Section:

Scapho-Capitate Fusion in Grade (III C) keinbock I Disease (Short Time Follow Up)

Bahaa A. Kornah
Amro A. Fouaad
Ahmed N. El-zebidy

Follow this and additional works at: https://aimj.researchcommons.org/journal
Part of the Medical Sciences Commons, Obstetrics and Gynecology Commons, and the Surgery Commons
ORIGINAL ARTICLE

Scapho-capitate Fusion in Grade (III C) keinbock I Disease (Short Time Follow-up)

Bahaa Ali Kornah, Amro Ahmed Fouaad Attia, Ahmed Nasr Mohamed El-Zebidy*

Department of Orthopedics, Faculty of Medicine - Al Azhar University, Cairo Branch, Egypt

Abstract

Background: Kienböck's disease is a vascular-necrosis wrist condition in addition to osteo-necrosis, lunato-malacia or ischemic-necrotic of the lunate bone. According to Lichtman in 2010, determine the third stage C (III C) of Kienböck's disease which characterized by chronic-coronal-fracture of lunate bone.

Aim: To study scaphocapitate with lunate excision fusion for symptomatic III C Kienböck's disease with short-time follow-up.

Patients and methods: A retrospective study included 20 patients conducted in a 60 months duration, the period from January 2017 to January 2022 in orthopedic department of Al-Hussein Hospitals, Al-Azhar University with postoperative short-time 6 months follow-up.

Results: The findings revealed that; Mean flexion range of operated side was nonsignificant increased to 47.6 ± 7.9 (25—40) and extension range 58.5 ± 10 (55—69) postoperative Dash score postoperative, the lowest represent 25 while the highest represent 33 P value 0.05.

Conclusion: Scapho-capitate fusion with lunate excision has the potential to become a widely used surgical option for patients of advanced III C Kienböck's disease.

Keywords: Scaphocapitate fusion, Lunate excision, Kienbock's disease, Fouad's score

1. Introduction

Kienböck's disease is a condition characterized by a vascular necrosis of the lunate bone.1 It is also known as osteonecrosis, lunate-malacia, and aseptic or ischemic necrosis of the lunate. Although the mechanisms by which this disorder develops are not fully understood, compromise of the bone vasculature is the most commonly proposed cause. Kienböck's disease is often progressive, resulting in joint destruction within 3–5 years if left untreated.2

Depending on Classification of Lichtman and colleagues3 in 1977 modified Stahl's original radiologic classification system to help select the most appropriate treatment of each patient. In 2010, Lichtman and colleagues4 introduced a new stage III C, which corresponds to chronic coronal lunate fracture.

Repetitive manual labor was reported as a risk factor but currently is recognized as a factor aggravating symptoms of an already established disease. Usually one hand is affected; only 4% of cases of the disease are bilateral.6 It is known that there is an association between Kienböck's disease and type1 diabetes mellitus, systemic lupus erythematosus, and Legg-Calve-Perth's disease.7

Treatment of Kienböck's disease varies, starting from conservative modalities to surgical procedures, although none of the gold standard.7 The algorithm of treatment depends on clinical and radiological symptoms. According to staging and ulna position, either positive or negative, there is different procedures for the management of Kienböck's disease starting from conservative treatment, drilling, distal-radius shortening, capitate shortening, partial wrist fusion or proximal raw carpectomy or ending with total wrist fusion.8
This study aim to evaluate the clinical and radiologic outcomes of scapho-capitate fusion for the treatment of stage III C Kienböck's disease with postoperative follow-up.

