

COMPARING THE HEALING DURATION AND FUNCTIONAL RESULTS FOR METACARPAL SHAFT FRACTURES TREATED WITH K WIRE AND A STYLET OF SPINAL NEEDLES: A PROSPECTIVE STUDY

Dr. K. L. Gaonkar¹ Dr. Paresh Patil² Dr. P. N. Kulkarni³

Professor and Head, Department of Orthopaedics Krishna Institute Of Medical Sciences, Krishna Institute of Medical Sciences, Krishna Institute of Medical Sciences Deemed to be University, Karad

Email : klgaonkar@gmail.com

ABSTRACT

Metacarpal shaft fractures treated with a stylet of 18–20-gauge spinal needles as an intramedullary elastic nail and K wire were examined for sequelae. From 6 weeks to 6 months, range of motion was measured. Michigan's score assesses. Both groups had similar complications. Infection and stiffness were the main problems in this study. Patients treated with a spinal needle stylet and a k-wire had 8.7% and 13.1% infection, respectively, and 10.9% and 15.2% stiffness.

KEYWORDS: K wire, Stylet, Michigan's Score.

INTRODUCTION

Metacarpal fractures are third only to pharyngeal and distal radius fractures in upper limb frequency. 70% of these fractures occur between the ages of 30 and 39, with the remainder occurring between the ages of 20 and 29. From radial to ulnar, metacarpal fractures increase. Due to the age group at risk for injury and hand damage, therapy and lost work time can be costly. These difficulties need early diagnosis, treatment, and rehabilitation. Metacarpal fractures are frequently overlooked or misdiagnosed, resulting in significant impairments.¹ Deformity,

stiffness, or both can worsen these fractures.²Most metacarpal shaft fractures are stable and can be treated with early range of motion.

Foucher et al. use a "bouquet" of small prebent K-wires to antegrade nail metacarpal fractures.³ Since then, many wire fixation procedures with varying entrance points, wire numbers, wire termination placement, postoperative immobilization, and rehabilitation have been proposed.⁴ Thus, the study compares metacarpal shaft fractures treated with a stylet of spinal needles (18–20 g) as an intramedullary elastic nail vs. K wire for union time and function

AIM

This study looked at the risks of using a stylet of 18–20-gauge spinal needles as an intramedullary elastic nail and K wire to treat metacarpal shaft fractures.

SOURCE OF SAMPLE

The Krishna Hospital's orthopaedic department in Karad, a tertiary care institution, undertook the investigation.

INCLUSIONCRITERIA

1. Patients 18 or older
2. Sexually active adult patients of both sexes
3. A willing patient.
4. Metacarpal shaft fractures, closed or open (Gustilo-Anderson categorization types 1 and 2)

EXCLUSION CRITERIA

1. Tendon/neurovascular injuries.
2. Gustillo-Anderson grade 3 compound fractures.
3. Pathological fractures
4. Uncooperative/elderly patients.

STUDY DESIGN: An intervention was prospectively implemented in this study.

STUDY POPULATION

The study included orthopaedic outpatient departments (OPDs) and casualty patients with metacarpal shaft fractures. The study included hospitalized cases undergoing surgery.

ETHICAL CONSIDERATION

Eligible volunteers were informed about the study, risks, and issues. Before enrolling, all cases were rigorously screened for eligibility. All subjects were informed that their entire treatment would be b.

