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ORIGINAL ARTICLE

# Meta-Analysis

# Effectiveness and Safety of Decompression Alone versus Decompression Plus Fusion in Recurrent Lumbar Disc Herniation: A Meta-Analysis Study

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## ABSTRACT

**Background:** Recurrent lumbar disc herniation may enhance morbidity during conventional posterior reoperation as complication of post scar formation, making it a serious issue. There is debate on the best surgical method for treating recurrent lumbar disc herniation. The aim of this study is to improve the outcome of patients who do Decompression Alone Versus Decompression Plus Fusion in Recurrent Lumbar Disc Herniation. **The primary objective** was to study re-operative rates. **The secondary objectives** included comparing for clinical improvement, operating time, blood loss, complications, and postoperative hospital stays between both techniques **Patients and methods:** In this Meta-analysis study, we searched the databases of prospective and retrospective studies for the management of RLDH that was confirmed by magnetic resonance Imaging, and we took into account comparative and non-comparative research within the study. The analysis covered both ipsilateral and contralateral disc herniations to study the effectiveness and safety of Decompression Alone versus Decompression Plus Fusion in the management of recurrent lumbar disc herniation (RLDH). The electronic literature search was performed in Google Scholars, Ovid Medline, Cochrane database, and PubMed Medline. Comparative studies and non- comparative studies in humans were selected. **Results:** the intraoperative and postoperative complications, including dural tear, neurological deficit, instability, surgical site infection, adjacent segment disease (ASD), pseudoarhtrosis, and recurrence and revision rates were comparable with the studied researches. **Conclusion:** The current study showed that decompression plus fusion procedure was associated with better functional outcome and lower complications compared to decompression only in the treatment of recurrent lumbar disc herniation.

**Keywords:** Recurrent lumbar disc herniation, decompression plus Fusion, decompression alone, meta-analysis

## INTRODUCTION

Good outcomes are achieved in 80–90% of cases of herniated lumbar discs during the first year following surgery. After lumbar surgery, recurrent lumbar disc herniation (RLDH) is frequently the reason of underwhelming results. There have been reports of a recurring disc herniation of 5% to 15%. After an initial lumbar discectomy, recurrent herniation is a common cause of pain, disability, and need for surgery. The overall risk of poor outcomes is between 5% and 20%. **[1].**

Prior research has demonstrated that in individuals who have repeated lumbar disc herniation, fusion was coupled to decompression to achieve better clinical outcomes. Other research, however, has shown that for those who experience lumbar disc herniations on a regular basis, spinal decompression accompanied by fusion has drawbacks over decompression alone. These drawbacks include increased blood loss, an extended hospital stay, and a longer surgical time. (LOS) **[2].**

Regarding the recommendation of spinal fusion for the management of lumbar disc herniation, there is still debate. According to several writers, disc excision alone can often produce excellent results in cases of lumbar disc herniation, negating the need for primary fusion **[3].**

Conversely, other writers show that lumbar fusion provides superior protection against pain recurrence. The majority of papers addressed the fusion's prescription based on overall findings, with little focus on specific variables that could affect outcomes, such as segmental instability on radiographs or the extent of a medium defect on myelograms **[4].**

**Hypothesis:**

Decompression plus fusion is better than decompression alone for recurrent Lumbar disc herniation.

**Aim of the work:**

The current study aims to address recurring lumbar disc hernias through therapy demonstrated that the decompression accompanied by fusion method was linked to a superior functional outcome and fewer problems than decompression alone.

## PATIENTS AND METHODS

In this Meta-analysis study, we searched the databases of prospective and retrospective studies for the management of RLDH that was confirmed by magnetic resonance Imaging, and we took into account comparative and non-comparative research within the study. The analysis covered both ipsilateral and contralateral disc herniations to study the effectiveness and safety in the treatment of recurrent lumbar disc herniation (RLDH) between decompression alone and decompression plus fusion. The Institutional Review Board of Zagazig, Egypt, provided ethical approval. All techniques were disclosed in conformity with (IRBZU-IRB#10107/10-11-2022) Zagazig's ethical rules.

**Inclusion criteria:** Research articles available in electronic databases including PubMed-NCBI, Cochrane Library, Scopus, and Web of Science, and Randomized control trails (RCTs) was one of our Inclusion criteria.

**Exclusion criteria:** Research involving cadavers, animals, case reports, cross-sectional studies, review papers, and Non-English studies.

**Statistical considerations:**

Outcomes from included studies were integrated using the Meta-analysis and systematic review manager software, and they were manually assessed for inclusion. Based on the search results and the inclusion/exclusion criteria, a PRISMA flowchart was created.

**Risk of Bias Assessment:**

To make it easier to analyze the potential risk of bias for each trial, data was gathered using the Cochrane Collaboration Tool for Risk of Bias Assessment. After combining the information gathered from the targeted search investigations, each of the relevant intended outcome measures has its relative risk determined. With Applying previous consideration included papers reached 8 papers.