2. Patients and Methods

Institutional ethics approval was obtained before the start of the study. A prospective and retrospective study included 20 patients conducted in a 60 months duration, the period from January 2017 to January 2022 in orthopedic department of Al-Hussein Hospitals, Al-Azhar University with postoperative short-time 6 months follow-up. Age 17–50 years-old, Both sexes, Kienbock's disease III C were included, tha 17 or more than 50 years-old, Patients complaining of wrist arthritis and Radiocarpal arthritis and Interosseal arthritis were excluded. All included patients were preoperative examined with: complaining of pain and limited range of motion was confirmed clinically examined the affected and contralateral wrists. Pain assessment by visual analog scale (VAS). Range of motion (ROM), Radiographic evaluation, Radiological staging, X-Ray, C.T scan and MRI scan. Intra-operative Surgical procedure: All patients was in supine position. The operation was done under general anesthesia or regional anesthesia, 15 regional and 5 general, Tourniquet was used 200 mmHg. Operative steps and Open dorsal approach for all patients. A radial and ulnar subcutaneous undermining was performed for partial wrist denervation. The extensor retinaculum was incised between the 3rd and 4th extensor compartment.

The denervation was completed by a resection of the terminal branch of the posterior interosseous nerve. After retracting the extensor tendons, an arthrotomy was performed by a T-shape opening of the articular capsule. A lunate excision was then performed. Followed by preparation of the articular surfaces between the scaphoid and the capitate using a bone drill.

Correction of scaphoid flexion was performed using a Kirschner (K-) wire inserted into the bone and allowing a ‘joystick’ effect. The scaphoid was fixed when the radio-scaphoid angle was less than 60. The arthrodesis between scaphoid and capitate was fixed using two K-wires in 10 cases and 9 cases with two screws and one screw and one K wire in one case. Distal radius Cancellous bone autograft was added in 12 cases, In 8 cases, no bone graft was used; In all cases the triquetrum was left in place to avoid ulnar translation of the carpus.

Intra operative assessment under C. Arm to ROM, Anatomical closure was done to capsule then compartments, extensor pollicis longus left free, subcutaneous closure, skin closure A hand forearm cast was held in place for a mean of 2.7 months (range 2–3 months). Less in Herbert screw than K wire. After Consolidation Rehabilitation started after cast removal. Kirschner wires were removed 2–3 months postoperatively.

2.1. Post-operative assessment

All the patients were examined at follow-up by a clinician independent from the case surgeon. Clinical evaluation analyzed pain level on a VAS, Joint mobility measured by a goniometer, Grip force was measured by the sphygmomanometer, Quick DASH and fouaad scores were also performed.

2.2. Clinical examination

Painless range of motion and good consolidation.

2.3. Radiological examination

X-ray.

2.4. Scoring system assessment

2.4.1. - Dash score

The main part of the DASH is a 30-item disability/symptom scale concerning the patient's health status during the preceding week. The items ask about the degree of difficulty in performing different physical activities because of the arm, shoulder, or hand problem (21 items), the severity of each of the symptoms of pain, activity-related pain, tingling, weakness and stiffness (5 items), as well as the problem's impact on social activities, work, sleep, and self-image (4 items). Each item has five response options. The scores for all items are then used to calculate a scale score ranging from 0 (no disability) to 100 (most severe disability)

2.4.2. Fouaad score

Although no scores were available pre-operatively. Fouaad score measuring different factors; pain, range of motion, re-turn to work, ROM flexion and extension, ROM radial and ulnar, and complications, each score ranged from 0 to 3 depends on degree of severity and difficulty. Pain: (0) no pain, (1) pain with extreme range of motion, (2) pain with range of motion and (3) pain at rest. Re-turn to work: (0) work normally.

(1) work with pain after heavy work, (2) tolerated pain and (3) cannot work totally. Complication:
(0) pin tract infection, (1) CRPs, (2) ulnar deviation and (3) progressive arthritis. **ROM flexion and extension**: (0) improved before surgery, (1) same as previous surgery, (2) limited that previous surgery 30 days and (3) stiff wrist. **ROM radial and Ulnar**: (0) improved before surgery, (1) same as previous surgery, (2) limited that previous surgery 10 days and (3) stiff wrist.

