



TREATMENT OF SCAPHOID NON-UNION FRACTURE BY PRONATOR QUADRATUS PEDICLE BONE GRAFT TRANSFIXED WITH KIRSCHNER WIRE

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ABSTRACT

Background: Treatment of scaphoid non-union fractures is controversial and challengeable in orthopaedic practice. Moreover, it is widespread of all fractures of the carpal bones. Scaphoid collapse and distortion may trend to develop after fractures. Furthermore, the questionable vascular anatomy of the scaphoid, the characteristic biomechanical instability of scaphoid fractures, and the struggle of radiographic finding are the reasons of nonunion. One common method for treating scaphoid nonunion with angular deformity is length restoration using a wedge bone graft. **Objective:** By this prospective study, we have highlighted and compared the outcomes of 3 fixation Kirschner wire for scaphoid non-union fracture. **Methods:** A prospective study that achieved on 8 patients who have scaphoid non-union fractures. The patients were treated at Al-Nu 'man Teaching Hospital and our private clinic in Baghdad, Iraq between March 2014 and April 2017. The scaphoid non-union fractures were treated by vascularized pronator quadrates muscle with bone from distal radius and transfixed by Kirschner wire. **Results:** The most common age (20-30) years with 8 patients. However, 7 male and 1 female were treated by vascularised pronator quadrates muscle pedicle bone graft fixed at fracture scaphoid by tunnel in fracture site with wire. The end result was excellent in 7 patients. Unfortunately, one female patient has got re-fracture who is treated by splint. **Conclusions:** Kirschner K-wire transfixation, which is a relatively simple, alternative operative procedure to manage a scaphoid non-union fracture. Moreover, all the patients had a well union that achieved stability and vascularity for fractures.

KEYWORDS: Scaphoid non-union fracture, Kirschner wire, Pronator Quadratus Pedicle Bone Graft.

INTRODUCTION

Rationale prospective study that we have achieved to managed the scaphoid non-union fracture by 3 fixation Kirschner wire, and to compare outcomes of this technique. The scaphoid is the most commonly fractured carpal bone, accounting for approximately 60% of all carpal fractures^[1] which usually caused by falls onto the out stretch hand. Most scaphoid fracture heals if properly immobilized in a plaster for sufficient period and diagnosed well. However, Some fractures haven't heal properly and would complicated by non-union. That is to say, the significant reasons for non-union are: displaced fractures, associated ligament injuries, don't recognize and poor blood supply.^[2] Herbert has classified scaphoid non-union into four group^[3,4] (Figure.1). TypeD2 Pseudoarthrosis (Early deformity) TypeD3 Sclerotic Pseudoarthrosis (Advance deformity) fixed dorsal intercalated segment instability (Disi). TypeD4 Avascular necrosis (Fragmented proximalpole) with collapse of proximal pole.^[3]

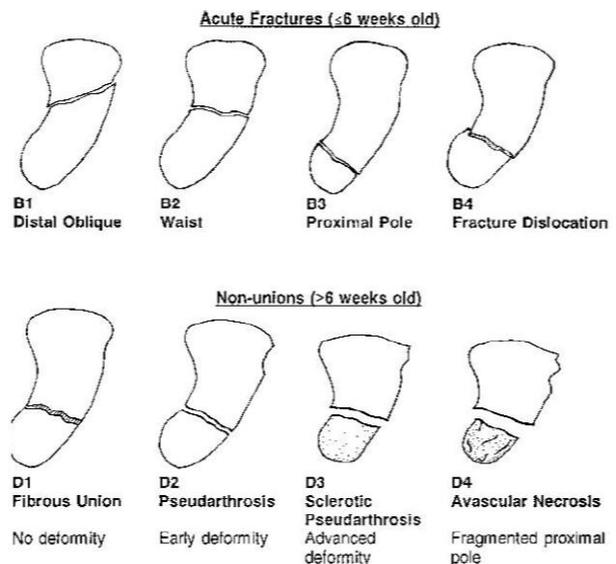


Figure. 1: T. J. Herbert Classification of Scaphoid Non-Union Fracture.

Technique

Scaphoid and distal radius are exposed by a linear incision (Volar Scaphoid Approach), the interval between radial artery and tendon of Flexor Carpi Radialis has identified, then the capsule of wrist joint has reflected to expose the scaphoid and distal margin of the radius. The fibrous tissue and vascularize bone have removed from the site of non-union by using curved osteotome. Afterward, the two poles at the site of non-union scaphoid fracture have separated with aid of appropriate traction by the thumb. The pronator quadratus with the wedge of 2cm bone has separated with an osteotome. Subsequently, scaphoid coupled with bone graft have transfixed with 1 or 2 k-wire introduce at scaphoid tuberosity and skin has closed without tension.



