Lunocapitate fusion with scaphoid excision for the treatment of scaphoid nonunion advanced collapse or scapho-lunate advanced collapse wrist

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Abstract

Background: Four-corner fusion is an effective procedure to treat advanced degenerative osteoarthritis of scaphoid nonunion advanced collapse or scapho-lunate advanced collapse wrists. However, lunocapitate fusion, an alternative procedure, shows benefits including less dissection of the soft tissue and also a shorter operation time. We reviewed 10 cases to reveal the complication rates and clinical outcomes of this procedure.

Methods: We retrospectively reviewed 10 patients with symptomatic scaphoid nonunion advanced collapse or scapho-lunate advanced collapse wrists who had received lunocapitate fusion with scaphoid excision. The average follow-up period was 44.5 months (range, 22–68 months). Clinical evaluations were conducted and determined by radiographs, range of motion (flexion–extension), visual analog scale, and Mayo wrist scores. Complications including nonunion and implant migration were recorded.

Results: Among these patients, eight developed solid radiographic union while the remaining two patients showed bone resorption and implant migration and needed revision surgeries. The visual analog scale was decreased from 5.0 to 1.1, and the flexion–extension arc was increased from 61° to 72.5°. The average Mayo Wrist Score was 70 points. The results showed outcomes similar to those of previous studies.

Conclusion: Through our investigation and findings, we conclude that lunocapitate fusion can restore a functional and almost pain-free wrist. Moreover, these results were maintained at follow-up sessions, with complication rates being similar to those of previous studies. These results conclude a satisfactory therapeutic alternative to four-corner fusion for advanced degenerative osteoarthritis of wrists.

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Keywords: lunocapitate fusion; partial wrist fusion; scapho-lunate advanced collapse (SLAC); scaphoid nonunion advanced collapse (SNAC); wrist arthritis

1. Introduction

Advanced degenerative osteoarthritis of the wrist, either secondary to chronic unstable scapholunate dissociation (scapho-lunate advanced collapse; SLAC) or longstanding scaphoid nonunion (scaphoid nonunion advanced collapse; SNAC) may become symptomatic and eventually require surgical treatment. Surgical treatments include either four-corner fusion (4CF), which fuses the lunate, triquetrum, capitate, and hamate, or lunocapitate (LC) fusion which fuses only the lunate and capitate. Both methods are particularly indicated for Stage III SLAC and SNAC, where the cartilage over the LC joint is already affected by the degenerative process.

Four-CF was indicated for pan-arthritis of the wrist, whereas LC fusion (partial wrist fusion) was indicated for early-stage SLAC or SNAC, in early studies. However, LC fusion in those studies had shown poor outcomes due to a high nonunion rate and complications. In more recent studies, many successful results were obtained using LC fusion. The purpose of this study was to provide data of patients who had undergone LC fusion for SLAC or SNAC wrists and the results of their follow-up sessions at our hospital.
2. Methods

From January 2009 to December 2015, 12 patients recorded with painful unilateral SLAC or SNAC wrists underwent LC fusion. Inclusion criteria were symptomatic SNAC or SLAC wrists with degenerative lesions (Stage II or III). All surgeries were performed by two hand surgeons in our institution. Out of the 12 patients, two did not return for follow-up sessions. Therefore, only 10 patients were included in this study: six had SNAC wrists and four had SNAC wrists. All of them were men, with a mean age of 55.9 years (range, 41–71 years).

Fixations of the LC fusion were all performed using two headless compression screws (Fig. 1), either antegrade or retrograde direction. Additional procedures were performed including total or partial scaphoidectomy in all 10 patients (6 patients total and 4 partial), radiostyloidectomy in three patients (according to the degree of radial deviation), and posterior interosseous neurectomy in six patients. All patients received autologous bone graft, which was harvested from excised scaphoid or distal radius. There was no triquetrum excised in any cases.

After the index surgery, all patients underwent at least four clinic visits (postoperative 2 weeks, 6 weeks, 10 weeks, and 14 weeks). Radiographs were taken at each clinic visit except the first one (postoperative 2 weeks). All of the patients followed the same rehabilitation protocol: short arm splint protection for at least 10 weeks. After the splint was removed, free wrist movement was allowed and strengthening exercises started. Full weight bearing started after bone union.

Patients were reviewed after an average of 44.5 months (range, 22–68 months). Informed consent was obtained at the latest clinic visit. Clinical evaluation included radiographs, wrist range of motion (flexion–extension arc), visual analog scale (VAS), and Mayo Wrist Score. Complications including nonunion, hardware migration, and lunotriquetral arthritis were recorded. Complete union was determined based on physical examination findings of absence of tenderness directly at the fusion site as well as radiographic evidence of bridging callus at the fusion site.

3. Results

Eighty percent of the 10 patients observed during follow-up sessions obtained radiographic and clinical union of the LC fusion at an average of 12 weeks after surgery. The remaining 20% showed signs of bone resorption at the fusion site with implant migration during follow-up sessions and needed revision surgeries.