2.5. Statistical Analysis

Statistical analysis was performed using the GraphPad Prism™ software. Since the data were not normally distributed, the comparisons of paired data between the preoperative and postoperative assessments were made using the non-parametric Wilcoxon rank sum test with continuity correction. The statistical threshold of significance was set at \( p < 0.05 \) (Figs. 1 and 2).

3. Results

This study included Twenty patients with Litchman stage III C Kienböck’s disease, all patients applied scaphoapitate fusion with luante excision with different fixation techniques: wire and screw with \( p \) value 0.231 non significantly difference. The mean postoperative and preoperative; flexion-extension range of motion was 105.5 ± 22 representing 74.9 ± 15 of the side range. The mean flexion range of operated side was non-significantly increased to 47.6 ± 7.9 (25–40); while extension range was significantly increased to 58.5 ± 10 (55–69)°. Regarding radial-ulnar deviation, the mean range was 33.5 ± 6.7 (45–25)° representing 76.5 ± 16 (100–50)% of the contralateral side. The mean ulnar deviation of operated side was significantly increased to 22 ± 3.5 (15–25)°, while radial deviation was non-significantly increased to 11.5 ± 4.1 (5–20)°. The mean grip strength of operated side was significantly increased to 90 ± 14.5 (70–110) mmHg representing 93.2 ± 11 (100–75)% of the operated side. Postoperative evaluation for the determination of infection, non-union, arthritis and carpal height ration. According to postoperative evaluation represent significantly differences with 0.05 \( p \) value (Figs. 3–13, Tables 1–9).

4. Discussion

Kienböck disease refers to avascular necrosis of the lunate carpal bone, known as lunatomalacia. The prevalence for Kienböck disease was 0.27 % (138 of 51,071), including 0.10 % for incidental disease (51 of 51,071) and 0.17 % for symptomatic disease (87 of 51,071) in 2022 according to world health organization.8

Our study aimed to conducted in a 60 months duration. All consecutive patients in a AL-Hussien Hospital of Al-Azhar University who underwent scaphocapitate fusion between January 2017 to January 2022 for symptomatic III C Kienböck’s disease with at least 12 months of follow-up were included in this study. This study was conducted on total of 20 patient grade III C Kienbock disease from the department of Orthopedic. In all cases, surgical management was performed due to persistent pain and impaired wrist function. Post-operative follow up were applied. Also, another cases also follow-up

---

**Fig. 1.** Open dorsal and Radial and ulnar subcutaneous wrist denervation.
Fig. 2. Correction of IIIC kienbock disease wrist bone.

Fig. 3. Preoperative imaging Case 1.

Fig. 4. Preoperative examination Case 1.
Fig. 5. Intraoperative opening dorsal of wrist Case 1.

Fig. 6. Post operative examination Case 1.

Fig. 7. Post operative follow up after 6 Months.
Fig. 8. Preoperative imaging Case 2.

Fig. 9. Intra operative and open dorsal of the wrist Case 2.
Fig. 10. Post operative imaging Case 2.

Fig. 11. Post operative examination Case 2.

Fig. 12. Post operative follow up after 6 Months.
since 2020 till 2021 as a prospective, retrospective and randomized comparative study.

Many operative treatment methods have been suggested for the various stages of Kienböck's disease and they can be grouped into three categories: revascularization, decompression of the lunate and salvage procedures for pain relief. However, little is known about their effectiveness, mainly because Kienböck's disease is not very common and a long duration of follow-up is needed to evaluate the ultimate outcome.

This study included Twenty patients with Litchman stage III C Kienbock's disease with p value 0.231 non significantly difference.

According to previous study applied by Oh et al.,9 demographic characteristics of this study including 88 male and 144 which were performed among large scale of patients the average age ranged from 18 to 55 years-old; all the included cases working hard and injured in both sides; the findings of our study in contrast with these study.

