Journal of Medicinal and Chemical Sciences 5 (2022) 315-320

Journal of Medicinal and Chemical Sciences

Journal homepage: http://www.jmchemsci.com/

Original Article

Treatment of Scaphoid Non-Union by Iliac Cancellous Bone

Bilal Salman Wafeeq [*,1], **Mohamed Hazim M. Noori** [1], **Saif Mohamed Kani** [2]

[1] *AlNuaman Teaching Hospital, Ministry of Health, Baghdad, Iraq*
[2] *Baghdad Medical Complexity Centre, Ministry of Health, Baghdad, Iraq*

ARTICLE INFO

Article history

Received: 2021-09-10
Received in revised: 2021-11-01
Accepted: 2021-11-07
Manuscript ID: JMCS-2109-1265
Checked for Plagiarism: **Yes**
Language Editor:
Dr. Behrouz Jamalvandi
Editor who approved publication:
Dr. Zeinab Arzehgar

DOI:10.26655/JMCHEMSCI.2022.3.4

KEYWORDS

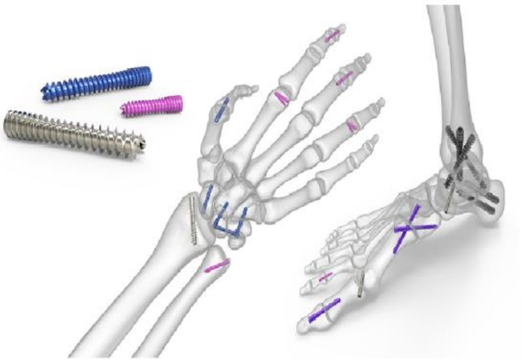
Headless screw fixation
Iraq
Modified mayo wrist score
Non-union
Scaphoid

ABSTRACT

This study investigated the outcomes of headless compression screw fixation and cancellous iliac crest bone graft chips procedure in the management of scaphoid waist non-union. The method was based on interventional research carried out in the Orthopedics operating room for a period from July 2018 to July 2020. It included 26 patients presented with symptomatic scaphoid nonunion confirmed by radiograph of the wrist and scheduled for surgical management by a non-structural autologous cancellous bone graft from the iliac crest and headless screw fixation. Patients were followed up at every four weeks' interval for six months and then three months for the total duration of 12 months. All parameters of the Modified Mayo Wrist Score were shown statistically significant at postoperative improvement except for grip strength. Total Modified Mayo Wrist Score showed that 61.5% of study patients were graded as a fair result, and no one reported excellent level. Six months postoperatively, 23.1% of patients reported excellent results, and 65.4% showed a good level.

GRAPHICAL ABSTRACT

Headless Compression Screw Fixation and Non-Structural Cancellous Iliac Crest Bone Chips Graft for Treatment of Scaphoid Non-Union



* Corresponding author: Bilal Salman Wafeeq
✉ E-mail: Email: shukribinbakar@gmail.com

Introduction

Scaphoid fractures are regarded as one of the most prevalent carpal fractures and usually happen in younger, energetic people [1–11]. They are responsible for nearly 2-7% of all of the fractures and roughly 60-70% of carpal bone fractures [12]. The foremost blood supply to the scaphoid is from the radial artery. Above 80% of the scaphoid, the surface is coated with articular cartilage [13, 14]. A scaphoid (navicular) fracture occurs when one of the wrist's tiny bones breaks. The most common cause of this fracture is a fall onto an extended hand. Pain and soreness in the region right below the base of the thumb are common symptoms of a scaphoid fracture. When you try to squeeze or grab anything, your symptoms may get worse. Depending on the degree of the fracture and its placement on the bone, scaphoid fracture treatment might range from casting to surgery. Complications with the healing process are prevalent because parts of the scaphoid have a weak blood supply, and a fracture can further impair the flow of blood to the bone.

Delays in diagnosing and inadequately treating dire scaphoid fractures can result in osteoarthritis, avascular necrosis, and nonunion [15–17]. In subjects with fractures in the middle part of the bone (waist of scaphoid) or the proximal pole, healing is more difficult [18, 19]. These areas of the scaphoid do not have a very good blood supply [20]. Nonunion takes place in over 12% of cases unless an occult fracture is identified and managed [21]. The severe outcomes of non-union, including increasing degenerative alterations and carpal collapse, the so-called SNAC wrist, have, for most cases, been normally active and young [22–24]. Treating scaphoid nonunion with carpal collapse offers a different difficulty for hand surgeons. Even though the scaphoid union is the major issue, surgeons need to be aware of scaphoid malalignment since the failure to identify and curing all of the parts of the deformity can lead to growing degenerative arthritis [25–27]. The current study aimed to analyze the outcome of headless compression screw fixation and cancellous iliac crest bone graft chips procedure in the management of scaphoid waist non-union.