**Extracted Data Items:** Examine the methodology, identification author, year of publication, and population norms (sample size, whether a precise age range was stated, and if so, what that age range was). The presence of a requirement for inclusion. If the randomization process was sufficiently and correctly explained. The capacity to replicate the process using the given details served as the measurement for this. Whether an ad hoc or post hoc power analysis was provided, and if so, what the estimated power was. The length of the follow-up term and the follow-up appointment schedule.

**Dealing with Missing Data:** Missing standard deviation (SD) of mean change from baseline was calculated from standard error or 95% confidence interval (CI) according**[5]** .

**Statistical Analysis**

We used Review Manager 5.4.1 to analyze all of the data. (The Nordic Cochrane Centre and the Cochrane Collaboration, Copenhagen, 2014). For binary outcomes, we estimated the odds ratio with a 95% confidence interval (CI). For continuous outcomes, we computed mean difference with 95% confidence interval. In cases where there is no indication of study heterogeneity, we employed a fixed-effect model with the Mantel-Haenszel method to compute the overall effect estimate with 95% CI. If not, a random-effects model utilizing DerSiomonian and Laird's approach was selected. The Q statistic and I2 test, which express the percentage of variability in the impact estimates, were used to assess heterogeneity across studies. P values less than 0.05 were regarded as significant.

## RESULTS

A total of 1095 references from the four databases were found using the electronic search, including 428 references from PubMed, 382 from Scopus, 156 from Embase, and 259 from Web of Science. 737 records were left for screening of titles and abstracts after 358 duplicates were removed. Forty pertinent articles met the requirements for full-text screening. The exclusion criterion resulted in the exclusion of twenty-eight articles. There were no further articles imported by the manual search of references table 1. Eventually, 13 articles fulfilled the predefined inclusion criteria and were ultimately included for qualitative analysis and nine studies were included for the qualitative analysis. **(Figure 1)** shows the flow diagram of the study selection process.

Publication year ranged from 2013 to 2021. The country of origin varied across the studies. Five studies were performed in China, three were performed in Egypt, two studies were conducted in Japan, two studies were performed in the USA, and one was conducted in Bangladesh. Nine research were retrospective, three were prospective non-randomized studies, and one was a randomized controlled trial (RCT). Nine studies were comparative, and four studies were non-comparative.

**Patient Characteristics:**

Participants' age was reported in all studies, ranging from 41 to 57.2 years in the D0 group, and ranging from 30 to 56 years in the DF group. Body mass index (BMI) was reported in seven studies, ranging from 24.6 to 29.4 kg/m$^2$ in the D0 group, and ranging from 23.7 to 30.1 kg/m$^2$ in the DF group. Gender distribution was reported in all studies. The majority of participants were males, ranging from 25% to 85.7% in the D0 group, and ranging from 35% to 72.4% in the DF group. Smoking prevalence was reported in seven studies, ranging from 8% to 66.4% in the D0 group, and ranging from 16.7% to 68% in the DF group. The number of involved spinal levels was reported in 11 studies, where single-level surgery was reported in 1005 patients, whereas double-level surgery was reported in only 118 patients. L2/3 was involved in three (0.3%) patients, L3/4 was involved in 10 (1%) patients, L4/5 was involved in 620 (60.8%) patients, and L5/S1 was involved in 456 (44.7%) patients. Average follow-up duration was reported in all studies, ranging from 3 to 65.6 months in the D0 group, and ranging from 12 to 68.6 months in the DF group as shown as table 2.

**Perioperative Outcomes:**

**Table 3** demonstrates the perioperative outcomes of both groups, such as blood loss, duration of hospital stay, and operation time.

In all, eight studies reported on intraoperative blood loss, but only four studies were suitable for analysis, 92 patients were in the DF group and 173 patients were in the D0 group. The analysis employed the random-effect model due to the detection of significant heterogeneity ($I^2$ = 83%, P<.001). -345.7 was the total MD and 95% CI (-457.5 to -234.0). The combined result suggested that larger amount of blood loss was associated with the DF group compared to the D0 group (Z = 6.06, *P* < .001).

In all, 11 studies reported on operating time, but only seven studies were suitable for analysis, 188 patients were in the DF group and 293 individuals were in the D0 group. The analysis employed the random-effect model due to the detection of significant heterogeneity ($I^2$ = 86%, P <.001). The combined MD and 95% CIs was -90.5 (-106.6 to -74.4). The combined result suggested that longer operating time was associated with the DF group compared to the D0 group (Z = 11.04, *P* < .001).

In all, 10 studies reported on length of hospital stay, but only seven studies were suitable for analysis, 188 patients were in the DF group and 293 individuals were in the D0 group. Since significant heterogeneity was found ($I^2$ = 94%, P <.001), we conducted our analysis using the random-effect model. The total MD and 95% CI came out at -3.09 (-4.4 to -1.8). The combined result suggested that longer hospital stay was associated with the DF group compared to the D0 group (Z = 4.61, *P* < .001).

