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CASE REPORT

# Comprehensive Functional and Vocational Rehabilitation of A Kitchen Worker with Kienbocks Disease

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**Abstract**
**Background:** A hand injury can be catastrophic because one needs to use their hand for many different tasks in day-to-day life. People who work in the kitchen on a regular basis must repeatedly move their hands, arms, wrists, and shoulders while stirring, chopping, lifting, and carrying heavy vessels. To perform all the activities of daily living complete or functional range of motion and grip strength are the important components. The present case study describes the case of post-operative wrist stiffness secondary to kienbocks disease. This impairment prevents the patient from working in the kitchen. The purpose of the study was to improve the range of motion and grip strength of her affected hand as she has to resume her work as soon as possible. **Case description:** A 30-year old female who is a kitchen worker has been complaining of pain, and weakness in her left hand was advised to have wrist surgery after the patient's investigations revealed that she had Kienbock's disease. The patient underwent proximal carpectomy of the wrist and was referred to physiotherapy after the sutures were removed. The patient initially complained of pain at the suture site and difficulty moving her left hand.Early physiotherapy was given to the reduce pain, improve the strength of the wrist and finger flexor extensors, improve the range of motion, and vocational rehabilitation to resume her work.

**Keywords**
Wrist Stiffness, Grip Strength, Functional Range Of Motion, Post-Operative Rehabilitation

## INTRODUCTION

Kienbock's disease is well defined by osteonecrosis of the lunate with an expected pattern of lunate collapse, carpal change, and degeneration resulting from a combination of vascular, anatomic, and traumatic insults. Kienbock (1910) claimed that kienbocks disease of the lunate bone arises from interference of blood supply. This interference attributes to injuries such as subluxation of the lunate bone or fracture of the lunate bone( Cetti & Reuther, 1982). In their study, Gelberman et al. found that the lunate's peculiar vascular or mechanical environment puts it at risk (Gelberman & Akeson,1980). It has extraosseous and intraosseous vessels running in the dorsal and volar radiocarpal ligaments. Theoretically 70% of lunates, multiple vessels enter volarly or dorsally, whereas in 30%, only one vessel is present, putting these lunates at risk of losing vascular supply. One of the important aetiological factors to kienbocks disease is the relative shortening of the lower end of the ulna thereby exposing the lunate bone at greater stress.

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Kienbocks disease typically presents between the age of 20-40yrs and the most common symptoms are wrist pain, swelling, restricted range of motion, and difficulty performing activities of daily living (Bain, & Begg, 2006) . Lichtman's modification of Stahl's classification divides kienbock disease into five stages: Stage I Normal radiographs, stage II increased radiodensity of lunate with possible decrease of lunate height on radial side only, stage IIIa lunate collapse, no scaphoid rotation, stage III b lunate collapse with fixed scaphoid rotation, stage IV degenerative changes around the lunate (van Leeuwen & Ring, 2016). The early stages are I, II, IIIa while the late stages are III b and IV. Plain radiographs are negative in early disease, osteopenia can be seen generally followed by patchy sclerosis and rim calcification.

The late-stage surgical treatment falls under six categories-Vascularized bone graft (VBG), radial osteotomy, partial arthrodesis, proximal row carpectomy (PRC), tendon or muscle ball arthroplasty. Though Kienbocks disease is described many years ago the etiology remains uncertain, and radiographic and clinical findings do not always correlate (Innes & Strauch, 2010).

## MATERIALS AND METHODS

***History***

A 30 year old female, kitchen worker with right hand dominance was apparently alright 5 months ago until she started experiencing pain, shivering and weakness in her left hand which was progressive in nature. Patient also had difficulty in lifting heavy objects with her left hand. She noticed a difference in the size of her left hand compared to the right hand. Then the patient visited Krishna Hospital on 12$^{th}$ March 2022 and consulted an orthopaedic surgeon who advised her to undergo all the necessary investigations like MRI, X-ray which were then carried out (Fig no 1,2).

