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Research Paper

Minimally Invasive Plate Osteosynthesis V/S Conventional Fixation Techniques for Surgically Treated Humeral Shaft Fractures: A Meta-Analysis

Medical Science

KEYWORDS : Minimally invasive plate osteosynthesis, Open reduction with plate osteosynthesis, Intramedullary nail, Humeral shaft fracture, Meta-analysis

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ABSTRACT

Background: In this study, we performed a meta-analysis to identify whether minimally invasive plate osteosynthesis (MIPO) was superior to conventional fixation techniques (CFT) for treating humeral shaft fractures.

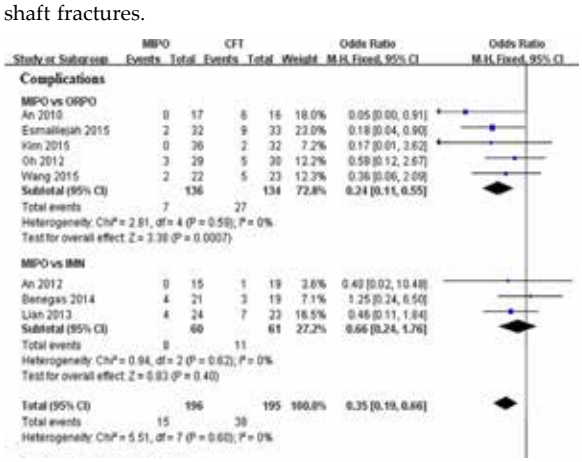
Methods: A systematic literature search was conducted up to February 2016 in ScienceDirect, Springer, MEDLINE, and PubMed databases for relevant papers that compared the outcomes of MIPO with CFT, such as open reduction with plate osteosynthesis (ORPO) and intramedullary nail (IMN) for treating humeral shaft fractures

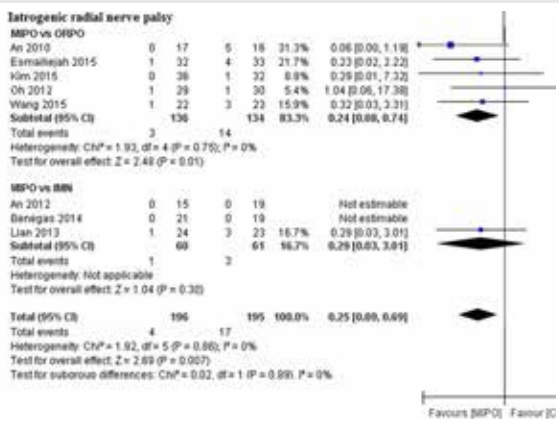
Results: According to the search strategy, eight studies that covered 391 patients were enrolled, including four randomized controlled trials (RCTs), two prospective cohort trials, and two retrospective cohort trials. Our meta-analysis did not detect any significant difference between MIPO and CFT (IMN and ORPO) in terms of operative time, fracture union rate, and fracture union time. However, MIPO has a less rate of complications and iatrogenic radial nerve palsy than that of ORPO and higher adjacent joint function scores than those of IMN ($p < 0.05$).

Conclusions: Based on the present evidence, this meta-analysis suggested that MIPO was a better choice for treating humeral shaft fractures than CFT. However, more high-quality randomized trials are still needed to further confirm this conclusion in the future.

BACKGROUND

Fractures of humeral shaft are common injuries, which make up 1 to 3 % of all fractures [1–5]. Historically, nonoperative treatment has been widely used for these injuries. However, a high rate of nonunion was reported in humeral shaft fracture patients with functional bracing [6, 7]. Therefore, many orthopedic surgeons tend to prefer operative treatment for humeral shaft fractures. Three main operative techniques have been developed for treating displaced humeral shaft fractures. Intramedullary nail and plate are the conventionally used surgical methods [5, 8]. Currently, open reduction and plate fixation remains to be the golden standard for humeral shaft fractures [9, 10]. Recently, minimally invasive plate osteosynthesis (MIPO) techniques with encouraging results in humeral shaft fracture patients have been reported [11–14]. This technique has advantages of less soft tissue dissection, a high rate of union, low risks of infection, and no need for radial nerve exposure [15]. It seems to imply that MIPO is superior to conventional fixation techniques (CFT), such as open reduction with plate osteosynthesis (ORPO) and intramedullary nail (IMN). Recently, several randomized controlled trials (RCTs) and comparative clinical studies have been conducted to compare MIPO with CFT for treating humeral shaft fractures. In this study, we performed a meta-analysis to identify whether MIPO was superior to CFT for treating humeral shaft fractures.