**Functional Outcomes:**

**Table 4** demonsatrtes the functional outcomes in both groups, including Oswestry Disability Index (DOI), Japanese Orthopedic Association (JOA) score, recovery rate, VAS for back pain, VAS for leg pain, and patient satisfaction.

In all, eight studies reported on DOI, but only six studies were suitable for analysis, DF group consisted of 344 patients while D0 group consisted of 398 patients. Since significant heterogeneity was found (I2 = 66%, P =.01), we conducted our analysis using the random-effect model. The combined MD and 95% confidence intervals were -0.30 (-1.09 to -0.49). In terms of DOI, the combined data shows no statistically significant difference between groups (Z = 0.74, P =.46).

In all, seven studies reported on DOI, but only four studies were suitable for analysis, 358 patients were in the D0 group and 262 patients were in the DF group. There was no evidence of significant heterogeneity. As a result, a fixed-effect model (I2 = 51%, P =.11) was employed for analysis. The total MD and 95% confidence intervals were -1.14 (-1.80 to -0.48). The combined result suggested that DF was associated with better postoperative JOA scores compared to D0 (Z= 3.40, *P* < .001).

In all, seven studies reported on recovery rate, but only four studies were suitable for analysis, 358 patients were in the D0 group, while 252 were in the DF group. There was no evidence of significant heterogeneity. As a result, a fixed-effect model (I2 = 3%, P =.38) was employed for analysis. The combined MD and 95% confidence intervals were -3.24 (-6.69 to 0.21). The combined result demonstrates no statistically significant difference between groups in terms of recovery rate (Z = 1.84, *P* = .07).

In all, nine studies reported on VAS for back pain, but only seven studies were suitable for analysis, 508 individuals were in the D0 group, and 369 patients were in the DF group. Because significant heterogeneity was identified (I2 = 94%, P.001), we employed the random-effect model for analysis. The combined MD and 95% CIs was 0.37 (-0.40 to 1.14). The combined result demonstrates no statistically significant difference between groups in terms of VAS for back pain (Z = 0.95, *P* = .34).

In all, nine studies reported on VAS for leg pain, but only seven studies were suitable for analysis, 508 individuals were in the D0 group, and 369 patients were in the DF group. There was no evidence of significant heterogeneity. As a result, a fixed-effect model (I2 = 45%, P =.09) was adopted for analysis. The total MD and 95% confidence intervals were -0.08 (-0.19 to 0.04). The combined result demonstrates no statistically significant difference between groups in terms of VAS for leg pain (Z = 1.36, *P* = .17).

In all, six studies reported on patient satisfaction, but only four studies were suitable for analysis, with 358 patients in the D0 group and 269 patients in the DF group. No significant heterogeneity was detected. Therefore, a fixed-effect model was used for analysis ($I^2$ = 0%, *P* = .92). The combined OR and 95% CIs was 0.58 (0.31 to 1.08). The combined result demonstrates no statistically significant difference between groups in terms of patient satisfaction (Z = 1.72, *P* = .09).

**Complications**

**Table 5** demonstrates the intraoperative and postoperative complications in both groups, including dural tear, neurological deficit, instability, surgical site infection, adjacent segment disease (ASD), pseudoarhtrosis, and recurrence and revision rates.

In all, 10 studies reported on intraoperative dural tear, but only six studies were suitable for analysis, 453 patients were in the D0 group, while 346 patients were in the DF group. There was no evidence of significant heterogeneity. As a result, a fixed-effect model (I2 = 15%, P =.32) was employed for analysis. The total OR and 95% confidence intervals were 0.86 (0.42 to 1.76). In terms of the incidence of dural tear, the combined result shows no statistically significant difference between groups (Z = 0.42, P =.67).

In all, eight studies reported on incidence of neurological deficit, but only five studies were suitable for analysis, with 405 patients in the D0 group and 320 patients in the DF group. No significant heterogeneity was detected. Therefore, a fixed-effect model was used for analysis ($I^2$ = 0%, *P*=.83). The combined OR and 95% CI was 1.48 (0.56 to 10.89). The combined result demonstrates no significant difference between groups in terms of incidence of neurological deficit (Z = 1.2, *P* = .23).

In all, three studies reported on incidence of spinal instability, 334 patients were in the D0 group, while 247 were in the DF group. There was no evidence of significant heterogeneity. Therefore, a fixed-effect model was used for analysis ($I^2$ = 0%, *P* = .54). The combined OR and 95% CI was 7.14 (1.27 to 40.1). The combined result suggested that D0 is associated with higher incidence of postoperative spinal instability (Z = 2.23, *P*=.03).

In all, seven studies reported on incidence of surgical site infection, but only five studies were suitable for analysis, 405 patients were in the D0 group and 320 patients were in the DF group. There was no evidence of significant heterogeneity. As a result, a fixed-effect model (I2 = 0%, P=.79) was employed for analysis. The total OR and 95% confidence interval was 0.62 (0.20 to 1.91). The combined result demonstrated that no statistically significant difference was found between groups regarding incidence of infection (Z=0.84, *P* = .40).

