Acute Fractures of the Carpal Scaphoid—Literature Review

Abstract

Background/Methods: Scaphoid fracture is the most common fracture in carpal bone of the wrist and represents 11% of all upper extremity fractures and between 70% and 80% of all carpal fractures. In most cases, the mechanism of injury is a fall with an outstretched hand. Although closed treatment of stable fractures of the scaphoid is associated with a high rate of healing, this method requires prolonged cast immobilization, which may lead to muscle atrophy, possible joint contracture, disuse osteopenia, and potential financial hardship. Because of this, internal fixation of fractures of the scaphoid has become popular.

The purpose of this review was to assess the current evidence supporting operative fixation versus casting for acute scaphoid fractures through a systematic review of the literature. Also assess if the final recommendations could be extrapolated to amateur or professional athletes.

Results: Our search yielded 69 articles that met our inclusion criteria with ten studies achieving level of evidence 1 according to Oxford Center for Evidence-based Medicine, 2 achieving level 2, and 57 levels 3 and 4.

Conclusion: This systematic review reveals that significant weaknesses exist in the literature with respect to the level of evidence and quality of published studies on this topic. Currently, there is insufficient evidence to support the most effective treatment for acute scaphoid fractures. We do not find randomized control trials about treatment of acute scaphoid fractures in athletes. Therefore, it is not possible to report treatment recommendations with adequate evidence-based support.

Keywords: Scaphoid fractures; Treatment; Sports; Injuries

Introduction

Scaphoid fractures are the most common fractures of the carpal bones of the wrist, and represent 11% of all fractures of the upper extremity and between 70% and 80% of all carpal fractures. In most cases, the mechanism of injury is a fall with an outstretched hand. Although closed treatment of stable fractures of the scaphoid is associated with a high rate of healing, this method requires prolonged cast immobilization, which may lead to muscle atrophy, possible joint contracture, disuse osteopenia, and potential financial hardship. Because of this, internal fixation of fractures of the scaphoid has become popular.

The importance of fracture of carpal scaphoid lies in the fact that the bone most commonly injured carpal is difficult to diagnose in many cases, and requires immobilization for long periods due in part to its peculiar vascularization [1].

Stable, minimally displaced or incomplete fractures can be treated conservatively, and generally the consolidation rate is high. But this method requires prolonged immobilization, which can cause muscle atrophy, joint stiffness, disuse osteopenia, as well as sports and prolonged sick leave [3].

Keywords: Scaphoid fractures; Treatment; Sports; Injuries

Results: Our search found 69 articles that met our inclusion criteria with ten studies achieving level of evidence 1 according to Oxford Center for Evidence-based Medicine, 2 achieving level 2, and 57 levels 3 and 4.

Conclusion: Currently there is insufficient evidence about the indications and effectiveness of conservative versus surgical treatment of acute fractures carpal scaphoid. There are no controlled clinical studies in only athlete population, so they cannot be made treatment recommendations based on the evidence in this subpopulation.

Introduction

The importance of fracture of carpal scaphoid lies in the fact that the bone most commonly injured carpal is difficult to diagnose in many cases, and requires immobilization for long periods due in part to its peculiar vascularization [1].

This type of fracture evolves with symptoms and clinical signs often confusing, which make the patient not seek immediate medical assistance; and when it does, this type of fracture may be missed on plain radiographs up to four weeks after the initial injury [2].

Stable, minimally displaced or incomplete fractures can be treated conservatively, and generally the consolidation rate is high. But this method requires prolonged immobilization, which can cause muscle atrophy, joint stiffness, disuse osteopenia, as well as sports and prolonged sick leave [3].

Because of these factors, internal fixation of minimally displaced fractures of the carpal scaphoid has become popular in recent years. There is general consensus on the treatment of fractures of the proximal pole of the scaphoid and delays of...
consolidation and nonunion, entities are treated surgically [4-6].

The main objective of this study is to establish the current evidence supporting surgical treatment versus conservative immobilization in acute fractures of the carpal scaphoid, through a literature review of the literature. Secondly, to analyze whether these therapeutic recommendations can be extrapolated to populations of amateur athletes and/or professionals.

**Material and Method**

The databases used for literature search were MEDLINE (PubMed-NCBI), Cochrane Library, MEDES (Medicine in Spanish), IME (Spanish Medical Index), and directories eBook as Virtual Health Library (VHL) Biblioteca Virtual Miguel de Cervantes and Project Gutenberg.

Within search strategies, the following keywords were used in databases in Castilian:

- a. “acute fractures” AND “scaphoid”
- b. “acute fractures” AND “navicular” AND “Deport **”
- c. “acute fractures” AND “navicular” AND “treatment”.

In the databases in English, the keywords used were:

- a. “acute fractures” AND “scaphoid”
- b. “acute fractures” AND “scaphoid” AND “sport **”
- c. “acute fractures” AND “scaphoid” AND “treatment”

To refine the search up several filters were applied. A time limit was established to focus the search between January 2001 and December 2011. The original language of accepted papers was limited to English and Spanish. Also only the search was limited to items which were human sample (not animal). The boolean AND operator was used.

