



Review

Is intramedullary fixation of displaced midshaft clavicle fracture superior to plate fixation? Evidence from a systematic review of discordant meta-analyses



Bin Xu, Yongsheng Lin*, Zhihong Wang, Junming Cao, Yipeng Yang, Hehuan Xia, Yingze Zhang

Department of Orthopedic Surgery, The Third Hospital of Hebei Medical University, Hebei, China

HIGHLIGHTS

- Discordant meta-analyses were found for the surgical treatment of displaced midshaft clavicle fracture.
- Nine meta-analyses met the inclusion criteria, five of which were Level-II evidence and four was Level-III evidence.
- Intramedullary fixation may be superior to plate fixation for treating displaced midshaft clavicle fracture.

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ABSTRACT

Objective: An increasing number of meta-analyses comparing intramedullary fixation (IF) with plate fixation (PF) for displaced midshaft clavicle fracture have been reported, but the inconsistent results obtained might confuse decision-making. We systematically reviewed discordant meta-analyses for assisting the decision-maker in interpreting and selecting amongst discordant meta-analyses and providing surgical recommendations for displaced midshaft clavicle fracture according to currently best available evidence.

Methods: Meta-analyses on IF and PF for displaced midshaft clavicle fracture were identified by searching PubMed, Embase and the Cochrane Library. A review of meta-analysis quality and data extraction was individually conducted by two reviewers. The meta-analysis providing the best available evidence was identified using the Jadad decision algorithm.

Results: Nine studies were included, five of which were of Level-II evidence and four of which were of Level-III evidence. These meta-analyses scored from 6 to 10 according to the Assessment of Multiple Systematic Reviews instrument. With respect to the Jadad decision algorithm, the best meta-analysis was chosen depending upon publication characteristics and methodology of primary studies, language restrictions, and whether data on individual patients were analysed. A meta-analysis incorporating more randomised controlled trials was eventually selected. The best available evidence indicated that the differences between IF and PF were not significant in terms of shoulder function or the rate of treatment failure. However, IF significantly decreased the operative time and the rate of non-operative complications, especially the rate of infection.

Conclusions: Based on the best available evidence, IF may be superior to PF for treating displaced midshaft clavicle fracture.

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1. Introduction

Clavicle fracture is a frequent injury that account for about 5% of fractures in adults, with approximately 80% of these fractures

located in the middle shaft [1–3]. About 73% of midshaft clavicle fractures are displaced [2]. These fractures have traditionally been managed by nonsurgical intervention, however, the use of conservative treatment in some specific subsets of patients results in a high incidence of nonunion, impaired shoulder function, disappointing cosmetic deformity and residual pain [4,5]. Therefore, surgical treatment has been increasingly performed for displaced midshaft clavicle fracture in clinical practice [4,6].

* Corresponding author. Department of Orthopedic Surgery, The Third Hospital of Hebei Medical University, No.139, Ziqiang Road, Shijiazhuang, Hebei, 050051, China.
E-mail address: linyongshenghb@126.com (Y. Lin).

If the surgery is indicated, there are two primary techniques for midshaft clavicle fracture, including intramedullary fixation (IF) and plate fixation (PF). An increasing number of randomised clinical trials (RCTs) have been reported that have compared the relative effectiveness of IF and PF, but their findings are conflicting [7–17]. Thus, the optimal operative procedures for midshaft clavicle fractures remain controversial. In addition, some meta-analyses have also been reported that compared these two surgical techniques for treating displaced midshaft clavicle fracture [18–26]. However, conflicts among these meta-analyses are also emerging. Some studies have reported that no differences in treatment effectiveness of IF and PF on fractures of the midshaft clavicle [18,19,22,24], while other studies concluded that IF is superior to PF for the treatment of midshaft clavicle fracture [20,21,23,25,26]. Such conflicting findings of these discordant meta-analyses have resulted in dilemmas for decision maker such as policy-makers and orthopaedic surgeons who are dependent on access to high quality evidence to choose from among the surgical procedures for displaced midshaft clavicle fractures.

