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Literature review

Systematic review and pooled analysis of the rate of carpal tunnel syndrome after prophylactic carpal tunnel release in patients with a distal radius fracture

Revue systématique et analyse poolée du taux de syndrome du canal carpien après la libération du canal carpien à ciel ouvert chez des patients atteints d'une fracture de l'extrémité distale du radius

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ABSTRACT

The aim of this study was to determine the rate of carpal tunnel syndrome (CTS) in patients with a volar plated distal radius fracture (DRF), with or without prophylactic carpal tunnel release (CTR). The PubMed database was searched for studies reporting on CTS in patients with a DRF fixed by a volar plate. Selected patients were those who underwent prophylactic CTR versus patients who did not. Pooled rates of CTS were calculated using inverse – variance weighting assuming a random effects model. Tests for heterogeneity were applied. In this study, 172 patients in the CTR group and 1839 patients in the non-CTR group were included. The pooled rate for CTS in the CTR group was 28.1% (95% CI: 11.8% to 48.2%) while it was 4.4% (95% CI: 3.1% to 6.0%) in the non-CTR group. CTR is of no prophylactic value for postoperative CTS in volar plated DRF patients.

RÉSUMÉ

Le but de cette étude était de déterminer le taux de syndrome du canal carpien (SCC) chez les patients atteints d'une fracture de l'extrémité distale du radius (EDR) fixée par une plaque palmaire, avec ou sans libération du nerf médian à ciel ouvert prophylactique. La base de données PubMed a été utilisée pour des études investiguant les SCC chez des patients atteints d'une fracture de l'EDR fixée par plaque palmaire. Les patients sélectionnés étaient ceux qui avaient subi la technique à ciel ouvert versus ceux qui ne l'avaient pas été. Les taux combinés de SCC ont été calculés en utilisant une pondération de variance inversée en supposant un modèle d'effets aléatoires. Des tests d'hétérogénéité ont été appliqués. Dans cette étude, 172 patients du groupe qui avait subi la libération du nerf médian à ciel ouvert et 1833 patients du groupe sans cette chirurgie ont été inclus. Le taux global de SCC dans le groupe de libérations à ciel ouvert était de 28,1 % (IC 95 % 11,8 % à 48,2 %) et 4,4 % (IC 95 % 3,1 % à 6,0 %) dans le groupe sans la libération chirurgicale du canal carpien à ciel ouvert. La libération chirurgicale du canal carpien à ciel ouvert n'a pas de valeur prophylactique pour le SCC postopératoire chez les patients atteints d'une fracture de l'EDR traitée par plaque palmaire.

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1. Introduction

One way to treat a distal radius fracture (DRF) is open reduction and volar plate fixation. The prevalence of acute carpal tunnel syndrome (CTS) after surgical treatment of a DRF is 5.4% [1]. Research suggests that suitable carpal tunnel release (CTR) in patients with a DRF is an effective way to decompress the median nerve and treat CTS [2]. Except for scar-related complications, this procedure rarely has any complications [3,4]. To prevent CTS after DRF, the carpal tunnel may be opened during volar plate fixation. However, the effectiveness of prophylactic CTR in patients with a DRF is still unclear.

The aim of this systematic review was to evaluate whether performing CTR during open reduction and volar plate fixation in DRF patients prevents CTS.

2. Material and methods

This systematic literature review was conducted and reported according to the standards set out in Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) [5]. The protocol was predefined.

2.1. Search strategy

The PubMed database was searched from database inception until February 1, 2017 for studies using the search string: ((“carpal tunnel syndrome” [MeSH] OR “carpal tunnel syndrome” [All Fields]) AND (“radius fractures/surgery” [MeSH] OR “radius fracture” [All Fields]) AND (“volar” [All Fields] OR “palmar” [All Fields)). The filter “English” was used to further narrow the search results. Reference lists of review articles and eligible studies were reviewed for additional studies that may have been missed.