METHODS

Search strategy Since there were only a small amount of relevant RCTs in the literature, observational studies were also included. A systematic literature search was conducted up to February 2016 in ScienceDirect, Springer, MEDLINE, and PubMed databases. We screened the title and abstract with key words as follows: "minimally invasive plate osteosynthesis" or "MIPO", "plate" or "plating", "intramedullary nail" or "intramedullary pin", and "humeral shaft fracture" or "fracture of humeral shaft". In addition, references of theselected articles and relevant review papers were also searched. The language of articles was limited to English. Inclusion and exclusion criteria.The following eligibility criteria were applied in selecting articles:

(1) RCTs or observational studies that compared the clinical and/or radiological outcomes of MIPO with CFT for treating humeral shaft fractures;
(2) totally followed patients had to be more than 30; and
(3) skeletally mature patients.

The exclusion criteria included the following:

(1) a pathologic fracture;
(2) studies that did not report the outcome of interest; and
(3) repeated studies or reviews.

Two people independently performed the selection of stud-

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ies. Any disagreement between the reviewers was resolved by consensus with a third reviewer. Data extraction Two reviewers extracted data independently based on the following categories:

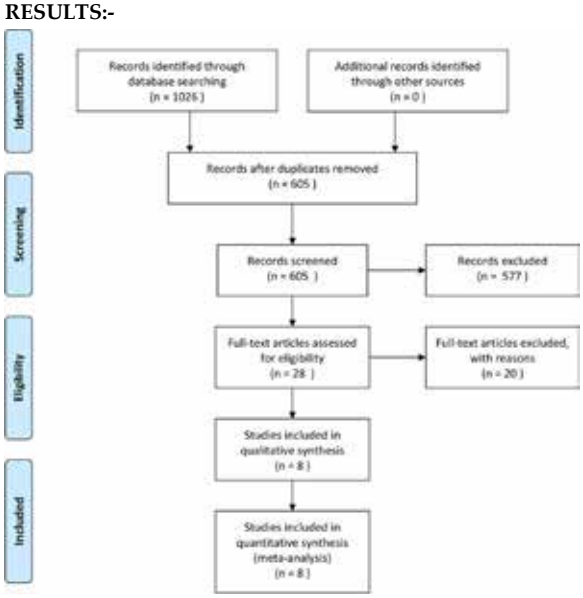
(1) basic characteristics, such as study design, published year, study population characteristics, and humeral shaft fracture type;
(2) primary outcomes, consisting of postoperative clinical function by the University of California, Los Angeles (UCLA) Shoulder Scale [16] and Mayo Elbow performance score (MEPS) [17]; and
(3) secondary outcomes, such as complications and iatrogenic radial nerve palsy, operative time, radiation exposure time, and fracture union time. Any disagreement between the reviewers was resolved by consensus with a third reviewer. Risk of bias assessment To assess the risk of bias of the included RCTs, the Cochrane Handbook for Systematic Reviews of Interventions observational studies was evaluated with the Newcastle– Ottawa Scale, and the trials with a total score over 5 were considered to be of high quality [18]. Statistical analysis Meta-analysis was performed using Review Manager 5.0 software (Cochrane Collaboration, Oxford, UK). Weighted mean difference (WMD) or standard mean difference (SMD) was calculated for continuous outcomes and risk ratios (RR) for binary outcomes, along with 95 % confidence intervals (CIs).

The level of significance was set at $p < 0.05$. Heterogeneity was evaluated using the $\chi 2$ test and I2 statistics. (Heterogeneity was detected when $p < 0.10$ or $I2 > 50$ %.) Fixed-effects models were applied unless statistical heterogeneity was significant, in which case random-effects models were used.

Standard deviation (SD) was estimated according to the method described by the Cochrane Handbook for Systematic Reviews of Interventions when it was not available.

In this paper, CFT was consisted of ORPO and IMN. Then, we conducted subgroup analyses based on the two kinds of CFT (ORPO subgroup and IMN subgroup).

RESULTS:-



CONCLUSIONS

In summary, based on the present evidence, MIPO is a better choice for treating humeral shaft fractures than CFT, though there is no significant difference between MIPO and CFT in terms of operative time, fracture union rate, and fracture union time. MIPO has a less rate of complications and iatrogenic radial nerve palsy than that of ORPO and higher adjacent joint function scores than those of IMN. However, more high-quality randomized trials are still needed to further confirm this conclusion in the future.

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