For the selection of useful items for the purpose of the study, the parameters of the Oxford Centre for Evidence-based Medicine (OCEBM) [7] were used, and these should meet the following criteria:

- a. Type of study: level 1 to 4 OCEBM: randomized controlled studies, prospective studies, retrospective studies, systematic reviews, meta-analysis and case series.
- b. Type of fracture: isolated carpal scaphoid fractures.
- c. Patient type: skeletally mature.
- d. Type of treatment: primary treatment.
- e. Date of the articles published between 2001 and 2011.

The exclusion criteria applied were:

- a. Type of study: OCEBM level 5 (expert opinions).
- b. Type of fracture: scaphoid fractures associated with fractures of other bones of the carpus or wrist, nonunion.
- c. Patient type: skeletally immature.
- d. Type of treatment: treatment of scaphoid nonunion, revision surgery of acute scaphoid fractures.

All work and selected items were classified in laboratory studies, descriptive epidemiological studies, intervention, case studies and literature reviews, according to the criteria of OCEBM (Table 1). The categories of types of studies are:

| Table 1: Levels of evidence for the research question. Types of studies. |
|---------------------------------------------------------------|
| **Therapeutic Studies: Research Treatment Outcomes** | **Prognostic Studies: Research the Effect of a Patient Characteristic in the Outcome of a Disease** | **Diagnostic studies: research of a diagnostic test** | **Economic Analysis of Decision-Making: Development of an Economic Model of Decision-Making** |
| Level 1 | Controlled clinical trial (ECC) High quality with statistically significant difference or without it but with narrow confidence intervals. systematic review and meta-analysis of ECC Level 1 | High quality prospective studies (all patients were enrolled in the same point in the course of the disease, with follow-up 80%). Systematic review of studies Level 1 | Test previously developed diagnostic criteria in consecutive patients (with application of an ideal reference standard). Systematic review of studies Level 1 | Costs and sensitive alternatives; values obtained from many studies; with multiple sensitivity analyzes. Systematic review of studies Level 1 |
| Level 2 | ECC lower quality (eg <80% follow-up, unblinded, inadequate random selection. Comparative prospective study. systematic review of studies of Level 2 or Level 1 with inconsistent results | Retrospective study. Untreated controls an ECC. Prospective study of lower quality (eg. Patients enrolled in different point in the course of the disease or tracking <80%). Systematic review of studies Level 2. | Development of diagnostic criteria previously developed in consecutive patients (with application of an ideal reference standard). Systematic review of studies Level 2 | Costs and sensitive alternatives; values obtained from a limited number of studies; with multiple sensitivity analyzes. Systematic review of studies Level 2 |
| Level 4 | Series cases | Case Series | Cases and controls study. Standard reference Poor | Analysis without sensitivity analysis |
| Level 5 | Expert opinion | Expert opinion | Expert opinion |

Citation: Jakabfy BIT, Jaén TF (2016) Acute Fractures of the Carpal Scaphoid-Literature Review. MOJ Orthop Rheumatol 15(5):00196. DOI: 10.15406/mojor.2016.05.00196
A. Laboratory study: Prospective, analytical and experimental study that generated primary data is obtained in a laboratory environment.

B. Descriptive epidemiological study: study (transverse or longitudinal) describing the frequency of carpal scaphoid fractures in a cohort or subgroup cohort.

C. Intervention study: study the cause-effect relationship in a population to intervene and change the course causal factor of the injury then measuring the effect of the change.

D. Case Study: detailed of a person or group that shares a particular injury or disease analysis.

E. Book review: detailed records of all previous investigations on a particular subject structural analysis.

The following data were evaluated for each item: sample size, type of treatment performed, complications reported, consolidation percentage, percentage of nonunion, and number of weeks for consolidation.

These variables were chosen because they were the most frequently mentioned in most of the items selected in this study. Unfortunately, data such as scale analog pain of patients, measurements of grip strength, joint range of motion, time to return to sports or work, economic cost effective direct or indirect sequel of fractures were not collected because they are inconsistently reported in the articles studied.

**Results**

After the search in the various databases, 1016 items in total, set out in the following table they were found.

i) 69 articles that met the inclusion criteria for analysis were selected.

ii) Those articles that met the agreed exclusion criteria were discarded.

iii) Only 10 items were considered belonging to the group 1 level of evidence OCEBM [8-17]

iv) Two items were classified in the group of evidence level 2 [18,19]

v) 57 items were considered belonging to groups 3 and 4 evidence [1, 4-6, 20-74].

Epidemiological data on carpal scaphoid fractures of the studies were inconsistent. Data such as patient age, dominant hand, occupation, sports habits, psychosocial habits (such as smoking), concurrent diseases, many of the items are not mentioned, or do so incompletely.

In those articles reporting the mechanism of injury, fall on the extended wrist was the most frequently mentioned. Carpal scaphoid fractures occurred predominantly in male patients (about 80% of cases).

**Summary of studies loe 1**

A total of 10 items were considered belonging to the level of evidence 1 (Table 2). Of these, 6 are articles consisting of controlled clinical trials [8-10,13,14,17] and 4 correspond to systematic reviews (meta-analysis) of randomized controlled trials [11,12,15,16].