Eleven studies reported on recurrence, but only nine studies were suitable for analysis, 556 patients were in the D0 group, while 417 were in the DF group. There was no evidence of significant heterogeneity. A fixed-effect model was used for analysis ($I^2$ = 0%, *P* = .93). The combined OR and 95% CI was 8.69 (3.26 to 23.18). The combined result suggested a higher rate of recurrence was associated with D0 group (Z = 4.32, *P* < .001).

Twelve studies reported on revision, but only nine studies were suitable for analysis, 556 patients were in the D0 group, while 429 patients were in the DF group. There was no evidence of significant heterogeneity. For analysis, a fixed-effect model was adopted. ($I^2$ = 0%, *P* = .62). The combined OR and 95% CI was 3.18 (1.44 to 7). The combined result suggested a higher rate of revision was associated with D0 (Z = 2.87, *P* = .004).

**Table (1):** Baseline Study Characteristics (N = 12 Studies)

| First Author | Year | Country | Sample Size | | Design | Surgical Technique | |
|---|---|---|---|---|---|---|---|
| | | | D0 | DF | | D0 | DF |
| **Comparative** | | | | | | | |
| **El-Shazly** [6] | 2013 | Egypt | 15 | 30 | RCT | Conventional | PLIF/TLIF |
| **Guan** [7] | 2016 | USA | 25 | 12 | Retrospective | Conventional | PLIF/TLIF/ MIS-TLIF |
| **Zaater** (8) | 2016 | Egypt | 24 | 15 | Prospective | Conventional | PLF |
| **Yao** (9) | 2016 | China | 47 | 58 | Retrospective | PELD | MIS-TLIF |
| **Liu** (10) | 2017 | China | 209 | 192 | Prospective | PELD | MIS-TLIF |
| **Carreon** (11) | 2019 | USA | 54 | 40 | Prospective | NA | NA |
| **Wang** (2) | 2020 | China | 24 | 22 | Retrospective | PELD | MIS-TLIF |
| **Ahsan** (12) | 2021 | Bangladesh | 110 | 25 | Retrospective | Conventional | TLIF |
| **Non-comparative** | | | | | | | |
| **Kabil** (13) | 2014 | Egypt | - | 50 | Retrospective | - | PLF |
| **Li** (14) | 2015 | China | - | 73 | Retrospective | - | TLIF |
| **Yoshikane** (15) | 2021 | Japan | 52 | - | Retrospective | PELD | - |
| **Terai** (16) | 2021 | Japan | 42 | - | Retrospective | MED | - |

NA: Data not available

**Table (2):** Baseline Patient Characteristics (N = 1193 Patients)

| First Author | Age, y | | BM, kg/m$^2$ | | Male, % | | Smoking, % | | Follow-up, m | |
|---|---|---|---|---|---|---|---|---|---|---|
| | D0 | DF | D0 | DF | D0 | DF | D0 | DF | D0 | DF |
| **Comparative** | | | | | | | | | | |
| **El-Shazly** (6) | 41 | 41.6 | NA | NA | 53.3 | 56.7 | NA | 16.7 | 38.6 | 36.2 |
| **Guan** (7) | 51 | 53 | 28.7 | 28.7 | 80 | 41.7 | 8 | NA | 26.4 | 26.4 |
| **Zaater** (8) | 50.2 | 52.8 | NA | NA | 66.7 | | NA | NA | 65.6 | 68.6 |
| **Yao** (9) | 47.9 | 46.7 | 24.6 | 23.7 | 72.3 | 72.4 | 17 | NA | 12 | 12 |
| **Liu** (10) | 57.2 | 55.9 | NA | NA | 52.6 | 47.9 | NA | 19.2 | 45.3 | 43.7 |
| **Carreon** (11) | 52.1 | 45.8 | 29.4 | 30.1 | 25.9 | 35 | 11.1 | 18.2 | 12 | 12 |
| **Wang** (2) | 49.3 | 56 | 25.4 | 26.2 | 58.3 | 63.6 | 20.8 | 68 | 12 | 12 |
| **Ahsan** (12) | 41.7 | 41.7 | NA | NA | 68.2 | 60 | 66.4 | 16.7 | 28.8 | 24.6 |
| **Non-comparative** | | | | | | | | | | |
| **Kabil** (13) | - | 30 | - | NA | - | 60 | - | NA | - | 22.9 |
| **Li** (14) | - | 46.2 | - | 26 | - | 57.5 | - | 28.8 | - | 49.2 |
| **Yoshikane** (15) | 48.4 | - | NA | - | 25 | - | NA | - | 18.6 | - |
| **Terai** (16) | 45.4 | - | 24.6 | - | 85.7 | - | NA | - | 3 | - |

NA: Data not available.

