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Surgical versus conservative treatment of undisplaced or minimally-displaced acute scaphoid waist fractures: a systematic review and meta-analysis

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TÍTULO DISSERTAÇÃO/~~MONOGRAFIA~~ (riscar o que não interessa)

Surgical versus conservative treatment of undisplaced or minimally-displaced acute scaphoid waist fractures: a systematic review and meta-analysis

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É AUTORIZADA A REPRODUÇÃO INTEGRAL DESTE TRABALHO APENAS PARA EFEITOS DE INVESTIGAÇÃO, MEDIANTE DECLARAÇÃO ESCRITA DO INTERESSADO, QUE A TAL SE COMPROMETE.	☐
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“Sometimes, the simplest clinical problems are very tough to sort out.”

Richard Buckley

Surgical versus conservative treatment of undisplaced or minimally-displaced acute scaphoid waist fractures: a systematic review and meta-analysis

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Keywords: Scaphoid fracture, surgical treatment, conservative treatment, systematic review, meta-analysis, randomized controlled trial.

Surgical versus conservative treatment of undisplaced or minimally-displaced acute scaphoid waist fractures: a systematic review and meta-analysis

ABSTRACT

Purpose: The aim of this study was to evaluate the effectiveness of surgical compared with conservative treatments for undisplaced or minimally-displaced acute waist scaphoid fractures.

Methods: Databases were searched for randomized controlled trials comparing surgical fixation with conservative treatment with or without possible early surgical fixation of fractures that fail to unite, in patients with acute undisplaced or minimally-displaced scaphoid waist fractures. Patient-reported functional outcome, wrist range of motion (ROM), grip strength, time to return to work, fracture union, and complications were assessed. The data of the studies included was pooled using a random-effects model. Weighted and standard mean differences or relative risk were calculated for continuous or dichotomous variables, respectively. PRISMA guidelines were followed.

Results: Five studies were included, representing data from a total of 643 patients. Meta-analysis showed that surgical treatment of nondisplaced or minimally-displaced scaphoid waist fractures results in significantly better patient-reported functional outcome, wrist ROM and grip strength at 12-weeks follow-up, but that there are no significant differences between the two groups regarding these outcomes at 52-weeks. No significant differences were found between the two treatment approaches on fracture union rate, but surgical fixation was associated with a significantly higher risk of complications.

Conclusions: On the management of undisplaced or minimally-displaced scaphoid waist fractures, although surgical treatment results in better functional outcomes on the short-term compared to conservative treatment, these differences decrease over recovery time with both groups showing good functional recovery. Additionally, when patients are initially treated with

cast immobilization and closely monitored targeting the early detection and fixation of fractures that fail to unite, they achieve a similar overall rate of fracture union avoiding surgical overtreatment and the related complications.

Level of Evidence: Therapeutic II

Keywords: Scaphoid fracture, surgical treatment, conservative treatment, systematic review, meta-analysis, randomized controlled trial.

INTRODUCTION

The scaphoid is the most commonly fractured carpal bone. Scaphoid fractures account for about 60-90% of carpal fractures,[1,2] and usually occur in young male patients in their most productive working years.[3-5] The typical mechanism of injury is a fall onto an outstretched hand with the wrist in extension and radial deviation.[2,6] Most fractures (64%) affect the waist of the scaphoid, with 31% occurring at the distal pole, and 5% at the proximal pole.[4]

Given the precarious vascular supply and the complex anatomy, the scaphoid bone is especially vulnerable to fracture-related complications.[7] Delays in diagnosis or inadequate treatment of acute scaphoid fractures can result in malunion, nonunion or avascular necrosis. If left untreated, these complications almost inevitably result in osteoarthritis, causing further functional limitation and disability at a relatively young age.[8]

Despite extensive research in this field, controversy still exists over which is the most appropriate therapeutic approach for selected types of scaphoid fractures. Particular discussion is seen in the literature regarding nondisplaced and minimally-displaced waist scaphoid fractures treatment. The best-established risk factor for nonunion of a waist scaphoid fracture is displacement.[9] A scaphoid fracture is considered displaced if radiographs show a step or gap of 1mm or more.[10] Angulation and rotation between fragments can also define displacement but are more difficult to assess. When displacement is > 2mm, most clinicians will opt for internal fixation, considering the unacceptable rate of osteonecrosis, delayed union, and nonunion observed with cast immobilization.[11]

Regarding nondisplaced or minimally-displaced scaphoid waist fractures, traditionally, cast immobilization has been the mainstay of treatment, with reported union rates ranging from 85% to 95%.[12] Notwithstanding, with the development and improvement of minimally invasive, percutaneous techniques, there has been a trend towards operative management of non- or minimally-displaced waist fractures, despite the lack of robust evidence supporting this

therapeutic choice[13].

Throughout the years, a handful of randomized clinical trials (RCTs)[14-20] comparing surgical and conservative treatments for acute scaphoid fractures have been done worldwide, in the hope of finding the best treatment evidence. Unfortunately, especially hampered by relatively small sample sizes, these studies rendered inconclusive and controversial results. Consequently, these RCTs have been systematically reviewed several times[21-25] with the overarching goal of archiving more robust conclusions. However, most previous systematic reviews did not focus only on undisplaced or minimally-displaced scaphoid waist fractures, analyzing data from studies that also included patients with other types of scaphoid fractures.

Therefore, we aim to do a systematic review and meta-analysis of the RCTs available to estimate the effectiveness of surgical fixation compared with cast immobilization for undisplaced or minimally-displaced (≤ 2mm displacement) acute waist scaphoid fractures hoping to reach more solid evidence that will allow clinicians to decide on the best treatment for these types of fractures.

METHODS

Study design

This systematic review and meta-analysis was developed according to the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) Statement.[26]

Search strategy

A systematic search was performed in MEDLINE (using the PubMed interface), SCOPUS, Web of Science, and Cochrane Central Register of Controlled Trials for articles published from database inception to December 2021, using the queries provided in Table S1. No language restrictions were applied. Additionally, clinical trial registration databases (ClinicalTrials.gov and WHO International Clinical Trials Registry Platform) were searched,

looking for relevant trials at any completion stage. Lastly, reference lists from relevant review articles identified during this search and the included RCTs were manually checked to identify additional potentially eligible trials.

Eligibility criteria

Inclusion criteria were: (a) studies: RCTs; (b) population: patients with acute undisplaced or minimally-displaced (≤ 2mm displacement) scaphoid waist fractures; (c) intervention: surgical fixation (open reduction and internal fixation, or percutaneous fixation); (d) comparison: initial conservative treatment (all types of cast immobilization) with or without possible early surgical fixation of fractures that fail to unite; (e) outcomes: patient-reported functional outcome, fracture union, wrist range of motion (ROM), grip strength, time to return to work and complications.

Study selection

After the removal of duplicates, two authors independently screened the titles and abstracts of the identified articles. Subsequently, after reading the full text of the articles not excluded in the screening phase, two authors independently selected those meeting the established eligibility criteria. Disagreements during the selection process were solved by consensus, or by the judgment of a third author.

Data extraction and risk of bias assessment

Data extraction was carried out independently by two authors using a predesigned data extraction form. When information of interest was not possible to extract from a publication, the corresponding author was contacted via e-mail requesting the unpublished data. Risk of bias was assessed by the same independent authors using the Cochrane Collaboration Risk of Bias Tool for RCTs.[27] Any discrepancies regarding the extracted data and risk of bias assessment were resolved by consensus.

Statistical analysis

A meta-analysis was performed for all outcome variables assessed by more than one study and for which we had sufficient data. Subgroup analysis was prospectively planned for studies that compared patients treated by surgical fixation with patients treated by (1) cast immobilization until fracture union or (2) cast immobilization followed by possible early surgical fixation of fractures that fail to unite. This subgroup analysis was only performed for those outcomes where more than one study in each subgroup reported eligible data. In cases where the standard deviations (SDs) were not provided, we used the method described in the Cochrane Handbook for Systematic Reviews of Interventions to obtain the required statistic from the *p*-value or the confidence interval (CI).[28] Pooled mean differences (MDs) with a 95% CI were used for the meta-analysis of continuous variables reported with the same scales, whereas standardized mean differences (SMDs) with a 95% CI were calculated whenever different studies evaluated the same continuous outcome with different measures. For the meta-analysis of dichotomous variables, the relative treatment effect was expressed as pooled risk ratios (RR) with a 95% CI. A random-effect model was used, and summary estimates of the overall treatment effects were provided in the form of a forest plot. A p-value of < 0.05 was interpreted as statistically significant. Heterogeneity was assessed by the Q-Cochrane p-value and by the I^2 statistics: a p-value < 0.10 and an $I^2 > 40\%$ were considered to represent substantial heterogeneity. Review Manager (RevMan) version 5.4.1 (The Cochrane Collaboration, 2020) was used for data processing and data analysis.

RESULTS

Search results

A total of 926 records resulted from our search strategy. After duplicate removal, 708 records remained for title and abstract screening, of which 684 were excluded leaving 24 articles

for full-text review. The full-text of one article was not available for retrieved, and 15 articles were excluded for not satisfying the eligibility criteria. As a result, 8 articles were included in this systematic review (Figure 1). One article from Dias et al.[17] reported the long-term follow-up data of a cohort of patients for which the short-term results have been previously published.[14] These two publications were considered to form one study, being combined in our analysis. Additionally, the results of one RCT have been published in two medical journals. For this systematic review, we mainly consulted the first publication[29] (primary clinical results), resorting to the second[30] (extended version reporting additional cost-benefits analysis) to obtain additional relevant information whenever it was not described in the first. Data from the same sample of patients were reported in two different publications from Clementson et al.[12,31] For this meta-analysis, only the publication reporting more complete information[31] was considered. No relevant additional studies were identified by analyzing the references of previous systematic reviews and the included articles.

Studies characteristics

The final five included studies[14-16,29,31] were published between April 2001 and October 2020. Overall, a total of 643 patients were assessed with sample sizes ranging from 25 to 439. The participants' mean age ranged from 24 to 33 years. Two RCTs[15,16] included only individuals with undisplaced scaphoid waist fractures, while the remaining[14,29,31] assessed patients with both undisplaced or minimally-displaced scaphoid waist fractures. Among the 643 patients, 313 were treated with surgical fixation, whereas 330 underwent conservative treatment. Surgical intervention included internal fixation by means of either an open (one RCT[14]), or percutaneous approach (three RCTs[15,16,31]), and in one study[29] the patients were treated with either one of the two previous describe approaches, depending on the surgeon's preferred technique. Cast immobilization included above and below elbow casts with or without inclusion of the thumb. Three studies[15,16,31] maintained cast immobilization until fracture union

and the two others studies[14,29] initially treated patients with cast immobilization for approximately 10 weeks, followed by recommendation for surgical fixation in fractures that fail to unite after this period (Table 1). Dias et al.[14] nominate this last approach as an "aggressive conservative treatment". For the purpose of this study, to facilitate the comprehension for the reader, we will adopt this designation.