MATERIAL & METHOD

MATERIAL

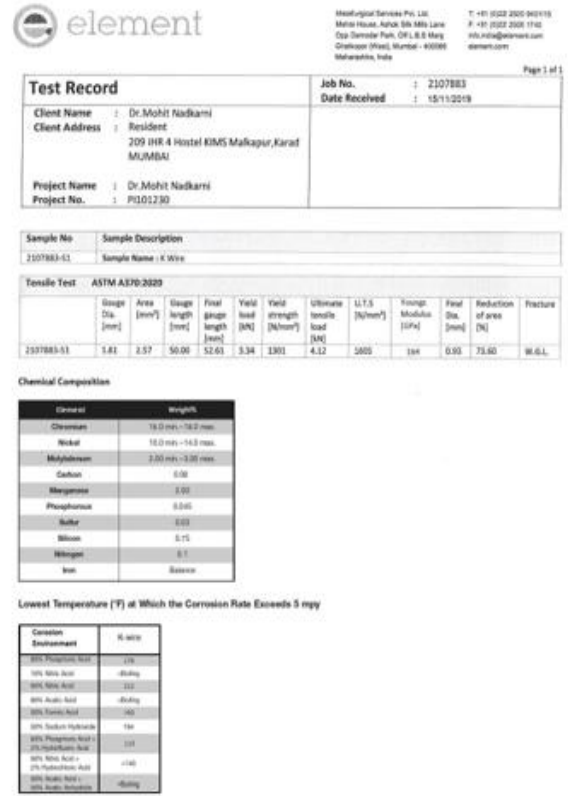
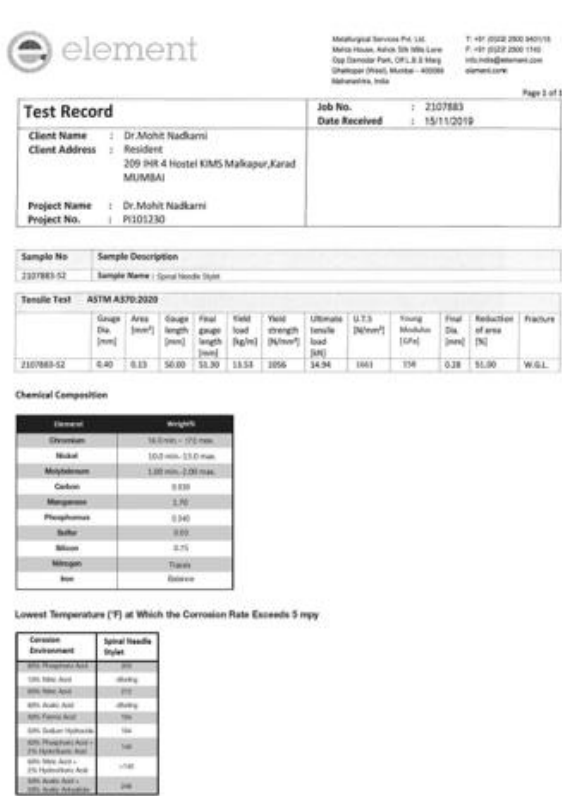


Figure 1: Metallurgy of implants

1. 1.5mm, 1.8mm, 2mm K wire
2. Carmimage intensifier, k-wire bender, cutter and plier
3. Gypsona [plaster]
4. Pointed reduction forceps



Figure 2: Operative Instruments

METHOD

The patient's fractures and soft tissue injuries determined the treatment plan. Sterile normal saline was used to clean and irrigate the wound. Metacarpal fractures were confirmed by hand radiographs. Antibiotics and tetanus toxoid were given. With strict pillow cover elevation, the patient received painkillers and anti-inflammatories.

OPERATIVE

- 1. Stylet of Spinal Needle Procedure-** Extraarticular entry was made at the head of the metacarpal on both sides. Traction-countertraction-manipulation decreased the fracture under the c-arm. An 18–20-gauge prebent spinal needle stylet was inserted through the entrance site. The arm fracture was reduced on AP and oblique images.
- 2. K-wire -** K-wires were inserted through the skull and engaged into the base of the metacarpal, similar to spinal needle entry. Below the elbow cockup slab, the wrist was in 20° extension and 70° flexion, and the interphalangeal joints were in extension. The procedure continued as described above for each individual patient.

On the third post-operative day, the patient was discharged and received outpatient physiotherapy. Active mobilization of fingers at the distal interphalangeal joint was initiated and

increased gradually within pain tolerance. Radiological union 6 weeks after spinal needles or K wires are removed Range of motion, clinical, and radiological fracture union status were assessed. The results of Brief Michigan's Score will be evaluated.

