

Long-Term Results of Vascularized Bone Graft for Stage III Kienböck Disease

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Purpose Vascularized bone grafting (VBG) is one of the therapeutic approaches for treating advanced Kienböck disease; however, few reports on long-term outcomes are available for this technique. The purpose of this study is to evaluate long-term results by following up patients with stage III Kienböck disease for more than 10 years after VBG.

Methods The study included 18 patients with advanced Kienböck disease (Lichtman stage IIIA, n = 10; stage IIIB, n = 8) who received VBG between 1996 and 2001 and were followed up for at least 10 years. Eleven patients received transplantation from the metacarpal base and 7 patients from the distal radius. Radial shortening and capitate shortening were performed in 5 and 2 stage IIIB patients, respectively.

Results The mean follow-up period was 12 years, 3 months. Based on the Mayo Modified Wrist Score, clinical results were excellent in 8 patients, good in 7 patients, and fair in 3 patients. The Stahl index and carpal height ratio were not improved in stage IIIA patients who received bone graft alone, whereas significant improvement was observed in stage IIIB patients who received shortening, as well.

Conclusions Vascularized bone grafting for stage III Kienböck disease demonstrated favorable long-term results and is recommended as a surgical treatment. (*J Hand Surg* 2013;38A:904–908. Copyright © 2013 by the American Society for Surgery of the Hand. All rights reserved.)

Type of study/level of evidence Therapeutic III.

Key words Kienböck disease, long-term study, shortening, vascularized bone graft.

VARIOUS SURGICAL METHODS have been reported for the treatment of Lichtman stage III Kienböck disease.¹ These are roughly classified into techniques for reducing dynamic load to the lunate and those for regenerating vascular flow. The former includes radial² or capitate³ shortening and radial wedge osteotomy,⁴ which are indicated for stage IIIA. The

latter includes vascularized bone grafting (VBG),^{5–11} which has been reported to be useful for patients with stage IIIB. However, most of the published reports have evaluated short-term or mid-term results, and long-term results are rarely reported. The purpose of this study was to report the long-term outcomes in patients with stage IIIA or IIIB Kienböck disease treated with VBG.

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Received for publication September 24, 2012; accepted in revised form February 1, 2013.

No benefits in any form have been received or will be received related directly or indirectly to the subject of this article.

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0363-5023/13/38A05-0010\$36.00/0
<http://dx.doi.org/10.1016/j.jhsa.2013.02.010>

PATIENTS AND METHODS

Of the 24 cases of VBG performed for stage III Kienböck disease between 1996 and 2001, 18 patients who were followed up for 10 years or longer were enrolled in this study. Diagnosis of Kienböck disease was made using plain X-ray, computed tomography, and magnetic resonance imaging, whereas staging was determined using plain X-ray and computed tomography. The VBG was performed by 3 hand surgeons. The patients in-

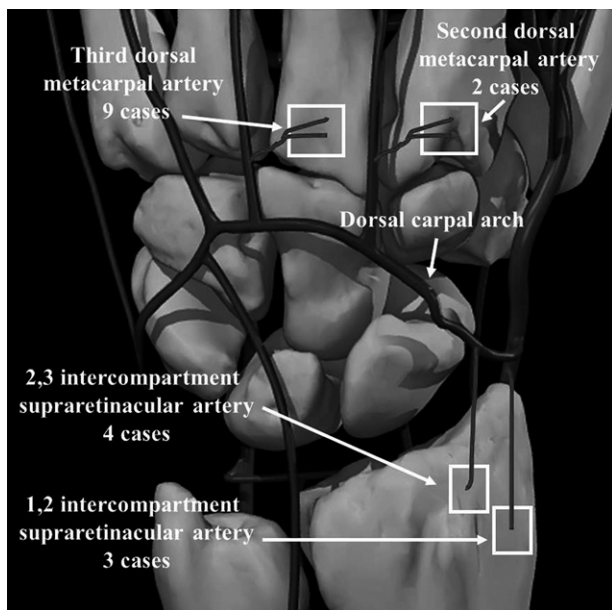


FIGURE 1: Sites of harvest of vascularized bone grafts.