Risk of bias assessment

Figures 2 and 3 summarize the risk of bias assessment of the included studies. Most of the studies met the random sequence generation and allocation concealment criteria, except for one study[31] that did not present a clear description of the randomization process. No study was blinded, and all studies reported losses of follow-up. Three studies[15,16,31] excluded patients after the randomization process, two of them[15,31] based on reasons that can potentially have created an imbalance between the two treatment arms. In only two of the five studies[14,29] did the authors clearly state that their analysis was based on intention-to-treat principles.

Functional patient-reported outcome

Three of the five selected studies assessed patient-reported functional outcome at different timepoints, but based on different validated scores of hand and wrist function: the Disabilities of Arm, Shoulder and Hand score[31], the Patient-Related Wrist Evaluation[29], and the Patients Evaluation Measure.[14]

Two studies[29,31] found statistically significant differences between the two treatment groups at 6-weeks, with patients treated with cast immobilization showing higher disability than patients treated with surgical fixation. The same effect was founded by one study[14] at 8-weeks, and by another[31] at 10-weeks. At 12-weeks, while one study[29] showed significantly higher scores for the conservative group, another study[14] did not find significant differences between the two groups. In the following timepoints, none of the studies found significant differences between groups on patient-reported functional outcome.

Data from one study[31] could not be included in our meta-analysis because it presents median and not mean values. Thus, data from patient-reported functional scores were pooled only across two studies.[14,29] Meta-analysis revealed a significant difference in pooled treatment effect in favour of surgical treatment at 12-weeks (SMD=-0.28, 95% CI=[-0.46, -0.10], p=0.002; I^2=0%, p=0.60). Patient-reported functional scores at 26- and 52-weeks follow-up were not significantly different between the two treatment groups (Figure 4).

Wrist range of motion and grip strength

All studies evaluated wrist ROM and grip strength but assessment timepoints were not always coincident.[14-16,29,31] Moreover, the measures used to present results on these outcomes also varied, with some authors presenting a percentage in comparison with the uninjured hand and others giving an actual value of the affected hand.

We were only able to perform a meta-analysis for the timepoints assessments in which more than one study reported consistent data. Meta-analysis found significant differences in wrist ROM at 12-weeks (SMD=0.20, 95% CI=[0.03, 0.37], p=0.02; I^2=0%, p=0.42), with patients treated with surgical fixation reporting better results than patients treated with cast immobilization. At 52-weeks no significant differences between the two treatment arms were found (Figure 5). Patients treated with surgical fixation had significantly greater grip strength than patients treated with cast immobilization at 12-weeks' follow-up (SMD=0.26, 95% CI=[0.03, 0.49], p=0.03; I^2=23%, p=0.26). However, differences between the two treatment groups were not significant at 52-weeks follow-up (SMD=0.16, 95% CI=[-0.36, 0.69], p=0.54), although substantial heterogeneity was observed (I^2=80%, p=0.02) (Figure 6).

Time to return to work

Three studies[14,16,29] reported patients' time to return to work. One study [16] reported that patients treated with surgical fixation returned to work significantly earlier than patients treated with cast immobilization. However, the two other studies[14,29] did not find significant differences

in the time off work between treatment groups.

No significant differences in time to return to work could be detected in our meta-analysis (MD=-19.6, 95% CI=[-52.52, 13.31], p=0.24), although severe heterogeneity was observed (I^2=99%, p<0.001) (Figure 7).

Fracture union

All studies assessed fracture union. Meta-analysis on the overall rates of union did not show significant differences between the two treatment groups. Subgroup analysis demonstrated that the rate of union was also not significantly different between patients treated with surgical fixation in comparison with patients treated only with cast immobilization or those receiving aggressive conservative treatment (Figure 8).

Complications

Complications were reported in all studies. Meta-analysis showed that the relative risk of complications was significantly higher in the surgical group when compared with the conservative group (RR=3.41, 95% CI=[2.06, 5.64], p<0.001; I^2=0%, p=0.92). Although, while subgroup analysis showed a significantly higher risk of complications in patients treated with surgical fixation in comparison with those treated with an aggressive conservative treatment (RR=3.51, 95% CI=[2.07, 5.94], p<0.001; I^2=0%, p=0.45), no significant differences were found between patients treated with surgical fixation and those treated with cast immobilization until fracture union (Figure 9).

DISCUSSION

Several previous systematic reviews and meta-analysis were documented in the literature comparing surgical and conservative treatments for acute scaphoid fractures, hoping to find a clear advantage of one treatment over the other.[21-24] However, seemingly no study has settled on a definitive conclusion. To the best of our knowledge, to date, no other systematic

review and meta-analysis comparing surgical with conservative treatment for only nondisplaced or minimally-displaced waist scaphoid fractures has been published. Proximal pole fractures are generally recommended to be treated with surgical fixation due to a reportedly high rate of nonunion, probably as a consequence of precarious blood supply.[32,33] Similarly, for those fractures with a displacement greater than 2mm, most clinicians advocated surgical management to decrease the gap between fragments, and reduce the difficulties to bridge this defect with bone.[11,30] Based on that, we advocated that the inclusion of these types of fractures in previous meta-analyses have represented a limitation to further achieving a robust conclusion.

Our meta-analysis found a significantly better functional outcome in patients treated with surgical fixation, at 12-weeks follow-up. As illustrated in three of the included primary studies that assessed patient-reported functional outcome, writs ROM, and grip strength at different timepoints of follow-up, these outcomes generally improve over time.[14,29] The active functional use of the hand and wrist after immobilization plays a key role in improving function. In both studies included in our meta-analysis, participants in the cast immobilization group were more likely to still be or had just come out from a plaster cast at 12-weeks follow-up.[14,29] Consequently, because they have had a shorter period of mobilization, is expected that they present more functional limitations in the firsts follow-up assessments. At 52-weeks, no significant differences were found between surgical and conservative treatments groups on these outcomes, which suggested that after initiating active mobilization, patients of both treatment groups were able to achieve a similar functional recovery. In agreement, studies assessing these outcomes two or more years after treatment also found no significant differences between the two treatment groups.[14,16,31]

In meta-analysis regarding the time off work, severe heterogeneity was observed. A plausible explanation for the high heterogeneity values may be related to the differences

between the populations assessed. Bond et al.[16] studied a sample of full-time military personnel and defined the variable time off work as the time until patients returned to full military duty. Given the fact that this is a job that implies high physical demands, it is more likely that it can only be fully performed after the complete remotion of the plaster cast. On the other hand, in the two other studies, the meantime off work was shorter than the meantime of cast immobilization, which suggests that many patients returned to work still immobilized with a cast or a splint. These studies found no significant differences in time off work between patients treated with surgical fixation and patients treated with cast immobilization.[14,29] The increasing trend to immediately fix waist scaphoid fractures is many times attributed to supposed short-term benefits such as a faster return to work.[13,18] However, pool data on this variable to provide clinical recommendations could be unwise. Although the return to work should be considered a relevant outcome, standardizing it may be questionable as this variable can be dependent on a host of confounding factors. Such as examples, it can depend on the patients' type of job, their motivation to return to work, the support and flexibility provided by their employer and insurance company, if the patient injured the dominant or nondominant hand, and the limitation inherent to the type of cast immobilization performed. Considering these difficulties in generalizing data, we highlight the need to analyze results on time off work with caution.

In trials in which surgical fixation was offered to patients in the conservative group who failed to achieve fracture union up to 12-weeks follow-up, meta-analysis showed no significant differences between the two treatment groups in the fracture union rates but a significantly higher risk of complications in the surgical treatment group. Patients with delayed union or nonunion are more likely to develop fracture-related complications.[8] Previous literature showed that the rate of union after early identification and surgical fixation of an ununited fracture is high.[30,34] Accordingly, this may suggest that when surgery is offered to patients that do not reach fracture union by 12-weeks of cast immobilization, this intervention reduces the risk of

developing consequent complications from fracture nonunion. Subgroup analysis regarding trials in which cast immobilization was maintained until fracture union was achieved, showed no significant differences in both fracture union and complications rate between the two treatment groups. Nevertheless, these findings must be interpreted with caution considering some limitations. All the studies included in this subgroup analysis have small samples sizes which limited the ability to detect clinically significant differences between treatment groups on nonunion and complication rates[15,16,31] Furthermore, two of the included studies had a high risk of bias and excluded patients after randomization which rendered the distribution between the two treatment groups uneven. [15,31]

Despite the foregoing limitations, we believe that this meta-analysis also has several strong points and offers useful conclusions based on the published RCTs. On the management of non- or minimally-displaced scaphoid waist fractures we showed that although surgical treatment results in better functional outcomes in the short term when compared to conservative treatment, these differences decrease over recovery time with both treatment groups showing good functional recovery. Additionally, it seems that when patients are initially treated with cast immobilization and closely monitored targeting the early detection and fixation of fractures that fail to unite, they achieve a similar overall rate of fracture union avoiding a surgical overtreatment and the related complications. If for some groups of patients, a faster recovery of function and a quick return to their previous full activity may be an important treatment goal, for others this may not be enough to reward the increased risk of complications arising from surgery, and the treatment option should reflect on that. Future additionally clinical trials carefully designed to overreach the methodological limitations previously exposed are needed to achieve more robust and comprehensive results in the field.