Material and Methods

Study design, setting, and time

It was an interventional investigation performed in the Orthopedics operating room at Al-Numaan Teaching Hospitals and AL-Qima Private Surgical Hospital, Baghdad, Iraq, for a period from July 2018 to July 2020.

Study Population and Sample Size

The study included 26 patients presented with symptomatic scaphoid nonunion confirmed by radiograph, including lateral and billiard views of the wrist, posteroanterior, and scheduled for surgical management. Patients with complex associated scaphoid nonunion (perilunate dislocation, distal radius fracture, or arthritis and revision surgical cases) were excluded from this study. All patients were verbally informed about the study, and they were asked for their permission to be part of the study.

Over three months' post-traumatic permanent fracture was described as Non-union, with sclerotic changes or bone resorption on plain radiograph. Non-union was graded based on Herbert and Fisher's classification as fibrous (D1) or sclerotic (D2) [28].

Surgical procedure

Before surgery, we assessed for osteonecrosis employing magnetic resonance imaging (MRI), common radiographic results of AVN, such as subchondral bone collapse, cystic changes, and three-dimensional CT for scaphoid humpback deformity, a rise in bone density, a loss of the normal trabecular appearance, a scaphoid bone defect, and a DISI pattern of carpal malalignment in planning for deformity correction and choice of grafting. The volar approach of the wrist slightly to the radial side of the flexor carpi radialis tendon was used; inside the wrist capsule, the sclerotic border of the non-union was exposed through longitudinal capsulotomy, i.e., the capsule which is attached to lunate should be preserved to promote better vascularity and blood supply, after removal of the surrounding scar tissue. We designed a biconcave cavity till the healthy, well-vascularized cancellous bone was presented, utilizing a curette and burr to include the bone graft. After the joystick maneuver restored scaphoid form and a length with wrist extension, the guide-pin of a Headless Compression Screw (HCS) was injected from the distal fragment and moved through the cavity to the proximal segment below direct vision, where we included an extra K-wire to restrict the fragments' rotation. The cancellous bone was collected from the iliac crest through roughly 2-3 cm of the cortical window. Accumulated cancellous bone was made as chips and inserted into the ready cavity around the guide pin. The dorsal perspective of the scaphoid deficit was filled first, spreading across the non-union, and 2.4 mm Titanium HCS was inserted to maintain the scaphoid under image-intensifier guidance. The principal portion of the screw was placed in the center on the proximal pole, with the threads entirely crossing the bone graft.

Functional evaluation

Cases were checked every four weeks for nearly six months and the next three months for a whole 12 months, during which clinical and functional results were estimated. We evaluated the Changed Mayo Wrist Score prior to operation and after half a year postoperatively. This is a clinician-completed scoring system employed to assess the disability level in the wrist, considering pain, functional status, motion range, and grip strength [29]. There are a whole 100 cases classified between the evaluator's evaluation of pain (25 points) and the capability of returning to normal activities or employment (25 points), grip strength as a percentage of the opposite side (25 points), and active flexion/extension arc as a percentage of the opposite side (25 points). The poor outcome is less than 65 points, fair is 65–79 points, good is 80–89, and finally perfect is 90–100 points.

Statistical analysis

We analyzed the data with the aid of SPSS (Statistical Package for Social Sciences version 26). Then, the data were provided as standard deviation, mean, and ranges. After that, categorical data were provided through percentages and frequencies. Paired t-test was utilized to make a comparison between the continuous variables preoperatively and six months postoperatively. A level of P – value less than 0.05 was regarded as significant.

Results and discussion

In this study, age ranged from 17 to 42 years with a mean of 24.69 ± 5.44 years. As shown in Table 1, 57.7% of patients were ≥ 30 years, the majority of whom were males (84.6%), and about two-thirds (65.4%) of them were living in Baghdad. Regarding fracture characteristics, 92.3% accounted for the waist, 61.5% for the left side and 69.2% of non-union were classified as D2 by Herbert and Fisher classification. Regarding duration from injury to surgical intervention, it ranged from 3-18 months with a mean of 8.54 ± 2.4 months, and 61.5% of cases were presented in the duration of less than one year from the time of injury.

