

Scaphocapitate Fusion in Management Of kienbock's disease

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Abstract

Background: The exact etiology of Kienböck's disease or lunate avascular osteonecrosis hasn't been elucidated yet but it has been shown that progressive loading leads to increased collapse of the lunate. Negative ulnar variance has been postulated to be more predisposing to this disease. The aim of this work was to evaluate the functional, clinical and radiological outcome of scaphocapitate fusion in the treatment of management of Kienböck's disease. **Methods:** This study was conducted including twenty patients with kienbock's disease. All patients will attend at the outpatient clinic of orthopedic surgery department at Benha university hospital. **Results:** The average age of patients in this study ranged from 21 to 55 years. Most of our patients were manual workers, 10 patients were heavy manual workers, and five housewives were from country-side with daily heavy manual works. According to Mayo score system, the results obtained after six months follow up were encouraging. The results of treatment of 20 patients were excellent in 6 patients [30%], good in 10 patients [50%], and fair in 4 patients [20%]. As regards pain, in this study 14 patients [70 %] had mild pain after performing stressful activities and 6 patients [30 %] had moderate pain . In this series, the mean grip strength improved from 38.7% of the normal side preoperatively to 72.6% of normal side postoperatively. In this series, the postoperative extension of the wrist averaged $42.9^{\circ} \pm 1.5$ [range: 40-45°], and the postoperative flexion of the wrist averaged $42.7^{\circ} \pm 2.4$ [range: 36-46°]. All patients had a functional range of motion for their needs. We did not have any non-unions in our series. **Conclusion:** Scaphocapitate arthrodesis achieved a high rate of satisfactory clinical and radiological results with minimal complications and preserves carpal height. DASH scores indicate that scaphocapitate fusion produces minimal to mild disability. Most patients return to their work and daily activities despite some residual pain. The SC arthrodesis is a good option for the treatment of stage II and IIIa Kienböck's disease.

Key words: Scaphocapitate Fusion - kienbock's disease.

1. Introduction:

The goals of limited wrist arthrodesis are similar to those of total wrist arthrodesis in providing pain relief and improved function by fusing across arthritic or unstable joints, with the added benefit of motion preservation. Biomechanical studies have determined that between 30% and 50% of sagittal motion at the wrist occurs through the mid-carpal joint, with the remainder through the radio-carpal joint. [1] Sparing of either the mid-carpal or the radio-carpal articulations avoids complete loss of wrist motion, and a compensatory increase in motion at the unfused joint has been shown for up to 1 year postoperatively. [2,3]

The primary treatment goal for Kienböck's disease remains decompression of the lunate. SC fusion mechanically decompresses the lunate and prevents progressive carpal instability. It can successfully unload the lunate by transferring the carpal load to the radioscapoid joint. However, load transfer to the radial column might result in degenerative arthritis of the radioscapoid joint.

Scaphocapitate [SC] arthrodesis was first described by **Sutro** in 1946 for the treatment of difficult scaphoid nonunion [4] Its use in the treatment of Kienböck's disease was described 45 years later in a report by **Pisano et al.** [5]

Several biomechanical studies have been published detailing the forces in the wrist resulting from various types of limited wrist arthrodesis that suggest that SC fusion results in increased axial load across the radioscapoid joint while decreasing the

joint force across the radiolunate and lunocapitate joints compared with the intact wrist [6,7]

The aim of this work was to evaluate the functional, clinical and radiological outcome of scaphocapitate fusion in the treatment of management of Kienböck's disease.

2. Patients and Methods

This study was conducted including twenty patients with kienbock's disease. All patients attended at the outpatient clinic of orthopedic surgery department at Benha university hospital.

2.1 Inclusion criteria:

- **Age group:** Skeletally mature adults.
- **Sex:** Both sexes.
- **Patients:** Generally active.
- Patients with history of chronic wrist pain diagnosed as kienbock's stage III according to Lichtman's classification.
- Patients with no previous history of carpal or radiocarpal procedure.

2.2 Exclusion criteria

- Patients with stage I, II, IV kienbock's disease.
- Patients of age less than 18 years and more than 65.
- Patients with arthritic radioscapoid joint.
- Patients with neurovascular problems on affected hand [hemiparesis, hemiplegia, ischemia, drop wrist].
- Patients with wrist problems on contralateral side.

2.3 Clinical evaluation

All patients will be followed up and evaluated postoperatively during 1 week, 2weeks, by wound healing and pain score then all patients will be followed up during 1 month, 3 months, 6 months, 9 months by ROM, Grip strength and Mayo Modified Wrist Score as compared to the contra lateral healthy unaffected wrist.

All patients will be followed up and evaluated

Mayo pain wrist score with four grades: no pain, intermittent mild pain associated with climatic changes or increased workload, tolerable moderate pain, and severe to intolerable pain.