REFERENCES

1. Hove LM. Epidemiology of scaphoid fractures in Bergen, Norway. *Scand J Plast Reconstr Surg Hand Surg*. Dec 1999;33(4):423-6. doi:10.1080/02844319950159145

2. Leslie IJ, Dickson RA. The fractured carpal scaphoid. Natural history and factors influencing outcome. *J Bone Joint Surg Br*. Aug 1981;63-b(2):225-30. doi:10.1302/0301-620x.63b2.7217146

3. Van Tassel DC, Owens BD, Wolf JM. Incidence Estimates and Demographics of Scaphoid Fracture in the U.S. Population. *Journal of Hand Surgery*. 2010;35(8):1242-1245. doi:10.1016/j.jhsa.2010.05.017

4. Garala K, Taub NA, Dias JJ. The epidemiology of fractures of the scaphoid: impact of age, gender, deprivation and seasonality. *Bone Joint J*. May 2016;98-b(5):654-9. doi:10.1302/0301-620x.98b5.36938

5. Swärd EM, Schriever TU, Franko MA, Björkman AC, Wilcke MK. The epidemiology of scaphoid fractures in Sweden: a nationwide registry study. *J Hand Surg Eur Vol*. Sep 2019;44(7):697-701. doi:10.1177/1753193419849767

6. Weber ER, Chao EY. An experimental approach to the mechanism of scaphoid waist fractures. *The Journal of Hand Surgery*. 1978/03/01 1978;3(2):142-148. doi:10.1016/S0363-5023(78)80062-8

7. Büchler U, Nagy L. The issue of vascularity in fractures and non-union of the scaphoid. *J Hand Surg Br*. Dec 1995;20(6):726-35. doi:10.1016/s0266-7681(95)80036-0

8. Vender MI, Watson HK, Wiener BD, Black DM. Degenerative change in symptomatic scaphoid nonunion. *J Hand Surg Am*. Jul 1987;12(4):514-9. doi:10.1016/s0363-5023(87)80198-3

9. Swart E, Strauch RJ. Diagnosis of scaphoid fracture displacement. *J Hand Surg Am*. Apr 2013;38(4):784-7; quiz 787. doi:10.1016/j.jhsa.2012.10.025

10. Garala K, Singh H, Dias J. Chapter 10 - Diagnosis of Displaced Scaphoid Fractures. In: Buijze GA, Jupiter JB, eds. *Scaphoid Fractures: Evidence-Based Management*. Elsevier; 2018:83-90.

11. Singh HP, Taub N, Dias JJ. Management of displaced fractures of the waist of the scaphoid: Meta-analyses of comparative studies. *Injury*. 2012/06/01/ 2012;43(6):933-939. doi:10.1016/j.injury.2012.02.012

12. Clementson M, Jørgsholm P, Besjakov J, Björkman A, Thomsen N. Union of Scaphoid Waist Fractures Assessed by CT Scan. *J Wrist Surg*. Feb 2015;4(1):49-55. doi:10.1055/s-0034-1398472

13. Dy CJ, Kazmers NH, Baty J, Bommarito K, Osei DA. An Epidemiologic Perspective on Scaphoid Fracture Treatment and Frequency of Nonunion Surgery in the USA. *Hss j*. Oct 2018;14(3):245-250. doi:10.1007/s11420-018-9619-3

14. Dias JJ, Wildin CJ, Bhowal B, Thompson JR. Should Acute Scaphoid Fractures Be Fixed?: A Randomized Controlled Trial. *JBJS*. 2005;87(10):2160-2168. doi:10.2106/jbjs.D.02305

15. Adolfsson L, Lindau T, Arner M. Acutrak Screw Fixation Versus Cast Immobilisation for Undisplaced Scaphoid Waist Fractures. *Journal of Hand Surgery*. 2001;26(3):192-195. doi:10.1054/jhsb.2001.0558

16. Bond CD, Shin AY, McBride MT, Dao KD. Percutaneous Screw Fixation or Cast Immobilization for Nondisplaced Scaphoid Fractures. *JBJS*. 2001;83(4):483. doi:10.2106/00004623-200104000-00001

17. Dias JJ, Dhukaram V, Abhinav A, Bhowal B, Wildin CJ. 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*. Jul 2008;90(7):899-905. doi:10.1302/0301-620x.90b7.20371

18. McQueen MM, Gelbke MK, Wakefield A, Will EM, Gaebler C. Percutaneous screw fixation versus conservative treatment for fractures of the waist of the scaphoid: a prospective randomised study. *J Bone Joint Surg Br*. Jan 2008;90(1):66-71. doi:10.1302/0301-620x.90b1.19767

19. Vinnars B, Pietreanu M, Bodestedt A, Ekenstam F, Gerdin B. Nonoperative compared with operative treatment of acute scaphoid fractures. A randomized clinical trial. *J Bone Joint Surg Am*. Jun 2008;90(6):1176-85. doi:10.2106/jbjs.G.00673

20. Saedén B, Törnkvist H, Ponzer S, Höglund M. Fracture of the carpal scaphoid. A prospective, randomised 12-year follow-up comparing operative and conservative treatment. *J Bone Joint Surg Br*. Mar 2001;83(2):230-4. doi:10.1302/0301-620x.83b2.11197

21. Al-Ajmi TA, Al-Faryan KH, Al-Kanaan NF, et al. A Systematic Review and Meta-analysis of Randomized Controlled Trials Comparing Surgical versus Conservative Treatments for Acute Undisplaced or Minimally-Displaced Scaphoid Fractures. *Clin Orthop Surg*. Mar 2018;10(1):64-73. doi:10.4055/cios.2018.10.1.64

22. Alnaeem H, Aldekhayel S, Kanevsky J, Neel OF. A Systematic Review and Meta-Analysis Examining the Differences Between Nonsurgical Management and Percutaneous Fixation of Minimally and Nondisplaced Scaphoid Fractures. *Journal of Hand Surgery*. 2016;41(12):1135-1144.e1. doi:10.1016/j.jhsa.2016.08.023

23. Buijze GA, Doornberg JN, Ham JS, Ring D, Bhandari M, Poolman RW. 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*. Jun 2010;92(6):1534-44. doi:10.2106/jbjs.I.01214

24. Shen L, Tang J, Luo C, Xie X, An Z, Zhang C. Comparison of Operative and Non-Operative Treatment of Acute Undisplaced or Minimally-Displaced Scaphoid Fractures: A

Meta-Analysis of Randomized Controlled Trials. *PLOS ONE*. 2015;10(5):e0125247. doi:10.1371/journal.pone.0125247

25. Ibrahim T, Qureshi A, Sutton AJ, Dias JJ. Surgical Versus Nonsurgical Treatment of Acute Minimally Displaced and Undisplaced Scaphoid Waist Fractures: Pairwise and Network Meta-Analyses of Randomized Controlled Trials. *Journal of Hand Surgery*. 2011;36(11):1759-1768.e1. doi:10.1016/j.jhsa.2011.08.033

26. Page MJ, McKenzie JE, Bossuyt PM, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ*. 2021;372:n71. doi:10.1136/bmj.n71

27. Higgins JP, Altman DG, Gøtzsche PC, et al. The Cochrane Collaboration's tool for assessing risk of bias in randomised trials. *Bmj*. Oct 18 2011;343:d5928. doi:10.1136/bmj.d5928

28. Higgins JPT LT, Deeks JJ (editors). Chapter 6: Choosing effect measures and computing estimates of effect. In: Higgins JPT TJ, Chandler J, Cumpston M, Li T, Page MJ, Welch VA, ed. *Cochrane Handbook for Systematic Reviews of Interventions version 63 (updated February 2022)*. www.training.cochrane.org/handbook.

29. Dias JJ, Brealey SD, Fairhurst C, et al. Surgery versus cast immobilisation for adults with a bicortical fracture of the scaphoid waist (SWIFFT): a pragmatic, multicentre, open-label, randomised superiority trial. *Lancet*. Aug 8 2020;396(10248):390-401. doi:10.1016/s0140-6736(20)30931-4

30. Dias J, Brealey S, Cook L, et al. Surgical fixation compared with cast immobilisation for adults with a bicortical fracture of the scaphoid waist: the SWIFFT RCT. *Health Technol Assess*. Oct 2020;24(52):1-234. doi:10.3310/hta24520

31. Clementson M, Jørgsholm P, Besjakov J, Thomsen N, Björkman A. Conservative Treatment Versus Arthroscopic-Assisted Screw Fixation of Scaphoid Waist Fractures. 2014; A

Randomized Trial With Minimum 4-Year Follow-Up. *Journal of Hand Surgery*. 2015;40(7):1341-1348. doi:10.1016/j.jhsa.2015.03.007

32. Saltzman EB, Rancy SK, Lee SK, Wolfe SW. Chapter 14 - Acute Management of Proximal Pole Scaphoid Fractures. In: Buijze GA, Jupiter JB, eds. *Scaphoid Fractures: Evidence-Based Management*. Elsevier; 2018:115-121.

33. Suh N, Grewal R. Controversies and best practices for acute scaphoid fracture management. *Journal of Hand Surgery (European Volume)*. 2018;43(1):4-12. doi:10.1177/1753193417735973

34. Thorleifsson R, Karlsson J, Sigurjonsson K. Fractures of the scaphoid bone. A follow-up study. *Arch Orthop Trauma Surg*. 1984;103(2):96-9. doi:10.1007/bf00389579

Figure 1. Flowchart of the studies selection process.

Figure 2. Risk of bias summary: review authors' judgements about each risk of bias item for each included study.

Figure 3. Risk of bias graph: review authors' judgements about each risk of bias item presented as percentages across all included studies.

Figure 4. Forest splot for patient-reported functional outcome at 12-weeks (A), 26-weeks (B), and 52-weeks (C).

Figure 5. Forest splot for wrist range of motion at 12-weeks (A), and 52-weeks (B).

Figura 6. Forest splot for grip strength at 12-weeks (A), and 52-weeks (B).

Figura 7. Forest splot for time to return to work.

Figura 8. Forest splot for fracture union rate.

Figura 9. Forest splot for complications rate.

Table 1. Studies characteristics

Authors Year Country	Participants No of participants Age, mean [range] Sex distribution, male/female	Eligibility criteria	Interventions	Follow-up	Outcome measured
Dias et al. 2020 UK	**Total** 439 33 years [16-80 years] 363/76 **Surgical treatment** 219 33 years 180/39 **Conservative treatment** 220 33 years 183/37	**Inclusion criteria** Patient ≥ 16 years old and skeletally mature with an acute (within 2 weeks of injury) clear bicortical scaphoid waist fracture on plain radiographs. **Exclusion criteria** Patients were excluded if they: - had a fracture displaced by more than 2 mm or that involved the proximal or distal pole; - had a trans-scaphoid-perilunate dislocation; - had multiple injuries in the same limb; - had a concurrent wrist fracture in the opposite limb; - had insufficient mental capacity to comply with treatment or data collection; - were pregnant; - did not reside in the catchment area of a participating hospital to allow follow-up.	**Surgical treatment** Percutaneous or open surgical fixation, with standard CE-marked headless compression screws. **Conservative treatment** Below-elbow cast immobilization for 6–10 weeks, with or without inclusion of the thumb*	Follow-up was carried out at 6-, 12-, 26-, and 52-weeks.	- Total PRWE score; - PRWE pain score; - PRWE function score; - SF-12 physical component score; - SF-12 mental component score; - Bone union; - Wrist ROM; - Grip strength; - Time to return to work; - Complications (defined as medical, surgical, or cast-related).
Clementson et al. 2015 Sweden	**Total** 38 31 years [18-63 years] 31/7 **Surgical treatment** 14 34 years [18-63 years] 11/3 **Conservative treatment** 24 30 years [18-63 years] 20/4	**Inclusion criteria** Patients with an acute (within lasts 14 days) non- or minimally displaced scaphoid waist fracture (displacement < 1 mm and/or volar angulation < 15° on CT scan). **Exclusion criteria** –	**Surgical treatment** Arthroscopic-assisted percutaneous cannulated compression screw fixation. **Conservative treatment** Below-elbow thumb spica cast, incorporating the thumb up to the interphalangeal joint until fracture union.	Follow-up was carried out at 6-, 10-, 14-, 26-, and 52-weeks. Participants were then invited for an extended follow-up at a median of 6 years (range, 4-8 years).	- Bone union - Wrist ROM - Grip Strength - Pinch Strength - Radioscaphoid arthritis - Watson shift test - DASH questionnaire - Overall patient satisfaction

