Arthroscopic Treatment of Stable Scaphoid Nonunion

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Patients and Methods

Between June 2012 and May 2014, 17 patients received arthroscopic refreshing and bone grafting for treatment of stable waist scaphoid nonunion. The mean follow-up was 13 months (ranged 6 - 18 months).

Results:
The mean flexion/extension of the wrist was 72 degrees (ranged 50 - 160 degrees) compared with the pre-operation 53 degrees (ranged 35 - 160 degrees) (P < 0.04). Grip strength at final follow-up averaged 28 kg (ranged 12 - 455 kg) indicating a significant improvement from 21 kg (ranged 5 - 41 kg) before the operation (P < 0.026). The mean Quick DASH scores showed a significant improvement from 4.3 (ranged 2 - 7) preoperatively to 1.03 (ranged 0 - 4) postoperatively (P < 0.04).

Conclusions:
Arthroscopic treatment of stable scaphoid nonunion is an effective alternative to the conventional treatment of stable Scaphoid nonunion.

Keywords: Hand Bones; Carpal Bones; Scaphoid Bone
3.2. Surgical Technique

An arthroscopic procedure was performed with tourniquet on upper arm, holding the hand in 5 kg of traction under general anesthesia. Standard radial and ulnar mid-carpal portals were used. Once the location and alignment of the fracture were seen through radial portal using a probe, we made a working portal through the ulnar portal (Figure 1).

If any doubt existed about nonunion site, we used operative fluoroscopy with a guide to find the fibrous nonunion site. The ulnar portal was useful for removing sclerotic or devitalized tissue from nonunion site with a motorized 2 mm burr under wet arthroscopy (Figure 2). Sometimes we had to change the working portal and debride the proximal segment with better access.

Cancellous bone graft was removed from the ipsilateral iliac crest and pushed to the nonunion site through the working portal through an arthroscopic sheath. It was then packed into the gap with increasing firmness using a probe without escape out into the joint.

The hand released from traction and put on a radiolucent hand table. Two 1.2 mm K-wires were inserted percutaneously from distal to proximal segment of scaphoid under fluoroscopy control (Figure 3).

The wrist was immobilized in a short-arm thumb Spica cast. After one week, it changed to a short thumb Spica cast. After twelve weeks of operation, the cast and the pins were removed and digital posteroanterior and lateral radiography were obtained. If bridging bone was not identified by 12 weeks, a rigid short-arm thumb Spica splint was applied for an additional six weeks. If bridging bone was not identified by 18 weeks, we considered the treatment as failure. Patients with union were visited every three months and wrist range of motion and grip strength and plain radiographs were evaluated at the final follow up.

4. Results

This study assessed finally 17 of 19 patients who underwent arthroscopic treatment for stable scaphoid nonunion because 2 patients were excluded due to incomplete follow-up. There were six women and 11 men at the final evaluation with a mean age of 27.5 years (ranged 19 - 43 years). The mean follow-up was 13 months (ranged 6 - 18 Months). The mean flexion/extension of the wrist was 72 degrees (ranged 50 - 160 degrees) in comparison with the pre-operation 53 degrees (ranged 35 - 160 degrees) (P < 0.04). Grip strength at final follow-up averaged 28 kg (ranged 12 - 455 kg) indicating a significant improvement from 21 kg (ranged 5 - 41 kg) before the operation (P < 0.026). The mean Quick DASH scores showed a significant improvement from 48 (ranged 27 - 90) preoperatively to 84 (ranged 76 - 100) postopera-
tively ($P < 0.05$). The VAS score showed a significant improvement from 4.3 (ranged 2 - 7) preoperatively to 1.03 (ranged 0 - 4) postoperatively ($P < 0.04$). All patients achieved a successful bony union by a mean 3.3 months (ranged 3 - 4.5 months).

We had a complication of escaped out of the bone graft in one patient who showed degenerative changes at follow-up radiography and underwent styloidectomy one year after index operation with relief of the pain (Figure 4). Three patients showed symptoms of algoneurodystrophy treated by prolonged physical therapy. All of them healed without complication at the final follow-up. We had not any cutaneous nerve injury, tendon injury or intraoperative cartilage injury.

Figure 4. A 37-Year-Old Man Treated With an Arthroscopic Technique for Scaphoid Nonunion

(A) That complicated with escaped out of the graft resulted in degenerative changes (B) at follow-up radiography and underwent styloidectomy (C And D)
5. Discussion

The development of arthroscopies brings a significant breakthrough in the history of wrist surgeries like scaphoid nonunion. It provides a thorough wrist biological environment for the union and minimal surgical trauma to the ligamentous architecture and vascularity.

The present study showed a significant improvement with arthroscopic management of the stable nonunion of scaphoid in grip strength and flexion/extension of the wrist. The overall functional outcomes for patients who achieved bony union were excellent or good like Kim et al. (15) report. We had a union rate of 100% like vascular bone graft that produced a 90% - 100% union rate, which may be due to relatively small number of patients (7). Arthroscopic management of scaphoid nonunion techniques continues to evolve. The present study showed the advantage of this method to achieve a more probably bone union (100%) with no delay union. The overall complication rate was 23.5%, which was higher than other studies; this may be due to the duration of the procedure or due to low skills. Kim et al. (15) reported a 7% complication rate in their study (arthroscopic surgery) and Slade and Gillon (16) reported a 9% complication rate and 96% union rate of nonunion group by nine months and 9% delay union.

In another study performed by Kolodziej et al. (17), nonunion rate after the Matti-Russe surgery method was 28% after a long-term follow-up of 2 - 27 years (mean: 8.8 years) and no complication reported.

Our procedure also can preserve cartilage and tendon and sensory cutaneous nerve, which consequently preserves wrist motion and grip and patient satisfaction (Figure 5).

![Figure 5. A 24-Year-old man Treated With an Arthroscopic Technique for Scaphoid Nonunion (A) that Treated Completely Without any Complication and Had Full Wrist Motion (C and D)](image-url)
Shaving of bony sclerosis is probably the main step in treating stable scaphoid nonunion and usually performed with cortical window at the nonunion site (1). Therefore, our procedure includes removing bony sclerosis until normal cancellous bone with punctate bleeding is seen.

For a fixation device in providing rigid fixation of stable scaphoid nonunion, it must be able to resist complex forces during normal functional loading (shearing or translation forces) (18, 19). The mechanical effectiveness of internal fixation is determined by five independent variables: bony quality, fragment geometry, reduction, implant and implant placement. While all the five variables are of importance, bone quality and fragment geometry depend on the patient. Reduction, implant placement and implant selection are the variables which the surgeon can manipulate. Implant placement in the biomechanically ideal position for the biomechanically ideal position for patient is probably the single most important one of the five variables (20).

In this study, we used two k-wire for nonunion fixation and found it sufficient in stable scaphoid nonunion. Arthroscopic refreshing and bone grafting and osteosynthesis of stable scaphoid nonunion have positive effects on the recovery of clinical wrist function and can be an effective alternative to the conventional method with few complication.

5.1. Limitation

This study had several limitations. It was a retrospective case study with no control group, the number of cases was relatively small. CT scan was not performed for as case study with no control group, the number of cases was relatively small. CT scan was not performed for assessing union of scaphoid as CT provides better accuracy than the plain radiographs.

References