2.4Radiological evaluation:

Plain film radiography in anteroposterior and lateral projection with the forearm in neutral rotation was performed.

Successful arthrodesis will be determined by solid trabeculation across the SC articulation and no persistent joint interstice visible on plain film radiographs. Correct scaphoid alignment will be determined using the radioscapoid angle, which should ideally range from 30° to 57° after SC fusion.

2.5Operative Intervention:

- a) General anesthesia
- b) Supine position.
- c) The hand on the hand table, and upper arm tourniquet inflated, a straight dorsal longitudinal incision over the wrist to reach the carpal bones.
- d) Correct scaphoid alignment will be obtained, The SC articulation will be transfixed under intraoperative imaging with two or three 1.5 mm K-wires or Herbert screw with

autogenous cancellous bone graft will be inserted into the denuded joint line between the two bones.

- The wound is closed in layers and below elbow thumb slab is applied.
- One day postoperative active finger motion will start.
- After two weeks will be remove the stitch and change the slab into short below elbow thumb Spica.
- The short arm thumb Spica cast will be kept for 9–12 weeks after surgery.
- After 12 weeks the resistive exercise will start.

2.6Post-operative followup:

- Patients will be followed up at 1 week, 2 weeks, 1 month, 3 months and 6 months post-operative.
- Complications [infection, persistent pain after surgery, loss of reduction, transient parasesthesia, mal-union and non-union] will be recorded.

2.7Ethical considerations

The study will be explained to all participants and informed consent will be taken from all participants. The study will be approved by the local ethics committee on research involving human subjects of Benha faculty of medicine.

2.8Statistical analysis:

Statistical analysis will be done with SPSS version 18 Software [statistical package for social sciences, SPSS Inc, Chicago, Illinois, USA].

3.Results

Table (1) shows: demographic data of the patients included in this study

| | |
|--|--------------|
| Mean age [range] [years] | 38.3 [21-55] |
| SEX | |
| Male | 8 [40%] |
| Female | 12 [60%] |
| Occupation | |
| Housemaids | 5 [27.8] |
| Quarry workers | 6 [46.15] |
| Carpenter | 3 [23.08] |
| Soldiers | 3 [23.08] |
| Student | 3 [23.08] |
| Mean duration of follow-up [range] [months] | 28 [18–61] |
| Ulnar variance | |
| Minus | 11 [55%] |
| Plus | 3 [15%] |
| Neutral | 6 [30%] |

Twenty SC fusions were performed in 20 patients [8 men and 12 women] .The mean age of the patients at the time of operation was 35.3 years [range 21–55 years]. All patients were available for follow up. Patients with stage III B Kienböck's

disease according to Lichtman's classification were included in the study. Eleven [55%] patients presented with ulnar minus variance, three [15%] with ulnar plus variance, and six [30%] with ulnar neutral variance.

Table (2) preoperative pain of the patients included in this study

| Studied variables | Pain [n [%] Preoperative |
|-----------------------|------------------------------|
| Severe to intolerable | 2 [10%] |
| Severe | 15 [75%] |
| Moderate | 3 [15%] |
| No pain | 0 [0.00] |

Pre-operatively, Three patients 15% had suffered from moderate pain with score of 6 on VAS pain score, 15 patients [75%] had suffered from sever pain which ranged from 7-9 on the scale, two patients[10%] had suffered from very severe pain.[Table2].

Post-operatively, 14 patients [70%] had suffered from mild pain with score of 1-3 on VAS pain score, 6 patients [30%] had suffered from moderate pain which ranged from 4-6 on the scale.

Table (3) Preoperative and postoperative grip strength among the studied group.

| Studied variables | Grip strength | | P value |
|-------------------|---------------|--------------------------------|---------|
| | Preoperative | Postoperative [after 6 months] | |
| Mean±SD | 38.7±3.35 | 72.6±3.29 | 0.061 |
| Range | 35-44 | 67-80 | |

Preoperatively, grip strength ranged from 35-44 of normal side with the mean of 38.7±3.35 . At the final follow-up, it ranged from 67-80 of the normal side, with mean of 72.6±3.29. There was no

statistically significant difference in the degree of grip strength preoperatively and at the final follow-up.

Table (4) Range of motion post operatively.

| Studied variables | Range of motion | | P value |
|-------------------|-----------------|---|---------|
| | Preoperative | Postoperative [after 6 months] Flexion | |
| Flexion | | | |
| Mean±SD | 33.1±2.91 | 42.7±2.4 | 0.001 |
| Range | 27-36 | 36-46 | |
| Extension | | | |
| Mean±SD | 33±1.77 | 42.9±1.5 | 0.002 |
| Range | 30-36 | 40-45 | |

The mean wrist motion showed significant change. In flexion, it ranged from 33.1±2.91to 42.7±2.4, in extension from 33±1.77 to 42.9±1.5.