**Table 2: Results of literature search for Databases.**

| Source                        | Result | selected |
|-------------------------------|--------|----------|
| NCBI-PubMed                   | 987    | 55       |
| Cochrane library              | 4      | 0        |
| Spanish Medicine (MEDES)      | 0      | 0        |
| EMI Biomedicine               | 1      | 0        |
| Virtual Health Library        | 24     | 14       |
| Biblioteca Virtual Miguel de Cervantes | 0    | 0        |
| Project Gutenberg             | 0      | 0        |
| **Total**                     | 1016   | 69       |

**Controlled clinical trials (CCTs):** Bond et al. [9] conducted a prospective controlled clinical trial where the results of 25 consecutive acute fractures of the carpal scaphoid in physical and athletically active military personnel were analyzed. They were randomly assigned to a group that underwent surgery with percutaneous cannulated screw by Acutrak (11 patients) or immobilized with antebrachiopalmar cast (14 patients). Variables such as time of fracture healing, range of motion of the wrist, grip strength, return to their work and sports activities, and the degree of satisfaction with the final results obtained were evaluated.

The fracture healing was obtained in an average of 7 weeks in the operated group and 12 weeks in the group treated with plaster casts (p = 0.0003) group.

The average time for return to work or sport was 8 weeks in the group operated, and 15 weeks in the non-operated (p = 0.0001). They found no significant differences in variables such as grip strength and joint range of motion two years after the injury.

The satisfaction rate was elevated with both procedures. Adolfsson et al. [8] treated 53 patients with undisplaced fractures of the carpal scaphoid, acute (less than 14 days duration). The cases were randomized into two groups: 28 were immobilized with a below the elbow plaster cast for 10 weeks, and 25 were surgically treated by percutaneous insertion of a screw Acutrak.

They found no statistically significant differences between treatment groups in relation to the rate of fracture healing or part-time consolidation of the same. There were no differences in grip strength of the affected hand, although those who had surgery had greater range of joint motion, assessed at week 16 of treatment. The authors concluded that percutaneous internal fixation of acute displaced fractures of the scaphoid using screws Acutrak allows early mobilization without adverse effects on fracture healing.

Vinnars et al [10] studied 83 patients with acute non-displaced fracture or minimally displaced scaphoid between 1992 and 1997. Patients were randomized into two groups: one immobilized with short cast below the elbow and another operated with Herbert screw osteosynthesis. An average of ten years after the initial injury, 75 (93%) of the patients were re-evaluated both clinically and radiologically.
The authors found that all fractures had consolidated. In the group that had surgery, there was a significantly higher prevalence of osteoarthritis between the trapezium and scaphoid joint. There were no differences regarding subjective symptoms between the two groups, and both grip strength of the hand and the range of joint movement were higher in the group not operated (but this difference was not significant from a statistical standpoint).

The authors found that there are no real long-term benefits of internal fixation compared with conservative treatment of these fractures and the long-term risks of internal fixation of acute fractures undisplaced or minimally displaced scaphoid should be considered and explained properly to patients when surgical treatment is recommended.

Dias et al. [13] studied 88 patients with acute fractures of the carpal scaphoid, and distributed randomly into two groups: 44 treated by immobilization with short cast below the elbow and free thumb and another group of 44 treated with internal fixation with Herbert screw. Patients were evaluated at weeks 2, 8, 12, 26 and 52 of evolution; severity of pain, edema, wrist mobility, grip strength, and related symptoms. In addition, radiographs each monitoring visits were made. They found that in the corresponding week 8 review, the range of joint mobility and grip strength were higher in the group operated, although it was on this visit when patients treated with plaster group were removed it.

Patients in both groups returned to their work or sports activities between weeks 5 and 6. In control of week 12, grip strength was greater in the group of operated cases. No significant differences between the two groups regarding the variables studied in the other control dates found. 10 patients in the treatment group with immobilization not consolidated in week 12, so the treatment was changed and underwent surgery. There were complications in 13 of the surgically treated, 10 of which were minors and related to surgical scar.

The study authors conclude that is not clearly demonstrates that early internal fixation of acute scaphoid fractures exceeds plaster fixation in the first 12 weeks. They believe that the strategy of internal fixation of minimally displaced scaphoid fractures or not displaced, which will also consolidate if are immobilized with a cast, will lead to an excessive number of surgery cases, exposing these patients to unnecessary risks.

So they advocated the treatment “aggressive conservative”, which begins with treatment with immobilization short cast and serial radiological controls (including computerized tomography) are performed until week 6 to 8. In patients with no radiographic signs consolidation treatment is changed for internal fracture fixation (with or without bone grafts). With this behavior they achieved consolidation rates higher than 95% in these patients.

Dias et al. [14], in an article published in 2008, described the outcome after 93 months of treatment of 71 patients with an acute fracture of the scaphoid who were randomly assigned to a group of conservative treatment with plaster below the elbow (36 cases) or a group that underwent surgery with Herbert screw (35 cases).

These patients were the same as discussed in the previous article [25], but now followed long term.

Radiographs were obtained in 59 patients. Osteoarthritis changes were found between the trapezium and scaphoid joint and radioscaphoid joints in 8 (13.5%) of those treated surgically, and in 6 (10.2%) treated conservatively. 3 patients had radiolucent images around the screw, but were asymptomatic. One patient in the conservative group had nonunion and avascular necrosis of the scaphoid.

The authors conclude that in the medium term (93-month follow-up) no statistically significant differences in the clinical and radiological outcome between the two groups of patients. Schaedel Hopfner et al. (17) conducted a prospective, multicenter clinical study with 94 patients with acute, stable, middle third of the scaphoid fracture. Patients were randomly assigned to a group that was operated with a cannulated screw or group immobilized with a short cast below the elbow. 6 months follow up in both groups of patients was performed.

