

The comparison of results for the bone grafting in treatment of scaphoid nonunion with and without avascular necrosis

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Abstract

Background: The varieties of treatment methods for the scaphoid nonunion have always been a discussable issue for orthopaedic surgeons. The current study, considered to be review for treatment results of the patients who sustained the scaphoid nonunion with or without avascular necrosis and compared these two groups clinically and radiologically.

Methods: The clinical and radiologic files of the patients who sustained the scaphoid nonunion and underwent surgical treatment between 2004 and 2009 in our hospital, were collected and in the final follow-up, 37 patients and 38 nonunions underwent physical exam, grip power test, DASH questionnaire and radiography.

Results: Avascular necrosis was detected in 22 cases and 16 cases had no avascular necrosis changes. Following open reduction and bone grafting, union was seen in 36 cases, and nonunion in 2 cases which one was in the avascular necrosis group and another in without avascular necrosis group. The comparison of the residual pain, range of motion, DASH score and grip power in two groups, did not show a meaningful difference ($p > 0.05$).

Conclusion: Although multiple studies indicated that in the presence of the avascular necrosis in the proximal fragment of the scaphoid, possibility of union in the conventional graft methods was lower than vascular pedicle grafts, but this study demonstrated that the conventional treatment method yet was associated with a considerable success and a reliable treatment method.

Keywords: Scaphoid nonunion, avascular necrosis.

Introduction

Scaphoid fracture is the second most common fracture in upper extremity after distal radius fracture. It is most frequent in males in second and third decade of life. Nonunion of scaphoid fracture is the most common in carpal fractures [1,2].

Non-union of scaphoid classified according to presence or absence of avascular necrosis [3,4,5].

Generally, bone graft application in addition to internal fixation used for treatment of nonunion of scaphoid fracture [6,7] Vascularized bone grafts are recommended in cases of

nonunion in present of avascular necrosis of scaphoid [7,8].

Outcome of non-vascularized bone graft application for treatment of nonunion of scaphoid with avascular necrosis was acceptable in few studies [9,10].

The aim of this study was to assess radiographic and functional outcome of patients with scaphoid nonunion in presence of avascular necrosis after operative treatment with non-vascularized bone graft.

Methods

Since 2004 to 2009, 44 patients (46 wrists) were treated operatively with method of Matti-

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Table 1. Wrist ROM (degree) for operated sides versus other sides.

	Mean(\pm SD) in operated side (group1/group2)	Mean(\pm SD) in intact side (group1/group2)	Mean differences (%) (group1/group2)	P-value
Flexion	63(\pm 10.3)/60(+/-11.9)	72(\pm 6.1)/71(+/-5.5)	-15/-13	>0.05
Extention	53(\pm 12)/54(+/-10.2)	67(\pm 5.8)/65(+/-6.1)	-17/-21	>0.05
Radial deviation	20(\pm 4.1)/21(+/-4.7)	30(\pm 3.8)/31(+/-3.1)	-32/-33	>0.05
Ulnar deviation	47(\pm 4.8)/42(+/-5.1)	51(\pm 3.8)/49(+/-3.9)	-14/-18	>0.05

Russe because of scaphoid non-union in our hospital. They all were operated by hand surgeons with volar approach.

We contacted them, and finally 37 patients with 38 scaphoid non-union, came back to participate in the study.

Initial plain x-ray and MRI of patients evaluated and presence or absence of avascular necrosis were determined.

All patients were asked about pain regardless of quality or quantity of it. Wrist range of motion and hand grip were measured in both sides of every patient. X-ray for anteroposterior and lateral views were done and DASH score questionnaire was filled for each patients.

Finally, patients were divided in two groups according to presence or absence of avascular necrosis of scaphoid.

Surgical technique: All cases were approached with volar incision of wrist and after exposure of the nonunion site of scaphoid, sclerotic bone ends freshened with a small gouge and a cavity with extension into each adjacent fragment formed. From iliac crest a piece of cancellous bone was obtained and shaped to fit into the performed cavity. Fixation with K-wires had performed in 27 cases, and casting was done for all cases.

Statistical analysis: Chi-square test was ap-

plied to evaluate the result, p-value <0.05 was considered as significant.

Results

All patients were men (37 pt.) and mean age of operating time was 24 (Range: 16- 51) years old. Dominant hand was detected in 54% and non – dominant in 43 % and bilateral involvement in 2.7% (one patient). Proximal third, middle third and distal third nonunions were seen in 4 cases (10.5%),30 cases (79%) and 4 cases(10.5%) respectively.

The mean duration between injury and operation was 11 months (Range: 4 mon. – 5 y.). The operating treatment was the unique treatment in all of cases, although some of them had casting for less than 2 months. The mean time between surgery and follow up was 27 months (Range: 6mon. – 5y.).

In 22 cases (58%) avascular necrosis was seen in preopaerative x-ray and MRI, but sixteen cases (42%) did not have any evidence of avascular necrosis.

None of studied cases had preoperative osteoarthritis in radiographs.