The results of the 10 patients are summarized in Table 1. The average pain on VAS was 1.1, and the flexion–extension arc was 72.5°. An average score of 70 points (point range, 45–100) was obtained on the Mayo Wrist Score, with one “Excellent” result, two “Good” results, six “Satisfactory” results, and one “Poor” result. Four out of 10 patients returned to their previous work, indicating a good outcome.

There were two nonunion cases that needed revision surgeries. Both cases received revision screw fixation with

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Table 1

<table>
<thead>
<tr>
<th>Case no.</th>
<th>Age a (y)</th>
<th>Sex</th>
<th>F/U period (mo)</th>
<th>Pre-op F/E arc (°)</th>
<th>Post-op F/E arc (°)</th>
<th>Post-op Mayo wrist score</th>
<th>Pre-op VAS score</th>
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<td>40</td>
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<tr>
<td>Average</td>
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<td></td>
<td>(22–68)</td>
<td>(40–90)</td>
<td>(50–105)</td>
<td>(45–100)</td>
<td>(3–6)</td>
<td>(0–4)</td>
</tr>
</tbody>
</table>

F/E = flexion/extension; F/U = follow up; M = male; Post-op = postoperatively; Pre-op = preoperatively; VAS = Visual Analogue Scale.

a Age was recorded at the time of surgery.
autologous bone graft (harvested from distal radius), at 39
months and 11 months postoperatively, respectively. Peri-
triquetral arthritis was found in both patients (Figs. 2A and
2B). Furthermore, there were more complaints of pain by these
two patients (VAS 3 and 4) during follow-up sessions.
Further arthritis change over the luno-hamate joint of the
operation wrist was found in one patient. VAS score did not
worsen, and there were no deteriorated functions noted for this
patient. Screw loosening was also found radiographically
during the long-term follow-up on two patients. However, there
were no complaints or functional deterioration in these
two patients.

4. Discussion

There are many treatment options for SLAC and SNAC
wrist. Four-CF has become one of the most popular choices of
treatment for most surgeons because of the higher fusion rate
when compared with LC fusion. However, LC fusion com-
bined with scaphoid excision has been advocated as a reliable
treatment method recently. It is now thought that the high
incidence of nonunion in early studies of LC fusion was likely
due to inadequate fixation techniques.2,3 Recent studies using
compression techniques which place compressive screws
parallel to the loading axis of the LC joint have demonstrated
remarkably lower nonunion rates that are equal to or lower
than those reported for 4CF.7–10 In our study, we reported
successful fusion in eight out of 10 patients (nonunion rate:
20%). The clinical results are similar to previous data. Range
of motion, Mayo score, and postoperative VAS score are
similar with those of previous studies (Fig. 3).

Calandruccio et al6 reported that restricting the number of
fused joints avoids wide areas of scarring and preserves wrist
movement. Scobercea et al11 in a cadaveric study, found that
LC fusion with scaphoid and triquetrum excision improved
motion but increased mean radiolunate contact pressures
compared with simulated 4CF. Also, the LC fusion requires a
shorter operation time and a surgical procedure that is more
defined, and easy to learn and reproduce. Ferreres et al9 re-
ported an incidence of radiolunate joint arthritis of about 25%.
The studied patients were all asymptomatic, with similar re-
sults compared with another group that underwent 4CF. Those
patients did not show radiolunate joint narrowing, but there
were slight osteophyte formations on the dorsal lip of the
radius. Whether these changes were the result of joint adap-
tation to the increased stress during wrist extension or an
indication of an early stage of joint degeneration is not known.
In our study, no radiolunate joint arthritis was found. This
might be due to the short follow-up period.

There is an important proprioceptive role of the triquetrum
as the key element in the detection of nociceptive stimuli
within the wrist: this function is impaired if the bone is fused
to the distal row.12 In our study, we did not perform triquetrum
excision or fusion. However, radiographic peritriquetral

Fig. 2. X-rays showing (A) Case Number 3, where pisotriquetral arthritis was
found at 11 months postoperative with lunocapitate fusion site nonunion and
(B) the revision of the same case, that underwent fusion over the hamate-
triqetral joint at 39 months postoperative.

Fig. 3. Comparison of wrist range of motion, Mayo scores, visual analog scores (VAS), and nonunion rate following lunocapitate fusion with other studies showed
similar results. F/E = flexion–extension arc.
arthritis was found in two patients’ wrists with complicated nonunion. The peritriquetral arthritis may be explained by load redistribution to the pisotriquetral joint due to the LC nonunion. Therefore, even subsequent symptomatic pisotriquetral arthritis occurred.

It has been reported that to remove the distal pole of the scaphoid is unnecessary. Thus, in our series, we did not perform total scaphoidectomy in all cases. The no-union rate was slightly higher in our study (20%) compared with recent studies (range, 0–12.5%). That may be because of the small sample size and the immature technique at the initial cases in our studies.

LC fusion allowed restoring a pain free and functional wrist in eight out of the 10 patients we reviewed. Results were maintained during follow-up sessions. We conclude that this is a satisfactory therapeutic alternative to 4CF for chronic instability of the wrist with osteoarthritis.

References