Table 1: Distribution of study patients by certain information

Variable	No. (n=26)	Percentage (%)
Age (Years)		
< 30	11	42.3
≥ 30	15	57.7
Gender		
Male	22	84.6
Female	4	15.4
Residence		
Baghdad	17	65.4
Outside Baghdad	9	34.6
Site of fracture		
Waist	24	92.3
Proximal pole	2	7.7
Side of fracture		
Left	16	61.5
Right	10	38.5
Non-union classification		
D1	8	30.8
D2	18	69.2
Duration from injury to surgical intervention (Month)		
< 12	16	61.5
≥ 12	10	38.5

Regarding parameters of Modified Mayo Wrist Score as shown in Table 2, there was statistically substantial postoperative advancement in all almost of the parameters (P < 0.05) except for grip strength when the improvement was statistically not significant (P = 0.121).

Table 2: Comparison in parameters of Modified Mayo Wrist Score preoperatively and six months postoperatively

Parameters of Modified Mayo Wrist Score	Time		P-Value
	Preoperatively Mean ± SD	Six months postoperatively Mean ± SD	
Pain Intensity	14.77 ± 1.7	21.15 ± 2.2	**0.001**
Functional Status	13.31 ± 1.4	20.38 ± 3.2	**0.001**
Range of Motion	11.37 ± 1.1	15.77 ± 2.8	**0.032**
Grip strength	13.44 ± 3.2	15.38 ± 4.8	**0.121**
Total Score	52.89 ± 4.4	72.69 ± 7.3	**0.001**

Regarding the total preoperative results of the Modified Mayo Wrist Score, 61.5% of study patients were graded as fair, and no one reported an excellent level. Six months postoperatively, 23.1% of patients reported excellent results, and 65.4% showed good levels, as shown in Table 3.

Table 3: Total results of Modified Mayo Wrist Score preoperatively and six months postoperatively

Modified Mayo Wrist Score	Time	
	Preoperatively (%) n= 26	Six months Postoperatively (%) n= 26
Poor	8 (30.8)	0 (0)
Fair	16 (61.5)	3 (11.5)
Good	2 (7.7)	17 (65.4)
Excellent	0 (0)	6 (23.1)

As shown in Table 4, by comparing follow up six months postoperatively to that preoperatively, highly statistically significant improvements were observed in pain score at the wrist from 1.54 to 0.15 (P = 0.001), when doing tasks from 6.77 to 1.15 (P = 0.001), when lifting a heavy object from 8.15 to 1.46 (P = 0.001), or at worst from 6.54 to 2.85 (P = 0.001) the last felling of pain from 5.54 to 1.92 (P = 0.001). Similarly, a high statistical significance (P = 0.001) was recorded in doing household work, personal care activities, or at work and leisure activities.

Table 4: Comparison in follow up parameters of pain and functions preoperatively and six months postoperatively

Follow up	Preoperatively Mean ± SD	Six months postoperatively Mean ± SD	P-value
1. Pain			
At rest	1.54 ± 0.97	0.15 ± 0.38	0.001
While performing a task with a repeated wrist/hand movement	6.77 ± 1.01	1.15 ± 0.9	0.001
When raising a heavy object	8.15 ± 0.8	1.46 ± 0.88	0.001
When it is at its worst	6.54 ± 0.66	2.85 ± 1.14	0.001
2. Function			
A - Specific activities			
Turn a doorknob using my affected hand	1.77 ± 1.24	1.31 ± 1.11	0.001
Cut meat using a knife in my affected hand	3.92 ± 1.44	2.38 ± 1.12	0.001
Fasten buttons on my shirt	1.46 ± 1.27	0.69 ± 1.11	0.112
Use my affected hand to push up from a chair Carry a 10lb object in my affected hand	5.77 ± 0.93	2.77 ± 0.73	0.001
Use bathroom tissue with my affected hand	4.77 ± 0.83	1.31 ± 1.18	0.001
B - Usual activities			
Personal care activities (washing, Dressing)	3.62 ± 0.96	1.92 ± 1.19	0.001
Household work (Cleaning, maintenance)	6.62 ± 0.96	3.00 ± 0.58	0.001
Other work (Your regular everyday work or job)	6.69 ± 1.11	3.46 ± 0.97	0.001
Recreational activities	6.54 ± 1.13	4.23 ± 1.09	0.001

Conclusion

Our surgery in scaphoid nonunion aims to achieve three goals: Restoring the scaphoid bone alignment and correcting any angular deformity, restoring the length of the scaphoid bone, treating the scaphoid nonunion, and achieving full integrity of bone. Amongst the various surgical options for treating scaphoid non-union, our option to use the iliac cancellous bone. Iliac cancellous bone is rich with Mesenchymal stem cells and/or corticocancellous bone grafting with compression headless screw fixation technique providing trustworthy outcomes [30].