**Table (3):** Perioperative Outcomes (N = 1193 patients)

| First Author | Blood Loss, ml | | Operating Time, min | | Hospital Stay, days | |
|---|---|---|---|---|---|---|
| | D0 | DF | D0 | DF | D0 | DF |
| **El-Shazly** (6) | 256.7 | 656.7 | 125.3 | 190 | 3.4 | 3.4 |
| **Guan** (7) | NA | NA | 82.7 | 229.6 | 1 | 3.7 |
| **Zaater** (8) | 170.8 | 546.7 | 103.4 | 187.5 | 2.3 | 4.8 |
| **Yao** (9) | Not Measurable | 111.38 | 63.3 | 140 | 8.1 | 12.7 |
| **Liu** (10) | NA | NA | NA | NA | NA | NA |
| **Carreon** (11) | NA | NA | NA | NA | NA | NA |
| **Wang** (2) | 17.75 | 245 | 113 | 232.5 | 1.9 | 5.8 |
| **Ahsan** (12) | 120 | 550 | 95 | 188 | 5 | 8 |
| **Kabil** (13) | - | 200 | - | 180.6 | - | 3.2 |
| **Li** (14) | - | 260 | - | 105 | - | 8.5 |
| **Yoshikane** (15) | NA | NA | 32.1 | - | NA | NA |
| **Terai** (16) | NA | NA | 69.2 | - | 6.2 | - |

NA: Data not available.

**Table (4):** Functional Outcomes (N = 1193 patients)

| First Author | DOI | | JOA | | Recovery | | Back Pain | | Leg Pain | | Satisfaction | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | D0 | DF | D0 | DF | D0 | DF | D0 | DF | D0 | DF | D0 | DF |
| El-Shazly [6] | NA | NA | 26.1 | 27.9 | 82.8 | 89.5 | NA | NA | NA | NA | 86.7 | 90 |
| Guan [7] | 11.6 | 15.6 | NA | NA | NA | NA | 3.3 | 4.2 | 3.2 | 3.8 | NA | NA |
| Zaater [8] | NA | NA | 25.8 | 25.6 | 84.8 | 83.8 | NA | NA | NA | NA | NA | NA |
| Yao [9] | 12.5 | 11.8 | NA | NA | NA | NA | 2.4 | 2.1 | 1.8 | 1.6 | NA | NA |
| Liu [10] | 11.4 | 12.4 | 25.7 | 26.1 | 75 | 77 | 3.1 | 1.4 | 1.1 | 1.2 | 91.4 | 95.3 |
| Carreon [11] | 25.5 | 33.2 | NA | NA | NA | NA | 3.4 | 4.1 | 3 | 3.3 | NA | NA |
| Wang [2] | 10.6 | 10.8 | NA | NA | NA | NA | 1.2 | 0.9 | 1.1 | 1 | 91.7 | 90.9 |
| Ahsan [12] | NA | NA | 23 | 25 | 70 | 80 | 2.4 | 1.1 | 1.9 | 1.5 | 80 | 88 |
| Kabil [13] | NA | NA | - | 12.5 | - | 75 | NA | NA | NA | NA | - | 90 |
| Li [14] | - | 20.4 | - | 25.2 | - | 89 | - | 1.1 | - | 1.2 | - | 91.8 |
| Yoshikane [15] | NA | NA | NA | NA | NA | NA | 2.8 | - | 3.1 | - | NA | NA |
| Terai [16] | 2 | - | 26 | | 81 | - | NA | NA | NA | NA | NA | NA |

NA: Data not available

**Table (5 A):** Complications (N = 1193 patients)

| First Author | Dural Tear | | Deficit | | Instability | | Infection | | ASD | | Pseudo-arthrosis | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | D0 | DF | D0 | DF | D0 | DF | D0 | DF | D0 | DF | D0 | DF |
| El-Shazly [6] | 4 | 3 | 2 | 1 | 1 | 0 | 0 | 1 | NA | NA | NA | NA |
| Guan [7] | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Zaater [8] | 5 | 2 | 0 | 0 | NA | NA | 0 | 1 | NA | NA | NA | NA |
| Yao [9] | 0 | 1 | 0 | 0 | NA | NA | 0 | 0 | NA | NA | NA | NA |
| Liu [10] | 2 | 6 | 1 | 0 | 8 | 0 | 0 | 1 | - | 5 | NA | NA |
| Carreon [11] | NA | NA | NA | NA | NA | NA | NA | NA | - | 1 | - | 1 |
| Wang [2] | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Ahsan [12] | 8 | 2 | 7 | 1 | 3 | 0 | 9 | 2 | NA | NA | - | 2 |
| Kabil [13] | - | 3 | - | 0 | NA | NA | - | 2 | - | | - | 8 |
| Li [14] | - | 3 | - | 0 | NA | NA | - | 0 | - | 3 | - | 5 |
| Yoshikane [15] | 1 | - | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Terai [16] | 2 | - | 0 | - | NA | NA | NA | NA | NA | NA | NA | NA |