Dias et al. 2005, 2008 UK	**Total** 88 30 years [16-61 years] 79/9	**Surgical treatment** 44 29 years 40/4 **Conservative treatment** 44 30 years 39/5	**Inclusion criteria** Patients, skeletally mature, with an acute (< 2 weeks after the injury) bicortical fracture of the waist of the scaphoid. **Exclusion criteria** Patients were excluded if they had: - less than 16 years old; - preexisting symptoms in the upper limb; - associated injuries; - unicortical or tuberosity fractures; - trans-scaphoid perilunate dislocations.	**Surgical treatment** Open Reduction and Internal Fixation (ORIF) using a Herbert screw, a cannulated Whipple screw, or a Kirschner wire. **Conservative treatment** Below-the-elbow cast with the thumb left free for 8 weeks*	Follow-up was carried out at 2-, 8-, 12-, 26-, and 52-weeks.	- Bone union - Symptoms of pain, swelling, and tenderness - Wrist ROM - Grip Strength - Complications - Time to return to work - Time needed after return to work to be able to perform work tasks comfortably - PEM Questionnaire
Adolfsson et al. 2001 Sweden	**Total** 53 31 years [15-75 years] 39/14	**Surgical treatment** 25 30 years [16-76 years] 20/5 **Conservative treatment** 28 36 years [15-73 years] 19/9	**Inclusion criteria** Patients with a recent (< 14 days old) undisplaced fracture of the waist of scaphoid **Exclusion criteria** Patients were excluded if they had: - a partial or longitudinal fracture; - signs of concomitant fractures or ligament injuries; - a previous injury or surgical intervention to the wrist.	**Surgical treatment** Percutaneous Acutrak screw fixation. **Conservative treatment** Bellow elbow plaster cast until fracture union.	Follow-up was carried out at 10-, 16-, and 24-weeks.	- Fracture union - Wrist ROM - Grip Strength - Complications
Bond et al. 2001 USA	**Total** 25 24 years [18-34 years] 22/3	**Surgical treatment** 11 24 years 9/2 **Conservative treatment** 14 24 years 13/1	**Inclusion criteria** Full-time military personnel with an acute (< 2 weeks after injury) nondisplaced fracture of the scaphoid waist. **Exclusion criteria** Patients were excluded if they: - were not evaluated within two weeks after the injury; - had a history of an untreated injury of the wrist; - had a fracture with >1 mm of displacement; - had a fracture that did not involve the waist of the scaphoid; - had a fracture that was associated with a scapholunate angle >60°.	**Surgical treatment** Percutaneous Acutrak screw fixation. **Conservative treatment** Long-arm thumb-spica cast, with interphalangeal joint free, for 6 weeks, followed by a short-arm thumb-spica cast until fracture union.	Follow up was caried out every 2-weeks until the fracture united and then every 3 months after union for 2 years.	- Fracture union - Time to union - Grip Strength - Wrist ROM - Time until the patient returned to full military duty - Complications - Overall patient satisfaction

CT: computerized tomography; PRWE: Patient-Rated Wrist Evaluation; SF-12: 12-item Short Form Survey; DASH: Disabilities of the Arm, Shoulder and Hand; PEM: Patient Evaluation Measure; ROM: range of motion

*in both studies, surgical fixation was offered if there was suspected nonunion on radiographs taken around 12-weeks and confirmed on a CT scan

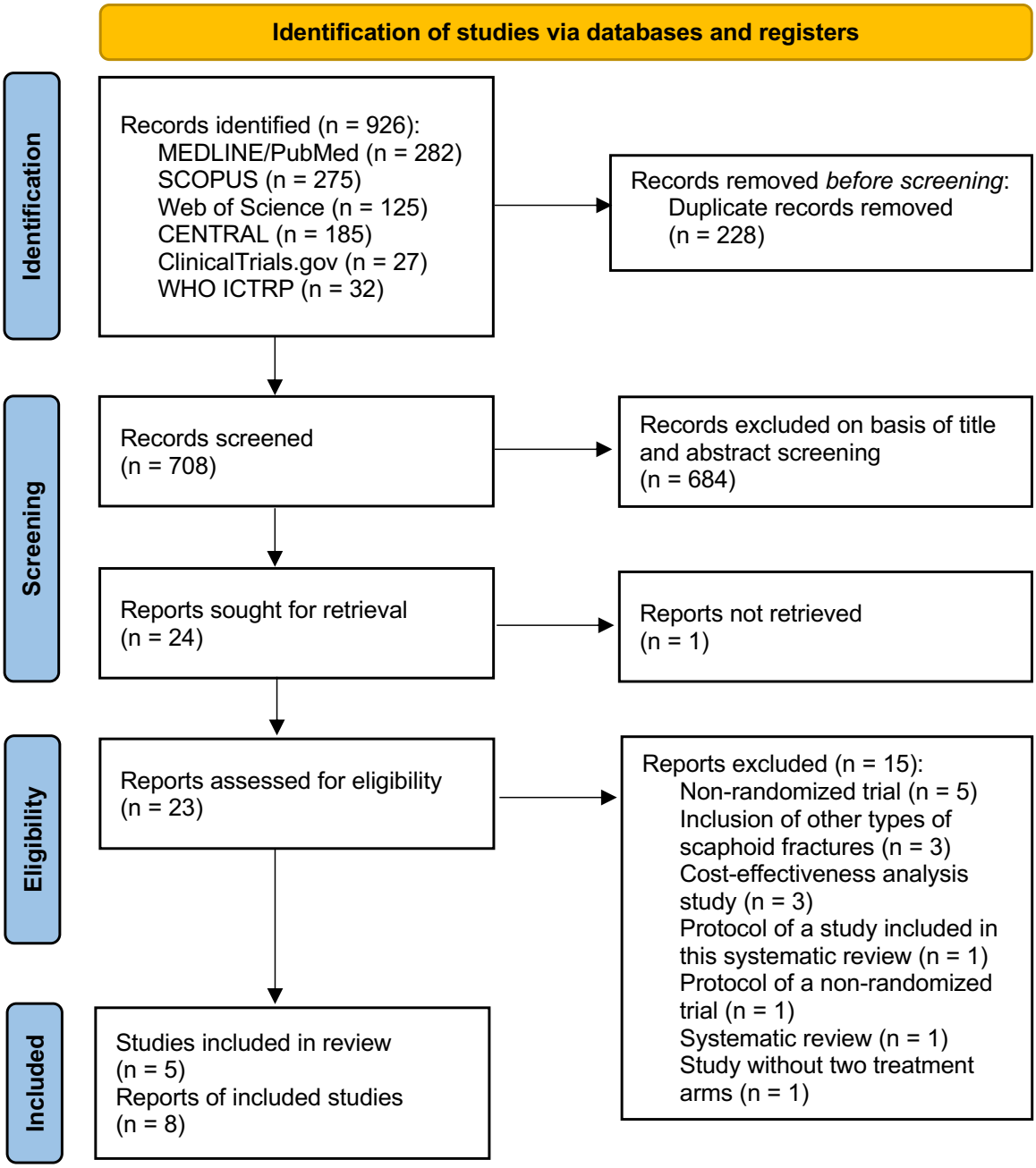

Identification of studies via databases and registers
Identification
Records identified (n = 926):
MEDLINE/PubMed (n = 282)
SCOPUS (n = 275)
Web of Science (n = 125)
CENTRAL (n = 185)
ClinicalTrials.gov (n = 27)
WHO ICTRP (n = 32)
Records removed *before screening*:
Duplicate records removed
(n = 228)
Screening
Records screened
(n = 708)
Records excluded on basis of title and abstract screening
(n = 684)
Reports sought for retrieval
(n = 24)
Reports not retrieved
(n = 1)
Eligibility
Reports assessed for eligibility
(n = 23)
Reports excluded (n = 15):
Non-randomized trial (n = 5)
Inclusion of other types of scaphoid fractures (n = 3)
Cost-effectiveness analysis study (n = 3)
Protocol of a study included in this systematic review (n = 1)
Protocol of a non-randomized trial (n = 1)
Systematic review (n = 1)
Study without two treatment arms (n = 1)
Included
Studies included in review
(n = 5)
Reports of included studies
(n = 8)

Figure 1.

