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Original article

HEADLESS COMPRESSION SCREW FOR SURGICAL TREATMENT OF SCAPHOID FRACTURES

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Abstract: **Introduction:** Scaphoid bone fractures are common and present unique challenges due to the bone's specific fracture patterns and vascular supply. Prompt diagnosis and treatment of acute scaphoid fractures are crucial to prevent nonunion and subsequent wrist arthritis. While non-displaced fractures can often be managed conservatively, advancements in diagnostics, surgical techniques, and implant materials have driven an increasing preference for early surgical fixation.

Patients and Methods: Over a 12-month period, 10 male patients with scaphoid fractures underwent surgical treatment at the University Clinic of Traumatology in Skopje, from January 2022 to March 2024. The patients' mean age was 27.3 years. Diagnosis was confirmed using CT scans and X-rays, with four fractures affecting the left hand and six the right. All patients underwent open reduction and internal fixation using a headless compression screw. A volar approach was used in nine cases, and a dorsal approach in one.

Six patients were treated surgically within 4–14 days post-injury, while four were treated for nonunion after previous conservative management. Among these four, two presented at three months and two at seven months post-injury. The latter group required spongyoplasty and osteosynthesis due to scaphoid deformity, resorption, and bone loss.

Results: Patients were followed up at 1, 3, 6, and 12 months post-surgery. Physical therapy commenced four weeks after surgery, and radiographic monitoring continued until fracture healing was confirmed. No cases of wrist osteoarthritis were observed during the follow-up period.

Conclusion: Although this study represents a small series, it highlights the importance of individualized clinical decision-making for scaphoid fractures. Early surgical intervention can enhance comfort, facilitate quicker return to daily activities, and reduce immobilization duration.

Keywords: Scaphoid fracture, surgical treatment, headless compression screw, nonunion.

INTRODUCTION

Scaphoid fractures represent up to 70% of carpal bone fractures and 2–7% of all fractures (1). Secure fixation procedures with shorter immobilization durations allow patients to return to normal activities more quickly.

Operative screw fixation is a widely accepted method for managing displaced scaphoid fractures, reducing the risk of malunion or nonunion. There is a growing trend toward surgical treatment for non-displaced scaphoid fractures as well.

Current evidence does not support the long-term benefits of surgery over conservative treatment for undisplaced scaphoid fractures. The SWIFFT study, published by Dias et al. in 2020, compared nonsurgical and conservative treatments for minimally displaced scaphoid fractures (2). The results showed no significant differences in union rates, wrist movement, or strength at the 1-year follow-up.

All implants aim to provide solid fragment congruence and strong interfragmentary compression, which aids in the early recovery of wrist mobility. The screw size and threading vary, as do the cannulated and non-cannulated insertion methods. Jason et al. (3) found that headless compression screws were the preferred surgical fixation method among nearly all surgeons in their study.

Our study aimed to assess the effectiveness of headless compression screws in treating acute scaphoid

fractures and, in two cases, nonunions following prior conservative treatment.

PATIENTS AND METHODS

Over a 12-month period, 10 patients with scaphoid fractures received surgical treatment at the University Clinic of Traumatology in Skopje from January 2022 to March 2024. The mean age of the patients was 27.3 years, and all were male. Diagnosis was confirmed using CT(*Computed tomography*) scans and X-rays. Four fractures occurred on the left hand, and six on the right. A tourniquet was applied in all cases for better visualization during surgery.

All patients underwent open reduction and internal fixation with a headless compression screw. A volar approach was used in 9 cases, and a dorsal approach in 1. Six patients were treated surgically within 4–14 days after injury, while four underwent surgery due to nonunion after previous conservative management—two at 3 months and two at 7 months post-injury.

Figure 1. *Volar and dorsal approaches. Post-operative pictures of our patients*

For both approaches (Figure 1), a lengthwise incision of approximately 3 cm was made, and reduction was controlled using an image intensifier. After careful dissection at the level of the scaphoid, a guide wire

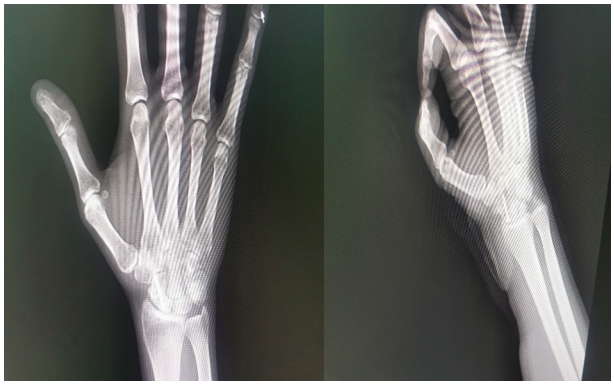

Figure 2. *Anteroposterior and lateral X-rays following the insertion of the headless compression screw*

Figure 3. *Comparative photos of wrist range of motion and grip strength between the operated and healthy hand, one year after surgery*

was placed under fluoroscopic guidance. The screw length was measured, and a cannulated reamer was inserted over the wire. Drilling was stopped before passing through the cortex of the proximal scaphoid pole.

A 2.5 mm headless screw of the appropriate length was placed after removing the reamer. Screw placement was confirmed by intraoperative fluoroscopy (Figure 2).