The investigations were then studied by the orthopaedic surgeon and he advised the patient to undergo surgery of the wrist joint as soon as possible. Due to the patient's financial condition, the patient postponed the surgery. During the period of two months and 22 days the patient only applied a crepe bandage on her hand to get relief. Then the patient was operated on 4th June 2022 at the Krishna Hospital and after 8 days of surgery the patient was discharged. While discharge, the patient's left forearm and wrist was plastered and was kept ia n cast for 21 days after which it was removed. After removing the plaster patient said that the pin was removed and bandaging was done and the patient was called for follow-up after 5 days. On 7th July 2022, she went for the follow-up and the orthopedician advised her to go for physiotherapy treatment, after the removal of sutures.The patient also gave a history of fall 15 years back on her left hand while riding a bicycle. She had severe pain and swelling but did not consult any doctor. She gave a history of going to a lady and massaging the painful and swollen area with oil for 8 days.

The patient visited physiotherapy OPD on July 7, 2022. The patient complained of pain at the suture site which was on the extensor aspect of the hand, she was experiencing difficulty in performing activities of left hand. A detailed examination of the patient was done. On general examination the pulse rate was 78 beats per minute, respiratory rate was 23 breaths per minute, blood pressure was 120/80 mmHg and the temperature was 98.6°F. Pain assessment was done using VAS(visual analogue scale ),VAS (on rest) was 2 while VAS (on activity ) was 8.(Table 1) On observation and posture assessmentnt the left shoulder was elevated and the carrying angle of the left elbow was greater compared to that of the right elbow. Arm swing appeared to be reduced of the affected hand compared to the unaffected hand.On scar inspection, the scar was present on extensor aspect of the left forearm extending from the mid forearm up to the midway of the dorsum of hand (Fig no 5).The scar length was 13.5 cm and was adhered. Grade 1 tenderness was present on palpation. Active range of motion (Table 2). Manual Muscle testing (Table 3) and Grip strength (Table 4) were evaluated.

***Diagnostic assessment***

Visual analogue scale (VAS) – At the beginning of the first and last treatment sessions, the patient was asked to rate her pain on VAS scale where 0 indicates no pain at all and 10 indicates worst pain which requires immediate treatment.

**Table 1.** Visual Analogue Scale (VAS)

| VAS | Pre-treatment | Post-treatment |
|---|---|---|
| Left wrist (At rest) | 4.6/10 | 0/10 |
| Left wrist (on activity) | 7.5/10 | 0/10 |

**Table 2.** Active Range of motion

| AROM* | Pre-treatment | Post-treatment |
|---|---|---|
| Wrist flexion | 0-12° | 0-58° |
| Wrist Extension | 0° | 0-37° |
| Ulnar deviation | 0-7° | 0-25° |
| Radial deviation | 0-3° | 0-12° |
| Forearm supination | 0-8° | 0-80° |
| Forearm pronation | 0-7° | 0-78° |
| **MCP** | | |
| Flexion | 0-3° | 0-80° |
| Extension | 0° | 0-32° |
| Abduction | 0-2° | 0-23° |
| **PIP** | | |
| Flexion | 0-9° | 0-98° |
| **DIP** | | |
| Flexion | 0° | 0-82° |
| **Thumb** | | |
| Flexion MCP | 0° | 0-48° |
| Flexion IP | 0° | 0-82° |

*AROM-Active Range Of Motion

**Table 3.** Manual Muscle testing

| MMT* | Pre-treatment | Post-treatment |
|---|---|---|
| Wrist flexors | 1/5 | +3/5 |
| Wrist extensors | 1/5 | +3/5 |
| Radial deviators | 1/5 | +3/5 |
| Ulnar deviators | 1/5 | +3/5 |
| Forearm supinator | -2/5 | 4/5 |
| Forearm pronators | -2/5 | -4/5 |
| Finger flexors | 1/5 | -4/5 |
| Finger extensors | 1/5 | -4/5 |
| Finger adductors | 1/5 | -4/5 |
| Finger abductors | 1/5 | +3/5 |
| Thumb abductor | 1/5 | -4/5 |
| Thumb adductor | 1/5 | -4/5 |
| Thumb extensor | 1/5 | -4/5 |

*MMT-Manual Muscle Testing

**Table 4.** Grip strength using Digital Hand Dynamometer

| Grip strength measurement using digital hand dynamometer | Pre-treatment | Post-treatment |
|---|---|---|
| | 3.6 kgs | 19.5 kgs |