2.2. Manuscript selection and eligibility criteria

Titles and abstracts of all retrieved studies were screened for eligibility by two reviewers (ZA and SAS) independently. Inconsistencies were resolved by consensus. Inclusion criteria were original data on CTS in patients with a DRF treated with volar plate fixation with or without CTR. Exclusion criteria were: patients who were diagnosed with CTS before surgery, patients who underwent CTR before surgery, patients with a previous history of CTS, any fixation plate other than a volar plate, non-clinical studies, case reports, non-DRF, cadaver studies and studies with undefined data.

2.3. Scientific level of evidence

The level of scientific evidence according to Mahid et al. was determined for each study; randomized controlled trials, cohort studies, and case series were considered eligible [6].

2.4. Risk of bias assessment

Two reviewers (ZA and SAS) independently assessed the methodological quality of each study using the Newcastle Ottawa Quality Assessment Scale [7]. The attainable points for cohort studies ranged from 0 to 9. Consensus was reached by discussion.

2.5. Data extraction

Predefined data extraction was done independently by two reviewers (ZA and SAS). The following information was retrieved when extracting data: first author, publication year, number of patients, gender and age of the patients, study type, CTR or no CTR, surgical approach, number of patients with CTS, technique used to diagnose CTS and duration of follow-up. The primary outcome was the CTS rate. Consensus in data extraction was reached by discussion with the principal investigator (MMEW).

2.6. Statistical analysis

Data were analyzed using MedCalc for Windows, version 16.4.3 (MedCalc Software bvba, Ostend, Belgium; https://medcalc.org;2016 MedCalc). CTS rates were computed for each study and subsequently pooled. An I^2 statistic greater than 40% was considered as representative of significant heterogeneity. Data were pooled using a random-effects model for binomial data. A random-effects model was planned a priori because of the anticipated heterogeneity across studies. Pooled rates are reported with 95% confidence intervals (CI).

3. Results

The PubMed search identified 38 articles (Fig. 1). Seven could not be included since the publication language was not English. Of the remaining 31 articles, 20 were excluded because they met the exclusion criteria. The reference lists of the remaining 11 articles were reviewed, which led to 5 additional articles being included. Sixteen articles remained for analysis: nine prospective cohort studies [8–16] and seven retrospective cohort studies [17–23] (Table 1). Two studies compared a CTR group with a non-CTR group [15,21]. Study characteristics are shown in Table 1. The mean Newcastle Ottawa Quality Assessment Scale score for both prospective and retrospective cohort studies was 6 out of 9 (range 4–8; Appendix 1).

Three studies, with a total of 172 patients, reported the rate of CTS after prophylactic CTR (Fig. 2A) [13,15,21]. The CTS rate of the individual studies ranged from 12.3% to 37.5%. The heterogeneity had an I^2 value of 85.9%. The pooled CTS rate was 28.1% (95% CI: 11.8% to 48.2%).

Fifteen studies, with a total of 1839 patients, reported the rate of CTS for patients treated without prophylactic CTR [8–12,14–23]. The CTS rate of the individual studies ranged from 1.1% to 17.8% (Fig. 2B). Heterogeneity across studies had an I^2 value of 42.0%. The pooled CTS rate was 4.4% (95% CI: 3.1% to 6.0%).

Except for three studies [18,20,21], all articles used undefined clinical to diagnose CTS. Odumala et al. defined CTS as altered motor, sensory and autonomic disturbances in the distribution of the median nerve [21]. Gwathmey et al. defined it as anesthesia, paresthesia, or dysesthesia referable to the thumb, index, long, and/or radial half of the ring ringer [13]. In all the other manuscripts, the clinical parameters were not defined [8–12,14–20,22,23] (Table 2). Odumala et al., Ho et al. and Obert et al. used conduction studies in addition to clinical parameters to diagnose CTS [18,20,21].

The postoperative follow-up in which CTS was diagnosed ranged from 2 weeks to 45 months (Table 2).

4. Discussion

In this systematic review, a pooled analysis based on existing literature was performed to assess the rate of CTS after prophylactic CTR versus no CTR in DRF patients treated by volar plate fixation. Postoperative CTS seemed more frequent in the prophylactic CTR-group than in the non-CTR group, suggesting that CTR does not help decrease the rate of CTS in patients with a DRF treated with volar plate fixation.

Although CTR is a safe procedure [3,4] our analysis suggests there are more CTS cases in the prophylactic CTR group; CTR may

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