After surgery, a short-arm orthosis was applied, allowing unrestricted thumb interphalangeal movement while maintaining slight wrist extension. Stitches were removed 14 days post-surgery.

Physical therapy and active motion exercises were recommended after four weeks, and full weight-bearing was permitted after three months.

RESULTS

The patients were followed up at 1, 3, 6, and 12 months after surgery. Four weeks post-surgery, the patients were referred for physical therapy. No postoperative complications were observed, including wound infections, hardware failure or loosening, malunions, or avascular necrosis. Screw insertion was also without issues. Radiographic images were obtained until the fractures healed. A comparative follow-up evaluation of wrist range of motion and grip strength after surgery is shown in Figure 3. No development of wrist osteoarthritis was observed during the follow-up period.

DISCUSSION

Surgical treatment of acute unstable and/or displaced scaphoid fractures, as well as two cases of nonunions following previous conservative treatment, resulted in good functional and radiological outcomes. The nonunion cases, associated with scaphoid deformity, resorption, and bone loss, were treated with spongyoplasty and osteosynthesis using the headless compression screw.

In a study by Sebastian V. Gehrmann et al. (4), 21 patients with scaphoid fractures treated with head-

less compression screws achieved positive functional and radiographic outcomes. The compression screw provided stable fixation, promoting bone healing. At the final follow-up, a low DASH score was recorded, alongside promising wrist motion and grip strength (88% compared to 86% of the uninjured side). The union of the fractures was challenging to assess, as it is difficult to measure the fracture gap after compression, which is the primary purpose of the screw. Therefore, patient satisfaction with postoperative results is a more appropriate conclusion.

Patterson et al. (5) identified three risk factors predicting scaphoid nonunion: age at the time of surgery, dominant hand injury, and previous surgery on the affected scaphoid. These factors can guide collaborative decision-making between the patient, surgeon, and healthcare team. In our study, two of these risk factors were addressed—mean age was 27.3 years, and no previous surgeries on the injured hand were reported. The third risk factor, dominant hand injury, was not assessed.

Our study has limitations, including a small sample size. Surgeons should consider individual circumstances, physical activity, and the type of work when making clinical decisions about the treatment of scaphoid fractures.

CONCLUSION

Although this study represents a small series, it highlights the importance of individualized clinical decision-making in the treatment of scaphoid fractures. Early surgical healing can provide greater comfort, a quicker return to daily activities, and earlier removal of immobilization.

Conflict of Interests: The authors declare no conflicts of interest related to this article.

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Availability of Data and Materials: Datasets are available through the corresponding author upon reasonable request.

Note: Artificial intelligence was not utilized as a tool in this study.

Sažetak

KOMPRESIVNI ZAVRTANJ ZA OPERATIVNO LEČENJE PRELOMA SKAFOIDNE KOSTI

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Uvod: Prelomi skafoidne kosti su česti i predstavljaju specifičan izazov zbog karakterističnih obrazaca preloma i vaskularizacije. Pravovremena dijagnoza i lečenje akutnih preloma skafoida od suštinskog su značaja kako bi se sprečilo nesrastanje i kasniji razvoj osteoartritisa zgloba. Iako se neprilagođeni prelomi često mogu lečiti konzervativno, napredak u dijagnostici, hirurškim tehnikama i materijalima za implantate doveo je do sve veće sklonosti ka ranom hirurškom fiksiranju.

Pacijenti i metode: Tokom perioda od 12 meseci, 10 muških pacijenata sa prelomima skafoidne kosti podvrgnuto je hirurškom lečenju na Univerzitetskoj klinici za traumatologiju u Skoplju, od januara 2022. do marta 2024. godine. Prosečna starost pacijenata bila je 27,3 godine. Dijagnoza je potvrđena pomoću CT-a i rendgenskih snimaka, pri čemu su četiri preloma bila na levoj ruci, a šest na desnoj. Svi pacijenti su prošli kroz otvorenu redukciju i unutrašnju fiksaciju korišćenjem bezglavog kompresivnog zavrtnja. Volarni pristup je primenjen u devet slučajeva, a dorzalni pristup u jednom. Šest pacijenata je hirurški tretirano u periodu od 4 do 14 dana nakon povrede, dok su četiri pacijenta tretirana zbog nesrastanja nakon prethodnog konzervativnog lečenja. Među ovim pacijentima, dva su se javila tri meseca nakon povrede, a dva sedam meseci nakon povrede. Grupa koja se kasnije javila zahtevala je spongioplastiku i osteosintezu zbog deformiteta skafoida, resorpcije i gubitka kosti.

Rezultati: Pacijenti su praćeni tokom 1, 3, 6 i 12 meseci nakon operacije. Fizikalna terapija je započeta četiri nedelje nakon operacije, a radiografsko praćenje je nastavljeno dok nije potvrđeno izlečenje preloma. Nisu zabeleženi slučajevi osteoartritisa zgloba šake tokom perioda praćenja.

Zaključak: Iako ovaj rad predstavlja mali broj slučajeva, on naglašava važnost individualnog donošenja kliničkih odluka u lečenju preloma skafoidne kosti. Rana hirurška intervencija može poboljšati komfor, omogućiti brži povratak svakodnevnim aktivnostima i smanjiti trajanje imobilizacije.

Ključne reči: Prelom skafoidne kosti, hirurško lečenje, bezglavi kompresivni zavrtanj, nesrastanje.

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