The authors found that at 15 weeks of evolution, patients who underwent surgery returned earlier to their regular work activities or sports that those immobilized in cast. They also had significantly better functional outcome, less pain and were generally more satisfied with the results.

They conclude that early surgical treatment facilitates return to previous activity level of patients with better functional outcome, less pain, achieving a higher level of satisfaction with low complication rates.

**Systematic reviews and meta-analysis of controlled clinical trials (MA) reviews:** We found 4 systematic reviews and meta-analysis of controlled clinical trials revisions. Suh et al. [11] performed in 2010 a systematic review and meta-analysis trying to establish the evidence for surgical or conservative treatment of acute fractures carpal scaphoid. They found 59 items in total that met their inclusion criteria, of which only 4 studios Sackett level 1 were considered.

After performing the meta-analysis, where 115 patients treated surgically and other 112 treated conservatively were included, they conclude that there is insufficient evidence to advocate the benefits of one treatment over another. The same results were obtained in the remaining 55 items classified as evidence levels 2 to 4.

Buijze et al. [12] conducted a systematic review of the literature between 1966 and 2009. They selected eight controlled trials comparing conservative and surgical treatment for acute scaphoid fractures in adults carpal. In the meta-analysis they included 419 patients in total, of which 207 were treated surgically and 212 with conservative methods.

They found mixed results favorable to the surgical option when measured variables such as satisfaction rates, grip strength, speed consolidation, labor and sports return. They found no significant differences between the groups of operated and treated conservatively when analyzing variables such as the presence of pain, range of motion of the wrist, nonunion, or treatment costs.

The complication rate was higher in the surgically (23.7%) compared with treated conservatively treated (9.1%) group, although the difference was not considered statistically
significant. The authors conclude that surgical treatment of these fractures provides superior results to conservative treatment on parameters such as satisfaction with the results, grip strength, return rates to work and sports. However, the presence of complications related to surgical treatment should be carefully weighed during clinical evaluation.

Doornberg et al. [15] conducted a systematic review of the literature between 1966 and 2010, and selected 4 items comparing different types of conservative treatment for acute fractures carpal scaphoid.

In total 523 patients were included. Two studies compared casts below the elbow against casts above the elbow. A study compared a cast below the elbow including the thumb versus a cast below the elbow excluding the thumb. Another study compared a cast below the elbow with wrist flexion of 20° against cast below the elbow with wrist extension of 20°.

After analyzing all the data, the authors conclude that there is no significant evidence regarding consolidation rates, grip strength, joint range of motion of the wrist, pain, nonunion or a vascular necrosis with different methods of conservative treatment studied.

Ibrahim et al. [16] conducted a systematic review of the literature from 1990 to 2009, and after evaluating 67 items, selected 6 controlled clinical studies, with a total of 363 patients with acute fractures including carpal scaphoid.

After the meta-analysis carried out, they found open and internal fixation of the fracture osteosynthesis with a Herbert screw had a probability of 0.73 of being the best available treatment, compared with percutaneous osteosynthesis, below the elbow plaster with or without inclusion of the thumb. The authors conclude that although Herbert screw osteosynthesis increases the rate of fracture healing in their meta-analysis, its superiority over other therapeutic alternatives is not significant from a statistical standpoint. Due to the higher rate of complications related to surgical treatment, recommend a pattern of aggressive conservative treatment.

**Summary of studies loe 2**

In our literature review two studies classified at the level of evidence 2 OCEBM were found.

McQueen et al. [18] studied 60 patients with fracture of the middle third of the scaphoid, which were randomly assigned to two groups. The first was treated by percutaneous internal fixation with a Acrutak screw and the second immobilized with below the elbow cast.

They studied variables such as grip strength, joint range of motion of the wrist, return to work or sport, functional recovery rate (by test Green / O’Brien), in addition to performing radiological studies in each follow-up visit. Patients were evaluated for 1 year. They found that patients in the surgical group had a rate of bone consolidation significantly greater than those treated conservatively (9.2 weeks vs 13.9 weeks, p <0.001). There was a higher rate of nonunion in conservatively treated.

Patients treated with internal fixation reintegrated more quickly to their sport and to their regular work. They found a very low rate of complications in both groups. The authors recommend that all active athletes and patients should be operated by a percutaneous internal fixation of scaphoid fracture.

Saeden et al. [19] compared the long-term results of 61 patients (62 fractures of the carpal scaphoid) treated conservatively or surgically. They randomly assigned 30 fractures to the group of conservative treatment with plaster below the elbow, and 32 fractures underwent surgical treatment using osteosynthesis with Herbert screw.

They found no statistically significant differences between the two groups to study variables as a function of the wrist, radiological fracture union, or carpal arthrosis after a follow-up period of 12 years.Surgically treated patients showed signs of osteoarthritis in the joint between trapezium and scaphoid more frequently but these findings were not correlated with subjective symptoms. The authors conclude that surgical treatment of acute scaphoid fractures lead to a faster return to previous sports or work levels, and should be considered in patients for whom prolonged cast immobilization is not acceptable, as athletes.

**Summary of studies loe 3 And 4**

A total of 57 studies were classified between levels of evidence 3 and 4 of the OCEBM [1,4-6,20-69,75-78].