### Table 1. Dash score grading system for wrist score.

<table>
<thead>
<tr>
<th>Grading</th>
<th>Dash Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>0–5</td>
</tr>
<tr>
<td>Good</td>
<td>6–15</td>
</tr>
<tr>
<td>Satisfactory</td>
<td>15–35</td>
</tr>
<tr>
<td>Poor</td>
<td>&gt;35</td>
</tr>
</tbody>
</table>

### Table 2. Fouaad Scoring and grading wrist system.

<table>
<thead>
<tr>
<th>Score/Grading</th>
<th>Pain</th>
<th>Re-turn to work</th>
<th>Complication</th>
<th>ROM Flexion and extension</th>
<th>ROM Radical and Ulnar</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>no pain</td>
<td>work normally</td>
<td>pin tract infection</td>
<td>improved before surgery</td>
<td>improved before surgery</td>
</tr>
<tr>
<td></td>
<td></td>
<td>work with pain after</td>
<td>CRPs</td>
<td>same as previous surgery</td>
<td>same as previous surgery,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>heavy work</td>
<td></td>
<td>limited that previous</td>
<td>limited that previous</td>
</tr>
<tr>
<td></td>
<td></td>
<td>tolerated pain and</td>
<td>ulnar deviation and</td>
<td>surgery 30 days</td>
<td>surgery 10 days</td>
</tr>
<tr>
<td>1</td>
<td>pain with extreme range of</td>
<td>cannot work totally</td>
<td>progressive arthritis</td>
<td>stiff wrist</td>
<td></td>
</tr>
<tr>
<td></td>
<td>motion</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>pain with range of motion</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>pain at rest</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table 3. Demographic characteristics of included patients.

<table>
<thead>
<tr>
<th>age</th>
<th>sex</th>
<th>side</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>26.3 ± 7.8</td>
<td>21.1 ± 3.8</td>
<td>12.2 ± 3.8</td>
<td>0.231 NS</td>
</tr>
</tbody>
</table>

### Table 4. Represents Clinical examination of affected wrist.

<table>
<thead>
<tr>
<th>Clinical Parameter</th>
<th>Preoperative</th>
<th>Postoperative</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexion</td>
<td>41.5 ± 8.1</td>
<td>47.6 ± 7.9 (25–40)</td>
<td>0.10562</td>
</tr>
<tr>
<td>Extension</td>
<td>51.1 ± 6.2</td>
<td>58.5 ± 10 (55–69)</td>
<td>0.10531</td>
</tr>
<tr>
<td>Radial Deviation</td>
<td>10.5 ± 2.8</td>
<td>23 ± 3.3 (19–28)</td>
<td>0.05</td>
</tr>
<tr>
<td>Ulnar Deviation</td>
<td>19 ± 3.9</td>
<td>2.3 ± 4.5 (2–27)</td>
<td>0.05</td>
</tr>
<tr>
<td>Grip</td>
<td>59.5 ± 3.3</td>
<td>90 ± 14.5 (45–80)</td>
<td>0.05</td>
</tr>
</tbody>
</table>

### Table 5. Postoperative evaluation of affected wrist.

<table>
<thead>
<tr>
<th>Clinical Parameter</th>
<th>Postoperative</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infection</td>
<td>1.0 ± 1.2</td>
<td>0.05</td>
</tr>
<tr>
<td>Non-Union</td>
<td>1.0 ± 0.1</td>
<td>0.05</td>
</tr>
<tr>
<td>Arthritis</td>
<td>1.0 ± 0.1</td>
<td>0.05</td>
</tr>
<tr>
<td>Carpal Height Ratio</td>
<td>1.0 ± 0.1</td>
<td>0.05</td>
</tr>
</tbody>
</table>

### Table 6. Evaluation of pain according fouaad scale.

<table>
<thead>
<tr>
<th>Clinical Parameter</th>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain</td>
<td>9.1 ± 2.9</td>
<td>4.2 ± 2.8</td>
<td>2.1 ± 1.5</td>
<td>0.0231</td>
</tr>
<tr>
<td>Fouad Score</td>
<td>12.5 ± 8.18</td>
<td>4.2 ± 2.98</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table 7. Evaluation of clinical parameter period of cast and smoking.