1.	Overall, how well did your hand(s) work during the past week?	Very good 1	Good 2	Fair 3	Poor 4	Very Poor 5
2.	How was the sensation (feeling) in your hand(s) during the past week?	Very good 1	Good 2	Fair 3	Poor 4	Very Poor 5
3.	How difficult was it for you to hold a frying pan during the last week?	Not at all difficult 1	A little difficult 2	Somewhat difficult 3	Moderately difficult 4	Very difficult 5
4.	How difficult was it for you to button a shirt or blouse during the past week?	Not at all difficult 1	A little difficult 2	Somewhat difficult 3	Moderately difficult 4	Very difficult 5
5.	In the past 4 weeks, how often were you unable to do your work because of problems with your hand(s)/wrist(s)?	Always 1	Often 2	Sometimes 3	Rarely 4	Never 5
6.	In the past 4 weeks, how often did you take longer to do tasks in your work because of problems with your hand(s)/wrist(s)?	Always 1	Often 2	Sometimes 3	Rarely 4	Never 5
7.	How often did the pain in your hand(s)/wrist(s) interfere with your daily activities (such as eating or bathing) in the past week?	Always 1	Often 2	Sometimes 3	Rarely 4	Never 5
8.	Describe the pain in your hand(s)/wrist(s) in the past week?	Very mild 1	Mild 2	Moderate 3	Severe 4	Very severe 5
9.	I am satisfied with the look of my hand(s).	Strongly agree 1	Agree 2	Neither agree nor disagree 3	Disagree 4	Strongly disagree 5
10.	In the past week, the appearance of my hand(s) interferes with my normal daily activities.	Strongly agree 1	Agree 2	Neither agree nor disagree 3	Disagree 4	Strongly disagree 5
11.	In the past week, how satisfied are you with the motion of your fingers?	Very satisfied 1	Somewhat satisfied 2	Neither satisfied nor dissatisfied 3	Dissatisfied 4	Very dissatisfied 5
12.	In the past week, how satisfied are you with the motion of your wrist?	Very satisfied 1	Somewhat satisfied 2	Neither satisfied nor dissatisfied 3	Dissatisfied 4	Very dissatisfied 5

Please provide the following information about yourself. (Please circle one answer for each question)

1. Are you right or left-handed?

a. Right-handed

b. Left-handed

c. Both

2. What is your ethnic background?

a. Hispanic or Latino/a

b. Not Hispanic or Latino/a

3. What is your racial background?

a. American Indian or Alaskan Native

b. Asian

c. Native Hawaiian or other Pacific Islander

d. Black or African-American

e. White

f. Other (Please specify) _____

4. a. Please describe the type of job you had before you injured your hand(s).

b. Please describe the type of job you are doing now.

5. How long after surgery did you return to work? _____

6. How long after surgery did you return to the same job you were doing before your injury?

7. What is your gender?

a. Male

b. Female

8. What is the highest level of education you received?

a. Less than high school graduate

b. High school graduate or GED

c. Vocational/technical school

d. Some college or Associate degree

e. College graduate

f. Professional or graduate school

Thank you very much for completing this questionnaire.

Please provide any additional comments regarding this survey:

How easy did you find this survey to be to complete?

Were any items confusing to you?

Were there items that were not asked of you that you feel are important?

Other comments?

Reverse Coding

Higher scores indicate better functioning. Therefore, the following items must be reversed before totaling to create the summary score:

1. Overall, how well did your hand(s) work during the past week?
2. How was the sensation (feeling) in your hand(s) during the past week?
3. How difficult was it for you to hold a frying pan during the last week?
4. How difficult was it for you to button a shirt or blouse during the past week?
8. Describe the pain in your hand(s)/wrist(s) in the past week?
9. I am satisfied with the look of my hand(s).
11. In the past week, how satisfied are you with the motion of your fingers?
12. In the past week, how satisfied are you with the motion of your wrist?