In these studies, they used all treatment methods mentioned above.

The consolidation rate obtained in different studies of series of cases in which treatment was surgical internal fixation was 96%, significantly higher than in those groups treated conservatively (90%).

The difference in the rate of consolidation was not significant from a statistical standpoint between groups treated surgically or conservatively. Nor was there any significant between different types of casts or different surgical techniques or materials used.

The most common complications reported among patients treated conservatively were carpal osteoarthritis and pain. The most frequent complications in the group underwent surgery were related to discomfort with osteosynthesis material, pain, infections in the surgical wound, dysesthesia in radial nerve, complex regional pain syndrome (reflex sympathetic dystrophy syndrome), carpal osteoarthritis distal, among other less frequent complications.

Due to the large number of studies covered, immobilization protocols, surgical approaches, and osteosynthesis materials were highly variable the postoperative care. The conclusions and recommendations were also highly variable. Many articles advise internal fixation of these fractures as they allow a faster sport and return to work with lower social and economic cost with few complications, without providing data to support these claims.

**Discussion**

Our literature review covers a decade, we analyzed a total of
69 studies published between 2001 and 2011 that met our criteria for inclusion and exclusion. Of these items, only 10 were described as belonging to the group of level 1 evidence, of which 6 are controlled clinical trials [8-10,13,14,17] and 4 are studies review and meta-analysis [11,12,15,16].

Therefore, there is little high quality literature on which to base appropriate treatment recommendations.

In articles where sports or work habits of the patients were described, usually athletes were included with sedentary patients in the same group. And in other articles the sport habits in patients was not described. Therefore there is no specific data regards athlete population in carpal scaphoid fractures.

A key aspect in all these studies is to define what each group of authors considers the consolidation of the scaphoid fracture, which varies from one study to another. For this reason, compare rates of fracture healing described in several studies may be inaccurate, since similar fractures can be interpreted as consolidated in a study or delayed union in another.

Dias et al. used conventional radiographs to establish bone fracture healing, reserving the use of computed tomography only for those cases in which a space between the fracture fragments in plain radiography after 16 weeks of treatment was observed. So they classified five fractures in the conservative treatment group as established nonunion, when later shown that consolidation finally occurs.

We believe the use of CT it is important when classifying fractures that are to be included in a study, as displaced fractures (they have a lower rate of bone healing). In studies like McQueen et al., both displaced fractures and non-displaced fractures were classified together in one group, possibly altering the final results. The results found in controlled clinical studies of group level 1 evidence have shown that patients undergoing surgery have achieved a higher rate of consolidation, and these data are statistically significant.

Surgical interventions made and osteosynthesis material used was different in each case. There was no consensus on the final recommendations of the authors, as some advocate internal fixation and internal fixation of fractures while others defend a conservative treatment, surgical intervention only in the absence of consolidation.

The results of the studies classified as evidence level 2 showed that there is no statistically significant difference between scaphoid fractures treated surgically or conservatively. McQueen et al. [18] certainly they describe a statistically significant difference over time consolidation, reporting faster in cases operated, but their results were based on a small number of patients that were operated by several surgeons. In addition, consolidation is determined based on plain radiographs, CT scans was not performed in these cases. And the authors mixed cases of displaced fractures with non-displaced fractures.

The results of the studies classified as Level 3 and 4 were highly variable and sometimes difficult to understand because they used very diverse data and in many case series there was no control group. For this reason the final recommendations of the authors of these studies were dismissed.

Based on our review of the medical literature it is not possible to establish a consensus on the appropriate treatment of acute fractures carpal scaphoid. We found that there is insufficient evidence in the literature to support the trend to surgical treatment. In fact, the surgical treatment of these fractures is associated with postoperative complications. Therefore, in certain cases it may be more convenient conservative treatment (sedentary workers, non-athletes, etc.).

Our findings are consistent with studies review and meta-analysis recently [11,12,15,16] published.

These authors have examined several controlled clinical studies of evidence level 1 (also included in our study), and its final conclusions state that the surgical treatment of acute non-displaced or minimally displaced scaphoid fractures has not proven to be superior to conservative treatment with immobilization in different variants.

The parameters studied were the rate of fracture healing, which are consistently described in all articles. Information concerning the grip strength, joint range of motion, pain, time to return to sport or work, patient satisfaction, were established in an inconsistent or incomplete manner.

Moreover, in these studies it is highlighted that surgical treatment is associated with complications such as osteoarthritis between the trapezium and scaphoid joint. Therefore, there is currently not enough evidence about the indications and the effectiveness of surgical versus conservative treatment of acute fractures carpal scaphoid.

Future studies should use a multicenter controlled clinical trial, to avoid the limitations of studies with few cases. A study should also be conducted in athletes population to assess the evidence of treatment in this special group. In addition, computed tomography should be used instead of plain radiographs to establish the types of scaphoid fracture and progression of bone consolidation.

Conclusion

Currently there is no evidence in the scientific literature to support the indication and the effectiveness of surgical versus conservative treatment of acute fractures carpal scaphoid. There are no controlled clinical studies that indicate the type of treatment to be applied in athletes.