<table>
<thead>
<tr>
<th>Clinical Parameter</th>
<th>1 M</th>
<th>2 M</th>
<th>Mild</th>
<th>3 M</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Period of Cast</td>
<td>8.1 ± 7.3</td>
<td>1.9 ± 1.5</td>
<td>2.1 ± 1.5</td>
<td>0.2371</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>125 ± 8.18</td>
<td>15.3 ± 2.1</td>
<td>105</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smoking</td>
<td>1.8 ± 1.1</td>
<td>125 ± 8.1</td>
<td>15</td>
<td>0.05</td>
<td></td>
</tr>
</tbody>
</table>

### Table 8. Postoperative and preoperative Scaphocapitate angle.

<table>
<thead>
<tr>
<th>Clinical Parameter</th>
<th>Preoperative</th>
<th>Postoperative</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scapholunate angle</td>
<td>39 ± 1.01</td>
<td>28.6 ± 2.89</td>
<td>0.05</td>
</tr>
</tbody>
</table>

### Table 9. Represent postoperative fouad score, dash score and return to work.

<table>
<thead>
<tr>
<th>Clinical Parameter</th>
<th>Preoperative</th>
<th>Post operative</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dash Score</td>
<td>56.3 ± 6.43</td>
<td>21.3 ± 1.012</td>
<td>0.002</td>
</tr>
<tr>
<td>Return to Work</td>
<td>55.2 ± 31.91</td>
<td>2.1 ± 1.90</td>
<td>0.02</td>
</tr>
</tbody>
</table>
Another study Giacalone et al.,10 performed on a small scale of patients injured with IIIC kienbock disease; included 20 male and 10 female were occupied in moderate to severe hard working daily with average range from 25 to 55 years-old both sides were affected; there finding were in line with our findings.

In the current findings; The mean postoperative and preoperative; flexion-extension range of motion was 105.5 ± 22 representing 74.9 ± 15 of the side range. The mean flexion range of operated side was non-significantly increased to 47.6 ± 7.9 (25–40); while extension range was significantly increased to 58.5 ± 10 (55–69°). Scaphotrapezio-Trapezoid fusion; gave good results have been described, although consolidation is sometimes difficult to obtain. Scaphocapitate arthrodesis for the treatment of advanced-stage Kienbock disease for the first time.

The postoperative and preoperative evaluation recorded a progressive range of motion with a decrease of flexion and extension which was statistically significant (p < 0.05), this finding is similar to that reported by Harris et al.,11 implicating the reduction in ulnar deviation, pointing towards the progressive nature of the disease and the inability of grip strength stabilisation to maintain the extension-flexion range of motion.

Our results observed that postoperative evaluation for the determination of infection, non-union, arthritis and carpal height ration. Among the included 20 patients; there is no infection, non-union, arthritis and carpal height represents normal. According to postoperative evaluation represent significantly differences with 0.05 p value.

In this study; postoperative evaluation for the determination of infection, non-union, arthritis and carpal height ration according to postoperative evaluation represent significantly differences with 0.05 p value.

As per a previous study; our findings in accordance with charre et al.,12 which proved that there is no infection or arthritis performed. In line with our findings; latest study proved that the carpal height ratio were determined postoperative and preoperative to obtain the normality and disability of carpal height. In contrast with our result; Rhee et al.13 were mentioned that scaphoapitate fusion surgery were affect carpal height and increases the formation of arthritis.

In the current study postoperative and preoperative pain evaluated as mild, moderate and sever which is non statistically differences with P value 0.0231.