**Treatment (** Skirven & Amadio, 2011; and Shah and Shinde, 2018 )

- **Day 1-14 (After suture removal)**
  1.Electrical muscle stimulation to wrist and finger extensors with faradic current (30 rep×3 sets).
  2.Motor point stimulation to flexor pollicis longus and lumbricals (30rep×3sets)
  3.Cross friction massage on suture sites on the dorsal aspect of the thumb.
  4.Desensitization
  4.Grade 1 Maitlandand mobilization for wrist and fingers (10 oscillations×3 sets)
  5.Desensitization
- **Day 15-28**
  1.Gentle isolated Active range of motion for wrist and fingers.
  2.Cross friction massage on suture site.
  3.Gentle isolated Active assisted range of motion exercises for wrist and fingers.

- **Week 5-week 7**
  1.Isometric exercises for wrist and fingers.
  2.Gentle strengthening exercises such as graded grip strengthening.(towel curls,squeezing of sponge ball,paper holding exercises)
  3. Thera putty exercises using clay.
  4. Isotonic exercises for the wrist and fingers.
- **Progressive resisted exercises begin at 8 weeks**
  Incorporating daily activities like buttoning and unbuttoning the shirt, tying shoe laces, and improving the grip.

**Table 5.** Functional testing of wrist and hand

| | Starting Position | Action | Functional Test |
|---|---|---|---|
| 1. | Foream supinated, resting on table | Wrist flexion | Lifts 1-2 lbs – Functionally poor |
| 2. | Foream pronated, resting on table | Wrist extension lifting 1-2 lbs | 1-2 reps - Functionally poor |
| 3. | Forearm between supination and pronation, resting on table | Radial deviation lifting 1-2 lbs | 1-2 reps - Functionally poor |
| 4. | Forearm between supination and pronation, resting on table | Thumb flexion with resistance from rubber band around the thumb | 3-4 reps – Functionally fair |
| 5. | Forearm resting on a table, a rubber band around thumb and index finger | Thumb Extension with resistance from rubber band | 3-4 reps – Functionally fair |
| 6. | Forearm resting on the table,rubber band around thumb and index finger | Thumb Extension with resistance from rubber band | 3-4 reps – Functionally fair |
| 7. | Forearm resting on a table | Thumb adduction lateral pinch of piece of paper | Hold 3-4 sec – Functionally fair |
| 8. | Forearm resting on table | Thumb opposition pulp to pulp pinch of piece of paper | Hold 3-4 sec – Functionally fair |
| 9. | Forearm resting on table | Finger flexion, patient grasps mug or glass using cylindrical grasp and lifting off table | 3-4 reps - Functionally fair |
| 10. | Forearm resting on table | Patient attempts to put on rubber glove keeping fingers straight | 10-20sec- Functionally poor |
| 11. | Forearm resting on table | Patient attempts to pull fingers apart (finger abduction) against resistance of rubber band and holds | Hold 1-2 sec – Functionally poor |
| 12. | Forearm resting on table | Patient holds piece of paper beetween fingers while examiner pulls on paper | Hold 1-2 sec – Functionally poor |

## RESULTS

The pain assessment was done using the visual analogue scale, pain on rest was 4.6/10 while pain on activity involving the wrist joint was 7.5/10 (Table 1). The pain was dull and aching. On posture examination, the left shoulder was slightly elevated. The carrying angle of the left elbow was greater as compared to the right elbow. The arm swing was reduced.On observation, the scar length was 13.5 cm (Fig 5). The muscle girth was assessed in both the upper limbs. The girth of the left arm was 27cm and left forearm was 19.5 cm while the muscle girth of right arm was 30cm and the right forearm was 23cm. Active range of motion, MMT (Table 3) and functional assessment(Table 5) was evaluated. She was screened according to ICF with these findings there was a significant impact on her activity limitation before the treatment (difficulty lifting and grasping utensils in the kitchen, Patient had difficulty in bathing, Patient had difficulty riding a scooter, Patient had difficulty holding a newspaper). The patient had difficulty resuming her work in the kitchen. By the 8$^{th}$ week of physiotherapy treatment, the patient demonstrated a nearly complete range of motion of wrist flexion and extension (Table 2).On doing the functional testing, the patient was able to perform most of the functions without pain (Table 5). The patient was pain-free and had increased grip strength (Table 4).

