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Comparing outcomes of fusion versus repeat discectomy for recurrent lumbar disc herniation: A systematic review and meta-analysis

Panagiotis Kerezoudis[a,b], Sandy Goncalves[a,b], Joseph D. Cesare[a,c], Mohammed Ali Alvi[a,b], Dennis P. Kurian[a,d], Arjun S. Sebastian[e], Ahmad Nassr[e], Mohamad Bydon[a,b,*]

[a] Mayo Clinic Neuro-Informatics Laboratory, Mayo Clinic, Rochester, MN, USA
[b] Department of Neurologic Surgery, Mayo Clinic, Rochester, MN, USA
[c] University of Wisconsin, Madison, WI, USA
[d] George Washington University School of Medicine and Health Sciences, Washington, DC, USA
[e] Department of Orthopedic Surgery, Mayo Clinic, Rochester, MN, USA

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ABSTRACT

Objectives: Current surgical treatment options for one-time recurrent lumbar disc herniation (RLDH) include repeat discectomy or discectomy supplemented with fusion. Significant contention exists within the surgical spine community with regard to the most effective treatment modality. The objective of this study is to compare reoperation rates and patient reported outcomes following fusion versus repeat discectomy for RLDH.

Patients and Methods: The electronic literature search was performed in Ovid Medline/Pubmed, EMBASE and Cochrane, Scopus and China National Knowledge Infrastructure for human studies directly comparing repeat discectomy with fusion for ipsilateral or contralateral RLDH. Random effects meta-analysis was conducted to pool the estimates of effect, using mean differences (MD) and odds ratios (OR) for continuous and categorical outcomes, respectively.

Results: A total of 1405 patients with RLDH (746 fusions and 659 repeat discectomies) from 15 studies (13 observational and 2 randomized controlled trials) were analyzed. Mean time to reherniation was 54.4 ± 30.4 months, while average follow-up time was 40 ± 11.7 months (range: 12–92.6). No difference was found between fusions and repeat discectomies with regards to related reoperations (OR: 0.68; 95% C.I: 0.14–3.2). Changes in PRO scores from baseline to last follow-up were also similar between the two groups, including VAS-back pain (MD, −0.3; 95% CI, −1.4 to 0.7), VAS-leg pain (MD, −0.3; 95% CI, −1.4 to 0.7), ODI (MD, 0.6; 95% CI, −0.2 to 1.4), JOA (MD: 1.0; 95% CI: 0.02 to 2.0) and MacNab satisfaction (OR: 1.5; 95% CI, 0.9 to 2.3).

Conclusion: Available evidence shows that in treating one-time recurrent disc herniations, repeat discectomy and fusion are associated with comparable reoperation rates, incidence of dural tears, functional outcomes as well as satisfaction with surgical treatment at last follow-up. Future longitudinal, randomized controlled trials should be completed to validate any associations found in this study.

1. Introduction

Symptomatic lumbar disc herniation is a relatively common spinal pathology with an estimated prevalence ranging between 1% and 3% [1]. A recurrent LDH (RLDH) is defined as an ipsilateral or contralateral disc herniation at the same level as the primary herniation typically after a 6-month pain-free interval from the index procedure [2,3]. In approximately 25% of surgically treated LDH cases, a re-herniation of the index level will occur [4,5], with a further 11% of those cases requiring revision surgery [6].

The most common treatment options can be categorized into either a repeat discectomy alone or as a discectomy supplemented with arthrodesis. In 2014, a study by Mroz and colleagues identified that of 445 spinal surgeons in the United States those who have been in practice for at least 15 years were more likely to select revision microdiscectomy compared to those with fewer years in practice who were more likely to recommend revision microdiscectomy supplemented with posterior or transforaminal lumbar fusion [7]. Considering

Abbreviations: CBRG, Cochrane Back Review Group; CI, Confidence interval; GRADE, Grading of recommendations assessment, development and evaluation; JOA, Japanese Orthopedic Association; MD, Mean difference; ODI, Oswestry Disability Index; OR, Odds ratio; PRISMA, Preferred reporting items for systematic reviews and meta-analyses; PROs, Patient reported outcomes; RCT, Randomized controlled trial; RLDH, Recurrent lumbar disc herniation; VAS, Visual analog scale

* Corresponding author at: Department of Neurologic Surgery, Mayo Clinic, 200 First Street SW, Rochester, Minnesota, USA.
E-mail address: Bydon.mohamad@mayo.edu (M. Bydon).

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the significant differences in cost associated with these two procedures [8–11], including hospital expenditures, complication profiles [11,12], as well as professional and implant fees, a more thorough understanding and description of current literature and practice would be beneficial to the community.

Previous systematic reviews have attempted to understand whether undergoing a fusion procedure offers significant advantage over repeat discectomy and found no evidence to support such a recommendation [6,13,14]. Nevertheless, these studies are limited by the inclusion of single-arm studies with small sample size that did not allow for a meta-analysis to be performed. As such, the contention regarding the superiority of one procedure over the other still remains unclear among the surgical spine community. To fill this critical knowledge gap, we conducted a systematic review and meta-analysis of all available studies that directly compared discectomy and fusion with repeat discectomy for patients with RLDH.