The results were satisfactory based on the Mayo wrist score questionnaire. In another study, the nonunion rate after the Matti-Russe surgery method was compared in patients with the bone union and patients with persistent nonunion after a long-term follow-up of 2 to 27 years (mean: 8.8 years), and it was reported to be 28%. This is almost higher than in our study, with a nonunion rate of 13.3% after six months [31]. This might be due to stabilization after undergoing the Matti-Russe method in our study. Grip strength and range of movement were similar in both groups. Better clinical outcomes in patients with the bone union were, of course, observed.

Comparable conclusions were achieved by another research regarding 29 symptomatic scaphoids nonunion handled by a manageable and minimally invasive method utilizing a percutaneous autologous corticocancellous bone graft, in which no cases had pain at work, and all had a somewhat normal motion range and grip strength [32].

Similar findings consistent with this study were observed in another study when they found that the Matti-Russe method had a high union rate, which is consistent with our study and is better specifically for united fractures [33].

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Authors' contributions

All authors contributed toward data analysis, drafting and revising the paper and agreed to be responsible for all the aspects of this work.

Conflict of Interest

The authors declare that they have no competing interests.

ORCID

Mohamed Hazim M. Noori:
https://www.orcid.org/0000-0003-3294-2556

References

[1]. Sengodan V. C., Appusamy N., J. Natural Sci. Bio. Med., 2020, 11:3[Google Scholar], [Publisher]

[2]. Jontony N., Hill E. B., Taylor C.A., Boucher L.C., O'Brien V., Weiss R., Spees, C.K., Am. J. Health Behav., 2020, **44**:432 [Crossref], [Google Scholar], [Publisher]

[3]. Zhu Y, Ortiz A, Costa M., *J. Carcinog,* 2021, **20**:2 [Google Scholar]

[4]. Ali R., Baban R., Ali S., *Baghdad J. Biochem. Appl. Biol.,* 2021, **2**:118 [Crossref] [Google Scholar], [Publisher]

[5]. Shalaby M.N., *Int. J. Pharm. Res. Allied Sci.,* 2018, **7**:126 [Google Scholar]

[6]. Shalaby M.N., Sakoury M.M.A., Al-jameel S.S., Alghamdi A., *Int. J. Hum. Mov. Sports Sci.,* 2021, **9**:1146 [Crossref], [Google Scholar]

[7]. Ansari M. J., Ahmed M. M., Fatima F., Anwer M. K., Jamil S., Al-Shdefat R., Ali B., *Int. J. Biol. Pharm. Allied Sci.,* 2014, **3**:2668 [Google Scholar]

[8]. Theodorou D.J., Theodorou S.J., Georgiadis G., Papakostidis K., *Emerg. Radiol.*, 2021, 1 [Crossref], [Google Scholar], [Publisher]

[9]. Dias J., Kantharuban S., *Hand Clin.*, 2017, **33**:501 [Crossref], [Google Scholar], [Publisher]

[10]. Amrami K.K., Frick M.A., Matsumoto J.M., *Hand Clin.*, 2019, **35**:241 [Crossref], [Google Scholar], [Publisher]

[11]. Hayat Z., Varacallo M., 2019 [Google Scholar], [Publisher]

[12]. Sabbagh M.D., Morsy M., Moran S.L., *Hand Clin.*, 2019, **35**:259 [Crossref], [Google Scholar], [Publisher]

[13]. Nguyen M.K., Arkader A., Kaplan S.L., Guariento A., Hong S., Moore Z.R., Nguyen J.C.,

Pediatr. Radiol., 2021, 1 [Crossref], [Google Scholar], [Publisher]

[14]. Ansari S.A., Hirst J.T., Younis F., *Br. J. Hosp. Med.*, 2021, **82**:1 [Crossref], [Google Scholar], [Publisher]