NA: Data not available

**Table (5 B):** Complications - Continued (N = 1193 patients)

| First Author | Recurrence | | Revision | |
|---|---|---|---|---|
| | D0 | DF | D0 | DF |
| El-Shazly [6] | 1 | 0 | 2 | 0 |
| Guan [7] | 3 | 0 | 3 | 0 |
| Zaater [8] | 1 | 0 | 1 | 1 |
| Yao [9] | 5 | 0 | 3 | 0 |
| Liu [10] | 12 | 0 | 0 | 1 |
| Carreon [11] | 1 | 0 | 3 | 2 |
| Wang [2] | 5 | 0 | 2 | 0 |
| Ahsan [12] | 8 | 0 | 11 | 1 |
| Kabil [13] | NA | NA | NA | NA |
| Li [14] | NA | NA | - | 3 |
| Yoshikane [15] | 3 | - | 3 | - |
| Terai [16] | 1 | - | 1 | - |

NA: Data not available

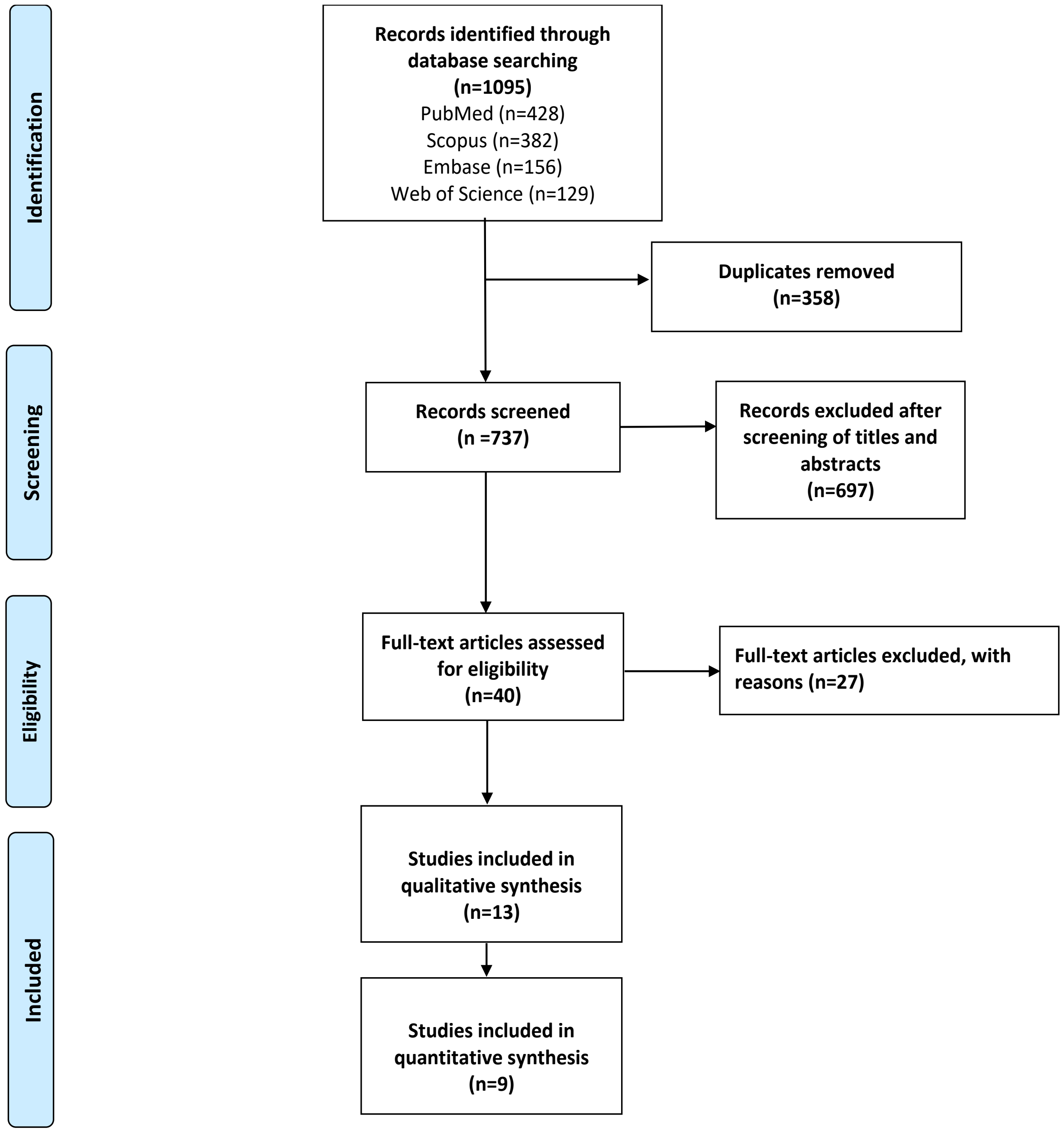


**Figure (1):** PRISMA Flow Diagram of the Study Selection Process

## DISCUSSION

After an initial discectomy, recurrent lumbar disc herniation (RLDH) is frequently the source of representation. It is defined as disc herniation at the same intervertebral level after a primary discectomy or decompression that has not caused discomfort for at least six months. There have been reports of RLDH incidences ranging from 0.5% to 25%. Therefore, the question of whether contemporaneous fusion is more beneficial for individuals with recurrent disc herniations than repeat decompression alone remains unanswered **[4]**.

