Original Article

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Comparison of Outcome of K-Wires Versus Plates & Screw Fixation for Management of Hand Fractures

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Author`s Contribution

[1,2]Substantial contributions to the conception or design of the work; or the acquisition, [3,5]Active participation in active methodology, [3]analysis, or interpretation of data for the work, [4]Drafting the work or revising it critically for important intellectual content

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ABSTRACT

Objective: To compare the outcomes of K-wires versus plate and screw fixation in managing hand fractures.

Methodology: This study was conducted at the Department of Plastic Surgery, PIMS, Islamabad, from April 2021 to April 2022. A total of 160 patients (aged 16–65 years) with hand fractures meeting inclusion criteria were included. Patients were followed up for three months, and success was defined as achieving >70% of the normal range of motion. Data analysis was done using SPSS, applying the Chi-square test to compare success rates, with $p < 0.05$ considered significant.

Results: The mean age was 29.1±5.8 years for the K-wires group and 28.2±5.6 years for the plate and screw group. Males comprised 60% of the K-wire group and 65% of the plate and screw group. Success rates were 76.2% in the K-wire group and 90% in the plate and screw group ($p < 0.05$).

Conclusion: Plate and screw fixation showed significantly better outcomes than K-wires for hand fracture management. Larger randomized clinical trials are needed to validate these findings.

Keywords: Hand fractures, K-wires, Plate, Range of motion, Screw fixation.

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Introduction

Metacarpal and phalangeal fractures are common in plastic surgery emergency departments. Among various types of these fractures, complicated fractures are more prevalent.[1] Unstable metacarpal and phalangeal fractures account for more than one-third of hand fractures. The severity of trauma directly influences the complexity of the fracture, necessitating precise management.[2]

Early mobilization through open reduction and internal fixation is crucial to prevent displacement and to manage any neurological or vascular injuries, ultimately restoring normal function and anatomy.[3] Timely intervention minimizes complications such as joint stiffness, edema, and adhesion to normal gliding structures.[4] The primary goal in fracture management is to achieve normal motion, though the choice of stabilization technique remains debated.[5]

Several fixation materials, including mini-plates, Kirschner wires (K-wires), and steel wires, are used for metacarpal and phalangeal fractures.[1] The ideal stabilization technique should be cost-effective, promote maximum bony union, maintain proper rotation, length, and alignment, and facilitate normal hand function without fear of displacement.[6]

K-wires offer advantages over mini-plates, such as minimal dissection, ease of application, and cost-effectiveness.[7] However, mini-plates, specifically designed for hand surgery, provide enhanced rigidity and length maintenance.[8,9] Additionally, compression screws have been introduced to complement the limitations of plate and K-wire fixation techniques.[10] Minimally invasive techniques allow early joint mobilization, reducing complications and improving functional recovery.[11]

Studies have demonstrated varying success rates: one trial reported 75% success with K-wires and 91.7% with plate and screw fixation ($p<0.05$)[13], while another found 100% success with K-wires compared to 92.2% with plates and screws ($p<0.05$).[14]

This study aims to compare the outcomes of K-wires versus plate and screw fixation for hand fractures. Conflicting literature exists regarding which method is

superior, and no local studies have been conducted on this subject. Therefore, we seek to generate evidence regarding the current practice of hand fracture management in a local setting to establish the optimal surgical approach for improved patient outcomes.

Methodology

This randomized controlled trial was conducted at the Department of Plastic Surgery, Pakistan Institute of Medical Sciences (PIMS) from April 2021 to April 2022. Ethical approval was obtained, and all participants provided informed consent.

A total of 160 patients were enrolled using the WHO sample size calculator and randomly assigned into two equal groups via envelope method: The K-wire group (Group A) and the plate plus screw group (Group B). Participants aged 16–65 years with hand fractures were included. Exclusion criteria encompassed ASA III & IV patients, bilateral cases, redo surgeries, active infections, diabetes mellitus (BSR>186 mg/dl), and chronic cases (>3 days post-fracture with debris or gangrene).

Demographic variables such as name, age, gender, duration of fracture, cause of fracture, and lateral side were recorded. All surgeries were performed under general anesthesia by a single surgical team. Surgery duration was documented, and patients received prophylactic antibiotics pre- and post-operatively for seven days. Post-surgical follow-ups were conducted for three months, assessing total active range of motion using a goniometer. Success was defined as achieving >70% of normal range of motion compared to the uninjured side. Patients with complications were managed per standard protocols.

