

Open Reduction and Internal Fixation with Bone Grafting for Scaphoid non-union: an experience at a tertiary care hospital

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ABSTRACT

Background: Scaphoid fractures are fairly common and have relatively good rates of successful treatment. However, due to precarious blood supply a small group of patients remain at risk of developing fracture non-union. This condition can be physically debilitating and lead to considerable functional loss.

Aim: To explore union rate and functional status after ORIF and bone grafting for established scaphoid non-unions.

Methods: After informed consent, using purposive non-probability sampling, fourteen patients of either sex with age ranging from 20-42 years with radiographically proven scaphoid non-union without AVN were included. All patients underwent ORIF of scaphoid non-union with non-vascularised bone grafting.

Results: 14 patients were included in this study, 10 male and 4 female. Average age was 29.4+/- 7.53 years. All patients achieved union after treatment. Average time to union was 17.6+/- 4.25 weeks.

Conclusions: ORIF and non-vascularized bone grafting can yield excellent results in patients with scaphoid non-union without evidence of AVN.

Keywords: Internal fixation, bone grafting, open reduction

INTRODUCTION

Scaphoid is the most commonly fractured carpal bone.^{1,3} The scaphoid's unique position spanning the proximal and distal carpal rows places it at risk during trauma.¹⁶ A scaphoid fracture is usually the result of a fall onto an outstretched hand and occurs most commonly in young and active adults.

Although the great majority of scaphoid fractures heal uneventfully with conservative management, the incidence of scaphoid nonunion may range from 5 percent to as high as 12 percent.^{4,5} Mainstay of treatment has been freshening of fracture ends and bone grafting with or without internal fixation with variable results reported in literature.^{2,10} In this study we present our experience of treating established scaphoid non-unions without AVN using ORIF and non-vascularised bone grafting.

SUBJECTS AND METHODS

In a descriptive case series study carried out at Orthopedic unit II of Jinnah hospital, Lahore from January 2015 to May 2018, 14 patients of either sex with age ranging from 20 to 42 years were included. All had clinically and radiographically proven scaphoid non-union with no evidence of AVN.

Inclusion criteria:

1. Fracture non union with displacement >1mm
2. Scapholunate angle >45 degrees
3. Lunocapitate angle >15 degrees

Exclusion criteria:

1. AVN of scaphoid
2. Carpal collapse
3. Evidence of wrist OA

After preparation and relevant investigations all patients were operated by the same surgeon with expertise in upper limb surgery. Volar approach to scaphoid was

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employed. The fibrous tissue and non viable bone at fracture gap was debrided. The resulting gap on the volar aspect of the bone was filled with non vascularized wedged bone graft taken from the iliac crest and secured with 1.5mm K-wire which was driven dorsally and kept buried under dorsal skin of the hand. The fracture site along with wedged bone graft was internally fixed using a cannulated Herbert screw to achieve compression. Post operatively all patients were given a short arm scaphoid cast for 3 to 6 months depending upon the healing progression. K-wire was removed at 6-8 weeks. Patients were followed up for 8-41 months using digital x-rays for healing assessment and Mayo wrist score to quantify functional improvement.

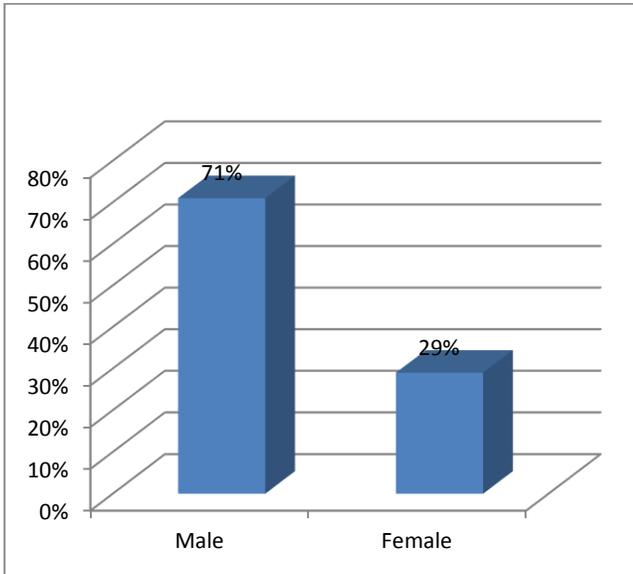
RESULTS

Fourteen patients were included in the study. Mean age was 29.4 +/- 7.53 years with a range of 20-42 years. 10(71.4%) patients were male and 4(28.6%) were female. All patients (100%) achieved union with treatment. The average time union was 17.6+/- 4.25 weeks with a range of 12-24 weeks. The Mayo wrist score improved in all patients. The average Mayo score after treatment was 78.41+/- 13.81. None of the patients developed AVN, Infection, degenerative changes or implant failure.