To aid decision makers in selecting the optimal treatment [27], systematic reviews have been increasingly published to evaluate the discordant meta-analyses on certain topic in recent years [28–32]. However, as far as we know, no such systematic review of discordant meta-analyses has been performed to investigate the relative effectiveness between IF and PF for fractures of the displaced midshaft clavicle. Thus, we conducted a systematic review of discordant meta-analyses regarding IF and PF for displaced midshaft clavicle fracture with the goals of assisting decision-makers in selecting among the discordant meta-analyses and providing surgical recommendations according to the best available evidence.

2. Materials and methods

This study was carried out in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) statement [33] and previous similar papers [28–31].

2.1. Literature search

A compute search was done using PubMed, Embase, and the Cochrane Library on December 1, 2016. The following keywords were used: “clavicle”, “clavicular”, “systematic review”, “meta-analysis”, “fracture”, and “fractures”. Two reviewers individually performed the literature search. The reference lists of the selected relevant meta-analyses were used to identify additional relevant studies. Study titles and abstracts were reviewed for potential eligible studies. The full text of each study was obtained when the information was insufficient. Any disagreement was resolved by involving a third reviewer.

2.2. Eligibility criteria

The inclusion criteria were as follows: (1) meta-analyses comparing IF with PF for displaced midshaft clavicle fracture; (2) articles published in English; (3) comparison of at least one outcome, such as functional outcomes and complications. Narrative reviews, meeting abstracts, correspondence, and systematic reviews with no meta-analyses were excluded.

2.3. Data extraction

The following basic information was independently extracted by the two reviewers: first author, publication year, database searched, the design of the primary study, the number of included studies and RCTs, I^2 statistic value, and outcomes. Disagreement between the

reviewers was solved via discussion with a third reviewer.

2.4. Quality assessment

The Oxford Levels of Evidence [34] and the Assessment of Multiple Systematic Reviews (AMSTAR) instrument [35] were completed to assess meta-analysis quality. AMSTAR is an evaluation tool of study methodology, with known good reliability, validity, and responsibility [36,37], and is increasingly used to evaluate the quality of systematic review [30,31]. The quality of meta-analyses was individually assessed by two reviewers. Disagreement between the reviewers was solved by discussion and, when necessary, with adjudication by a third author.

2.5. Application of Jadad decision algorithm

The source of the discordance among the meta-analyses, incorporating clinical question, inclusion and exclusion criteria, data extraction, quality assessment, data synthesis, and statistical analysis, was assessed using the Jadad decision algorithm [27]. This has been increasingly applied for offering medical recommendations among meta-analyses with conflicting results [28–31]. Three reviewers individually assessed the meta-analyses by using this algorithm, and obtained a consensus on which study provided the current best evidence.

3. Results

3.1. Literature search

The search strategy found a total of 387 records from the three databases. The selection process is shown in Fig. 1. Ultimately, nine meta-analyses were included in this study [18–26]. The general information of these studies is summarized in Table 1. One study was published in 2011 [18], four studies were published in 2015 [19–22], and the other four studies were published in 2016 [23–26]. The number of primary studies ranged from two to twenty, and the number of included RCTs varied from two to ten (Table 2).

3.2. Search methodology

Three meta-analyses restricted the publication language to English [21,24,25], while the others reported no language limitation [18–20,22,23,26]. The Embase database was used as a search location in all of the included studies, and whether PubMed, MEDLINE, of Cochrane Library was used in literature search was discordant among the meta-analyses (Table 3).

3.3. Study quality

Five studies were of Level-II evidence according to the Oxford Levels of Evidence [18,19,21,22,25], while the other four studies were of Level-III evidence (Table 4) [20,23,24,26]. The GRADE was applied in two studies [19,25]. The AMSTAR scores are depicted in Table 5, which ranged from six to ten (median 7).

3.4. Heterogeneity evaluation

Heterogeneity was assessed by statistical method using the I^2 statistic value in the meta-analyses (Table 6). Four meta-analyses included the subgroup analyses (Table 4) [19,23–25]. The I^2 statistic values are shown in Table 6. Most outcomes are acceptable in the heterogeneity.

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