



Identifying Risk Factors for Reintervention Following Closed Reduction and Percutaneous Pinning of Metacarpal Fractures

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INTRODUCTION

- Metacarpal fractures are among the most common orthopaedic injuries.^{1,2}
- Frequently treated with closed reduction and percutaneous pinning (CRPP).^{1,2}
- Risk factors for treatment failure and need for reintervention after CRPP remain unclear.¹

METHODS

- The TriNetX database was queried for patients with metacarpal fractures treated with CRPP.
- Patient demographics, psychosocial history, and fracture characteristics were assessed for association with treatment failure, defined as any reintervention within 6 months of injury.
- Associations identified on univariate were further analyzed after 1:1 propensity score-matching (PSM) using logistic regression.

Table 1: Demographics of the Study Population

Demographics of the Study Population		Reintervention
Age (mean, SD)	33.1 ± 17.2 years	
Sex	Male: 74.5%	ORIF 360 (2.2%)
	Female: 23.1%	CRPP 490 (3.2%)
Race/Ethnicity	White: 65.2%	Any Reintervention 770 (5.1%)
	Black: 15.9%	ORIF: Open reduction and internal fixation; CRPP: Closed reduction and percutaneous pinning
Other/Unknown: 18.8%		
Fractured metacarpal	3,352 (21.7%)	
1st Metacarpal	1,343 (8.7%)	
2nd Metacarpal	1,465 (9.5%)	
3rd Metacarpal	3,070 (19.8%)	
4th Metacarpal	6,248 (40.4%)	
5th Metacarpal		
Fracture location		
Base	5,027 (33.3%)	
Neck	4,937 (32.7%)	
Shaft	5,116 (33.9%)	

Table 2: PSM Analysis of Outcomes by Clinicodemographic Data

Propensity Score-Matched Analysis of Outcomes by Clinicodemographic Data						
	ORIF Reintervention		CRPP Reintervention		Any Reintervention	
	Cohort vs. Ref. (Relative Risk)	p-value	Cohort vs. Ref. (Relative Risk)	p-value	Cohort vs. Ref. (Relative Risk)	p-value
Age						
≥ 65 years	-	-	4.1% vs. 3.3% (RR 1.31)	p=0.1503	6.1% vs. 5.6% (RR 1.10)	p=0.498
≤ 30 years	1.2% vs. 2.3% (RR 0.54)	p=0.0001	2.3% vs. 3.1% (RR 0.77)	p= 0.1561	3.2% vs. 5.0% (RR 0.63)	p<0.0001
Sex						
Male	4.6% vs. 4.2% (RR 1.11)	p=0.358	-	-	5.3% vs. 4.2% (RR 1.28)	p=0.028
Female	1.5% vs. 2.8% (RR 0.54)	p=0.0002	-	-	4.3% vs. 5.8% (RR 0.74)	p=0.007
Race/Ethnicity						
White	2.5% vs. 1.9% (RR 1.40)	p=0.025	3.7% vs. 2.4% (RR 1.57)	p=0.0001	5.6% vs. 4.6% (RR 1.23)	p=0.029
Hispanic	-	-	2.7% vs. 3.2% (RR 0.85)	p= 0.4513	4.1% vs. 5.5% (RR 0.74)	p=0.060
Medical comorbidities						
Diabetes mellitus	2.0% vs. 2.1% (RR 0.96)	p=0.878	-	-	6.2% vs. 7.5% (RR 0.83)	p=0.230
Malnutrition	-	-	5.7% vs. 4.5% (RR 1.25)	p= 0.4937	8.1% vs. 6.7% (RR 1.22)	p=0.487
Inflammatory polyarthropathies	2.4% vs. 2.2% (RR 1.11)	p=0.749	4.8% vs. 3.4% (RR 1.44)	p= 0.1055	6.8% vs. 6.0% (RR 1.13)	p=0.496
Corticosteroid use	2.1% vs. 2.0% (RR 1.04)	p=0.772	3.5% vs. 3.3% (RR 1.07)	p= 0.5621	5.6% vs. 5.4% (RR 1.04)	p=0.687
Socioeconomic and psychosocial difficulties	2.7% vs. 2.4% (RR 1.17)	p=0.574	3.6% vs. 3.7% (RR 0.98)	p=0.9087	5.8% vs. 4.7% (RR 1.24)	p=0.244
Psychiatric disorders						
Mood (affective)	-	-	3.9% vs 2.8% (RR 1.39)	p=0.0289	6.2% vs 4.4% (RR 1.42)	p=0.006
Anxiety disorders	2.5% vs. 2.1% (RR 1.18)	p=0.297	3.5% vs. 4.2% (RR0.85)	p=0.2095	5.5% vs. 5.4% (RR 1.01)	p=0.906
Substance use						
Alcohol	-	-	4.4% vs. 3.9% (RR 1.13)	p= 0.4804	6.3% vs. 5.6% (RR 1.12)	p=0.421
Nicotine	-	-	4.1% vs. 3.1% (RR 1.34)	p= 0.0120	-	-
Cannabis	6.2% vs. 6.1% (RR 1.02)	p= 0.8742	4.0% vs. 3.8% (RR 1.04)	p= 0.8399	6.3% vs. 4.0% (RR 1.58)	p=0.008

