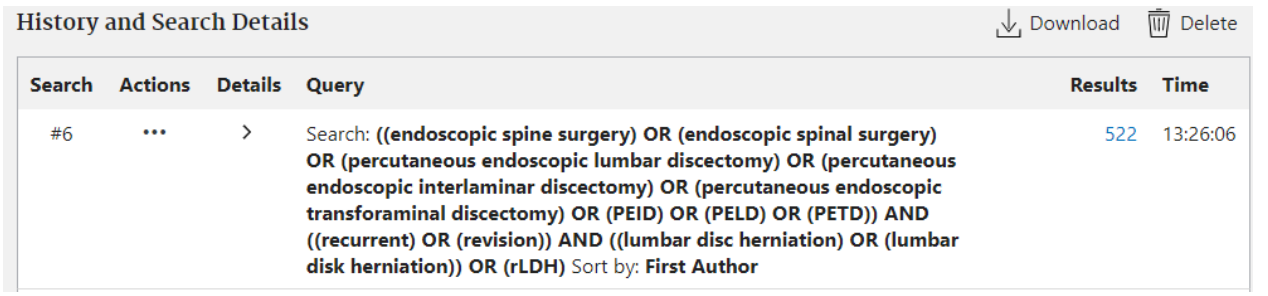
Supplementary

## Appendix 1

Date: 5/20/2024

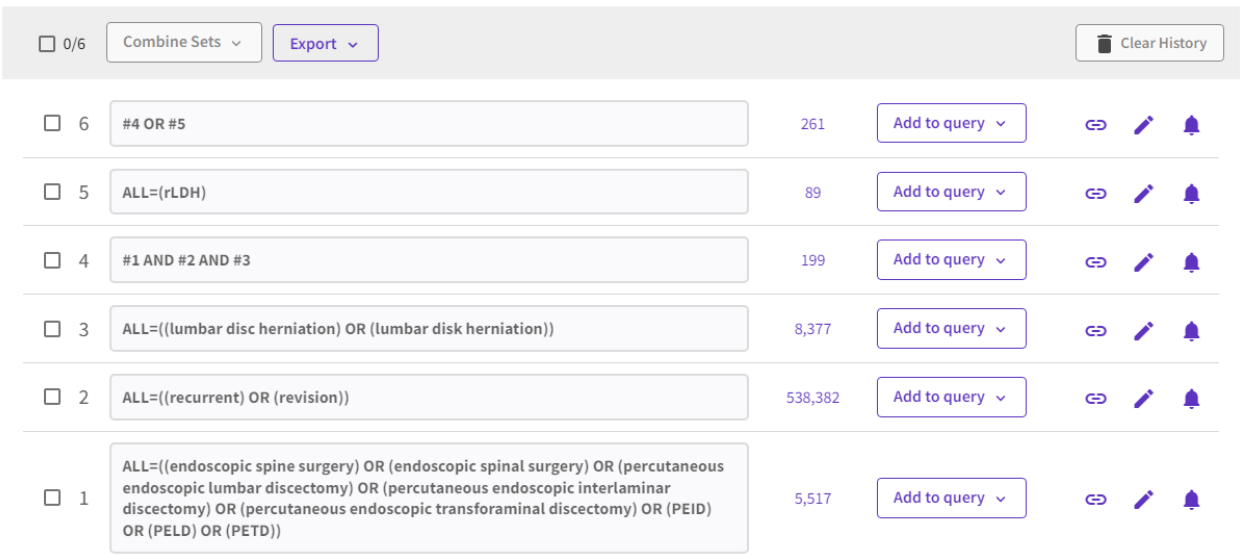
Query: ((endoscopic spine surgery) OR (endoscopic spinal surgery) OR (percutaneous endoscopic lumbar discectomy) OR (percutaneous endoscopic interlaminar discectomy) OR (percutaneous endoscopic transforaminal discectomy) OR (PEID) OR (PELD) OR (PETD)) AND ((recurrent) OR (revision)) AND ((lumbar disc herniation) OR (lumbar disk herniation)) OR (rLDH)

