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Review

Anterior versus posterior approach for the treatment of cervical compressive myelopathy due to ossification of the posterior longitudinal ligament: A systematic review and meta-analysis

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HIGHLIGHTS

- The optimal surgical strategy for cervical OPLL remains controversial.
- We have compared two surgery approaches in treatment of cervical OPLL.
- Based on the results, we thought anterior approach especially preferable to patients with canal-occupying ratio > 50%–60% and posterior approach suggested for patients with canal-occupying ratio < 50%–60%.

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ABSTRACT

Purpose: The purpose of the study is to perform a systematic review and meta-analysis to evaluate the clinical results of anterior and posterior approaches for the treatment of cervical compressive myelopathy due to cervical ossification of the posterior longitudinal ligament (OPLL).

Methods: Randomized controlled trials or non-randomized controlled trials published since January 1995 to October 2015 that compared the clinical effectiveness of anterior and posterior surgical approaches for the treatment of cervical OPLL were acquired by a comprehensive search in three electronic databases (PubMed, EMBASE, Cochrane library). A total of 13 studies (1050 patients) were included in this systematic review and meta-analysis.

Result: The results indicated that no statistically significant differences between the anterior group and posterior group in terms of preoperative JOA score [P = 0.16, SMD = 0.1 (−0.04, 0.23)] and recovery rate of patients with canal-occupying ratio < 50%–60% [p = 0.89, SMD = 0.03 (−0.35, 0.41)]. The anterior group showed higher postoperative JOA score [P < 0.05, SMD = 0.23 (0.05, 0.41)], overall recovery rate (regardless of canal-occupying ratio) [P < 0.01, SMD = 0.79 (0.31, 1.27)], especially a significant higher recovery rate of patients with canal-occupying ratio > 50%–60% [P < 0.01, SMD = 1.50 (0.52, 2.47)]. However, it also revealed that the postoperative complication rate [P < 0.05, OR = 1.90 (1.08, 3.36)], blood loss [P < 0.01, SMD = 0.63 (0.34, 0.93)] and operative time [P < 0.01, SMD = 1.86 (1.07, 2.65)] were significantly higher.

Conclusion: Based on the results above, anterior approach surgery was associated with better overall (regardless of the canal-occupying ratio) postoperative neural function than posterior approach in the treatment of cervical compressive myelopathy due to OPLL. We thought anterior approach especially preferable to patients with canal-occupying ratio > 50%–60%, although it leads to a higher surgical trauma and incidence of surgery-related complications. Posterior approach surgery was relatively safer with lower surgical trauma and incidence of complications. We also suggest posterior approach for patients with canal-occupying ratio < 50%–60%, since the postoperative neural function was similar between the two groups for this part of patients.

1. Introduction

OPLL was first described in Japanese patients and has classically

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been considered a cause of cervical myelopathy in patients of East Asian origin. In Asian countries, the prevalence of OPLL has been 1.9%–4.3% among individuals older than 30 years, as shown by epidemiologic studies [1–4]. In a large cohort research by Cervical Spine Research Society in 1997, surgery for cervical OPLL remained 5% of cervical spine surgery, with possibly higher actual rate because of recent awareness of the disease among spine surgeons [5]. Surgical decompression is frequently indicated in patients with cervical myelopathy due to OPLL. Anterior decompression typically consists of diskectomy or corpectomy along with direct removal of the OPLL mass. Posterior approaches use an indirect decompression via either laminoplasty or laminectomy [6]. Each of these approaches entails advantages and risks, controversies still remain on the surgical options. Anterior decompression and direct removal of OPLL seems to be radical, because the major pathomechanism of OPLL is anterior compression of the spinal cord [7,8], moreover, some authors have shown the benefit of anterior decompression in cases with a high occupying ratio of OPLL [9,10]. However, the procedure is more complicated and prone to high risk of complications [9,11–13]. Posterior decompression is the preferred choice of surgical treatment for cervical OPLL in many institutes [14–17]. For it's a relatively safer procedure and can provide extensive decompression of segments more easily. However, such an approach has a risk of OPLL progression and limited effectiveness in cases with severe kyphotic deformity OPLL [9,18,19]. The purpose of the study is to perform a systematic review and meta-analysis to evaluate the clinical results of anterior and posterior approaches for the treatment of cervical OPLL.