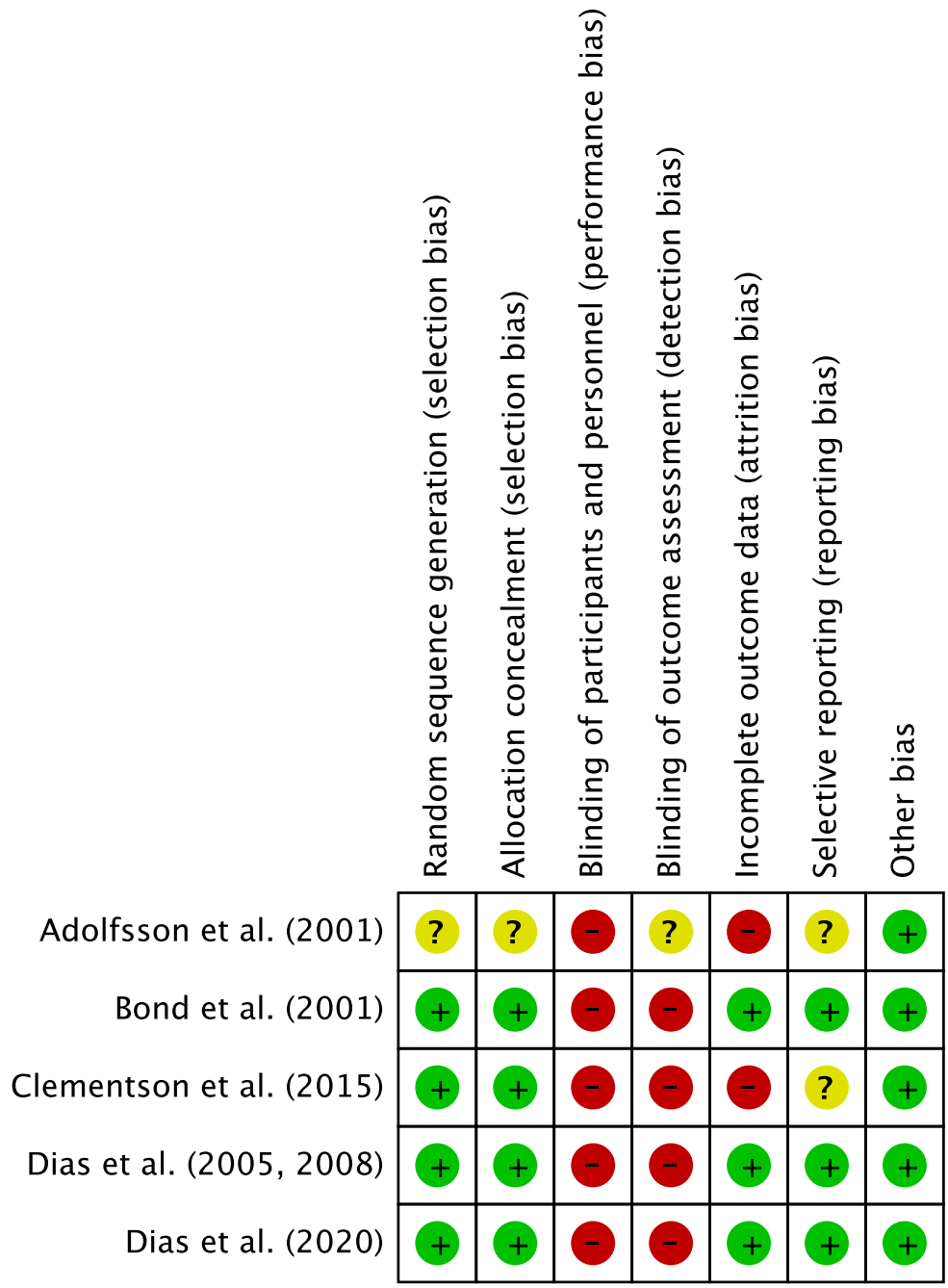

Random sequence generation (selection bias)
Allocation concealment (selection bias)
Blinding of participants and personnel (performance bias)
Blinding of outcome assessment (detection bias)
Incomplete outcome data (attrition bias)
Selective reporting (reporting bias)
Other bias
Adolfsson et al. (2001)
Bond et al. (2001)
Clementson et al. (2015)
Dias et al. (2005, 2008)
Dias et al. (2020)

Figure 2.

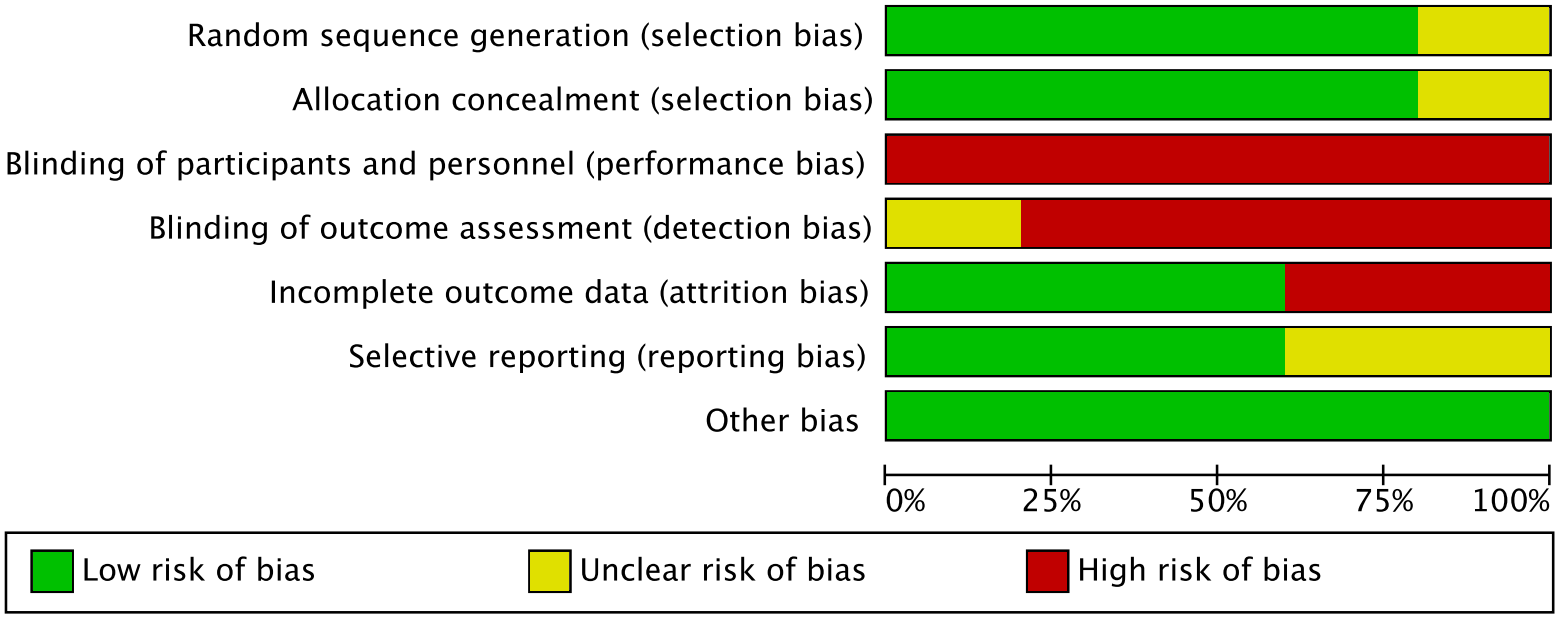

Random sequence generation (selection bias)
Allocation concealment (selection bias)
Blinding of participants and personnel (performance bias)
Blinding of outcome assessment (detection bias)
Incomplete outcome data (attrition bias)
Selective reporting (reporting bias)
Other bias
0%
25%
50%
75%
100%
Low risk of bias
Unclear risk of bias
High risk of bias

Figure 3.

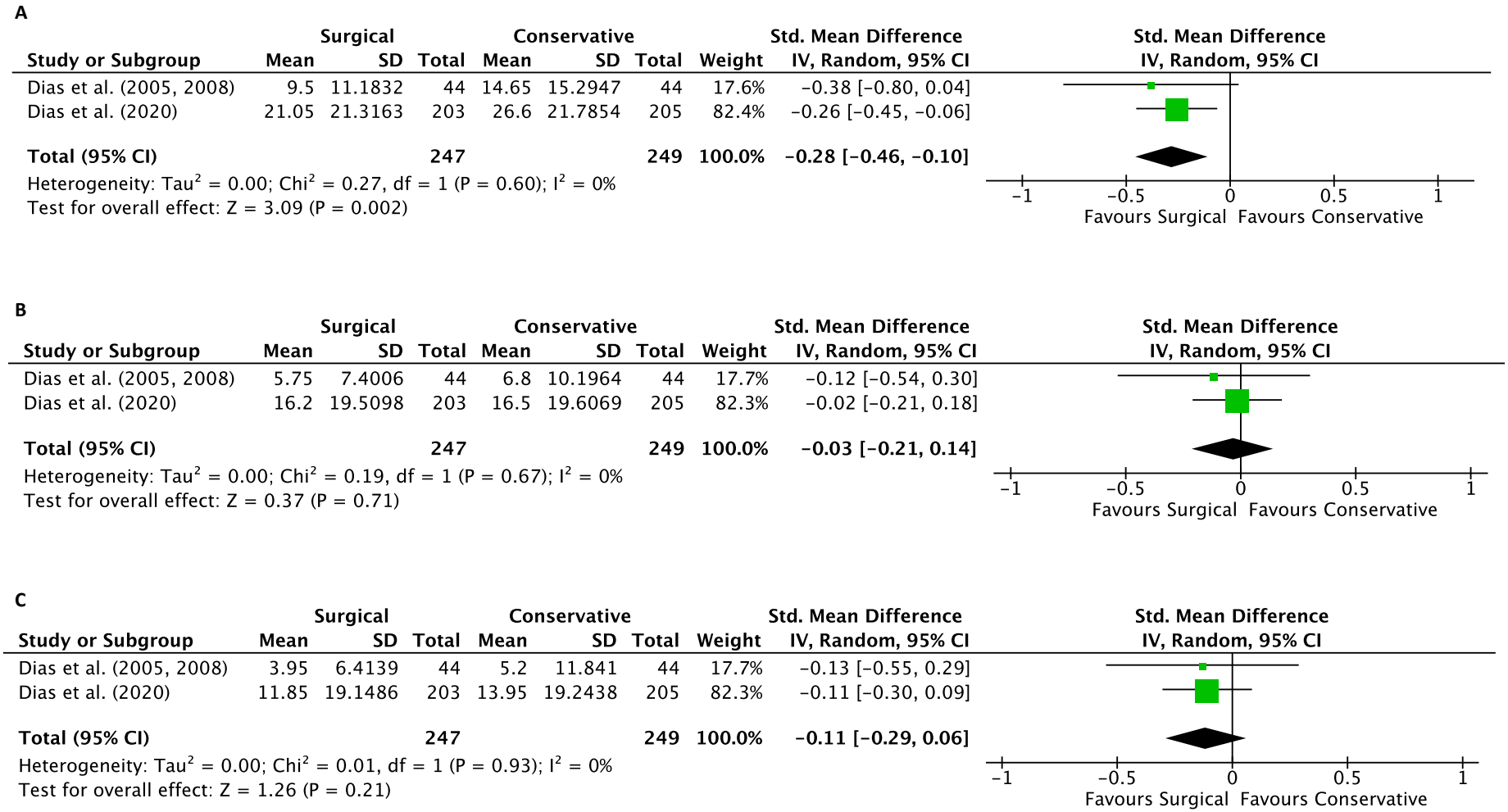

A
Surgical
Conservative
Std. Mean Difference
Std. Mean Difference
Study or Subgroup Mean SD Total Mean SD Total Weight IV, Random, 95% CI
IV, Random, 95% CI
Dias et al. (2005, 2008) 9.5 11.1832 44 14.65 15.2947 44 17.6% -0.38 [-0.80, 0.04]
Dias et al. (2020) 21.05 21.3163 203 26.6 21.7854 205 82.4% -0.26 [-0.45, -0.06]
Total (95% CI) 247 249 100.0% -0.28 [-0.46, -0.10]
Heterogeneity: Tau² = 0.00; Chi² = 0.27, df = 1 (P = 0.60); I² = 0%
Test for overall effect: Z = 3.09 (P = 0.002)
-1 -0.5 0 0.5 1
Favours Surgical Favours Conservative
B
Surgical
Conservative
Std. Mean Difference
Std. Mean Difference
Study or Subgroup Mean SD Total Mean SD Total Weight IV, Random, 95% CI
IV, Random, 95% CI
Dias et al. (2005, 2008) 5.75 7.4006 44 6.8 10.1964 44 17.7% -0.12 [-0.54, 0.30]
Dias et al. (2020) 16.2 19.5098 203 16.5 19.6069 205 82.3% -0.02 [-0.21, 0.18]
Total (95% CI) 247 249 100.0% -0.03 [-0.21, 0.14]
Heterogeneity: Tau² = 0.00; Chi² = 0.19, df = 1 (P = 0.67); I² = 0%
Test for overall effect: Z = 0.37 (P = 0.71)
-1 -0.5 0 0.5 1
Favours Surgical Favours Conservative
C
Surgical
Conservative
Std. Mean Difference
Std. Mean Difference
Study or Subgroup Mean SD Total Mean SD Total Weight IV, Random, 95% CI
IV, Random, 95% CI
Dias et al. (2005, 2008) 3.95 6.4139 44 5.2 11.841 44 17.7% -0.13 [-0.55, 0.29]
Dias et al. (2020) 11.85 19.1486 203 13.95 19.2438 205 82.3% -0.11 [-0.30, 0.09]
Total (95% CI) 247 249 100.0% -0.11 [-0.29, 0.06]
Heterogeneity: Tau² = 0.00; Chi² = 0.01, df = 1 (P = 0.93); I² = 0%
Test for overall effect: Z = 1.26 (P = 0.21)
-1 -0.5 0 0.5 1
Favours Surgical Favours Conservative