Early surgical treatment of carpal scaphoid fractures is supported by a small number of studies of variable level of evidence, and is associated with complications such as trapezium and scaphoid joint osteoarthritis. We recommend that all studies in the future consist in a multicenter controlled clinical trial, avoiding the limitations of studies with few cases. In addition, we recommend conducting a controlled clinical study in athlete’s population to delineate the therapeutic indications in these patients.
References

1. Basu A, Lomasney LM, Demos TC, Bednar MS (2005) Your diagnosis? Scaphoid fracture. Orthopedics 28(2):86, 177-180.

2. Chen AC, Lee MS, Ueng SW, Chen WJ (2010) Management of late-diagnosed scaphoid fractures. Injury 41(6): e10-e14.

3. Geissler WB, Adams JE, Bindra RR, Lanzinger WD, Slutzky DJ (2012) Scaphoid Fractures: What’s Hot, What’s Not. J Bone Joint Surg Am 94(2): 169-181.

4. Muller M, Germann G, Sauerbier M (2008) Minimal invasive screw fixation and early mobilization of acute scaphoid fractures in the middle third: operative technique and early functional outcome. Tech Hand Up Extrem Surg 12(2): 107-113.

5. Haisman JM, Rohde RS, Weiland AJ (2007) Acute fractures of the scaphoid. Instr Course Lect 56: 69-78.

6. Drexler M, Haim A, Pritsch T, Rosenblatt Y (2011) [Isolated fractures of the scaphoid: classification, treatment and outcome] Article in Hebrew Harefuah 150(1): 50-55,67.

7. Group OLoEW (2011) The Oxford 2011 Levels of Evidence.

8. Adolfsen L, Lindau T, Arner M (2001) Acutrak screw fixation versus cast immobilisation for undisplaced scaphoid waist fractures. J Hand Surg Br 26(3): 192-195.

9. Bond CD, Shin AY, McBride MT, Dao KD (2001) Percutaneous screw fixation or cast immobilization for nondisplaced scaphoid fractures. J Bone Joint Surg Am 83A(4): 483-488.

10. Vinnars B, Pietreanu M, Bodestedt A, Ekenstam F, Gerdin B (2008) Nonoperative compared with operative treatment of acute scaphoid fractures. A randomized clinical trial. J Bone Joint Surg Am 90(6):1176-1185.

11. Suh N, Benson EC, Faber KJ, MacDermid J, Grewal R (2010) Treatment of acute scaphoid fractures: a systematic review and meta-analysis. Hand (N Y) 5(4): 345-353.

12. Buijze GA, Doornberg JN, Ham JS, Ring D, Bhandari M, et al. (2010) Surgical compared with conservative treatment for acute nondisplaced or minimally displaced scaphoid fractures: a systematic review and meta-analysis of randomized controlled trials. J Bone Joint Surg Am 92(6): 1534-1544.

13. Dias JJ, Wildlin CJ, Bhowal B, Thompson JR (2005) Should acute scaphoid fractures be fixed? A randomized controlled trial. J Bone Joint Surg Am 87(10): 2160-2168.

14. Dias JJ, Dhiukaram V, Abhinav A, Bhowal B, Wildlin CJ (2008) Clinical and radiological outcome of cast immobilisation versus surgical treatment of acute scaphoid fractures at a mean follow-up of 93 months. J Bone Joint Surg Br 90(7):899-905.

15. Doornberg JN, Buijze GA, Ham SJ, Ring D, Bhandari M, et al. (2011) Nonoperative Treatment for Acute Scaphoid Fractures: A Systematic Review and Meta-Analysis of Randomized Controlled Trials J Trauma 71(4):1073-1081.

16. Ibrahim T, Qureshi A, Sutton AJ, Dias JJ (2011) Surgical versus nonsurgical treatment of acute minimally displaced and undisplaced scaphoid waist fractures: pairwise and network meta-analyses of randomized controlled trials. J Hand Surg Am 36(11): 1759-1768.e1.

17. Schädel Hopfner M, Marent Huber M, Gazyakan E, Tanzer K, Werber KD, et al. (2010) Acute non-displaced fractures of the scaphoid: earlier return to activities after operative treatment. A controlled multicenter cohort study. Arch Orthop Trauma Surg 130(9): 1117-1127.

18. McQueen MM, Gelbeke MK, Wakefield A, Will EM, Gaebler C (2008) Percutaneous screw fixation versus conservative treatment for fractures of the waist of the scaphoid: a prospective randomised study. J Bone Joint Surg Br 90(1): 66-71.

19. Saeden B, Tornkvist H, Ponzer S, Hoglund M (2001) Fracture of the carpal scaphoid. A prospective, randomised 12-year follow-up comparing operative and conservative treatment. J Bone Joint Surg Br 83(2): 230-234.

20. Chen NC, Jupiter JB, Jebsen PJL (2009) Sports-Related Wrist Injuries in Adults. Sports Health: A Multidisciplinary Approach. Sports Health 1(6): 469-477.

21. Geissler WB (2001) Carpal fractures in athletes. Clin Sports Med 20(1): 167-188.

22. Arora R, Gschwentner M, Krappinger D, Lutz M, Blauth M, et al. (2007) Fixation of nondisplaced scaphoid fractures: making treatment cost effective. Prospective controlled trial. Arch Orthop Trauma Surg 127(1): 39-46.

23. Atiken S, Court Brown CM (2008) The epidemiology of sports-related fractures of the hand. Injury 39(12): 1377-1383.

24. Arbiter D, Piatek S, Wielas F, Winckler S (2009) [The scaphocapitate fracture syndrome (Fenton)]. Handchir Mikrochir Plast Chir 41(3): 171-174.