2. Materials and methods

2.1. Search strategy

A master's level medical librarian with extensive meta-analytical experience conducted the electronic searches using Ovid Medline/PubMed, Ovid Embase, Ovid Scopus and Ovid Cochrane Database and China National Knowledge Infrastructure in June 2017 without timeframe limitations. The keywords used are presented in Appendix 1. The compiled reference lists were then reviewed for potential relevance. The bibliographies of included articles were also searched for missed articles. This study complied with the guidelines outlined in the Preferred Reporting Items for Systematic reviews and Meta-analyses (PRISMA) [15].

2.2. Selection criteria

Studies were eligible for this systematic review if they fulfilled the following eligibility criteria: (1) direct comparison study design, i.e. observational cohort or randomized controlled trial (RCT), (2) at least 12 months of follow-up, (3) pain relief of at least 6 months after the index procedure and (4) reporting of at least one of the following patient-reported outcomes (PROs): Oswestry Disability Index (ODI), modified Japanese Orthopedic Association (JOA) Scale, Visual Analogue Scale (VAS) for back and leg pain and MacNab's outcome assessment of patient satisfaction. Confirmation of RLDH in all studies was carried out with Magnetic Resonance Imaging. Both ipsilateral and contralateral disc herniations were included in the analysis. No language criteria were applied. Cadaveric studies, abstracts, commentaries and editorials were excluded.

2.3. Outcomes of interest

Patient reported outcomes and reoperation rates comprised the primary endpoints for the present study. VAS for back and leg pain is reported on a scale from 0 to 10, where 0 is no pain experienced and 10 is the worst possible pain imaginable [16]. Patient disability was measured using ODI assessment, a patient-subjective scale with scores ranging from 0 to 100, with 0 denoting zero and 100 denoting bed-bound disability [17]. The modified JOA scale for low back pain disorders was used to evaluate the severity of back pain [18]. Finally, outcome assessment of patient satisfaction with surgery was performed using the MacNab criteria [19]. MacNab classification is a 4-point scale that categorizes patient satisfaction following surgical treatment [Table 1]. Patients are asked to rank each symptom using the following criteria: excellent, good, fair and poor. Surgical success was defined as an excellent or good outcome. With respect to returns to the operating room, we counted any reoperations related to the index procedure towards the primary outcome; these could include, but were not limited to, surgical site infections, hematoma evacuations, subsequent fusion (for repeat discectomy patients) as well as hardware removal, adjacent segment disease, and pseudarthrosis (for fusion patients). Secondary outcome measures included: operative time, estimated blood loss, length of hospital stay (LOS) and incidence of dural tears.

Table 1
MacNab outcome assessment of patient satisfaction.

Grade	Description
Excellent	No pain; no restriction of activity
Good	Occasional back or leg pain of sufficient severity to interfere with the patient's ability to do his normal work or his capacity to enjoy himself in his leisure hours.
Fair	Improved functional capacity, but handicapped by intermittent pain of sufficient severity to curtail or modify work or leisure activities.
Poor	No improvement or sufficient improvement to enable increase in activities; further operative intervention required

2.4. Data extraction and processing

The following data were extracted: year of study, study design, country, patient demographics (age, sex and BMI) duration of follow-up, surgeon's specialty and time to re-herniation. We also abstracted the PRO scores at baseline (i.e. pre-surgical intervention) and at last follow-up. Data extraction from articles, tables and figures was performed by one reviewer (J.C.) with accuracy of data entry confirmed by a second reviewer (P.K.). We also documented the utilization of minimally invasive surgical (MIS) approaches including endoscopic, tubular and percutaneous techniques.

2.5. Assessment of risk of bias and quality of evidence

Risk of bias was assessed using the criteria described by the Cochrane Back Review Group (CBRG) [20] for RCTs and the Newcastle-Ottawa Quality Assessment Scale [21] for observational studies. According to the CBRG criteria, each RCT was rated overall as either "yes", "no", or "unclear" in the following categories: method of randomization, concealment of treatment allocation, patient and/or provider blinding of intervention, description of drop-out rate, randomization of patients in specific groups, suggestion of selective outcome reporting, baseline similarity between the important prognostic factors, co-interventions, patient compliance rate, and the timing of outcome assessment similarity in all groups. With regard to observational studies, stars were placed on the fulfilling criteria as is indicated in the Newcastle-Ottawa Quality Assessment Scale guidelines: clear definition of study population, clear definition of outcomes and outcome assessment, independent assessment of outcome parameters, sufficient duration of follow-up time, selective loss during follow-up, and the identification of important confounders and prognostic factors included in the study design. Last, confidence in effect estimates was assessed using the GRADE (Grading of Recommendations Assessment, Development and Evaluation) evidence profiling [22,23]. Differences in quality assessment were resolved by consensus.

2.6. Statistical analysis

Odds ratio (OR) for binary outcomes (MacNab, dural tears) and mean difference (MD) for continuous outcomes (operative time, EBL, LOS and change in PRO scores from baseline to last follow-up) were calculated to pool effect estimates. The I^2 statistic was used to determine the percentage of total variation across studies secondary to heterogeneity rather than chance, with values greater than 50% representing substantial heterogeneity [24]. In the present meta-analysis, the DerSimonian and Laird random-effects model was utilized in order to take into account the clinical diversity between studies [25].

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