According to a recent comprehensive analysis, the evidence for discectomy alone or discectomy combined with fusion is insufficient. when it comes to treating recurrent disc herniation. Some studies have showed larger pain reductions with fusion than with repeat decompression alone, despite the fact that fusion is more costly, involves more blood loss, requires longer hospital stays, and longer operating hours. It's also unclear what aspects of the patient and radiography the surgeon takes into account when determining whether to do a fusion and decompression or a decompression by itself **[11]**.

Interestingly, a study by **Mroz et al [17]** discovered that whether or not a decompression alone will be used to treat a recurrent disc herniation depends on the characteristics of the surgeon. According to the study, surgeons with a high volume of cases (>200 cases per year) and who have been in practice for a longer period of time (15-20 years) were more likely to perform a fusion rather than a repeat decompression.

Although there are no guidelines to help surgeons decide which operation is best for treating recurrent disc herniation, some writers recommend discectomy in patients who just have radiculopathy. In the presence of lumbar instability, radiological degenerative changes, and/or chronic low back discomfort, fusion is recommended**[11**].

More research is required because it is still unknown how safe and for patients with recurrent Lumbar Disc Herniation, either successful decompression alone or in combination with fusion is recommended. The process of synthesizing comparable study findings is known as meta-analysis, and it can increase sample size and enhance statistical validity, particularly when results from earlier studies are contradictory. Meta-analysis can produce conclusions that are more grounded in detailed analysis and current research findings, bringing the results closer to practical application.

We conducted a comprehensive review and meta-analysis to assess the safety and effectiveness of decompression alone (D0) or in combination with fusion (DF) in the setting of recurrent lumbar disc herniation.

**Perioperative Outcomes**

Regarding Blood Loss, the pooled result suggested that larger amount of blood loss was associated with the decompression combined with fusion group compared to the decompression alone (P < .001).

In agreement with the current study **Tanavalee et al [18]** in systematic review and meta-analysis compared contrasted fusion with repeat discectomy as a treatment for recurrent lumbar disc herniation and found that in the majority of the included trials, fusion was related with more blood loss. Moreover, in the meta-analysis and systematic review conducted by **Kerezoudis et al [19]** they evaluated 1405 patients from 15 studies undergoing surgery for RLDH and revealed that decompression plus fusion was associated with more blood loss during surgery as compared to decompression alone.

In addition, **Drazin et al [4]** found that when treating recurrent disc herniation, decompression + fusion resulted in much higher blood loss than decompression alone in their systematic analysis.

Regarding operative time, the pooled result suggested that the decompression combined with fusion takes significantly longer operating time compared to the decompression alone (P < .001).

In agreement with the current results the meta-analysis by **Tanavalee et al [18]** showed revealed the repeat discectomy group's operating time was noticeably shorter compared to fusion group. As well, in concordance with the current study the systematic review and meta-analysis by **Kerezoudis et al [19]** when compared to repeat discectomy, the fusion group had a significantly longer operative period. In keeping with the current findings, as well **Drazin et al [4]** in their in systematic review showed that decompression plus fusion resulted in considerably longer recovery period during surgery for treating recurrent disc herniation as opposed to decompression alone.

Regarding length of hospital stay, the pooled results suggested that the decompression combined with fusion takes significantly hospital stay compared to the decompression alone (P < .001).

As fusion plus decompression procedure was more invasive than decompression only, it was linked to a longer operating duration and increased blood loss, and consequently longer hospital stay, resulting in higher economic burden.

In harmony with the current study the meta-analysis by **Tanavalee et al [18]** showed that length of postoperative hospital stay was significantly shorter in the repeat discectomy group compared to fusion group. As well, in concordance with the current study the systematic review and meta-analysis by **Kerezoudis et al [19]** showed that patients in the fusion group stayed in the hospital on average for nearly three days longer than those in the repeat discectomy group, which was associated with a significantly longer hospital stay.

**Functional Outcomes**

Regarding Oswestry Disability Index (ODI), the pooled results demonstrated no statistically significant difference between groups in terms of DOI (P = 0.46). However, regarding Japanese Orthopedic Association Score (JOA), the pooled results suggested that decompression combined with fusion was associated with better postoperative JOA scores compared to decompression alone (P < .001). So, the current study showed that Both saw comparable improvements in their ODI scores, but the Fusion group's JOA score was marginally higher.

In concordance with the current study the systematic review by **Dower et al [4]** they came to the conclusion that, in comparison to reoperation without fusion, fusion might have a higher improvement in pain and functional results. Additionally corroborating the possible advantages of instrumented spinal fusion are the pooled JOA recovery scores (ISF) in the context of back discomfort. The fusion and decompressed group showed significantly higher clinical improvements, according to the findings. The pooled JOA recovery rate for DF patients was of 86.6% compared to 70.8% in the D0 cohorts.