	Time to union
Minimum	12
Maximum	24
Average	17.6
SD	4.25

	Mayo wrist score
Minimum	60
Maximum	100
Average	78.41
SD	13.81

	Complications
Infection	0
Hardware failure	0
AVH	0



30 years old Pharmacist with Rt Scaphoid fracture non-union of 9 months



Pre-operative Scaphoid fracture non-union, 9 months



Post-operative follow up, 6 weeks



Post-operative follow up 6 weeks, showing K-wire holding the wedged iliac crest bone graft, Herbert screw fixation and scaphoid spica



10th weeks follow up with Pain free wrist extension



10th weeks follow up with pain free wrist flexion

10th weeks follow up with complete bony union



10th weeks follow up with pain free supination



10th weeks follow up with pain free pronation



DISCUSSION

Nonunion may occur in scaphoid fractures (5%–10% of all cases^{21,23,24}), and numerous series have documented

progression of nonunion to collapse and arthritis if left untreated.^{6,7} It is for this reason that diagnosis and appropriate treatment of the acute fracture, and the possible sequelae of nonunion, is recommended.^{6,7,13}

Treatment of an established scaphoid nonunion requires not only consideration of patient age and functional demands but also nonunion characteristics.^{8,9,17} The non-displaced stable nonunion without degenerative changes (Mack-Lichtman type I) can be treated with bone grafting with or without hardware.^{24,28,29} Hardware placement has the advantage of conferring stability with compression across non-union site but might require removal.²⁹ Non-vascularized autogenous bone graft from the distal radius or iliac crest may be sufficient, although vascularized bone grafting has historically shown to give superior results.^{27,28} One must consider the relative risks and benefits of non-vascularized or vascularized bone grafting. Non-vascularized bone grafting is probably sufficient for most waist fracture non-unions and those with preserved vascularity of the proximal pole.³⁰

This study aimed to show that in the experienced hands, technically correct operation with non-vascularized bone grafting can achieve excellent results. In our study all 14 patients achieved union (100%). In a series of 160 scaphoid non-unions^{28,29} treated with internal fixation and non-vascularized bone grafting, 90% healed. Failure to achieve union was related to a proximal fracture location, avascularity of the proximal pole, instability of the fracture, and delay to surgery.²⁹

In another study²¹ done at the Mayo clinic USA 72% of the scaphoid non-unions healed with vascularized bone grafting (36/50), and healing occurred at an average of 16 weeks (range 8–40 weeks). Factors adversely affecting the union rate included female sex¹⁶ (union rate: 30% vs. 82% in males); tobacco use¹² (union rate: 81% in nonsmokers vs. 46% in smokers), and proximal pole avascularity²⁰ [48% union rate in the presence of avascular necrosis (AVN) vs. 91% in the absence of AVN. The Mayo clinic included non-unions with evidence of AVN which might account for the difference.²⁸ In our study the average time to union after surgery was 17.6 weeks which was comparable. Another study by Steinmann et al. showed that 100% union rate was achieved in 14 patients at a mean 11.1 weeks³⁰

Two other studies in the literature showed relatively low healing rates of 60%¹² and 27%¹⁴ respectively. In the study by Boyer et al.,²⁷ 10 proximal pole non-unions underwent vascularized bone grafting with a 60% union rate. The four failures occurred in patients who had previously undergone treatment with a bone grafting procedure.

Mayo clinic reported that type of internal fixation also influenced the union rate.²¹ Simple K-wire fixation resulted in a 53% union rate, whereas screw fixation resulted in an 88% union rate.²⁸ In our study all patients underwent stable fixation with headless Herbert screws.

Most studies^{12,17,22,25,27} have only measured the success and time to union as end points. In our study we also measured functional improvement after treatment using Mayo wrist score which make the results more comprehensive. The scores improved in all patients and ranged from 60 to 100 with a mean of 78.41 +/- 13.81

Various studies^{27,28,29,30} have reported complications including infections, graft extrusion, graft resorption and progressive degenerative changes requiring further surgery but none was happened in our series.

CONCLUSION

In the author's opinion, Scaphoid non-unions without evidence of AVN can be adequately treated with ORIF and non-vascularized bone grafting with excellent results and low morbidity.

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