PUBMED: 522 results




Embase: 222 results

Web Of Science: 261 results





https://dx.doi.org/10.21037/jss-24-47

**Table S1** Study information: MIS-TLIF

| Study No. | Year published | First author | Country/region of origin | MIS-TLIF total N patients | MIS-TLIF N: L4–L5 | MIS-TLIF N: L5–S1 |
|---|---|---|---|---|---|---|
| 1 | 2017 | Yuan Yao | China | 26 | 18 | 8 |
| 2 | 2017 | Yuan Yao | China | 58 | 30 | 28 |
| 3 | 2017 | Chao Liu | China | 192 | 101 | 91 |
| 17 | 2020 | Anqi Wang | China | 22 | 13 | 9 |

MIS-TLIF, minimally invasive translumbar interbody fusion.

**Table S2** Study outcomes—minimally invasive trans lumbar interbody fusion (MIS-TLIF)

| Study No. | First author | Country/region of origin | VAS/NRS back, mean (SD) | | | VAS/NRS leg, mean (SD) | | | ODI, mean (SD) | | | Operative time (min), mean (SD) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Pre-op | Post-op | Improvement | Pre-op | Post-op | Improvement | Pre-op | Post-op | Improvement | |
| 1 | Yuan Yao | China | 5.96 (1.15) | 3.92 (1.38) | 2.04 (1.3) | 7 (1.3) | 5.4 (1.5) | 1.6 (1.41) | 28 (4.0) | 16 (4.4) | 12 (4.21)* | 146.5 (38.1) |
| 2 | Yuan Yao | China | 5.9 (1.2) | 2.2 (0.9) | 3.7 (1.1)* | 7.1 (1.1) | 1.6 (0.7) | 5.5 (0.96)* | 27.8 (3.6) | 11.8 (1.7) | 16 (3.12)* | 140.1 (57.1) |
| 3 | Chao Liu | China | 4.4 (1.2) | 1.4 (0.8) | 3 (1.1)* | 5.9 (2.3) | 1.2 (0.7) | 4.7 (2.04)* | 39.2 (5.7) | 12.4 (3.6) | 26.8 (4.99)* | Not reported |
| 17 | Anqi Wang | China | 7.2 (0.79) | 0.9 (0.57) | 6.3 (0.7)* | 7.1 (0.74) | 1 (0.47) | 6.1 (0.65)* | 28.3 (2.0) | 10.8 (0.63) | 17.5 (1.77)* | 232.5 (58.5) |

MIS-TLIF, minimally invasive translumbar interbody fusion; pre-op, pre-operation; post-op, post-operation; VAS, visual analog scale; NRS, Numerical Rating Scale; ODI, Oswestry Disability Index; SD, standard deviation.

**Table S3** Total and major complications encountered amongst patients treated with PELD and MIS-TLIF

| Study No. | First author | Country/region of origin | MIS-TLIF | | | | PELD | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | N | Total complications, n (%) | Major complications, n (%) | Re-recurrence | N | Total complications, n (%) | Major complications, n (%) | Re-recurrence, n |
| 1 | Yuan Yao | China | 26 | 1 (3.8) | 1 (3.8) | 0 | 28 | 4 (14.3) | 0 | 7 |
| 2 | Yuan Yao | China | 58 | 1 (1.7) | 1 (1.7) | 0 | 47 | 4 (8.5) | 0 | 5 |
| 3 | Chao Liu | China | 192 | 12 (6.3) | 12 (6.3) | 0 | 209 | 11 (5.3) | 11 (5.3) | 12 |
| 17 | Anqi Wang | China | 22 | 1 (4.5) | 1 (4.5) | 0 | 24 | 2 (8.3) | 0 | 5 |

Major complications: dural tear, permanent neurologic deficit, intervertebral infection, instability, adjacent segment disease, epidural hematoma, retained disc fragment, persistent difficulty voiding, delayed wound healing; Total complications: re-recurrence is excluded in this count. PELD, percutaneous endoscopic lumbar discectomy; MIS-TLIF, minimally invasive trans lumbar interbody fusion.

