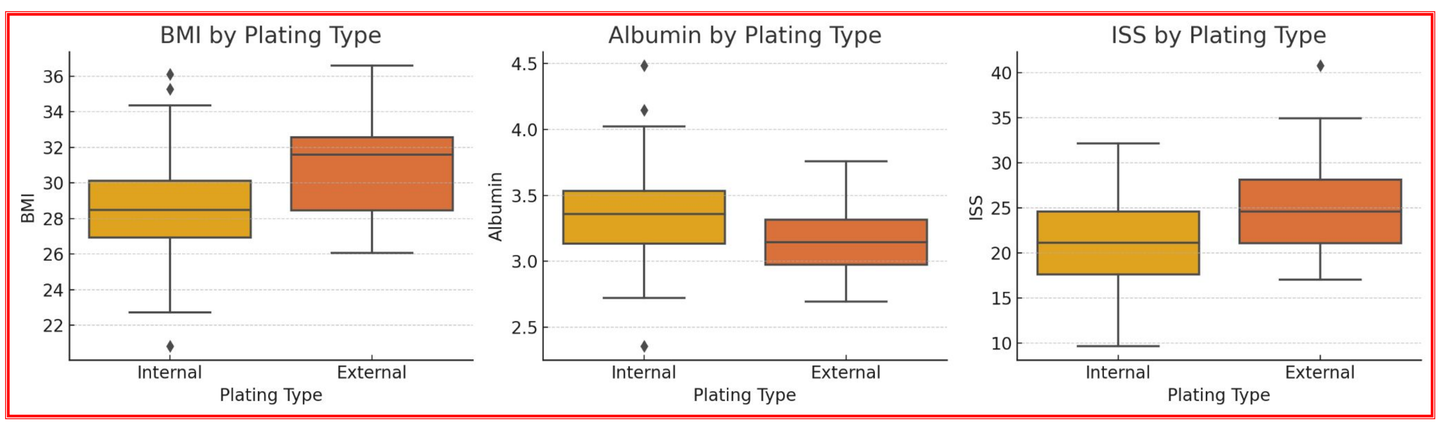

Figure 4. Distribution of Injury Severity Score (ISS), BMI, and serum albumin by plating type. External plating group had significantly higher ISS (p = 0.039), and trended toward higher BMI (p = 0.069) and lower albumin (p = 0.084).

Discussion

External plating was consistently and independently associated with increased risk of surgical site infection.

While cryoablation, comorbidities, and traditional wound healing predictors were not significantly associated with infection, trends in albumin, BMI, and surgical complexity variables support further investigation.

Findings suggest procedural factors related to external plating may drive infection risk more than patient-specific variables.

Conclusion

Plating technique matters: external plating is linked to higher SSI risk.

Clinical decision-making in SSRF should account for this procedural factor alongside patient comorbidities.

Larger, prospective studies are needed.

References

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