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Review

Anterior corpectomy comparing to posterior decompression surgery for the treatment of multi-level ossification of posterior longitudinal ligament: A meta-analysis

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HIGHLIGHTS

- Anterior surgery achieve better JOA scores and recovery rates for OPLL.
- The complications caused by anterior surgery are more than posterior surgery.
- Anterior directly decompression is advised when complications could be controlled.

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ABSTRACT

Background: Ossification of posterior longitudinal ligament (OPLL) can be treated by two surgical strategies, anterior decompression with fusion and posterior decompression with laminoplasty or laminectomy. It has been debated which surgical approach is more appropriate for the treatment of multilevel OPLL. The purpose of this study is to compare the outcomes of anterior corpectomy surgery to posterior decompression surgery for the treatment of multilevel ossification of OPLL.

Materials and methods: The databases of Medline, Embase, Pubmed, Cochrane library, and Cochrane Central Register of Controlled Trials was searched and we included trials which comparing anterior to posterior surgery for multilevel OPLL. There was no language restrictions. Two authors independently assessed the methodological quality of included trials. The data of outcomes was extracted and analyzed by STATA 12.0.

Results: Six studies were included in this meta-analysis, and totally 123 patients were undergone anterior cervical corpectomy and fusion (ACCF) and 216 patients were decompressed by posterior approach. In this meta-analysis, the postoperative JOA score of anterior surgery was higher than posterior surgery at one year follow-up. Consistently, the recovery rate of anterior surgery was higher than posterior surgery. However, the anterior surgery (ACCF) showed significantly more complications comparing to posterior surgery for the treatment of multilevel OPLL.

Conclusion: This meta-analysis indicates that the parameters of outcomes and functional recovery of patients performed with anterior surgery achieve better JOA scores and recovery rates to those with posterior surgery. Though the incidence of complications of anterior surgery are higher than posterior surgery, the anterior directly decompression is advised when the complications could be controlled by advanced surgical technique.

1. Introduction

Ossification of posterior longitudinal ligament (OPLL) usually occurs in cervical vertebra in Asian population. It can be treated by two surgical strategies, anterior decompression with fusion and posterior decompression with laminoplasty or laminectomy. The

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anterior approach can achieve complete decompression by removing the ossified ligament, and accomplish a solid fusion of cervical vertebra. The posterior approach makes the decompression from the dorsal part of the cervical spinal cord. It was previously reported that when the ossification of posterior longitudinal ligament involves less than 3 segments, especially when the canal narrowing ratio >60%, the anterior approach would be advised [1,2]. The anterior approach could make a direct decompression and reconstruct the stability by a solid spinal fusion, however, the anterior approach required more techniques, more bone grafts for fusion and longer postoperative immobilization of the neck [3].

The posterior surgery has been thought to decompress the spinal cord indirectly by laminoplasty or laminectomy for the treatment of multilevel myelopathy and OPLL [4]. The surgical technique is less difficult than anterior cervical corpectomy and fusion (ACCF). But the effect of the posterior surgery depends on the backward shift of the cervical spinal cord. If the ossified mass of ligament invades the canal severely and the spinal cord still cannot escape from the compression after posterior surgery, the outcomes may not be satisfying [5]. Therefore, it has been debated which surgical approach is more appropriate for the treatment of multilevel ossification of posterior longitudinal ligament. The purpose of this study was to compare the outcomes of anterior surgery to posterior surgery for the treatment of multilevel OPLL.

2. Materials and methods

2.1. Search strategy

A PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses)-compliant search was performed in the databases of Medline, Embase, Pubmed, Cochrane library, and Cochrane Central Register of Controlled Trials (CENTRAL) by using combinations of the following keywords: ossification of posterior longitudinal ligament (OPLL), multilevel/multi-level myelopathy, cervical decompression, anterior cervical corpectomy and fusion (ACCF), laminoplasty, laminectomy. We searched for randomized controlled trails (RCTs), prospective cohort and retrospective cohort published between January 1990 and June 2016 that compared anterior surgery with posterior surgery for the treatment of multilevel OPLL. We placed no restrictions on the language of the publication. References cited in the relevant articles were also reviewed. All researches were carefully estimated to identify repeated data. Criteria used to define duplicate data included study centers, treatment information, and any additional inclusion criteria.

2.2. Inclusion and exclusion criteria

Researches that conformed to the following criteria were eligible for inclusion in this study: (1) original researches; (2) studies that include anterior surgery with posterior surgery for the treatment of multilevel OPLL; (3) studies with follow-up more than one year. We excluded studies in the thoracic or lumbar spine, articles that were duplicate reports of an earlier trial, reviews, and case-reports.

2.3. Data extraction

Two of the authors extracted the data from eligible studies independently, discussed discrepancies, and reached conformity for all items. The indispensable information extracted from all primary researches included the titles, author names, year of publication, original country, study design, sample size, surgical technology, duration of follow-up, and outcome parameters. The corresponding author of each study was contacted to obtain any missing information if it was required. The extracted data were rechecked for accuracy or against the inclusion criteria by the corresponding author.

2.4. Outcomes

The following outcomes were extracted from the included publications: 1) Japanese Orthopedic Association (JOA) score system was used to evaluate the severity of cervical myelopathy; 2) Recovery rate. The recovery rate was calculated by the JOA scores evaluated before surgery and 1 year after surgery; 3) Complications included the following severe events related to surgical procedures or implants: numbness or paresthesia, dural tear, cerebrospinal spinal fluid leakage, hematoma formation, dysphagia, dysphonia, and deep infections.

2.5. Quality assessment

The quality of the studies was independently assessed by the authors according to the Newcastle-Ottawa Scale (NOS). The manual was downloaded from Ottawa Hospital Research Institute online. The NOS uses a pentagram symbol "☆" rating system (a pentagram symbol stands for one score), to judge quality of cohorts based on three aspects of the cohort studies: selection, comparability and outcomes. Scores were ranged from 0 to 9. Studies with a score $\geq$7 were regarded to be of high quality.

2.6. Statistical analysis

We performed all meta-analyses with the STATA 12.0 (StataCorp LP, College Station, TX, USA). For continuous outcomes, means and standard deviations were pooled to generate a mean difference (MD), and 95% confidence intervals (CI) were generated. For dichotomous outcomes, the risk ratio (RR) or the odds ratio (OR) and 95% CI were assessed. A probability of $p < 0.05$ was considered to be statistically significant. Assessment for statistical heterogeneity was calculated using the I-square tests, which described the proportion of the total variation in meta-analysis assessments from 0 to 100% [6]. The random effects model was used for the analysis when an obvious heterogeneity was observed among the included studies ($I^2 > 50\%$). The fixed-effects model was used when there was no significant heterogeneity between the included studies ($I^2 \leq 50\%$) [7]. The possibility of publishing bias was not evaluated because there were less than ten studies assessed.

3. Results

3.1. Study characteristics

By searching in PubMed, Embase, Medline, and Cochrane library, 104 studies were initially identified. 98 studies were excluded because they did not meet the inclusion criteria. A flow diagram of the selection process for relative articles was shown in Fig. 1. Finally, six studies [8–13] were included into our meta-analysis and the characteristics were presented in Table 1. One of these six studies is designed as prospective cohort and the other five are retrospective cohort. Totally, 123 patients were undergone ACCF and 216 patients were decompressed by posterior approach.

3.2. Quality assessment

Assessment of the study specific quality scores from NOS system were shown in Table 2. The median score of included studies was 7.33, with a range from 6 to 8. Five of the six studies were identified as relatively high-quality.