All patients had functional range of motion for their needs

Table (5) union of the follow up

| Studied variables | union |
|-------------------|---------------|
| | Postoperative |
| Mean±SD | 11.35±0.93 |
| Range | 10-13 |

Union was obtained in all cases as proved by clinical examination and radiographic evaluation. On radiographs the arthrodesis had consolidated in all

cases. The mean time to union was 11.35±0.93 weeks [range 10-13 weeks]. Table [5].

Table (6) Mayo score system distribution among studied group [N= 20]

| Studied variables | n [%] |
|--------------------------|----------|
| Mayo score system | |
| Excellent | 6 [30%] |
| Good | 10 [50%] |
| Fair | 4 [20%] |

According to Mayo score system, the results obtained after 6 months follow-up were encouraging. The results of treatment of 20 patients were excellent

4. Discussion

The average age of patients in this study ranged from 21 to 55 years. Most of our patients were manual workers, 10 patients were heavy manual workers, and five housewives were from country-side with daily heavy manual works.

This was consistent with the agreement of **Allan et al** [8] in their papers, when they said that; Kienböck's disease affects young individuals between the age of twenty and forty especially those engaged in manual works.

It is also similar to the average age reported by **Sennwald and Ufenast** [9] which was 30 years [range from 19 to 52 years], and comparable to that reported by **Rongieres** [10] which was 36.6 years [range, 24 to 55 years].

According to **Mayo score system**, the results obtained after six months follow up were encouraging. The results of treatment of 20 patients were excellent in 6 patients [30%], good in 10 patients [50%], and fair in 4 patients [20%].

As regards pain, in this study 14 patients [70 %] had mild pain after performing stressful activities and 6 patients [30 %] had moderate pain .

Compared with previous international literature, in series of 14 patients by **Rongieres et al.** [10], eight [57.14] patients were very satisfied, four [28.57%] were satisfied, and two [14.29%] were poorly or not satisfied. Three [21.43%] wrists were painless and only one [7.14%] wrist had no improvement. In the series of 17 patients by **Pisano et al.** [5], seven [41%] patients had pain on performing stressful activities. In the series by **Zdravkovic and Sennwald** [11], four [36%] patients had pain on performing stressful activities; of them two [18%] patients had to change their profession, whereas two [18%] continued their work at a reduced level of activity.

In this series, the mean grip strength improved from 38.7% of the normal side preoperatively to 72.6% of normal side postoperatively. This was compared with 48% of the normal side preoperatively increasing to 67% postoperatively in the series of **Young Szalay et al.** [12] also comparable with many published studies, **Rongieres et al** [10] obtained grip strength that reached 64.5% of the contra-lateral side. In **Pisano's** [5] study grip strength was 74%, while better results were obtained by **Sennwald and Ufenast** when grip strength reached 83% of unaffected side. [9] Wrist movements slightly improved post-operatively, the results of this study were comparable to other series as regards the range of wrist motions .

We find that our results are comparable to other series as regards the range of wrist motion. In this series, the postoperative extension of the wrist

in six [30%] patients, good in 10 [50%] patients, and fair in 4 [20%] patients. [Table 6]

averaged $42.9^{\circ} \pm 1.5$ [range: 40-45°], and the postoperative flexion of the wrist averaged $42.7^{\circ} \pm 2.4$ [range: 36-46°].

All patients had a functional range of motion for their needs. This is compared to an average flexion extension arc was 64° [40-96], equivalent to 48% of the healthy side, and an average radial-ulnar deviation was 28° [5-60], equivalent to 47% of the healthy side in the series by **Zdravkovic, and Sennwald**[11] Whereas in the series of **Young Szalay et al** [12] the average wrist motion was 70° [flexion – extension], and 33° radial-ulnar deviation. The greatest loss in the range of motion was in radial deviation which was down to 54% of the preoperative value.

Although the most common reported complication of SC arthrodesis in the literature is non-union; we did not have any non-unions in our series as compared to 2 [12%] non-unions in the series of **Pisano et al** [5] 2 [18%] in the series of **Zdravkovic, and Sennwald** [11] and 6 [20%] in the series of **Young Szalay et al** [12].

5. Conclusion

Scaphocapitate arthrodesis achieved a high rate of satisfactory clinical and radiological results with minimal complications and preserves carpal height. DASH scores indicate that scaphocapitate fusion produces minimal to mild disability. Most patients return to their work and daily activities despite some residual pain. The SC arthrodesis is a good option for the treatment of stage II and IIIa Kienböck's disease.

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