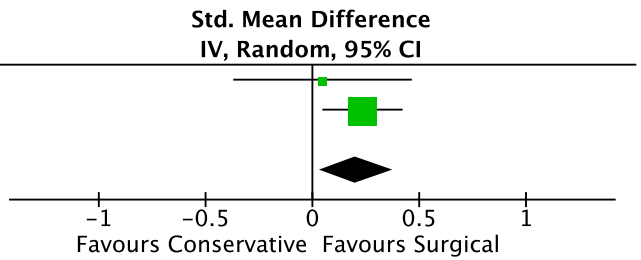
Figure 4.

A

Study or Subgroup	Surgical Mean	Surgical SD	Surgical Total	Conservative Mean	Conservative SD	Conservative Total	Weight	Std. Mean Difference IV, Random, 95% CI
Dias et al. (2005, 2008)	80.7	19.0772	44	79.9	13.8145	44	16.8%	0.05 [-0.37, 0.47]
Dias et al. (2020)	59.7	14.85	219	55.95	17	220	83.2%	0.23 [0.05, 0.42]
Total (95% CI)			**263**			**264**	**100.0%**	**0.20 [0.03, 0.37]**

Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 0.64$, df = 1 (P = 0.42); $I^2 = 0\%$

Test for overall effect: Z = 2.32 (P = 0.02)



B

Study or Subgroup	Surgical Mean	Surgical SD	Surgical Total	Conservative Mean	Conservative SD	Conservative Total	Weight	Std. Mean Difference IV, Random, 95% CI
Dias et al. (2005, 2008)	94.15	12.0055	44	93.4	16.1169	44	16.7%	0.05 [-0.37, 0.47]
Dias et al. (2020)	63.45	16.22	219	63.5	13.92	220	83.3%	-0.00 [-0.19, 0.18]
Total (95% CI)			**263**			**264**	**100.0%**	**0.01 [-0.16, 0.18]**

Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 0.06$, df = 1 (P = 0.81); $I^2 = 0\%$

Test for overall effect: Z = 0.07 (P = 0.95)

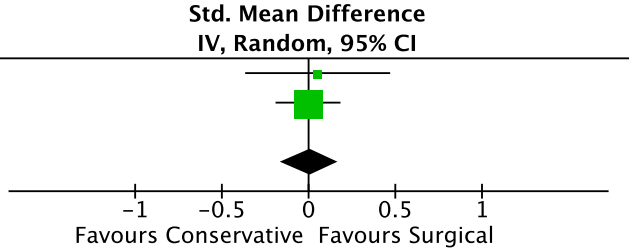


Figure 5.

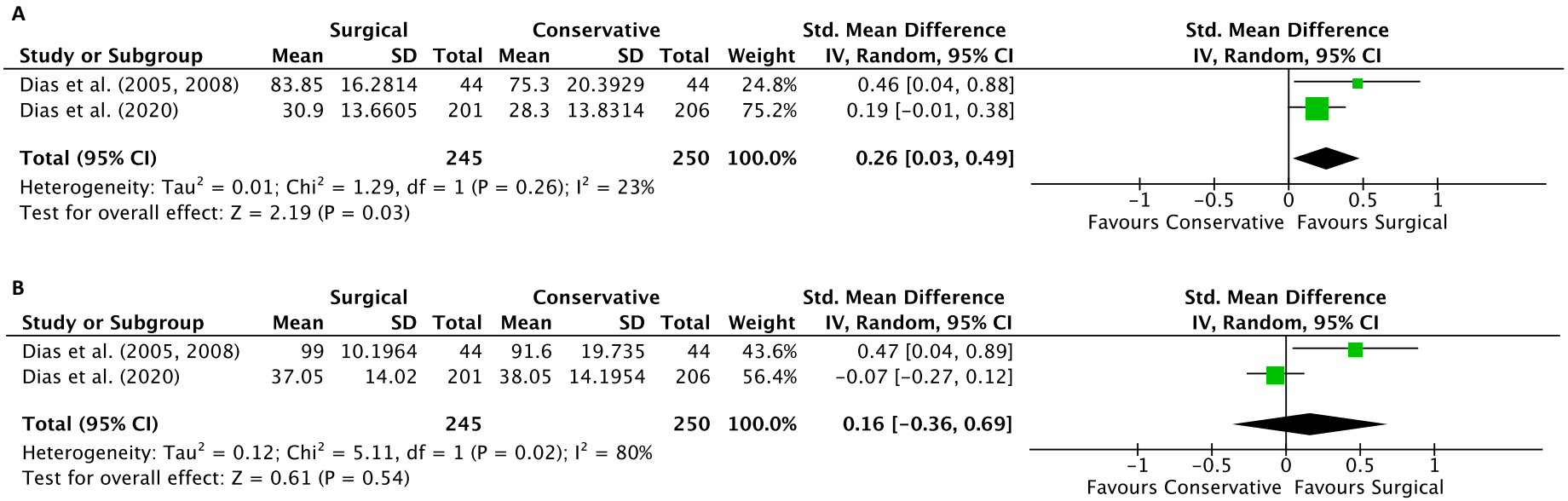

A
Surgical
Conservative
Std. Mean Difference
Std. Mean Difference
Study or Subgroup Mean SD Total Mean SD Total Weight IV, Random, 95% CI
IV, Random, 95% CI
Dias et al. (2005, 2008) 83.85 16.2814 44 75.3 20.3929 44 24.8% 0.46 [0.04, 0.88]
Dias et al. (2020) 30.9 13.6605 201 28.3 13.8314 206 75.2% 0.19 [-0.01, 0.38]
Total (95% CI) 245 250 100.0% 0.26 [0.03, 0.49]
Heterogeneity: Tau² = 0.01; Chi² = 1.29, df = 1 (P = 0.26); I² = 23%
Test for overall effect: Z = 2.19 (P = 0.03)
-1 -0.5 0 0.5 1
Favours Conservative Favours Surgical
B
Surgical
Conservative
Std. Mean Difference
Std. Mean Difference
Study or Subgroup Mean SD Total Mean SD Total Weight IV, Random, 95% CI
IV, Random, 95% CI
Dias et al. (2005, 2008) 99 10.1964 44 91.6 19.735 44 43.6% 0.47 [0.04, 0.89]
Dias et al. (2020) 37.05 14.02 201 38.05 14.1954 206 56.4% -0.07 [-0.27, 0.12]
Total (95% CI) 245 250 100.0% 0.16 [-0.36, 0.69]
Heterogeneity: Tau² = 0.12; Chi² = 5.11, df = 1 (P = 0.02); I² = 80%
Test for overall effect: Z = 0.61 (P = 0.54)
-1 -0.5 0 0.5 1
Favours Conservative Favours Surgical

Figure 6.

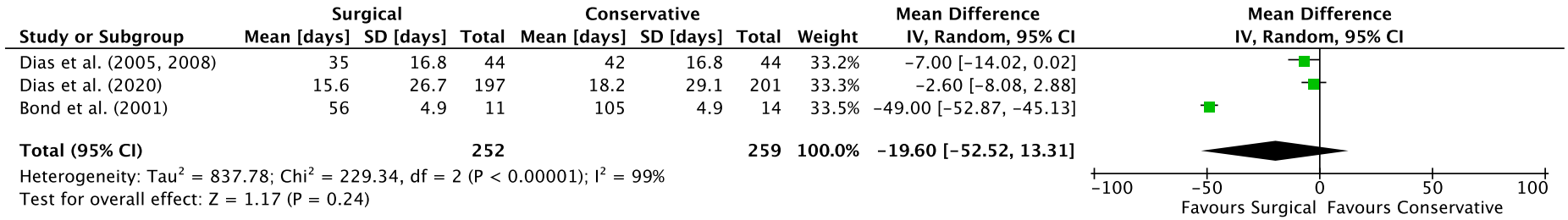

Surgical
Conservative
Mean Difference
Mean Difference
Study or Subgroup
Mean [days] SD [days] Total Mean [days] SD [days] Total Weight IV, Random, 95% CI
IV, Random, 95% CI
Dias et al. (2005, 2008) 35 16.8 44 42 16.8 44 33.2% -7.00 [-14.02, 0.02]
Dias et al. (2020) 15.6 26.7 197 18.2 29.1 201 33.3% -2.60 [-8.08, 2.88]
Bond et al. (2001) 56 4.9 11 105 4.9 14 33.5% -49.00 [-52.87, -45.13]
Total (95% CI) 252 259 100.0% -19.60 [-52.52, 13.31]
Heterogeneity: Tau² = 837.78; Chi² = 229.34, df = 2 (P < 0.00001); I² = 99%
Test for overall effect: Z = 1.17 (P = 0.24)
-100
-50
0
50
100
Favours Surgical
Favours Conservative

Figure 7.