cluded 12 men and 6 women, with a mean age at the time of surgery of 44 years (range, 18 to 67 y). The mean duration from symptom onset to surgery was 13 months (range, 3 to 28 mo). Ten patients were graded as stage IIIA, and 8 patients were stage IIIB. The harvest sites of the vascular pedicle were the base of the third metacarpal (9 patients), base of the second metacarpal (2), distal radius with the second and third intercompartmental supraretinacular artery (4), and distal radius with the first and second intercompartmental supraretinacular artery (3) (Fig. 1). Selection of the VBG harvest site was according to the surgeon's preference.

Whereas stage IIIA patients received VBG alone, VBG was combined with shortening osteotomy in stage IIIB patients. Radial shortening osteotomy was performed for 5 patients with negative ulnar variance, and capitate shortening was performed for 2 patients with null variance. A shortening procedure was not performed for 1 stage IIIB patient with ulnar plus variance, in consideration of a risk of postoperative ulnocarpal abutment syndrome.

The Mayo Modified Wrist Score was used for preoperative and postoperative evaluation of wrist function. Of the full score of 100 points, scores of 90 to 100 points were graded as excellent, 80 to 89 points as good, 65 to 79 points as fair, and less than 65 points as poor. Range of motion and grip strength were compared between preoperative and final follow-up. In plain radiographs, the Stahl index and the carpal height ratio (CHR) were compared between preoperative and final follow-up. Changes in Kienböck disease stage were

evaluated using plain radiograph. Magnetic resonance imaging was performed at the final follow-up to assess revascularization of the lunate, and a radiologist evaluated whether the intensity of the bone marrow was normalized.

The study was approved by the local ethics committee, and informed consent was obtained from all patients. The data are shown as mean \pm standard deviation. The Wilcoxon test was used for statistical analysis, and $P < .05$ was considered a statistically significant level.

RESULTS

The mean follow-up period was 12 years, 3 months (range, 10 y, 2 mo to 15 y, 6 mo). Preoperative wrist function was poor in all patients. The clinical results were graded as excellent in 8 patients, good in 7 patients, fair in 3 patients, and poor in no patients (Table 1). In stage IIIA, wrist extension compared to the unaffected hand improved 8%, and wrist flexion improved 18% (Table 2). Grip strength compared to the unaffected hand stage IIIA improved 53%. For the stage IIIB patients, wrist extension improved 18%, and wrist flexion improved 17%. Grip strength compared to the unaffected hand in stage IIIB improved 59%. All these changes were statistically significant (Table 2).

We observed no significant improvement in the mean Stahl index for all patients, from 0.435 ± 0.018 to 0.442 ± 0.014 , and for IIIA patients, but significant improvement was observed in the stage IIIB patients who received shortening as well ($P < .05$) (Fig. 2). We observed no significant improvement in mean CHR for all patients, from 0.483 ± 0.012 before surgery to 0.485 ± 0.014 at final follow-up. Although significant change in CHR was not observed in stage IIIA patients, significant improvement was observed in stage IIIB patients (Table 2).

Two patients progressed from stage IIIA to stage IIIB, and none progressed to stage IV. No patients regressed to a less involved Lichtman stage. Magnetic resonance imaging was performed in all patients at final follow-up, and normalized bone marrow intensity was confirmed in 15 of 18 patients (83%). Partial segmentation of the lunate was observed in 3 patients whose intensity did not normalize, and intensity at this site partially included low intensity on T1-weighted images.

DISCUSSION

Some researchers have reported long-term results for surgical treatment in Kienböck disease. Koh et al followed up 25 patients for 10 years or more after radial

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