The Journal of Foot & Ankle Surgery 54 (2015) 646–651

Contents lists available at ScienceDirect

The Journal of Foot & Ankle Surgery

journal homepage: www.jfas.org

A Meta-Analysis for Postoperative Complications in Tibial Plafond Fracture: Open Reduction and Internal Fixation Versus Limited Internal Fixation Combined With External Fixator

Dong Wang, MD [1], Jian-Ping Xiang, MD [1], Xiao-Hu Chen, MD [2], Qing-Tang Zhu, MD [1]

[1] *Department of Orthopedics and Microsurgery, First Affiliated Hospital of Sun Yat-sen University, Guangzhou City, Guangdong Province, China*
[2] *Department of Orthopedics, HuiYa Hospital of HuiZhou, Sun Yat-sen University, Huizhou City, Guangdong Province, China*

ARTICLE INFO

Level of Clinical Evidence: 2

Keywords:
ankle
fracture fixation
surgical complication
tibia

ABSTRACT

The treatment of tibial plafond fractures is challenging to foot and ankle surgeons. Open reduction and internal fixation and limited internal fixation combined with an external fixator are 2 of the most commonly used methods of tibial plafond fracture repair. However, conclusions regarding the superior choice remain controversial. The present meta-analysis aimed to quantitatively compare the postoperative complications between open reduction and internal fixation and limited internal fixation combined with an external fixator for tibial plafond fractures. Nine studies with 498 fractures in 494 patients were included in the present study. The meta-analysis found no significant differences in bone healing complications (risk ratio [RR] 1.17, 95% confidence interval [CI] 0.68 to 2.01, $p = .58$], nonunion (RR 1.09, 95% CI 0.51 to 2.36, $p = .82$), malunion or delayed union (RR 1.24, 95% CI 0.57 to 2.69, $p = .59$), superficial (RR 1.56, 95% CI 0.43 to 5.61, $p = .50$) and deep (RR 1.89, 95% CI 0.62 to 5.80) infections, arthritis symptoms (RR 1.20, 95% CI 0.92 to 1.58, $p = .18$), or chronic osteomyelitis (RR 0.31, 95% CI 0.05 to 1.84, $p = .20$) between the 2 groups.

Tibial plafond fractures occur at the distal end of the tibial bone and often involve destruction of the ankle joint (1–3). Such fractures are uncommon in the injuries, representing 5% to 10% of all tibial fractures (4). Most tibial plafond fractures will be caused by high-energy trauma, often resulting in significant displacement, articular comminution, and severe soft tissue injuries (5). Therefore, the treatment of such fractures remains challenging to orthopedic surgeons.

Various methods have been introduced for the treatment of tibial plafond fractures (6). The most widely used methods for the treatment of tibial plafond fractures include open reduction and internal fixation (ORIF) and limited internal fixation combined with an external fixator (LIFEF). ORIF was regarded as a safe technique with good clinical results, because it restored the anatomic structure of the bone (7,8). However, the extensive dissection of the soft tissue associated with ORIF might lead to increased complications, making LIFEF seem preferable (9,10).

As an alternative to ORIF, LIFEF minimizes the operative incision and soft tissue disruption and, thus, was generally advocated for tibial plafond fractures. Nevertheless, whether these theoretical advantages will result in better outcomes remains controversial. Some studies have shown that LIFEF was associated with few complications, and other studies have reported more postoperative complications in the LIFEF group (11–13).

Therefore, we conducted a meta-analysis to quantitatively compare the postoperative complications between ORIF and LIFEF.

Materials and Methods

Our meta-analysis was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines (14).

Search Strategies

The search terms included "open reduction and internal fixation," "ORIF," "limited internal fixation," "LIFEF," "external fixation," "external fixator," "external device," "tibial plafond fracture," and "tibial pilon fracture." PubMed, EMBASE, the Cochrane Library, ISI Web of Knowledge, and Chinese Biomedical Database were searched for the eligible studies to November 2013. All searches were conducted without language, date, and publication status restrictions. Two of us (D.W. and J.-P.X.) independently performed the searches and included the relevant reports. Disagreements were resolved by discussion with a third author (Q.-T.Z.).

Inclusion Criteria for Considering Studies for Our Review

All randomized controlled trials and nonrandomized studies, whether prospective or retrospective, were included in the present study. The following criteria were considered in the included studies:

Financial Disclosure: None reported.
Conflict of Interest: None reported.
Dong Wang and Xiao-Hu Chen contributed equally to this work.
Address correspondence to: Jian-Ping Xiang, MD, Department of Orthopedics and Microsurgery, First Affiliated Hospital of Sun Yat-sen University, No. 58 Zhonshan Road 2, Guangzhou City, Guangdong Province 510080 People's Republic of China.
E-mail address: xiangjpzhsh@126.com (J.-P. Xiang).

1067-2516/$ - see front matter © 2015 by the American College of Foot and Ankle Surgeons. All rights reserved.
http://dx.doi.org/10.1053/j.jfas.2014.06.007

1. Studies comparing ORIF and LIFEF in tibial plafond fractures
2. Adult patients, excluding children
3. A follow-up period of at least 6 months

The primary outcomes included nonunion, malunion or delayed union, superficial and deep infections, arthritis symptoms, and chronic osteomyelitis.

Data Extraction and Quality Assessment

Two independent authors (D.W. and X.-H.C.) extracted the data, including participant characteristics, country in which the trial had been centered, and the number of participants allocated to each intervention group. The methodologic quality of the included studies was assessed using the Center for Evidence-Based Medicine (Oxford, UK) rating scale (15). Differences were resolved by discussion until a consensus had been reached.

Statistical Analysis

The meta-analysis was performed using Review Manager 5.2 software (Cochrane Informatics and Knowledge Management Department; available at http://tech.cochrane.org) and included union, malunion, nonunion, and postoperative complications. The risk ratio (RR) with the 95% confidence interval (CI) was used to analyze the dichotomous data. Heterogeneity among studies was detected using the I^2 value. When heterogeneity was significant (I^2 >50%), the meta-analysis was performed using the random-effect model and otherwise, using the fixed-effect model. Sensitivity analysis was performed by excluding the data from the low-quality studies.

Results

Literature Search and Characteristics of Included Studies

Fig. 1 shows the chart of data screening. A total of 845 potentially relevant studies resulted from the initial search. Finally, 9 studies (3 randomized controlled trails [RCTs] and 6 non-RCTs) met the inclusion criteria (7,11–13,16–20). All studies were published from 1996 to 2012; 5 studies were from the United States (7,11,16,18,20), 3 studies were from China (12,13,17), and 1 was from Australia (19).

In the included studies, a total of 498 fractures in 494 patients were involved. Of these fractures, 273 were treated with ORIF and 225 with LIFEF. The average patient age ranged from 37.2 to 57.6 years. Using the quality rating scale of Evidence-Based Medicine of Oxford (15), 3 studies (11,12,17) were rated as level I evidence, 1 (16) as level II, and 5 (7,13,18–20) as level III (Table).

Meta-Analysis Results

Subgroup Analysis for Bone Healing Complications

A subgroup analysis was performed for bone healing complications (nonunion, malunion, and delayed union).

Nonunion. A total of 7 studies with 450 fractures were included in the meta-analysis (7,11–13,16–18). The rate of nonunion was 9 of 202 in the LIFEF and 10 of 248 in the ORIF group, respectively. Meta-analysis showed no difference in nonunion between the 2 groups (RR 1.09, 95% CI 0.51 to 2.36, $p = .82$). The heterogeneity among the studies was not significant ($I^2 = 0\%$; Fig. 2).

Malunion or Delayed Union. A total of 5 studies with 363 fractures reported the results of malunion or delayed union (7,11,12,17,18). The rate of malunion or delayed union was 12 of 157 fractures in the LIFEF group and 12 of 206 fractures in the ORIF group. The meta-analysis

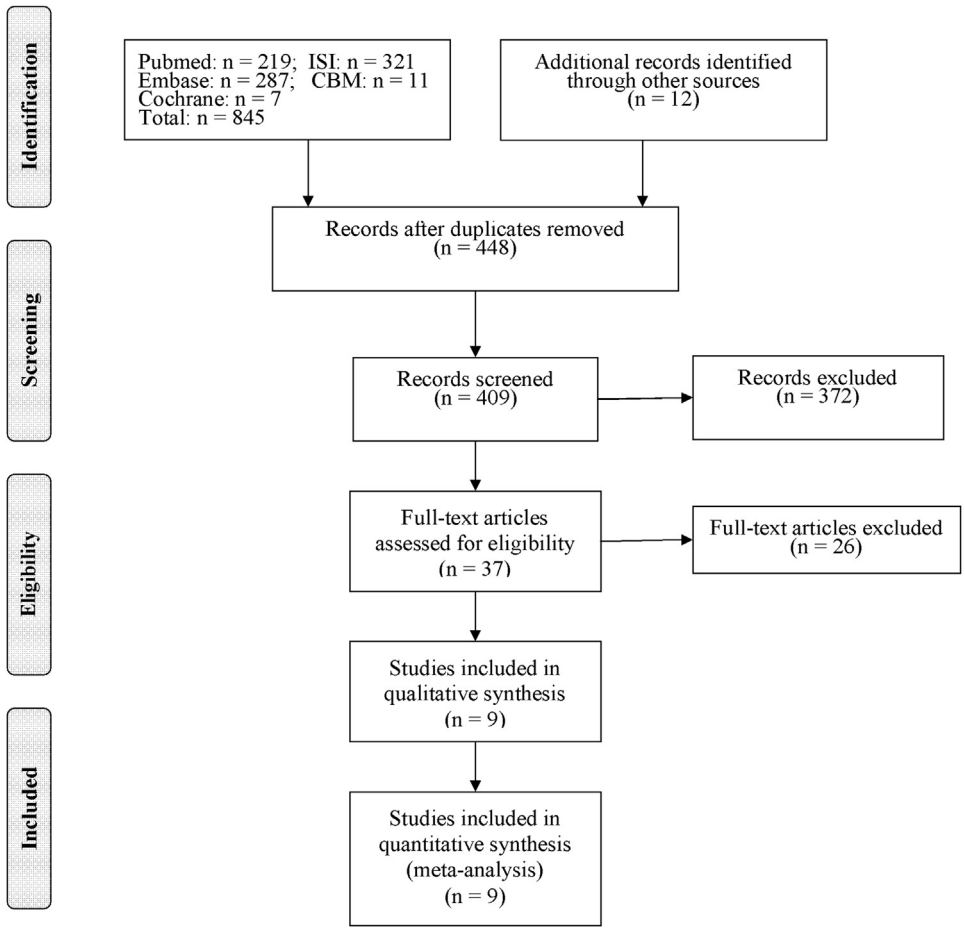

Fig. 1. Flow chart of literature screening.