25. Brutus JP, Baeten Y, Chahidi N, Kinnen L, Moermans JP, et al. (2002) Percutaneous Herbert screw fixation for fractures of the scaphoid: review of 30 cases. Chir Main 21(6): 350-354.

26. Brutus JP, Chahidi N (2004) Could this unusual scaphoid fracture occurring in a badminton player be a stress fracture? Chir Main 23(1): 52-54.

27. Rizzo M, Shin AY (2006) Treatment of acute scaphoid fractures in the athlete. Curr Sports Med Rep 5(5): 242-248.

28. Heckmann A, Lahoda LU, Alkandari Q, Vogt PM, Knohlock K (2008) C-type scaphoid fracture in a elite power lifter. Sportverletz Sportschaden 22(2): 106-108.

29. Bedi A, Jebsen PJ, Hayden RJ, Jacobson JA, Martus JE (2007) Internal fixation of acute, nondisplaced scaphoid waist fractures via a limited dorsal approach: an assessment of radiographic and functional outcomes. J Hand Surg Am 32(3): 326-333.

30. Webb BG, Rettig LA (2008) Gymnastic wrist injuries. Curr Sports Med Rep 7(5): 289-295.

31. Zlotow DA, Bennett C (2008) Athletic injuries of the hand and wrist. Current Orthopaedic Practice 19(2): 206-211.

32. Van Tassel DC, Owens BD, Wolf JM (2010) Incidence estimates and demographics of scaphoid fracture in the U.S. population. J Hand Surg Am 35(8): 1242-1245.

33. Shih JT, Lee HM, Hou YF, Tan CM (2005) Results of arthroscopic reduction and percutaneous fixation for acute displaced scaphoid fractures. Journal of arthroscopic & related surgery 21(5): 620-626.

34. Drac P, Manak P, Labonek I (2005) Percutaneous osteosynthesis versus cast immobilisation for the treatment of minimally and non-displaced scaphoid fractures. Biomed Pap Med Fac Univ Palacky Olomouc Czech Repub 149(1): 149-151.
35. Drac P, Manak P, Cizmar I, Hrbek J, Zapletalova J (2010) [A palmar percutaneous volar versus a dorsal limited approach for the treatment of non- and minimally-displaced scaphoid waist fractures: an assessment of functional outcomes and complications]. Acta Chir Orthop Traumatol Cech 77(2): 143-148.

36. P Dráč, P Manák, I Čížmař, J Hrbek, J Zapletalová (2010) Pálmové perkutání nebo dorzální limitované operace v průběhu minimálně diskolokovaných a nediskolokovaných zlomenin střední tretiny chováte kostí: funkční výsledky a měří komplikací. Acta chirurgiae orthopaedicae et traumatologiae 77: 143-148.

37. Cecília López D, Suárez Arias L, Jara Sánchez F, Resines-Erasun C (2009) Fracturas del escafoides tratadas mediante osteosíntesis percutánea volar. Revista Española de Cirugía Ortopédica y Traumatología 53(6): 364-370.

38. Hosey RG, Hauk JM, Boland MR (2006) Scaphoid stress fracture: an unusual cause of wrist pain in a competitive diver. Orthopedics 29(6): 503-505.

39. Parmelee Peters E, Kauthore SW (2005) The wrist: common injuries and management.Prim Care 32(1): 35-70.

40. Knobloch K, Kramer R, Redelcr J, Spies M, Vogt PM (2009) Scaphoid fracture in motorcross riders. Sportverletz Sportschaden 23(4): 217-220.

41. Muramatsu K, Doi K, Kuwata N, Kawakami F, Ibara K, Kawai S (2002) Scaphoid fracture in the young athlete-therapeutic outcome of internal fixation using the Herbert screw. Arch Orthop Trauma Surg. 122(9): 510-513.

42. Shin AH, Hofmeister EP (2004) Percutaneous fixation of stable scaphoid fractures. Tech Hand Up Extrem Surg 8(2): 87-94.

43. Nowak MR, Kirkpatrick AW, Boffard JA, Amponsah D, Dulchavsky SA (2009) Snowboarding injuries: a review of the literature and an analysis of the potential use of portable ultrasound for mountainside diagnostics. Curr Rev Musculoskelet Med 2(1): 25-29.

44. Morgan WI, Slowman LS (2001) Acute hand and wrist injuries in athletes: evaluation and management. J Am Acad Orthop Surg 9(6): 389-400.

45. Meyers MC, Sterling JC, Souryal TD (2003) Radiographic findings of the upper extremity in collegiate rodeo athletes. Med Sci Sports Exerc 35(4): 543-547.

46. Yip HS, Wu WC, Chang RY, So TY (2002) Percutaneous cannulated screw fixation of acute scaphoid waist fracture. J Hand Surg Br 27(1): 42-46.

47. Meermans G, Verstreken F (2008) Percutaneous transtrapezial fixation of acute scaphoid fractures. The Journal of hand surgery. European volume 33(6): 791-796.