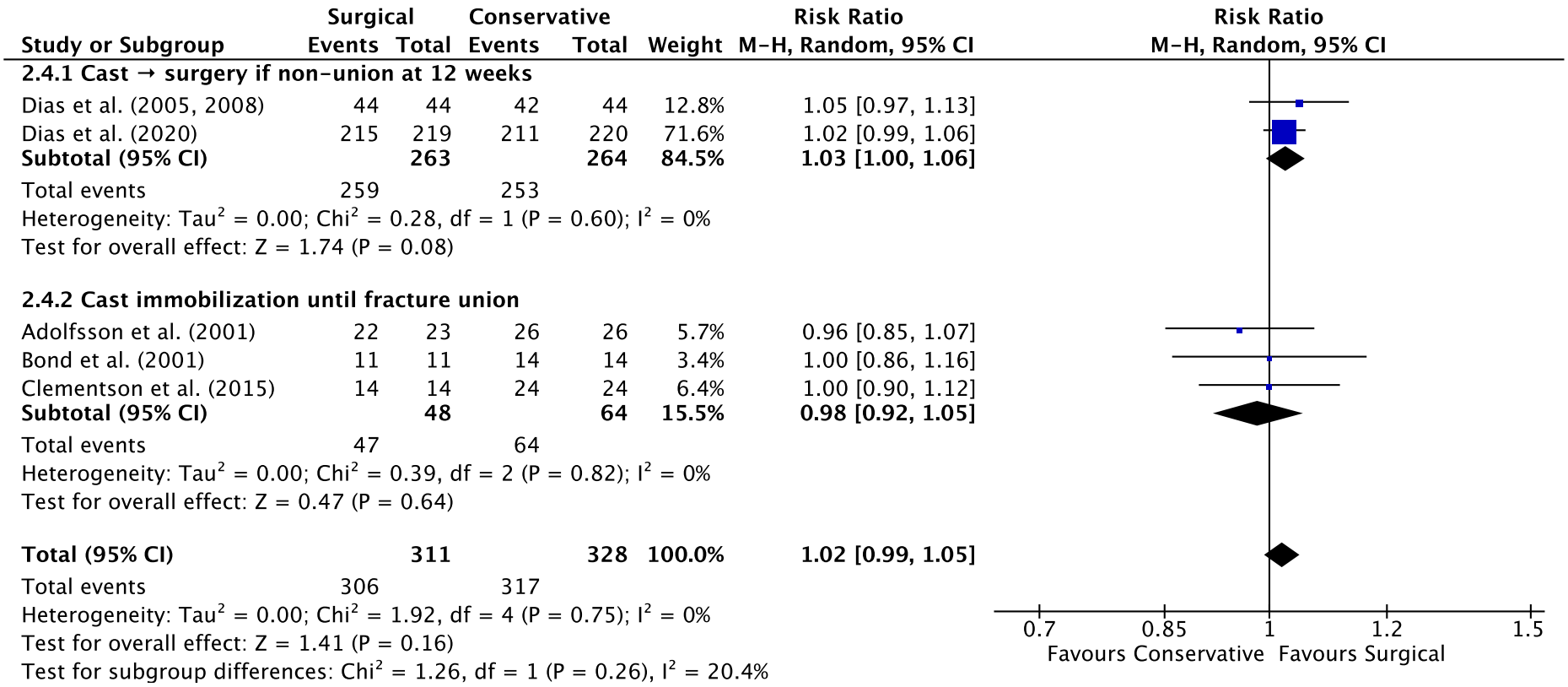

Surgical
Conservative
Risk Ratio
Risk Ratio
Study or Subgroup
Events Total Events Total Weight M-H, Random, 95% CI
M-H, Random, 95% CI
2.4.1 Cast → surgery if non-union at 12 weeks
Dias et al. (2005, 2008) 44 44 42 44 12.8% 1.05 [0.97, 1.13]
Dias et al. (2020) 215 219 211 220 71.6% 1.02 [0.99, 1.06]
Subtotal (95% CI) 263 264 84.5% 1.03 [1.00, 1.06]
Total events 259 253
Heterogeneity: Tau² = 0.00; Chi² = 0.28, df = 1 (P = 0.60); I² = 0%
Test for overall effect: Z = 1.74 (P = 0.08)
2.4.2 Cast immobilization until fracture union
Adolfsson et al. (2001) 22 23 26 26 5.7% 0.96 [0.85, 1.07]
Bond et al. (2001) 11 11 14 14 3.4% 1.00 [0.86, 1.16]
Clementson et al. (2015) 14 14 24 24 6.4% 1.00 [0.90, 1.12]
Subtotal (95% CI) 48 64 15.5% 0.98 [0.92, 1.05]
Total events 47 64
Heterogeneity: Tau² = 0.00; Chi² = 0.39, df = 2 (P = 0.82); I² = 0%
Test for overall effect: Z = 0.47 (P = 0.64)
Total (95% CI) 311 328 100.0% 1.02 [0.99, 1.05]
Total events 306 317
Heterogeneity: Tau² = 0.00; Chi² = 1.92, df = 4 (P = 0.75); I² = 0%
Test for overall effect: Z = 1.41 (P = 0.16)
Test for subgroup differences: Chi² = 1.26, df = 1 (P = 0.26), I² = 20.4%
0.7
0.85
1
1.2
1.5
Favours Conservative
Favours Surgical

Figure 8.

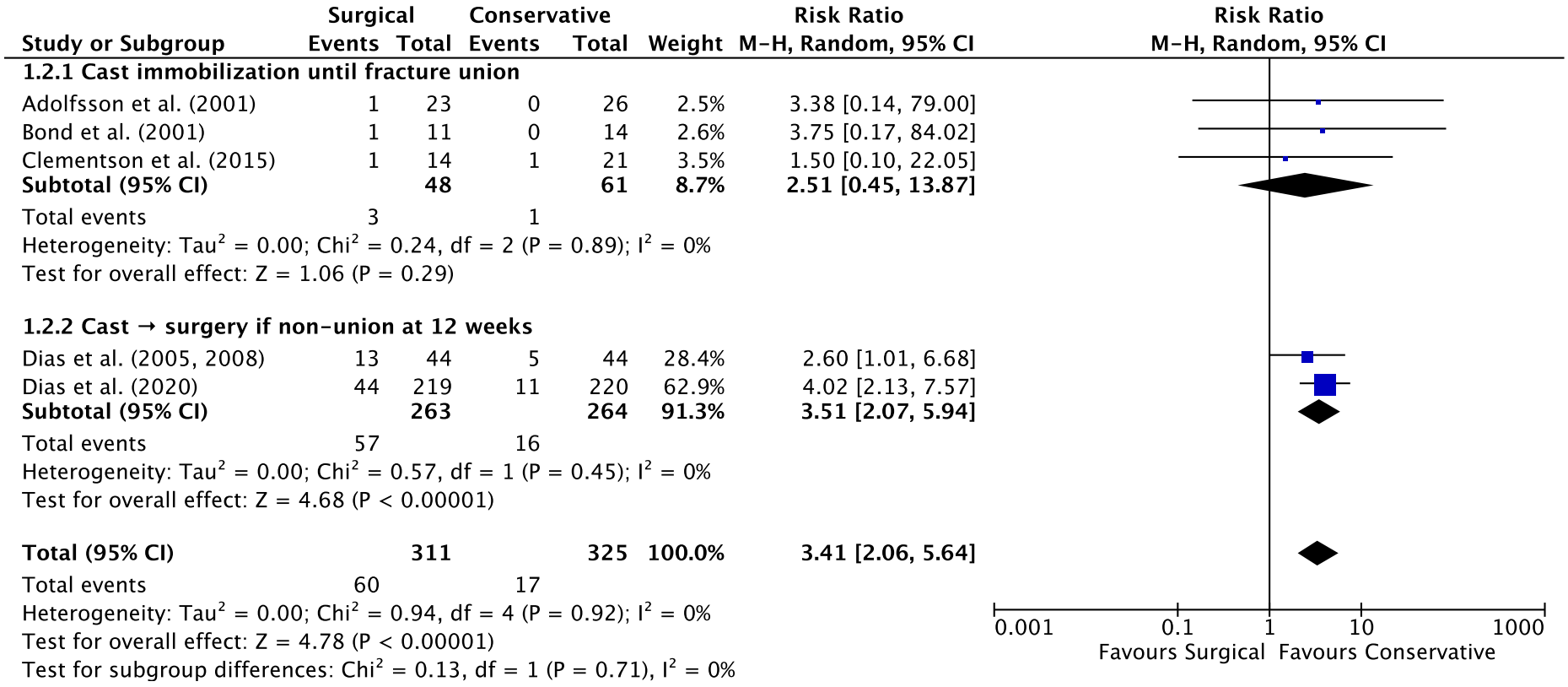

Surgical
Conservative
Risk Ratio
Risk Ratio
Study or Subgroup Events Total Events Total Weight M-H, Random, 95% CI
M-H, Random, 95% CI
1.2.1 Cast immobilization until fracture union
Adolfsson et al. (2001) 1 23 0 26 2.5% 3.38 [0.14, 79.00]
Bond et al. (2001) 1 11 0 14 2.6% 3.75 [0.17, 84.02]
Clementson et al. (2015) 1 14 1 21 3.5% 1.50 [0.10, 22.05]
Subtotal (95% CI) 48 61 8.7% 2.51 [0.45, 13.87]
Total events 3 1
Heterogeneity: Tau² = 0.00; Chi² = 0.24, df = 2 (P = 0.89); I² = 0%
Test for overall effect: Z = 1.06 (P = 0.29)
1.2.2 Cast → surgery if non-union at 12 weeks
Dias et al. (2005, 2008) 13 44 5 44 28.4% 2.60 [1.01, 6.68]
Dias et al. (2020) 44 219 11 220 62.9% 4.02 [2.13, 7.57]
Subtotal (95% CI) 263 264 91.3% 3.51 [2.07, 5.94]
Total events 57 16
Heterogeneity: Tau² = 0.00; Chi² = 0.57, df = 1 (P = 0.45); I² = 0%
Test for overall effect: Z = 4.68 (P < 0.00001)
Total (95% CI) 311 325 100.0% 3.41 [2.06, 5.64]
Total events 60 17
Heterogeneity: Tau² = 0.00; Chi² = 0.94, df = 4 (P = 0.92); I² = 0%
Test for overall effect: Z = 4.78 (P < 0.00001)
Test for subgroup differences: Chi² = 0.13, df = 1 (P = 0.71), I² = 0%
0.001
0.1
1
10
1000
Favours Surgical
Favours Conservative

Figure 9.