Figure. 2: Scaphoid non-union fracture fixed by K-wire.

MATERIAL AND METHODS

A prospective study was accomplished between March 2014 and April 2017, on eight^[8] patients who have old non-union scaphoid fractures. Additionally, they have treated in Al-Nu' man Teaching Hospital and our private clinic in Baghdad, Iraq. Radiological signs of non-union where well documented preoperatively. Explicitly, they have got loss of normal trabecular appearance, cystic changes and collapse of the affected side.^[5] (Figure 3).

Epidemiologically; Age of all cases between (20-30y), seven^[7] from eight patients were male, and seven^[7] of eight patients their dominant hand has affected. six^[5] of eight were their initial treatment for a scaphoid fracture by cast below elbow for a mean period of^[7] months preoperative, two cases have no treatment for mean period^[6] months and one case treated by brace only . A 50% patient where the proximal third of the scaphoid has affected and another 50% waist of scaphoid. All have been treated by Pronator Quadratus Pedicle Bone Graft transfixed with 3 Kirschner wire. What's more, they follow up for 6-12 months (The Mean Time=9 months). (Table 1). Furthermore, the anteroposterior, lateral and scaphoid view with the affected wrist in full ulnar deviation and an arm in 3 degree of supination which reveal radiographic signs of union has been developed at fracture site.

Table 1: Preoperative data on 8 patients.

Case No.	Sex & Age	Affected side	Treatment	Site of non-union	Preoperative Duration
1	M*20	Right	Cast below elbow	Proximal third	4
2	F*30	Right	Cast below elbow	Proximal third	6
3	M26	Right	None	Waist	6
4	M24	Left	None	Waist	7
5	M23	Right	Cast below elbow	Proximal third	6
6	M20	Right	Cast below elbow	Waist	12
7	M25	Right	Cast below elbow	Proximal third	8
8	M30	Right	Brace	Waist	8

M*=Male, F*= Female

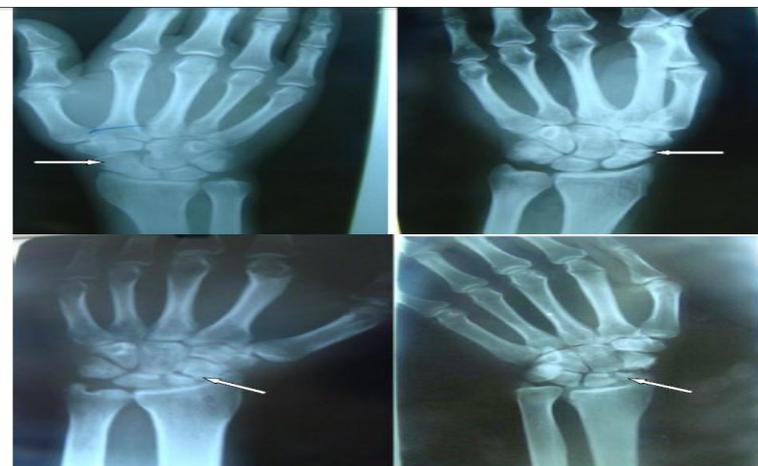


Figure. 1: Radiological findings of scaphoid non-union fracture.

Table. 2: According to wrist mayo clinic table2,3.

Case	Sex age	Side	Treatment	Site of nonunion	Duration before operation
1	Male20	Right	Bellow the elbow cast	Proximal third	4
2	F30	Right	Bellow the elbow cast	Proximal third	6
3	M26	Right	None	Waist	6
4	M24	Left	None	Waist	7
5	M23	Right	Bellow the elbow cast	Proximal third	6
6	M20	Right	Bellow the elbow cast	Waist	12
7	M25	Right	Bellow the elbow cast	Proximal third	8
8	M30	Right	Brace	Waist	8

Table. 3: Mayo Wrist Scoring System Pain.