**Fig. 1**. Showing pre-operative MRI of the wrist joint.

**Fig. 2.** Showing pre-operative X-ray of the wrist joint.

**Fig. 3.** Showing post-operative x-ray of the wrist joint.

**Fig. 4.** Showing a post-operative (proximal row carpectomy) x-ray of the left wrist joint.

**Fig. 5.**Showing post-operative extensor aspect Of left hand on 1st day of physiotherapy

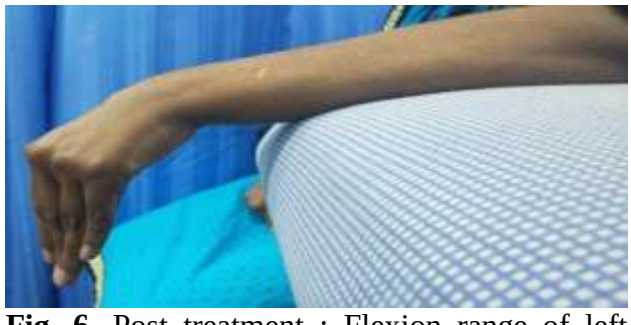

**Fig. 6.** Post treatment : Flexion range of left wrist joint

**Fig .7** Post treatment : Extension of left wrist joint

**Fig. 8** (a)

**Fig. 8** (b)

**Fig. 8(a) and (b)** Post treatment : Hand grip.

**Fig. 9.** Post treatment: Ulnar deviation of left wrist joint

## DISCUSSION

This case describes the physiotherapy management and its outcomes on post-operative wrist stiffness secondary to kienbocks disease of a 30-year-old female patient who is a kitchen worker. Use of hand is very essential for those who work in the kitchen on daily basis. The work in a kitchen involves repetitive motion of hands, arms, wrists, and shoulders for stirring, chopping, or lifting or carrying heavy vessels. An injury to the hand can be devastating as one needs to perform various tasks with their hand in day-to-day life. Physiotherapy goals are to restore the normal movements and functions of the hand ( Shinde andGhadage, 2022).

Proximal row resection is an anatomical and simplification of the carpals consisting of removal of the scaphoid, lunate, and hamate (Richou et al. (2010). In the present case study the scaphoid, lunate, triquetrum, and hamate are resected. The major advantages of proximal row carpectomy are technical simplicity, short rehabilitation and immediate functionality of the wrist, and resumption of daily activities. David P. Green in his study has mentioned that though the surgery would appear to be destructive and totally unphysiological, it can provide a functional and pain-free wrist even in an individual who does reasonably heavy work ( Green DP 1987). Normal biomechanics cannot be expected but the range of motion remains compatible with everyday life. Early rehabilitation can help in achieving range of motion and muscular strength of the wrist joint and might also help in returning to work and daily activities help in returning to work and daily activities ( Edouard et al. (2010).

When the patient came to the physiotherapy center post-operatively the patient was unable to perform any activities with her left hand after 8 weeks of physiotherapy the patient was able to perform most of the activities of daily living and most importantly she could gradually resume her work in the kitchen. The patient's range of motion was near normal with no pain at rest and during activities. The adoption of suitable physiotherapy management contributed to an overall good functional outcome.

## CONCLUSION

The post-operative physiotherapy management focuses on both functional and vocational rehabilation. All the effects enhanced patients overall functions of the wrist, and the patient was able to resume her kitchen work. In this case report, a 30-year-old female kitchen worker with post-operative wrist stiffness secondary to Kienbock's disease had a better outcome due to decreased post-operative complications and achieving nearby complete range of motion with improved grip strength.

**Conflict of interest**

No conflict of interest is declared by the authors. In addition, no financial support was received.

**Ethics committee approval:**

The study protocol was carried out in accordance with the Helsinki Declaration of 1975 and Written informed consent forms were obtained from all participants prior to the study. Informed consent form code: 9923919434

**Author Contributions**

Study Design: SS, RA, SD; Data Collection: SS, RA, SD, RB, AS; Statistical Analysis: SS; Data Interpretation: SS, RA; Manuscript Preparation: SS, RA, SD, RB; Final review and editing: SS and AS; Literature Search, SS, AS. All authors have read and agreed to the published version of the manuscript.

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