Non- union after surgery was seen in one case (95% union rate) from avascular necrosis groups (group 1) and there was no evidence for union in one case (94% union rate) in group without avascular necrosis (group 2).There was no significant difference between two

Table 2. Hand grip (Kg.) for operated sides compared with other sides

	Mean(\pm SD) in operated side	Mean(\pm SD) in intact side	Mean differences (%)	P-value
Group 1	27(\pm 4.9)	34(\pm 4.2)	-21	>0.05
Group 2	28(\pm 5.2)	35(\pm 4.9)	-20	>0.05

groups ($p > 0.05$).

In group 1, 11 patients (50%) and group 2, 9 patients (52%) had pain ($p > 0.05$).

Range of motion was decreased in operated side compared with other side (Table 1), but there was not any significant difference between group 1 and group 2 ($p > 0.05$).

The difference between hand grip in operated side with other side was evaluated in two groups (Table 2), and there was no significant difference ($p > 0.05$).

Mean DASH score for group 1, was 40 ± 7.2 and for group 2 was 41 ± 7.1 (Table 3) with no significant differences ($p > 0.05$).

Discussion

Most of studies do not recommend traditional bone grafting in cases of scaphoid nonunion and presence of avascular necrosis, although few studies recommend this method [9,10]. Success of treatment with this method had reported from 47% [9] to 100% [13].

In this study, 38 cases of scaphoid nonunion were evaluated, and 58% had avascular necrosis changes. The most important result of this study was high rate of union (95%) after operative treatment with non vascularized bone grafting in patient with avascular necrosis changes. There was no significant differences in rate of union in patient with avascular necrosis and those without avascular necrosis

Table 3. Results of DASH score questionnaires.

DASH score in group 1 (mean \pm SD)	40 \pm 7.2
DASH score in group 2 (mean \pm SD)	41 \pm 7.1

($p > 0.05$).

Residual pain after union of scaphoid was a major reason for decrease in the functional level of patients [11]. Residual pain in variety of studies reported to be between 62-64% [5,10, 12], but it was 54% in our study. There was no significant difference between group 1 and group 2.

Decrease in range of motion is a reason of decrease in function of hand jobs [11]. In our study, like other studies, decrease in range of motion especially in radial deviation was seen.

Decrease in hand grip is an objective functional marker after treatment and was reported 4% in a similar study, but it was 20% in this study.

There was no significant differences in decrease of range of motion and hand grip, between two groups in our study.

Moreover there was not significant differences in DASH score between two groups, with no subjective functional differences between 2 groups.

Finally, we assumed that non vascularized bone grafting with Matti– Russe method, is an

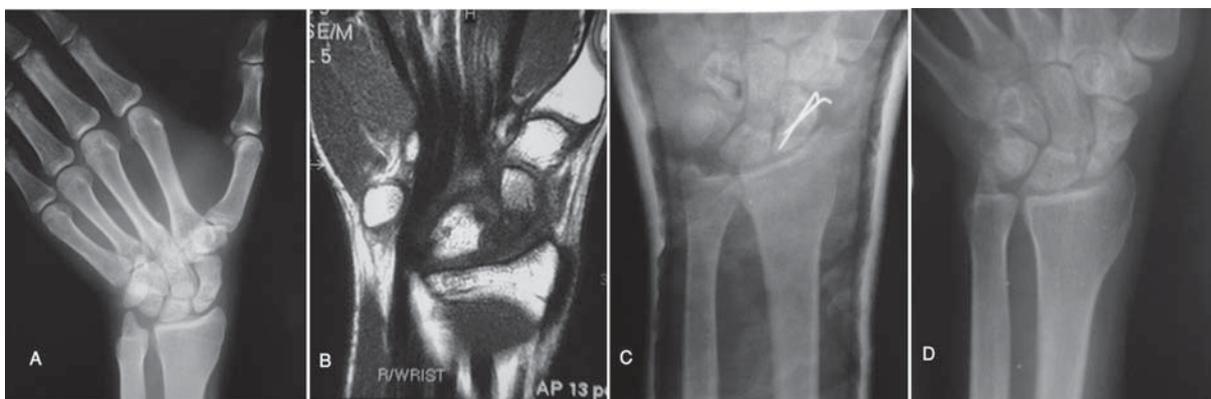


Fig. 1. X-ray show scaphoid fracture nonunion with increase in density of proximal 3rd in a 19 years old male (A); MRI demonstrated avascular necrosis in proximal fragment (B); Postoperative X-ray(C); Follow up X-ray 6 months later (D).

acceptable therapeutic method with high rate of success according to radiologic and clinical outcome for scaphoid nonunion even in presence of avascular necrosis . Avascular necrosis may develop in proximal fragment of fractured scaphoid , but scaphoid is not a weight bearing bone and structure of bone preserved in most of cases, therefore after fixation and bone grafting of fractured scaphoid it plays a osteoconductive role which replaced with new bone formation.

Although, vascularized bone grafting preferred in most of studies, but most of orthopedic surgeons do not have any experience in this method. Regardless of function of vascular pedicle, fundamental basis of this method, influence the outcome.

Conclusion

Finally, based on our study results, we recommend traditional bone grafting method for treatment of scaphoid nonunion even in presence of avascular necrosis.

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Conflict of interest

All named authors hereby declare that have no conflicts of interest to disclose.

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