**Table S4** Study information: OLM

| Study No. | Year published | First author | Country/region of origin | OLM total n patients | OLM N: L4–L5 | OLM N: L5–S1 |
|---|---|---|---|---|---|---|
| 5 | 2018 | Jung-Sup Lee | Korea | 48 | 35 | 0 |
| 13 | 2009 | Dong Yeob Lee | Korea | 29 | 29 | 0 |

OLM, open lumbar microdiscectomy.


https://dx.doi.org/10.21037/jss-24-47

**Table S5** Study outcomes: OLM

| Study No. | First author | Country/region of origin | VAS/NRS back, mean (SD) | | | VAS/NRS leg, mean (SD) | | | ODI, mean (SD) | | | Operative time (min), mean (SD) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Pre-op | Post-op | Improvement | Pre-op | Post-op | Improvement | Pre-op | Post-op | Improvement | |
| 5 | Jung-Sup Lee | Korea | 5.15 (0.90) | 2.85 (1.09) | 2.29 (1.41)* | 8.15 (0.65) | 2.52 (1.25) | 5.62 (1.42)* | 44.98 (2.37) | 16.98 (4.13) | 28.00 (4.22)* | Not reported |
| 13 | Dong Yeob Lee | Korea | 5.4 (3.7) | 3.1 (2.5) | 2.3 (4.4)* | 8.6 (1.7) | 3.5 (3.1) | 5.1 (3.2)* | Reported as percentage | Reported as percentage | Reported as percentage | 73.8 (25.7) |

OLM, open lumbar microdiscectomy; pre-op, pre-operation; post-op, post-operation; VAS, visual analog scale; NRS, Numerical Rating Scale; ODI, Oswestry Disability Index; SD, standard deviation.

**Table S6** Total and major complications encountered amongst patients treated with PELD and OLM

| Study No. | First author | Country/region of origin | OLM | | | | PELD | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | N | Total complications, n (%) | Major complications, n (%) | Re-recurrence | N | Total complications, n (%) | Major complications, n (%) | Re-recurrence, n |
| 5 | Jung-Sup Lee | Korea | 48 | 9 (18.8) | 9 (18.8) | 7 | 35 | 0 | 0 | 2 |
| 13 | Dong Yeob Lee | Korea | 29 | 3 (10.3) | 3 (10.3) | 3 | 25 | 1 (4.0) | 1 (4.0) | 1 |

Major complications: dural tear, permanent neurologic deficit, intervertebral infection, instability, adjacent segment disease, epidural hematoma, retained disc fragment, persistent difficulty voiding, delayed wound healing; Total complications: re-recurrence is excluded in this count. OLM, open lumbar microdiscectomy; PELD, percutaneous endoscopic lumbar discectomy.

**Table S7** Study information: MED

| Study No. | Year published | First author | Country/region of origin | MED total N patients | MED N: L4–5 | MED N: L5–S1 |
|---|---|---|---|---|---|---|
| 1 | 2017 | Yuan Yao | China | 20 | 13 | 7 |
| 4 | 2009 | Sebastien Ruetten | Germany | 50 | 18 | 21 |

MED, microendoscopic discectomy.

