

# Olecranon Fixation Strategies: A Multicenter Review of 880 Patients

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## INTRODUCTION

- **Background:**
  - Olecranon fracture and osteotomy fixation comprise a significant portion of upper extremity orthopaedic procedures.
  - Historically, the most common fixation strategies have been plate (e.g. pre-contoured anatomic locked plate) and tension band with K-wire constructs.
  - Intramedullary (IM) screw fixation, although underreported in the literature, is another fixation strategy that offers theoretical advantages due to its simplicity and low-profile design.
- **Purpose:** The purpose of this study is to assess these olecranon fixation strategies by comparing their rates of unplanned reoperation.
- **Hypothesis:** We hypothesized that IM screw fixation carries a lower risk of unplanned reoperation compared to the more common plate and tension band strategies.

## METHODS

- **Design:** retrospective cohort study.
- **Setting:** two Level I trauma centers.
- **Population:** patients who underwent open reduction and internal fixation of an olecranon fracture or osteotomy from 2007 to 2018.
- **Primary outcome measure:** the rate of unplanned reoperation.
- **Secondary outcome measures:** the rates of unplanned reoperation due to stiffness, wound complications, and hardware prominence.
- **Analysis:**
  - A total of 927 patients were identified.
  - The three most common fixation strategies (plate, tension band, and IM screw) yielded 880 patients to be included in the analysis.
  - A time-to-event analysis was used to compare the study outcomes between treatment groups.
  - Hazard ratios are reported with the 95% confidence interval and p-value.
  - Results were adjusted for patient age, sex, and trauma center.

**Table 1:** Patient characteristics

Overall		n = 880		
	Age (mean, SD)	45.0, 18.4		
	Male	603 (68.5%)		
	Female	277 (31.5%)		
	Avg. follow-up length (weeks)	31.3		
Treatment:		Plate	Tension band	IM screw
Combined		n = 299	n = 153	n = 428
	Age (mean, SD)	41.4, 16.0	44.7, 18.9	47.6, 19.2
	Male	218 (72.9%)	98 (64.1%)	287 (67.1%)
	Female	81 (27.1%)	55 (35.9%)	141 (32.9%)
	Avg. follow-up length (weeks)	21.0	30.4	38.9
Center 1		n = 260	n = 48	n = 26
	Age (mean, SD)	40.3, 15.1	37.2, 14.4	46.7, 19.9
	Male	196 (75.4%)	35 (72.9%)	20 (76.9%)
	Female	64 (24.6%)	13 (27.1%)	6 (23.1%)
	Avg. follow-up length (weeks)	18.3	14.8	25.6
Center 2		n = 39	n = 105	n = 402
	Age (mean, SD)	48.7, 19.8	48.1, 19.7	47.7, 19.2
	Male	22 (56.4%)	63 (60.0%)	267 (66.4%)
	Female	17 (43.6%)	42 (40.0%)	135 (33.6%)
	Avg. follow-up length (weeks)	39.1	37.5	39.8

**Table 2:** Unplanned reoperation rates

Treatment	Unplanned Reoperation Rate (%)	Adjusted Hazard Ratio (95% CI, p-value)
Overall	18.3	
Plate	11.4	Ref (1.0)
Tension band	23.5	1.46 (0.84 – 2.52, p = .18)
IM screw	21.3	0.95 (0.56 – 1.60, p = .84)

**Table 3:** Unplanned reoperation rates due to stiffness

Treatment	Unplanned Reoperation Rate, Stiffness (%)	Adjusted Hazard Ratio (95% CI, p-value)
Overall	4.8	
Plate	1.3	Ref (1.0)
Tension band	5.9	2.72 (0.53 – 13.91, p = .23)
IM screw	6.8	2.35 (0.50 – 11.05, p = .28)

**Table 4:** Unplanned reoperation rates due to wound problems

Treatment	Unplanned Reoperation Rate, Wound Problems (%)	Adjusted Hazard Ratio (95% CI, p-value)
Overall	5.7	
Plate	4.7	Ref (1.0)
Tension band	4.6	0.77 (0.31 – 1.90, p = .58)
IM screw	6.8	0.95 (0.50 – 1.78, p = .87)

**Table 5:** Unplanned reoperation rates due to hardware prominence

Treatment	Unplanned Reoperation Rate, Hardware Prominence (%)	Adjusted Hazard Ratio (95% CI, p-value)
Overall	3.8	
Plate	2.3	Ref (1.0)
Tension band	7.2	2.55 (0.84 – 7.74, p = .10)
IM screw	3.5	0.89 (0.28 – 2.86, p = .85)

## RESULTS

- The overall unplanned reoperation rate was 18.3% (161/880).
  - Plate: 11.4% (34/299)
  - Tension band: 23.5% (36/153)
  - IM screw: 21.3% (91/428)
- The overall average follow-up length was 31.3 weeks.
  - Plate: 21.0 weeks
  - Tension band: 30.4 weeks
  - IM screw: 38.9 weeks
- IM screw patients were 0.95 (95% CI: 0.56 – 1.60, p = .84) times as likely as plate patients to have an unplanned reoperation, and tension band patients were 1.46 (95% CI: 0.84 – 2.52, p = .18) times more likely.
- For reoperations due to stiffness, IM screw patients were 2.35 (95% CI: 0.50 – 11.05, p = .28) times more likely than plate patients to undergo this reoperation.
- For reoperations due to hardware prominence, tension band patients were 2.55 (95% CI: 0.84 – 7.74, p = .10) times more likely than plate patients to undergo this reoperation.

## CONCLUSION

- Adjusting for patient age, sex, and trauma center, there was no statistically significant difference in the rate of unplanned reoperation between treatment groups.
- Looking at specific reoperation categories:
  - Patients treated with an IM screw may have an increased risk of reoperation for stiffness compared to plate patients.
  - Patients treated with the tension band and K-wire construct appear to have an increased risk of reoperation for both stiffness and hardware prominence.
- Although we were able to adjust for the difference in follow-up rate between centers, we are unable to account for the presumed differences in surgeon indication for reoperation.
- Further analysis should account for any differences in the severity of these complications by assessing the number of unplanned readmissions and reoperations required to treat them, allowing surgeons to better understand the differences in patient and health care burden between these fixation strategies.