As regards pain; included 11 patients who had mild pain at rest, as compared to 7 patient in Van Leeuwen et al.,14 in series of 25 patients, and 2 patients in Guner et al.,15 series of 30 patients. However, this mild pain was adequately controlled by conservative methods and did not affect the activities of daily living of our patients. On performing stressful activities (work), 6 of our patients had moderate pain that did not affect their work, while 2 more patients (11 %) had moderate pain that required modification of the level of their work, but still they kept their professions. This is compared to 3 patient who had pain on stressful activities in the series of 17 patients by Rhee et al.16

In the series by Hohendroff et al.,17 4 patients had pain on stressful activities, of which two patients had to change their profession, while two others continued their work at a reduced level of activity; in line with our results there is 3 patients had severe pain.

Our study found that postoperative and preoperative period of cast evaluated through 1 M, 2 M and 3 M which is statistically differences with p value 0.05.

Furthermore, none of the patients underwent additional surgery during the follow-up. The patient-rated outcome evaluation, including period of case demonstrated that postoperative and preoperative assessment were non significantly differences of patients with clinically significant improvement, and patients were used to or not used to smoking were showed an excellent outcome. This procedure has several advantages. Although in line with our findings Stewart et al.,18 were proved.

The scaphoapitate angle were calculated to estimate the changes in each degree with p value 0.517 which is significantly differences.

First, it can preserve the scaphoapitate angle in both the radiocarpal and midcarpal joints. The limited wrist fusion with lunate excisions could provide the postoperative and preoperative wrist range of motion (flexion-extension) ranged from 50° to 60° in short-term follow-up.However, another study arthroscopic lunate excision could provide averaged 120° in the 2-year follow-up as mentioned by Rhee et al.19

Second, it needs only short-term postoperative therapy. Although limited wrist fusions require wrist immobilization for 6–12 weeks with short or long arm casts, arthroscopic lunate excision requires 3 weeks of immobilization with a short arm cast, which is similar to the postoperative and preoperative course of proximal row carpectomy in accordance with Cross and Matullo.20

As per our findings; return back to work considered as postoperative and preoperative evaluation to obtain month of recovery after surgical operation through months is statistically differences P value 0.02.
In another previous study Bellne’re et al.\(^2\) return back to work have been studied and the authors concluded that return back to work increased more than 1 year due to the radio scaphoid mean pressure and decreased radio lunate mean pressure and had little effect on radio carpal mean pressure. However; another author Chantelot et al.\(^2\) mentioned that after SC surgery were return back to work after 4 months in line with our findings.

In this study Dash score represents postoperative and preoperative changes after surgical operation, for the determination of disability among patients; the lowest represent 25 while the highest represent 33 with mean and standard deviation 21.32 ± 1.012 which is statistically differences P value 0.05.

The average DASH score of our patients was ranged from 100 (23–33) which is comparable to that of the series of Chi et al.\(^2\) with an average DASH score of 20 (range 1–52).

In the current study; Fouad’s score in this study were a patent scoring system for the determination of pain, range of motion, re-turn to work, ROM flexion and extension, ROM radial and ulnar, and complications. Although no scores were available pre-operatively. Fouad score measuring different factors each score ranged from 0 to 3 depends on degree of severity and difficulty. Grading score system of fouad’s excellent results were ranged from 4 patients represents 17 and 3 patients represents 6 which is Very good with mean and standard deviation 4.2 ± 2.98 which is statistically differences P value 0.05.

5. Conclusion

In conclusion, this study confirmed our hypothesis concerning the short-term results of scaphocapitate fusion with lunate excision for the treatment of advanced IIIC grade Kienböck’s disease. Also; our study observed that fouad’s score grading system were invented scoring system applied in this study for the determination of different factors with high specificity.

Recommendation

Scaphocapitate fusion can reliably provide good outcomes and this is maintained in the mid to short-term follow-up. Fouad Score expected to be used in the future coming studies of IIIC grade and kienbock disease.

Limitation

Short time follow-up of patients showed minimal functional outcomes both clinically and in patient-reported outcome scores. Functional scoring was done only at the end of the follow-up period post-operative and preoperative.

Conflict of interest

There is no any conflict of interest.

References