For these items, the responses must be reversed in the following way:

1=5, 2=4, 4=2, 5=1

Scoring

Raw score range:

Minimum score (poorest functioning) = 1

Maximum score (ideal functioning) = 5

After averaging the items, the raw scores are then normalized to generate a score that is scaled from 0 (poorest function) to 100 (ideal function).

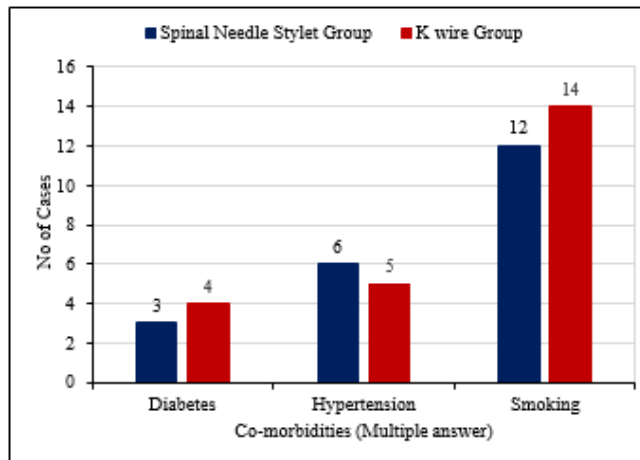
SAMPLE SIZE: 92 participants (46 in group 1 and 46 in group 2) were studied.

RESULT

Co-morbidities (Multiple answer)	spinal needle stylet group	K wire Group	P value
Diabetes	3 (6.5%)	4 (8.7%)	0.694
Hypertension	6 (13%)	5 (10.9%)	0.748
Smoking	12 (26.1%)	14 (30.4%)	0.643

Table 1: Comparison of co-morbidities among patients of both the groups

Chi-square P values. Table 1 compares co-morbidities in both groups. Diabetes, hypertension, and smoking were observed in 6.5%, 13%, and 26% of stylet spinal needle patients and 8.7%, 10.9%, and 30.4% of K-wire patients, respectively. Co-morbidities were not statistically different across groups.

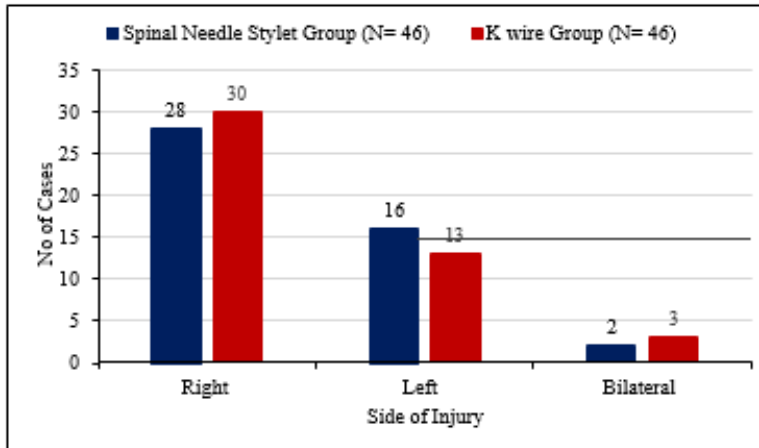


Graph 1: Comparison of co-morbidities among patients of both the groups.

Side of injury	spinal needle stylet group	K wire Group
Right	28 (60.9%)	30 (65.2%)
Left	16 (34.8%)	13 (28.3%)
Bilateral	2 (4.3%)	3 (6.5%)
Total	46 (100%)	46 (100%)

Table 2: Comparison of side of injury among patients of both the groups

P = 0.748 (chi square test). Table 2 compares the severity of injury for patients in both groups. 60.9% of stylet spinal needle patients and 65.2% of K-wire patients suffered right-side injuries. However, side-of-injury distribution is nearly identical. (p>0.05).