2. Materials and methods

2.1. Inclusion criteria and exclusion criteria

Studies were included if they met the following criteria: (1) randomized or non-randomized controlled study; (2) included patients with cervical compressive myelopathy due to OPLL; (3) included patients who underwent surgical treatment; (4) posterior cervical canal decompression and anterior cervical canal decompression were compared (regardless of the specific surgical approaches); (5) included patients >18 years of age; and (6) The mean follow-up periods >1 year. Studies were excluded if they: (1) were non-controlled; (2) combined anterior and posterior surgery; (3) included patients with cervical compressive myelopathy not caused by OPLL; (4) OPLL in the thoracic spine; (5) average follow-up time <1 year.

2.2. Search methods and selection of studies

Relevant literature searches were performed using PubMed EMBASE and Cochrane library. The key words for literature searches included “ossification of the posterior longitudinal ligament”, “cervical”, “treatment outcome”, “surgery”, “anterior approach” and “Posterior approach”. The search was performed with limiting factors of “human” and “English language”, published time from January 1995 to October 2015.

Each article selected for inclusion has been reviewed by the junior authors to ensure proper selection. In cases of disagreement, the senior author arbitrated for the final inclusion or exclusion.

2.3. Data extraction and management

The following information was collected from each study using a standardized form: (1) study ID; (2) study design; (3) study location; (4) main inclusion/exclusion criteria; (5)patient demographics; (6) length of follow-up; (7) surgical approach for each group; (8) JOA scores before and after surgery; (9) recovery rate (overall recovery rate; severe disease (canal-occupying ratio > 50%–60%) recovery rate; less severe disease (canal-occupying ratio60<% to 50%) recovery rate); (10)number of complications, type of complications, and rate of complications; and (11) operation time and blood loss.

2.4. Subgroup analysis

Subgroup analysis was conducted according to the standard of severe and less severe disease; subgroup A included studies in which the severe disease canal-occupying ratio > 60%, the less severe disease canal-occupying ratio < 60%.whereas subgroup B included studies in which the severe disease canal-occupying ratio > 50%, the less severe disease canal-occupying ratio < 50%.

2.5. Statistical analysis

Heterogeneity was tested using the chi-square test and quantified by calculating the I^2 statistic, for which a P value less than 0.1 and an I^2 value greater than 50% was considered to be statistically significant. For the pooled effects, weighted mean difference or standard mean difference was calculated for continuous variables according to the consistency of measurement units, and the odds ratio (OR) was calculated for dichotomous variables. Continuous variables are presented as mean differences and 95% confidence intervals (CI), whereas dichotomous variables are presented as OR and 95% CI. Random-effects or fixed-effects models were used depending on the heterogeneity of the studies included. All statistical tests were performed with SPSS version 19.0 statistical software (SPSS Inc, Chicago, Illinois) and Review Manager version 5.3 software (The Cochrane Collaboration, Oxford, United Kingdom).

3. Results

3.1. Search results

A total of 574 studies were found in PubMed, 127 in EMBASE, and 21 in the Cochrane Library. These articles were reviewed and a total of 537 titles and abstracts were screened after removing duplicates, irrelevant studies, case reports and not comparative studies. Secondary stage screening of abstracts was based on study design, population, purpose of interventions, and outcome index, and a total of 37 articles were obtained in full and screened, yielding a total of 13 articles for this systematic review and meta-analysis [9,10,18,20–29]. The detail selection process is shown in Fig. 1.

3.2. Quality assessment and baseline characteristics

No randomized controlled trial was identified. All 13 studies included 11 were retrospective comparative studies, 1 was prospective cohort study and 1 retrospective cohort study with relatively low quality (Table 1). The quality of evidence using GRADE was not upgraded and remained low due to the unspecific description of study design and the less rigorous methodology in observational studies. The major baseline characteristics of participants in each study (study design, study location, Number of patients, patients age statistics, Follow-up time and surgical approach) are presented in Table 2.

3.3. Clinical outcome

12 studies used the JOA score to assess the clinical outcome, all