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Functional Outcome by Evaluation of DASH Score Post K-wire Removal on Upper Extremity: A Descriptive Study

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ABSTRACT

Introduction: K-wire is a very simple and economical implant but an indispensable one for any orthopaedic surgery. Complications associated with the K-wiring procedure vary from minor to life-threatening.

Methods: Disability of the Arm, Shoulder, and Hand score (DASH) calculations have been carried out on patients who underwent ORIF or Closed reduction K-Wire insertion surgery on the upper extremity at Dr. Saiful Anwar Malang General Hospital in 2022-2024.

Results: In the DASH score post removal of K-wire on the upper extremity in 22 patients, it was found that 14 patients had a minimal disability, 7 had moderate ability, and 1 patient had severe disability. The patients who have minimal disability, on average, undergo K-wire removal surgery in around 4-8 weeks.

Discussion: Complications associated with the K-wiring procedure vary from minor to life-threatening. Previous studies described fatal complications following the distant migration of a K-wire to vital structures. A previous study showed that open reduction and internal fixation with a Volar locking plate provided statistically lower DASH scores of patients, reduced incidence of total postoperative complications, and specifically lowered the rate of superficial infection when compared over a 1-year follow-up to percutaneous K-wire fixation.

Conclusion: Complications are part of operative procedures, and it is important to determine what causes them to take preventative measures.

Keywords: bone wires, DASH score, patient outcome assessment, upper extremity

INTRODUCTION

K-Wires or Kirschner wires are sterile stainless-steel pins that are commonly used in Orthopaedic surgery to hold bones in place while they heal.[1] Kirschner wire (K wire) is a very simple and economical but indispensable implant for any orthopaedic surgery. K-wire was first introduced by Martin Kirschner in 1909; it underwent a lot of modifications for the next century, and World War II opened a new horizon for K-wire. Initially, it was introduced for skeletal traction. Later, Otto Loewe 1932 used it for fracture fixation, and a few years later, Frederick Powell, 1940, used it for tension band wiring. Present-day orthopaedics, especially paediatrics and hand surgery, cannot be implemented without the use of K wire. [2]

However, complications associated with the K-wiring procedure vary from minor to life-threatening. There are several reports in the

literature describing fatal complications following distant migration of a K-wire to vital structures such as the heart, thoracic big vessels, and lungs. Minor complications could be important factors in enhancing parental anxiety and prolonging patients' recovery; however, they are extremely under-reported. This study aims to perform the Disability of the Arm, Shoulder, and Hand score (DASH) of the patients who undergo surgery with open or close reduction with k-wire insertion as fixation of the fracture on the upper extremities. So, we can consider using the k-wire or the other option of fixation based on the result of this study.

MATERIALS & METHODS

DASH score calculations have been carried out on patients who have undergone ORIF or Closed reduction K-Wire insertion surgery at Dr. Saiful Anwar Malang General Hospital on the upper extremity in 2022-2024, including on the supracondylar humerus, radial head, metaphyseal distal radius, metacarpal, and phalange of the hand. Patients who have had the K-wire removed need an examination and history taking to calculate the DASH score after the K-wire removal.

Table 1. DASH Score Interpretation

Score (%)	Category	Interpretation
0 – 20	Minimal Disability	Patients can cope with most living activities; usually, no treatment is indicated apart from advice on lifting and sitting exercises.
21 – 40	Moderate Ability	The patient experiences more pain and difficulty with sitting, lifting, and standing; travel and social life are more difficult. They may be disabled from work; personal care, sexual activity, and sleeping are not affected and can usually be managed conservatively.
41 – 60	Severe Disability	Pain remains the main problem, and activities of daily living are affected; these patients require a detailed investigation.
61 – 80	Crippled	Back pain impinges on all aspects of the patient's life, so positive intervention is required.
81 – 100		Patients are either bed-bound or exaggerating their symptoms.

RESULT

In the DASH score post removal of K-wire on the upper extremity in 22 patients, it was found that 14 patients had a minimal disability, 7 had a moderate ability, and 1 patient had severe disability. Patients who have severe disability undergo K-wire removal at the elbow after 20 weeks of installation, so after the K-wire removal, this patient must undergo physiotherapy to train Range of Movement. Patients who have moderate ability, on average, undergo K-wire removal around 8-16 weeks after K-wire fixation. They also have to undergo physiotherapy to return their range of movement to normal.

Patients who have minimal disability on average undergo K-wire removal surgery in around 4-8 weeks so that they can immediately train their range of movement to normal. On average, those who experience minimal disability do not need physiotherapy because their range of movement is close to normal or has returned to normal. From the existing data, it can be seen that the case and duration from the time of K-wire installation until removal greatly determines the patient's DASH score and determines the disability that will occur in the patient after the K-wire is removed.