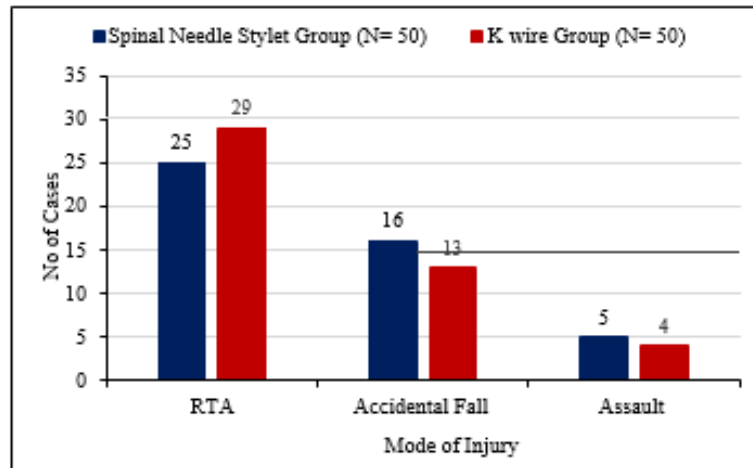


Graph 2: Comparison of side of injury among patients of both the groups.

Mode of Injury	spinal needle stylet group	K wire Group
RTA	25 (54.3%)	29 (63%)
Accidental Fall	16 (34.8%)	13 (28.3%)
Assault	5 (10.9%)	4 (8.7%)
Total	46 (100%)	46 (100%)

Table 3: Comparison of mode of injury among patients of both the groups.

P = 0.6985 (chi square test). Table 3 compares injury modes between groups. RTA was the most prevalent injury in 54.3% of stylet spinal needle patients and 63% of K-wire patients. Falling was both groups' second-most common injury. Both groups had similar RTA rates (p > 0.05).

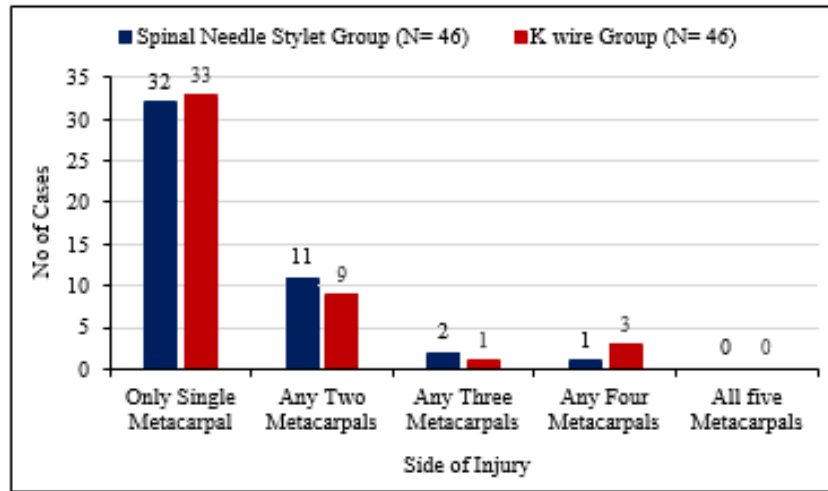


Graph 3: Comparison of mode of injury among patients of both the groups.

No. of Metacarpals Involved	spinal needle stylet group	K wire Group
Only Single Metacarpal	32 (69.6%)	33 (71.7%)
Any Two Metacarpals	11 (23.9%)	9 (19.6%)
Any Three Metacarpals	2 (4.3%)	1 (2.2%)
Any Four Metacarpals	1 (2.2%)	3 (6.5%)
All five Metacarpals	0 (0%)	0 (0%)
Total	46 (100%)	46 (100%)

Table 4: Comparison of no. of Metacarpals Involved among patients of both the groups.

Table 4 compares the metacarpals involved in patients from both groups. Most patients had one metacarpal fracture, followed by two.