[15]. Welle K., Täger S., Hackenberg R.K., Markowetz A., Schildberg F.A., Burger C., Wirtz D.C., Jansen T., Kabir K., *Z. Orthop. Unfall.*, 2021, **159**:202 [Crossref], [Google Scholar], [Publisher]

[16]. Warwick D., Watts A., Thomas J., *Apley Solomon's Syst. Orthop. Trauma,* CRC Press, 2017 [Google Scholar]

[17]. Buijze G.A., Jupiter J.B., *Scaphoid Fractures: Evidence-based Management*. Elsevier Health Sciences, 2017 [Google Scholar], [Publisher]

[18]. Ahrend M.-D., Teunis T., Noser H., Schmidutz F., Richards G., Gueorguiev B., Kamer L., *J. Orthop. Surg*., 2021, **16**:1 [Crossref], [Google Scholar], [Publisher]

[19]. Miyamura S., Lans J., He J.J., Murase T., Jupiter J.B., Chen N.C., *Bone Joint. J.*, 2020, **102-B**:1200 [Crossref], [Google Scholar], [Publisher]

[20]. Wildemann B., Ignatius A., Leung F., Taitsman L.A., Smith R.M., Pesántez R., Stoddart M.J., Richards R.G., Jupiter J.B., *Nat. Rev. Dis. Primers*, 2021, **7**:1 [Crossref], [Google Scholar], [Publisher]

[21]. Dana A., Christodoulides E., *J. Rehabil. Sci. Res.*, 2020, **7**:25 [CrossRef], [Google Scholar], [Publisher]

[22]. Aribert M., Bouju Y., Chaise F., Loubersac T., Gaisne E., Bellemère P., *Hand Surg. Rehabil.*, 2019, **38**:34 [Crossref], [Google Scholar], [Publisher]

[23]. Cioffi A., Rossello I.M., *medRxiv*, 2021 [Crossref], [Google Scholar], [Publisher]

[24]. Sheikh H., Morell D., Orthop. *Trauma*, 2021, **35**:180 [Crossref], [Google Scholar], [Publisher]

[25]. Aibinder W.R., Wagner E.R., Bishop A.T., Shin A.Y., *Hand*, 2019, **14**:217 [Crossref], [Google Scholar], [Publisher]

[26]. Kollitz K.M., Pulos N., Bishop A.T., Shin A.Y., *J. Hand Surg. Eur. Vol.*, 2019, **44**:600 [Crossref], [Google Scholar], [Publisher]

[27]. Yeo J.H., Kim J.Y., *J. Hand Surg. Asian-Pac. Vol.*, 2018, **23**:450 [Crossref], [Google Scholar], [Publisher]

[28]. Delgado-Serrano P.J., Jiménez-Jiménez I., Nikolaev M., Figueredo-Ojeda F.A., de Rozas-López M.G., *Rev. Esp. Cir. Ortopédica Traumatol. Engl. Ed.*, 2017, **61**:216 [Crossref], [Google Scholar], [Publisher]

[29]. Ma Z., Liu Z., Shi Q., Li T., Liu Z., Yang Z., Liu Y., Xu Y., Dai K., Yu C., *Orthop. Surg.*, 2020, **12**:792 [Crossref], [Google Scholar], [Publisher]

[30]. Mayfield C.K., Gould D.J., Dusch M., Mostofi A., *Hand*, 2019, **14**:508 [Crossref], [Google Scholar], [Publisher]

[31]. Kolodziej R.K., Blacha J., Bogacz A., Mazurkiewicz T., Ortop. Traumatol. Rehabil., 2006, **8**:507 [Google Scholar], [Publisher]

[32]. Bullens P.H.J., Driesprong M., Lacroix H., Vegter J., *J. Hand Surg.*, 2005, **30**:365 [Crossref], [Google Scholar], [Publisher]

[33]. Raju P.K., Kini S.G., *J. Orthop. Surg.*, 2011, **19**:80 [Crossref], [Google Scholar], [Publisher]

HOW TO CITE THIS ARTICLE

Mohamed Hazim M. Noori, Bilal Salman Wafeeq. Treatment of Scaphoid Non-Union by Iliac Cancellous Bone, *J. Med. Chem. Sci.*, 2022, 5(3) 315-320

DOI: 10.26655/JMCHEMSCI.2022.3.4

URL: http://www.jmchemsci.com/article_141316.html