Table 2. The DASH score on research subjects

Case	Duration of Remove K-Wire	DASH Score	Interpretation Score
Union Supracondylar L Humerus post CRPP	4 weeks	12.9	Minimal Disability
Union Metaphyseal R Distal Radius Frykmann type I post CRPP	11 weeks	28.4	Moderate Ability
Union Supracondylar L Humerus post CRPP	5 weeks	0	Minimal Disability
Union L Supracondylar Humerus post K-wire Insertion	14 weeks	3.7	Minimal Disability
Union Fracture Dislocation L Elbow post K-wire Insertion	20 weeks	42.2	Severe Disability
Union R Supracondylar Humerus post CRPP	3 weeks	0	Minimal Disability
Union R Metaphyseal Distal Radius post CRPP	6 weeks	2.5	Minimal Disability
Union R Supracondylar Humerus post K-wire Insertion	14 weeks	38.4	Moderate Ability
Union R Olecranon post TBW Olecranon	7 weeks	0	Minimal Disability
Union Dislocation R Elbow post Open Reduction + K-wire Insertion	16 weeks	33	Moderate Ability
Union Metaphyseal R Distal Radius Ulna, 2nd and 3rd Metacarpal post K-wire Insertion	6 weeks	4.7	Minimal Disability
Union R Proximal Humerus post Open Reduction K-wire Insertion + Union Metaphyseal R & L Distal Radius post CRPP Distal Radius Bilateral	5 weeks	10	Minimal Disability
Union R Metaphyseal Distal Radius Intraarticular post CRPP	12 weeks	0	Minimal Disability
Union R Hand post Debridement + Repair Stump + K-wire Insertion	12 weeks	33.8	Moderate Ability
CFL Galeazzi post ORIF P-S Radius + Transfixing Wire + CF L Styloid Ulna post K-wire Insertion	12 weeks	0.8	Minimal Disability
Union Metaphyseal L Distal Radius post K-wire Insertion	16 weeks	28.4	Moderate Ability
Union R Radial Head post K-wire Insertion Radial Head	20 weeks	28.4	Moderate Ability
Union R Radius post CRPP	24 weeks	2.5	Minimal Disability
Union Supracondylar R Humerus post K-wire Insertion	8 weeks	26.4	Moderate Ability
Union Proximal Phalanx L Little Finger post K-wire Insertion	4 weeks	0.83	Minimal Disability
Union Metaphyseal R Distal Radius post P-S Radius + K-wire Insertion	5 weeks	1.7	Minimal Disability
Union Metaphyseal R Distal Radius post CRPP	16 weeks	0.89	Minimal Disability

Table 3. The average duration of K-wire removal based on DASH score

The average duration of K-wire removal	DASH Score
4-8 weeks	Minimal disability
8-16 weeks	Moderate disability
20 weeks	Severe disability

DISCUSSION

Complications associated with the K-wiring procedure vary from minor to life-threatening. Previous studies described fatal complications following distant migration of a K-wire to vital structures such as the heart, thoracic big vessels, and lungs. Minor complications could be important factors in enhancing parental anxiety and prolonging patients' recovery; however, they are extremely underreported.[3] Stahl and Schwartz reported 15.2%, and Stern and Fulton reported 42% complication rates with the K-wiring procedure, but these were confined to the hand and wrist region and related to adult patients.[4,5]

In addition, Leet et al. (2002) observed 30 patients (18.98%) with unsatisfactory results

in a review of 158 type 3 supracondylar humerus fractures.[6] Leet et al. (2002) reported higher complication rates (33%) in a retrospective study of 21 medial condylar fractures.[7] A previous study conducted by Al-Traigy et al. (2020) showed that open reduction and internal fixation with a Volar locking plate provided statistically lower DASH scores of patients, reduced incidence of total postoperative complications, and specifically lowered the rate of superficial infection when compared, over a 1-year follow-up, to percutaneous K-wire fixation.[8] Whereas our study showed that the DASH score post removal of K-wire on upper extremity in 22 patients, it was found that 14 patients had minimal disability, 7 had moderate ability, and 1 patient had severe disability.

The literature reveals existing controversies regarding the timing of implant removal, which ranges from 3 to 8 weeks.[6,9] Our study showed that patients who have minimal disability, on average, undergo K-wire removal surgery in around 4-8 weeks so that they can immediately train their range of movement to normal. In this regard, our findings are consistent with a study conducted by Thomas et al. (2001), in which the authors concluded 3 weeks of smooth K-wire fixation and elbow immobilization were sufficient to achieve healing in most displaced fractures of the lateral humeral condyle treated by open reduction.[9] Furthermore, Pirone et al. (1988) advocated percutaneous K-wire fixation as the method of choice for displaced extension-type supracondylar fracture of the humerus for 3 weeks to achieve the highest percentages of excellent results.[10] On the contrary, Cardona et al. (2002) and Leet et al. (2002) emphasized that implants should not be removed until healing can be demonstrated radiographically. This time averaged 6 or more weeks in most of the patients with displaced fractures of the lateral humeral condyle.[6,11]

Very little evidence is available directed specifically towards the possible problems and pitfalls associated with the use of K-wire. The K-wiring fixation procedure is the most available and forgiving technique for the fixation of the majority of fractures in children and adults. Pre-operative planning, proper pin placement in the intra-operative, and postoperative patient compliance could reduce the complication rate. The complications in the K-wiring procedure are multifactorial.

CONCLUSION

K-wires are versatile but not inherently benign. Complications are part of operative procedures, and it is important to determine what causes them to take preventative measures. Our study confirmed that patients who have minimal disability, on average, undergo K-wire removal surgery in around 4-8 weeks.

Declaration by Authors

Ethical Approval: Approved by Health Research Ethics Committee Saiful Anwar General Hospital with number 400/273/K.3/102.7/2024

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Conflict of Interest: The authors declare no conflict of interest.

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