However, **Tanavalee et al [18]** showed that both techniques showed equal functional enhancement in the management of lumbar disc herniation recurrently. Likewise, **Kerezoudis et al [19]** showed that the two groups' differences in functional score changes from the last follow-up to the baseline included ODI and JOA. The differences between studies may be resulted from the difference in the used scores and inclusion criteria.

Regarding recovery rate, the combined result demonstrates there was no statistically significant variation in the recovery rate across the groups (Z= 1.84, P = 0.07).

This comes in agreement with the meta-analysis by **Tanavalee et al [18]** who revealed that Regarding recovery rate, there was no statistically significant difference amongst the techniques examined. However, in contrast to the current study showed that **Dower et al [19]** revealed that the fusion group showed significantly higher recovery rate compared to repeat discectomy for the management of recurrent herniation of the lumbar disc (86.6% vs. 70.8%).

Regarding VAS for Pain, the pooled results demonstrated no statistically significant difference between groups regarding the VAS for leg pain and the VAS for back pain (P>0.05).

In concordance with the current study the a thorough investigation and meta-analysis by **Kerezoudis et al [19]** demonstrated that, in terms of the VAS for the legs and back, there was no statistically significant difference between the investigated approaches pain VAS back pain and VAS-leg pain. However, the systematic review by **Dower et al [19]** showed in a different investigation of leg and back pain, DF performed better for improving leg pain and had better results for improving back pain. Since back pain is evaluated more heavily in the JOA score than leg pain, the DF group's JOA score was higher.

Regarding Patient Satisfaction, the pooled results demonstrated in terms of patient satisfaction, there was no statistically significant difference between groups (P = 0.09).

In agreement with our results, the a thorough investigation and meta-analysis by **Kerezoudis et al [19]** indicated that there was no statistically significant difference between the techniques under examination in terms of patient satisfaction.

**Complications**

Regarding dura tear, the combined result demonstrates There was no statistically significant variation in the incidence of dura tears between the groups (P = 0.67).

In agreement with the current study the systematic review by **Dower et al [4]** The D0 group had a greater dura tear, but the difference was not statistically significant. **Tanavalee et al [18]** meta-analysis found that Dura tear events were 0.136% in the D0 group and 0.11% without statistical significance in the DF group. Additionally, in line with the current study, **Kerezoudis et al** systematic review and meta-analysis **[19]** demonstrated that, in terms of the incidence of dura tear, there was no statistically significant difference between the techniques evaluated. Regarding neurological deficit, the pooled results demonstrated There is no discernible variation in the incidence of neurological disorders between the groups deficit (P = 0.23).

In agreement with the current study **Drazin et al [4]** in their in systematic review showed that when comparing the incidence of neurological problems across the procedures under study, there was no statistically significant difference found.

Regarding spinal instability, the pooled result suggested that decompression only was associated with higher incidence of postoperative spinal instability (P = 0.03). Also, the decompression only procedure was associated with significantly higher incidence of spinal instability, other complications including Surgical Site Infection were comparable between both procedures. As regard recurrence rate, the pooled data suggested a higher rate of recurrence was associated with decompression only group (P < .001).

Also, in agreement with the current study **Ajiboye et al [20]** in their systematic review and meta-analysis showed that fusion surgeries eliminated re-recurrence of disk herniation.

Concerning Revision Rate, the pooled result suggested a higher rate of revision was associated with decompression only (P = .004).

In concordance with the current study the thorough investigation and meta-analysis by **Kerezoudis et al [19**] showed found the reoperation rates did not differ statistically significantly across the procedures under study. Still, in contrast to the present investigation **Ajiboye et al [20**] in their systematic review and meta-analysis, showed that fusion surgeries have higher incidences of complications and reoperation

**Conclusions:**

The current study showed that decompression plus fusion procedure was linked to a more favorable functional outcome and fewer problems when treating recurrent lumbar disc herniation than when decompression alone was used.

**Study Limitations:**

It is well recognized that thorough and explicated procedures are needed in meta-analyses to decide which research to include and which to omit. These eligibility criteria are explained by a combination of relevance and considerations of bias and are typically decided before the search for the studies. Although of this, we were unable to locate many RCTs or studies with suitable patient allocation in investigations with sizable sample sizes. Three of the included studies were prospective, and one was a randomized clinical trial, hence the quality of the included research was not very good.

Unpublished data and studies, along with non-English literature, are also taken into account as study limitations for studies that meet eligibility criteria. This may result in the addition of a highly valuable, well-randomized controlled trail to this meta-analysis being missed. These restrictions need to be taken into account in the next research, and the researchers need to think about how to get around these restrictions in future investigations. This can be accomplished by setting up well-designed, large-scale randomized controlled trials to get compelling evidence of the advantages of both approaches, also, Non-compare the cost of each procedure which is a factor of bias for patient, surgery, and institute to decide the type of protocol to be done.

Longer follow-up and a larger sample size are needed in future clinical studies to corroborate our findings and uncover risk factors for recurrence.

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