Propensity score-matched for statistically significant independent variables on unmatched univariate analysis for each dependent variable.

Ref.: Reference cohort without risk factor; (-): Variable not statistically significant on unmatched univariate analysis.

Table 3: PSM Analysis of Outcomes Stratified by Injury Characteristics

Propensity Score Matched Analysis of Outcomes Stratified by Injury Characteristics						
	ORIF Reintervention		CRPP Reintervention		Any Reintervention	
	Cohort vs. Ref. (Relative Risk)	p-value	Cohort vs. Ref. (Relative Risk)	p-value	Cohort vs. Ref. (Relative Risk)	p-value
Fractured metacarpal						
1st metacarpal	-	-	3.9% vs 3.4% (RR 1.16)	p= 0.3034	5.6% vs 4.7% (RR 1.20)	p=0.160
2nd metacarpal	7.6% vs 4.0% (RR 1.94)	p=0.0001	4.2% vs 2.0% (RR 2.12)	p= 0.0013	7.3% vs 3.7% (RR 1.96)	p=0.0002
3rd metacarpal	6.4% vs 4.7% (RR 1.39)	p= 0.0522	-	-	6.3% vs 4.2% (RR 1.52)	p=0.015
4th metacarpal	-	-	1.9% vs 1.8% (RR 1.04)	p= 0.8416	-	-
5th metacarpal	3.1% vs 4.6% (RR 0.69)	p= 0.0005	2.1% vs 3.0% (RR 0.70)	p= 0.014	3.6% vs 4.7% (RR 0.71)	p=0.006
Fracture location						
Shaft	5.8% vs 3.9% (RR 1.51)	p= 0.0001	-	-	6.0% vs 4.2% (RR 1.41)	p=0.011

Propensity score-matched for statistically significant independent variables on unmatched univariate analysis for each dependent variable. Ref.:

Reference cohort without risk factor; (-): Variable not statistically significant on unmatched univariate analysis.

RESULTS/DISCUSSION

- Among 15,154 patients, 5.1% required reintervention
- Risk factors:** male sex, white race, mood disorders, nicotine/cannabis use, second/third metacarpal and shaft fractures
- Protective factors:** age ≤30, female sex, and 5th metacarpal fractures
- Age ≥65 was not linked to increased reintervention risk whereas those ≤30 years had a reduced risk.
- Fracture characteristics were the strongest predictors of revision to ORIF.
 - Shaft and 2nd/3rd metacarpal fractures had higher reintervention risk; 5th metacarpal fractures were associated with lower risk
- Affective mood disorders increased reintervention risk, unlike other psychiatric conditions, highlighting the need for improved preoperative counseling and mental health support.
- Nicotine and cannabis use raised risk; alcohol did not, indicating substance-specific effects on healing and outcomes.³

CONCLUSION

- Reintervention risk after CRPP is multifactorial.
- Identifying key demographic, psychosocial, and injury-specific risk factors can guide surgical decision-making and enhance patient counseling, leading to better outcomes in metacarpal fracture management.

REFERENCES

- Kollitz KM, Hammert WC, Vedder NB, Huang JI. Metacarpal Fractures: Treatment and Complications. *HAND*. 2014;9(1):16-23. doi:10.1007/s11552-013-9562-1
- Nakashian MN, Pointer L, Owens BD, Wolf JM. Incidence of Metacarpal Fractures in the US Population. *HAND*. 2012;7(4):426-430. doi:10.1007/s11552-012-9442-0
- Milttenberg B, Nemirov D, Siddiqui H, Kasper A, Ilyas AM. Metacarpal Fracture Repair: Early Reoperation Rates and Characteristics. *J Hand Surg Glob Online*. 2024;6(1):27-30. doi:10.1016/j.jhsg.2023.08.003