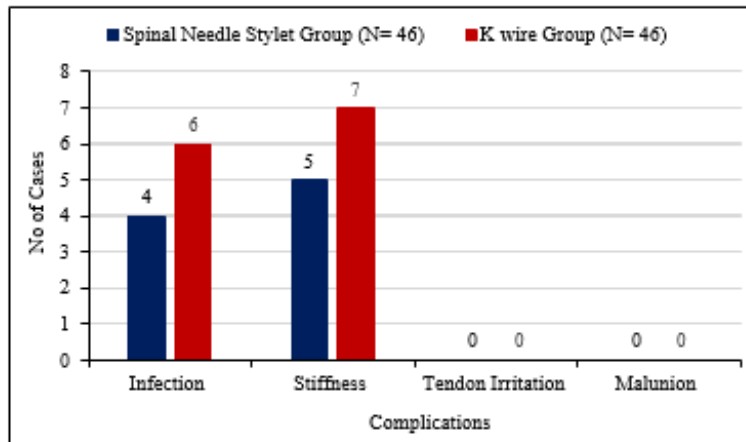


Graph 4: Comparison of no. of Metacarpals Involved among patients of both the groups.

Complications	spinal needle stylet group	K wire Group
Infection	4 (8.7%)	6 (13.1%)
Stiffness	5 (10.9%)	7 (15.2%)
Tendon Irritation	0 (0%)	0 (0%)
Malunion	0 (0%)	0 (0%)
No Complication	37 (80.4%)	33 (71.7%)

Table 5: Comparison of complications among patients of both the groups.

Pvalue0.1649(comparingcomplicationvsnocomplications)(chi-squaretest) Table 5 compares patient problems in both groups. Both groups had similar complication rates. Infection and stiffness were the main problems in this study. Patients treated with a spinal needle stylet and a K wire had 8.7% and 13% infection, respectively, and 10.9% and 15.2% stiffness.



Graph 5: Comparison of complications among patients of both the groups.

DISCUSSION

92 metacarpal shaft fracture patients were studied. Two equal groups of eligible patients were treated with stylets of spinal needles (18–20 g) as intramedullary elastic nails or K wire. This study compared union time and function.

Most patients had one metacarpal fracture, followed by two. In a study by Van Bussel EM et al., twenty of the 27 fractures were in the fifth metacarpal bone, nine in the fourth, and two in the third. This study group had no second metacarpal shaft fractures. Multi-metacarpal involvement is rare. Single metacarpal fractures in patients operated on with a stylet of spinal needle were 69.6% and, in the K, -wire group, 71.7%, with right-handed dominance.⁵

Diabetes, hypertension, and smoking were observed in 6.5%, 13%, and 26% of stylet spinal needle patients and 8.7%, 10.9%, and 30.4% of K-wire patients, respectively. Co-morbidities were not statistically different across groups. In this study, 60.9% of spinal needle stylet patients and 65.2% of K-wire patients suffered right-side injuries. However, side-of-injury distribution is nearly identical. ($p>0.05$) RTA was the most prevalent injury in 54.3% of stylet spinal needle

and 63% of K-wire patients. Falling was both groups' second-most common injury. Both groups had similar RTA rates ($p > 0.05$). Van Bussel EM et al discovered that the majority of punch-related metacarpal shaft fractures occur in young men.⁵ Both groups had similar complication rates. Infection and stiffness were the main problems in this study. Patients who underwent spinal needle and k-wire surgery had 8.7% and 13% infection, respectively, and 10.9% and 15.2% stiffness. Metacarpal shaft fractures have 32–36% complications.^{6,7} McLain RF et al.⁶ found 36% complications in 66 metacarpal shaft fractures treated with various methods. Stiffness was the most common consequence, with 76% of patients having complete active motion under 220°. Sixteen percent of problems had little extensor lag, 7.9% had contractures, and 6.3 percent had significant lag. Nonunion, infection, and tendon rupture are rarer consequences.

CONCLUSION

Both groups had similar complications. Infection and stiffness were the main problems in this study. Patients treated with a spinal needle stylet and a k-wire had 8.7% and 13.1% infection, respectively, and 10.9% and 15.2% stiffness.

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