**Table S8** Study outcomes—MED

| Study No. | First author | Country/region of origin | VAS/NRS back, mean (SD) | | | VAS/NRS leg, mean (SD) | | | ODI, mean (SD) | | | Operative time (min), mean (SD) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Pre-op | Post-op | Improvement | Pre-op | Post-op | Improvement | Pre-op | Post-op | Improvement | |
| 1 | Yuan Yao | China | 6.2 (1.4) | 3.94 (1.73) | 2.26 (1.6)* | 7.35 (0.99) | 5.39 (1.29) | 1.96 (1.2)* | 29.10 (5.17) | 15.33 (7.00) | 13.77 (6.29)* | 85.25 (41.60) |
| 4 | Sebastien Ruetten | Germany | Values reported are outside range | Values reported are outside range | – | Values reported are outside range | Values reported are outside range | – | Not reported | Not reported | – | 58 (19) |

MED, microendoscopic discectomy; pre-op, pre-operation; post-op, post-operation; VAS, visual analog scale; NRS, Numerical Rating Scale; ODI, Oswestry Disability Index; SD, standard deviation.

**Table S9** Total and major complications encountered amongst patients treated with PELD and MED

| Study No. | First author | Country/region of origin | MED | | | | PELD | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | N | Total complications, n (%) | Major complications, n (%) | Re-recurrence | N | Total complications, n (%) | Major complications, n (%) | Re-recurrence, n |
| 1 | Yuan Yao | China | 20 | 2 (10.0) | 0 | 3 | 28 | 4 (14.3) | 0 | 7 |
| 4 | Sebastien Ruetten | Germany | 50 | 13 (26.0) | 6 (12.0) | 2 | 50 | 3 (6.0) | 1 (2.0) | 3 |

Major complications: dural tear, permanent neurologic deficit, intervertebral infection, instability, adjacent segment disease, epidural hematoma, retained disc fragment, persistent difficulty voiding, delayed wound healing; Total complications: re-recurrence is excluded in this count. MED, microendoscopic discectomy; PELD, percutaneous endoscopic lumbar discectomy.


https://dx.doi.org/10.21037/jss-24-47

**Table S10** Risk of bias Cochrane questionnaire: cohort studies

| Study information | | | | | Risk of bias Cochrane questionnaire: cohort studies | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Study No. | Title | First author | Country of origin | Study design | 1. Was selection of exposed and non-exposed cohorts drawn from the same population? | 2. Can we be confident in the assessment of exposure? | 3. Can we be confident that the outcome of interest was not present at start of study? | 4. Did the study match exposed and unexposed for all variables that are associated with the outcome of interest or did the statistical analysis adjust for these prognostic variables? | 5. Can we be confident in the assessment of the presence or absence of prognostic factors? | 6. Can we be confident in the assessment of outcome? | 7. Was the follow up of cohorts adequate? | 8. Were co-interventions similar between groups? |
| 1 | Comparison of Three Minimally Invasive Spine Surgery Methods for Revision Surgery for Recurrent Herniation After Percutaneous Endoscopic Lumbar Discectomy | Yuan Yao | China | Retrospective Cohort Study | Definitely Yes | Definitely Yes | Definitely Yes | Definitely Yes | Probably Yes | Probably Yes | Probably Yes | Probably No |
| 2 | Minimally Invasive Transforaminal Lumbar Interbody Fusion Versus Percutaneous Endoscopic Lumbar Discectomy: Revision Surgery for Recurrent Herniation After Microendoscopic Discectomy | Yuan Yao | China | Retrospective Cohort Study | Definitely Yes | Definitely Yes | Definitely Yes | Definitely Yes | Probably Yes | Definitely Yes | Probably Yes | Probably No |
| 3 | Percutaneous Endoscopic Lumbar Diskectomy and Minimally Invasive Transforaminal Lumbar Interbody Fusion for Recurrent Lumbar Disk Herniation | Chao Liu | China | Prospective Cohort Study | Definitely Yes | Definitely Yes | Definitely Yes | Probably Yes | Probably Yes | Definitely Yes | Definitely Yes | Probably No |
| 5 | Comparison of Percutaneous Endoscopic Lumbar Diskectomy and Open Lumbar Microdiskectomy for Recurrent Lumbar Disk Herniation | Jung-Sup Lee | Korea | Retrospective Cohort Study | Probably Yes | