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Volar locking plate *versus* external fixation for the treatment of unstable distal radial fractures: a meta-analysis of randomized controlled trials

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ABSTRACT

Background: The choice between volar locking plates (VLP) and external fixation (EF) for unstable distal radius fractures have not reached a consensus. The meta-analysis of randomized controlled trials was performed to compare VLP with EF to determine the dominant strategy.
Materials and methods: Meta-analysis was performed with a systematic search of studies conducted by using the PubMed, Embase, and Cochrane Central Register of Controlled Trials databases. The randomized controlled trials that compared VLP with EF was identified. Characteristics, functional outcomes, radiological results, and complications were manually extracted from all the selected studies.
Results: Six studies encompassing 445 patients met the inclusion criteria. There was significant difference between two procedures in disabilities of the arm shoulder and hand scores at 3,6, and 12 mo, visual analogue scale at 6 mo, grip strength at 3 mo, supination at 3 and 6 mo, extension at 3 mo, ulnar variance at 12 mo, and reoperation rate at 12 mo, postoperatively. However, there was no significant difference between flexion, pronation, radial deviation, and ulnar deviation at all follow-up points postoperatively and overall complications at 12 mo, postoperatively.
Conclusions: EF had less reoperative rate due to complications, however, VLP had advantages in functional recovery in the early period after surgery, but two methods had similar functional recovery at 12 mo, postoperatively. Clinician should make the treatment decision with great caution for the patients who sustained unstable distal radial fractures.

1. Introduction

The distal radius fractures, which is one of most common osteoporotic fractures [1], bring high numbers of emergency department visits. They account for >8% of all bony injuries seen in the emergency department [2] and the incidence rate was 31 per 10^4 persons per year [3]. Although the rate was not very high, the absolute numbers of distal radius fractures and

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the related costs are expected to increase with the aging population worldwide [4].

Several choices can be made for managing unstable fractures of distal radius, such as closed reduction with percutaneous Kirschner-wire [5], pins and plaster [6], closed reduction with external fixation (EF) [7], and internal fixation (IF) with plates [8], of which EF and IF with plates, especially volar locking plates (VLP), are likely two common methods in recent decades [9]. As a traditional and important treatment for complex fractures of distal radius, EF can make less invasive and obtain acceptable results [10]. However, the recurrent displacements happened in more than half of the cases [11] and the complication rate is 20%–35% [12] in this technique. Since the introduction of locked plates, the shift of surgical methods to open reduction and IF with VLP have occurred over the last decade [3]. IF using a VLP can provide robust and satisfactory stability [13] and prevent the damage of the dorsal extensor tendons due to the volar approach. Additionally, using VLP have an advantage of biomechanics among the treatments for the unstable fractures of distal radius [12], but whether VLP are superior to EF in clinical results in the treatment for the unstable distal radius fractures remains uncertain. Although several randomized controlled trials (RCTs) that have been published in recent years, there was no consensus across the studies, as well as the small sample sizes.

Recently, a meta-analysis of RCTs compared VLP with EF for the treatment of unstable distal radius fractures [14], but whether one technique is superior to the other had not been reached as a conclusion in the study, which included only three studies. Moreover, additional studies have been reported [15,16] since the earlier meta-analysis, which will make the present meta-analysis more precise and reliable.

We conducted this comprehensive meta-analysis based on all relevant RCTs to compare the VLP with EF in the treatment of unstable distal radius fractures (Fig. 1). The outcomes we were interested in included clinical functional outcomes, radiological results, and rate of complications.

2. Methods

2.1. Search strategy

A search for PubMed, Embase, and Cochrane Central Register of Controlled Trials (central) databases from inception to September 2013 about the distal radius fractures was performed according to the search strategy mentioned in Cochrane Handbook 5.1.0 [17]. We used the following items: (distal radius or distal radial) and (fracture or fractures) and (EF or external fixator) and (volar locking plate or volar locked plate). Publication language restriction was not imposed in the search. The references of the retrieved articles were also affirmed. Two co-authors completed the search performance independently.

2.2. Eligibility criteria

Studies on comparison between VLP and EF for the treatment of unstable distal radius fractures were included. The inclusion criteria are as follow: the design of study must be RCT; the original study must report at least one of the outcomes as follow: disabilities of the arm shoulder and hand (DASH) score [18], visual analogue scale postoperatively, patients related wrist evaluation (PRWE), grip strength, the range of wrist motion, the radiological results, and complications. The trials in which participants included children were excluded.

Because there are no uniform criteria established for the definition of an unstable distal radial fractures, we made the

Fig. 1 – Diagram of two techniques.