Categories	Score	Finding
Pain(25 point)	25	No pain
	20	Mild pain with vigorous activities
	20	pain only with weather changes
	15	Moderate pain with vigorous activities
	5	Moderate pain with activities of daily living
	0	Pain at rest
Satisfaction(25 points)	25	Very satisfied
	20	Moderately satisfied
	10	No satisfied ,but working
	0	No satisfied, unable to work
Range of Motion (25point)	25	100% percentage of normal
	15	75%-99% percentage of normal
	10	50%-74% percentage of normal
	5	25%-49% percentage of normal
	0	0%-24%
Grip strength (25 point)	25	100% percentage of normal
	15	75%-99% percentage of normal
	10	50%-74% percentage of normal
	5	24%-49% per percentage of normal cent normal
	0	0%-24%
Final Result	90-100	Excellent
Total point	80-89	Good
	65-79	Fair
	<65	Poor

DISCUSSION

Russe inlay bone graft is considered as the treatment of well-chosen for the patients with scaphoid non-union.^[5,6,7,8] Chen et al. in the retrospective study had reviewed 39 patients with scaphoid non-union that treated by "sandwich" method that consisted of a wedge corticocancellous strut graft and numerous cancellous bone chips. Brunelli et al^[9] described a bone graft that obtained from the distal part of the second metacarpal. Chacho.^[10] reported that use of bone graft with vascular pedicle on two patient because short follow up. Guimberteau JC, Panconi B^[11] reported vascularized cortical and cancellous bone graft from the ulna. Furthermore, the vascular pedicle has obtained from the ulnar artery. However, it has disadvantages include a long operating time and the need for an ulnar artery with a venous graft.

Zaidenberg et al^[10] reported success with the use of vascularised bone graft from the radial styloid process

after the Matti-Russe procedure has failed.^[12] Guimberteau JC, Panconi B.^[11] used up a vascularised bone graft that obtained from the ulna. Harpf et al. reported a 90% union rate after using the free vascularised iliac-crest.^[12]

RESULTS

The total number of study patients was eight. All of them were complaining from old nonunion scaphoid fracture treated with a muscle graft (pronator quadrates pedicle bone graft). Study patient's age was ranging from 20 to 30 years with a mean of 24.7 years and standard deviation (SD) of ± 3.88 years. males represented 87.5%, while the female of study patients. (Figure 4).

The right side was involved in 87.5% of cases and the site was evenly distributed between the proximal third and waist (50% for each one). (Table 1).

Duration before the operation was ranging from four months to one year with a mean of 7.12 ± 2.35 months.

Most cases were treated by below elbow cast (62.5%).

Broadly translated our findings indicate that patients of study have achieved two important issues: First, the stability and vascularity which have gained at the same time due to the well-rounded union at the fracture site. (Figure 5).

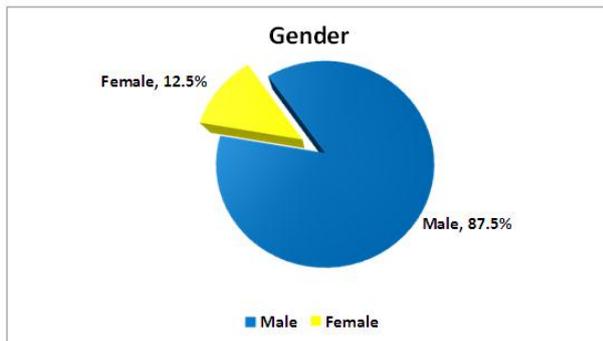


Figure 4: Distribution of study patients by gender.

Table 4: Distribution of study patients by certain fracture details.

Variable	No. (n=8)	Percentage (%)
Site of fracture		
Proximal Third	4	50.0
Waist	4	50.0
Side of fracture		
Left	1	12.5
Right	7	87.5

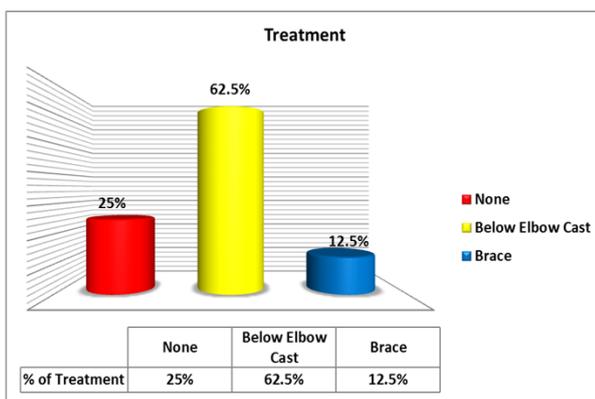


Figure 5: Distribution of study patients by treatment.

Mayo score Evaluation has ranged from 80 to 85 score with a mean of 82.5 ± 2.67 . Postoperatively, there were a radiological signs of union for all study patients after nine weeks.

CONCLUSION

Secondly, Kirschner K-wire fixation is relatively simple as well as it considers substitute operative method compared with other vascularized bone-grafting, like

inlay bone grafting procedures and to the methods of the avascular bundle which are more difficult technique.

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