Supplementary Data

Table S1: Search strategy and results

Source	Search terms	Last search date	Searched results
PubMed	(("scaphoid bone"[MeSH Terms] OR ("scaphoid"[All Fields] AND "bone"[All Fields]) OR "scaphoid bone"[All Fields] OR "scaphoid"[All Fields]) AND ("fractures, bone"[MeSH Terms] OR ("fractures"[All Fields] AND "bone"[All Fields]) OR "bone fractures"[All Fields] OR "fractures"[All Fields])) AND ((“randomized controlled trial”[Publication Type] OR “controlled clinical trial”[Publication Type] OR “randomized”[Title/Abstract] OR “placebo”[Title/Abstract] OR “drug therapy”[Subheading] OR “randomly”[Title/Abstract] OR “trial”[Title/Abstract] OR “groups”[Title/Abstract]) NOT (“animals”[MeSH Terms] NOT “humans”[MeSH Terms]))	December 21, 2021	282
SCOPUS	(TITLE-ABS-KEY (fracture) AND TITLE-ABS-KEY (scaphoid)) AND ((TITLE-ABS-KEY ("clinical trial" OR "randomized controlled trial" OR "controlled clinical trial" OR "random allocation" OR "randomly allocated" OR "allocated randomly" OR "double-blind method" OR "single-blind method" OR "cross-over studies" OR "placebos” OR "cross-over trial" OR "single blind" OR "double blind" OR "factorial design" OR "factorial trial" OR "multicenter study")) OR (TITLE-ABS (clinical AND trial* OR trial* OR rct* OR random* OR blind*)))	December 23, 2021	275
CENTRAL	#1: MeSH descriptor: [Scaphoid Bone] explode all trees #2: ("scaphoid bone"):ti,ab,kw #3: (scaphoid fracture):ti,ab,kw	December 28, 2021	185

	#4: (scaphoid fractures):ti,ab,kw #5: #1 OR #2 OR #3 OR #4		
Web of Science	(ALL=(Scaphoid)) AND (ALL=(fracture)) AND (TS=(randomised OR randomized OR randomisation OR randomisation OR placebo* OR (random* AND (allocat* OR assign*)) OR (blind* AND (single OR double OR treble OR triple))))	December 30, 2021	125
ClinicalTrials.gov	Status: All studies; Condition or disease: Scaphoid Fracture	December 30, 2021	27
WHO International Clinical Trials Registry Platform Search Portal	Search term: Scaphoid Fracture	December 30, 2021	32
In Total			926

PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page and line/table/figure #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	Page 7; Lines 1-2
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	Pages 7-8; Lines 4-29
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	Pages 9-10; Lines 62-84
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	Page 10; Lines 85-89 “Therefore, we aim to do a systematic review and meta-analysis (…) best treatment for these types of fractures.”
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	Not applicable
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	Pages 10-11; Lines 99, 104-111 “No language restrictions were applied.” “Inclusion criteria were: (a) studies: RCTs; (b) population: patients with acute undisplaced or minimally-displaced (≤ 2mm displacement) scaphoid waist fractures; (c) intervention: surgical fixation (open reduction and internal fixation, or percutaneous fixation); (d) comparison: initial conservative treatment (all types of cast immobilization) with or without possible early surgical fixation of fractures that fail to unite; (e) outcomes: patient-reported functional outcome, fracture union, wrist range of motion (ROM), grip strength, time to

			return to work and complications.”
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	Pages 10-11; Lines 96-103 A systematic search was performed in MEDLINE (using the PubMed interface), SCOPUS, Web of Science, and Cochrane Central Register of Controlled Trials (…). Additionally, clinical trial registration databases (ClinicalTrials.gov and WHO International Clinical Trials Registry Platform) were searched, looking for relevant trials at any completion stage. Lastly, reference lists from relevant review articles identified during this search and the included RCTs were manually checked to identify additional potentially eligible trials.”
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	Pages 38-39; Table S1
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	Page 11; Lines 113-117 “After the removal of duplicates, two authors independently screened the titles and abstracts of the identified articles. Subsequently, after reading the full text of the articles not excluded in the screening phase, two authors independently selected those meeting the established eligibility criteria. Disagreements during the selection process were solved by consensus, or by the judgment of a third author.”
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	Page 11; Lines 119-124 “Data extraction was carried out independently by two authors using a predesigned data extraction form. When information of interest was not possible to extract from a publication, the corresponding author was contacted via e-mail requesting the unpublished data. (…) Any discrepancies regarding the extracted data and risk of bias assessment were resolved by consensus.”
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	Pages 26-27; Table 1

Risk of bias in individual studies / Risk of bias across studies	12/ 15	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	Page 11; Lines 121-124 "Risk of bias was assessed by the same independent authors using the Cochrane Collaboration Risk of Bias Tool for RCTs."
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	Page 12; Lines 132-140 "In cases where the standard deviations (SDs) were not provided, we used the method described in the Cochrane Handbook for Systematic Reviews of Interventions to obtain the required statistic from the *p*-value or the confidence interval (CI).[28] Pooled mean differences (MDs) with a 95% CI were used for the meta-analysis of continuous variables reported with the same scales, whereas standardized mean differences (SMDs) with a 95% CI were calculated whenever different studies evaluated the same continuous outcome with different measures. For the meta-analysis of dichotomous variables, the relative treatment effect was expressed as pooled risk ratios (RR) with a 95% CI."
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	Page 12; Lines 140-144 "A random-effect model was used, and summary estimates of the overall treatment effects were provided in the form of a forest plot. A p-value of < 0.05 was interpreted as statistically significant. Heterogeneity was assessed by the Q-Cochrane p-value and by the I2 statistics: a p-value < 0.10 and an I2 > 40% were considered to represent substantial heterogeneity."
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	Page 12; Lines 128-132 "Subgroup analysis was prospectively planned for studies that compared patients treated by surgical fixation with patients treated by (1) cast immobilization until fracture union or (2) cast immobilization followed by possible early surgical fixation of fractures that fail to unite. This subgroup analysis was only performed for those outcomes where more than one study in each subgroup reported eligible data."
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	Pages 12-13; Lines 149-163 "A total of 926 records resulted from our search strategy. After duplicate removal, 708 records remained for title and

			abstract screening, of which 684 were excluded leaving 24 articles for full-text review. The full-text of one article was not available for retrieved, and 15 articles were excluded for not satisfying the eligibility criteria. As a result, 8 articles were included in this systematic review (Figure 1). (…) No relevant additional studies were identified by analyzing the references of previous systematic reviews and the included articles." Page 29; Figure 1
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	Pages 26-27; Table 1 Pages 13-14; Lines 165-178 "The final five included studies[14-16,29,31] were published between April 2001 and October 2020. Overall, a total of 643 patients were assessed with sample sizes ranging from 25 to 439. The participants' mean age ranged from 24 to 33 years. (…) fractures that fail to unite after this period (Table 1)."
Risk of bias within and across studies	19/ 22	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	Page 14; Lines 182-188 "Figures 2 and 3 summarize the risk of bias assessment of the included studies. Most of the studies met the random sequence generation and allocation concealment criteria (…) intention-to-treat principles." Pages 30-3; Figures 2-3
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	Pages 32-37; Figures 4-9
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	Pages 32-37; Figures 4-9
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	Pages 36-37; Figures 8-9
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	Pages 16-19 Example: Lines 268-273: "At 52-weeks, no significant differences were found between surgical and conservative treatments groups on these outcomes, which suggested that after initiating active mobilization, patients of both treatment groups were

			able to achieve a similar functional recovery. In agreement, studies assessing these outcomes two or more years after treatment also found no significant differences between the two treatment groups." Lines 310-311 "Despite the foregoing limitations, we believe that this meta-analysis also has several strong points and offers useful conclusions based on the published RCTs."
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	Example: Page 19; Lines 304-309 "Nevertheless, these findings must be interpreted with caution considering some limitations. All the studies included in this subgroup analysis have small samples sizes which limited the ability to detect clinically significant differences between treatment groups on nonunion and complication rates[15,16,31] Furthermore, two of the included studies had a high risk of bias and excluded patients after randomization which rendered the distribution between the two treatment groups uneven."
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	Page 19; Lines 311-323 "On the management of non- or minimally-displaced scaphoid waist fractures we showed that (…). Future additionally clinical trials carefully designed to overreach the methodological limitations previously exposed are needed to achieve more robust and comprehensive results in the field."
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	Not applicable

From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

THE JOURNAL OF HAND SURGERY

An International Journal Devoted to Surgery of the Upper Extremity

AUTHOR INFORMATION PACK

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ISSN: 0363-5023

DESCRIPTION

The *Journal of Hand Surgery* publishes original, peer-reviewed articles related to the **diagnosis**, **treatment**, and **pathophysiology** of **diseases** and **conditions** of the **upper extremity**; these include both clinical and basic science studies, along with case reports. Special features include Clinical Perspective articles, Comprehensive Review manuscripts, and Surgical Technique articles that provide an overview of hand surgery, technical aspects of surgery, and current controversial topics.

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•Manske PR. Structures and format of peer-reviewed scientific manuscripts. *J Hand Surg Am*. 2006;31(7):1051–1055.
•Flatt AE. Words. *J Hand Surg*. 2000;25(2):201–210.

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The review section of the *Journal* will feature Current Concepts articles on a monthly basis, as well as review articles in a monthly Hand Surgery Landscape section.

Current Concepts is designed to provide review articles that focus on up-to-date information covering essential topics on a three-year rotation. Authors are invited based on their expertise. Unsolicited material is considered after contacting the Review Deputy Editor, Dawn M. LaPorte, MD, at jhs@assh.org with a completed Proposal.

Current Concepts articles are no more than 3,000 words and include a one-paragraph abstract. They must review recent developments and must emphasize the best evidence for management and treatment strategies. In addition to the article, the authors must provide four choice continuing medical education (CME) questions together with a rationale and references for the best answer. Include at least one reference to a "classical article" that has stood the test of time.

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Finally, Current Concepts articles should have no more than four authors and generally have no more than 20 references.

The Hand Surgery Landscape articles are designed to generate interest and comment among readers. These articles present content that otherwise might be outside the traditional scope of a typical review topic for *The Journal of Hand Surgery*. Invitations to contribute articles for this series are made either by the Review Deputy Editor or the Editor-in-Chief. Unsolicited submissions must first be made as a proposal to the Review Editor using the template and sent to Dawn M. LaPorte, MD, at jhs@assh.org. Some, but not all, unsolicited manuscripts may be sent out for peer review. The focus will be on encouraging thought leaders in the areas described below.

This monthly feature has a word count of no more than 2,000 words and includes a one-paragraph abstract. There is no prescribed format other than the maximum word count. References are required for any statements that should be supported by outside sources.

The spectrum of content considered for this series will include:

- Innovative clinical topics
- Education
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The *Surgical Techniques* section is an online-only section that provides step-by-step details of various surgical procedures relevant to clinical practice. Articles discuss indications and contraindications, surgical anatomy, surgical technique, postoperative management, pearls and pitfalls, and complications; many articles also provide a case illustration. *Surgical Technique* articles will be solicited from experts and are open for submission upon receipt of a Proposal. Articles should be no more than 2,500 words, and they should include a one-paragraph abstract. Videos and/or high-resolution photographs are strongly encouraged.

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BEFORE YOU BEGIN

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