Data was analyzed using SPSS version 21. Quantitative variables (age, fracture duration, surgery duration, and range of motion) were expressed as mean and standard deviation. Qualitative variables (gender, lateral side, cause of fracture, and success rate) were presented as frequency and percentage. Chi-square tests compared success rates between groups, with a p-value < 0.05 considered significant. Data stratification was performed based on age, gender, fracture duration, lateral side, cause of fracture, and surgery duration.

Results

The mean age in the K-wire group was 29.1±5.8 years (CI: 27.80–30.39), and in the plate plus screw group, it was 28.2±5.6 years (CI: 26.95–29.44). The mean duration of fracture was 3.9±2.1 weeks (CI: 3.43–4.36) in the K-wire group and 4.5±2.6 weeks (CI: 3.92–5.07) in the plate plus screw group. Surgery duration was 85.4±9.6 minutes (CI: 83.26–87.53) for K-wires and 86.7±9.4 minutes (CI: 84.60–88.79) for plate plus screw fixation.

Table I: Comparison of Outcomes on Range of Motion for K-Wires Versus Plate-Plus-Screw Fixation. (n=160)

GROUPS	OUTCOMES				P value
	Excellent	Good	Fair	Poor	
K-Wires (n=80)	28 (35.0%)	33 (41.3%)	14 (17.5%)	5 (6.3%)	0.098
Plate + Screw (n=80)	38 (47.5%)	34 (42.5%)	5 (6.3%)	3 (3.8%)	

Discussion

Metacarpal fractures comprise 18% of hand and forearm fractures, ranking third in frequency behind radius/ulna and phalangeal fractures.[14] While most metacarpal fractures can be managed non-operatively, rotational stability and length maintenance remain critical for functional outcomes.[15] The severity of fracture displacement dictates surgical intervention, ensuring proper alignment and joint preservation. [5]

Metacarpal head fractures account for 4–5% of metacarpal injuries.16 Intra-articular fractures often necessitate surgical fixation for anatomical reduction and joint congruency maintenance. Studies comparing K-wires and plates have demonstrated mixed outcomes. While K-wires offer ease of use and minimal invasiveness, plates provide superior stability and load distribution.[17] Some studies favour plates due to enhanced rigidity, whereas others highlight the benefits of K-wires in preserving soft tissue integrity and allowing early mobilization.[18]

Our findings align with existing literature, demonstrating superior success rates with plate plus screw fixation compared to K-wires. However, both methods yielded acceptable functional outcomes, suggesting that fixation choice should be based on individual fracture characteristics and patient needs.

Conclusion

This study demonstrates that both K-wire and plate plus screw fixation effectively manage hand fractures, with a higher success rate observed in the plate plus screw group. Given the conflicting literature, further research with larger sample sizes is recommended to refine surgical decision-making and optimize patient outcomes.

Table II: Stratification of Success Achieved by Age, Gender, Fracture Duration, Lateral Side, Surgery Duration, and Causes of Fracture.

Stratification	Subgroup	Group	Success Achieved (n)	Yes (%)	No (%)	p-value
Age Group (Years)	16–30 (n=108)	K-Wires	43	81.1	18.9	0.117
		Plate + Screw	50	90.9	9.1	
	>30 (n=52)	K-Wires	18	66.7	33.3	0.066
		Plate + Screw	22	88.0	12.0	
Gender	Male (n=100)	K-Wires	35	72.9	27.1	0.089
		Plate + Screw	45	86.5	13.5	
	Female (n=60)	K-Wires	26	81.3	18.8	0.074
		Plate + Screw	27	96.4	3.6	
Fracture Duration (Weeks)	3–5 (n=122)	K-Wires	49	80.3	19.7	0.012
		Plate + Screw	58	95.1	4.9	
	>5 (n=38)	K-Wires	12	63.2	36.8	0.364
		Plate + Screw	14	73.7	26.3	
Lateral Side	Right (n=97)	K-Wires	44	80.0	20.0	0.676
		Plate + Screw	35	83.3	16.7	
	Left (n=63)	K-Wires	17	68.0	32.0	0.002
		Plate + Screw	37	97.4	2.6	
Surgery Duration (Minutes)	40–80 (n=118)	K-Wires	40	87.0	13.0	0.409
		Plate + Screw	66	91.7	8.3	
	>80 (n=42)	K-Wires	21	61.8	38.2	0.395
		Plate + Screw	6	75.0	25.0	
Causes of Fracture	RTA (n=85)	K-Wires	31	77.5	22.5	0.075
		Plate + Screw	41	91.1	8.9	
	Fall from Height (n=46)	K-Wires	20	83.3	16.7	0.551
		Plate + Screw	19	86.4	13.6	
	Other (n=29)	K-Wires	10	62.5	37.5	0.074
		Plate + Screw	12	92.3	7.7	

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