48. Walsh JJ (2004) Fractures of the hand and carpal navicular bone in athletes. South Med J 97(8): 762-765.

49. Teng XF, Chen H, Wei P (2009) Treatment of scaphoid waist fractures. Zhongguo Gu Shang 22(12): 946-948.

50. Snead D, Rettig AC (2001) Current Opinion in Orthopaedics 12(2): 160-166.

51. Slade JF, 3rd, Grauer JN, Mahoney JD (2001) Arthroscopic reduction and percutaneous fixation of scaphoid fractures with a novel dorsal technique. Orthop Clin North Am 32(2): 247-261.

52. Slade JF 3rd, Jaskwhich D (2001) Percutaneous fixation of scaphoid fractures. Hand Clin 17(4): 553-574.

53. Sauerbier M, Muller M (2007) Scaphoid fractures: diagnosis, surgical approach, and complications. Zentralbl Chir 132(3): W42-W53, quiz W4-W5.

54. Rettig AC (2003) Athletic injuries of the wrist and hand. Part I: traumatic injuries of the wrist. Am J Sports Med 31(6): 1038-1048.

55. Ram AN, Chung KC (2009) Evidence-based management of acute nondisplaced scaphoid waist fractures. J Hand Surg Am 34(4): 725-738.

56. Papaloizos MV, Fusetti C, Christen T, Nagy L, Wasserfallen JB (2004) Minimally invasive fixation versus conservative treatment of undisplaced scaphoid fractures: a cost-effectiveness study. J Hand Surg Br 29(2): 116-119.

57. Oeppen RS, Jaramillo D (2003) Sports injuries in the young athlete. Top Magn Reson Imaging 14(2):199-208.

58. Le TB, Hentz VR (2000) Hand and wrist injuries in young athletes. Hand Clin 16(4): 597-607.

59. Kujala S, Raatikainen T, Kaarela O, Ashamakhi N, Ryhanen J (2004) Successful treatment of scaphoid fractures and nonunions using bioabsorbable screws: report of six cases. J Hand Surg Am 29(1): 68-73.

60. Kovacicj, Bengfeldj (2005) Return to play issues in upper extremity injuries. Clin J Sport Med 15(6): 448-452.

61. Kawamura K, Chung KC (2008) Treatment of scaphoid fractures and nonunions. J Hand Surg Am 33(6): 988-997.

62. Irisarri Castro C, Y-Ez Calvo J, Pombo Exp Sito S (2007) Fracturas y pseudoartrosis del escafoides carpiano. Revista Española de Cirugía Ortopédica y Traumatología 51: 113-123.

63. Iacobellis C, Baldan S, Aldegger R (2011) Percutaneous screw fixation for scaphoid fractures. Musculoskelet Surg 95(3): 199-203.

64. Chen AC, Chao EK, Hung SS, Lee MS, Ueng SW (2005) Percutaneous screw fixation for unstable scaphoid fractures. J Trauma 59(1): 184-187.

65. Karle B, Mayer B, Kitzinger HB, Frohner S, Schmitt R, et al. (2005) Scaphoid fractures--operative or conservative treatment? A CT-based classification. Handchir Mikrochir Plast Chir 37(4): 260-266.

66. Blum A, Sauer B, Detreille R, Zabel JP, Pierrucci F, Witte Y, et al. (2007) The diagnosis of recent scaphoid fractures: review of the literature. J Radiol 88(Pt 2): 741-759.

67. Moreno Ramos MD, Martinez Hervás M, Sanz Rupp P, Ramos Medrano J (2011) Analysis of the management of occult fractures of the scaphoid through early magnetic resonance imaging. Radiología 55(3): 247-252.

68. Geissler WB, Hammit MD (2001) Arthroscopic aid in the management of scaphoid fractures. Hand Clin 17(4): 575-588.

69. Shin AH, Horton T, Bishop AT (2005) Acute coronal plane scaphoid fracture and scapholunate dissociation from an axial load: a case report. J Hand Surg Am 30(2): 366-372.

70. Wong K, von Schroeder HP (2011) Delays and poor management of scaphoid fractures: factors contributing to nonunion. J Hand Surg Am 36(9): 1471-1474.
71. Fowler JR, Ilyas AM (2010) Headless compression screw fixation of scaphoid fractures. Hand Clin 26(3): 351-361.

72. Colvin AC, Lynn A (2010) Sports-related injuries in the young female athlete. Mt Sinai J Med 77(3): 307-3014.

73. Goldfarb CA (2007) Traumatic wrist instability: what's in and what's out. Instr Course Lect 56: 65-58.

74. Ghoneim A (2011) The unstable nonunited scaphoid waist fracture: results of treatment by open reduction, anterior wedge grafting, and internal fixation by volar buttress plate. J Hand Surg Am 36(1): 17-24.

75. Li B, Yuan H, Bai JP, Xilin BL (2009) Surgical or conservative treatment for acute nondisplaced scaphoid fractures in adults: a systematic review (Provisional abstract). Chinese Journal of Evidence-Based Medicine 9(8):844-848.

76. Evans MW (2004) Hamate hook fracture in a 17-year-old golfer: importance of matching symptoms to clinical evidence. J Manipulative Physiol Ther 27(8): 516-518.

77. Bjørnsen LP (2008) Bilateral combined fractures of the scaphoid and distal radius in a 13-year-old male. Acta Orthop Belg 74(6): 856-859.

78. Cho CH, Song KS, Min BW, Bae KC, Lee KJ, et al. (2009) Scaphoid nonunion in break-dancers: a report of 3 cases. Orthopedics 32(7): 526.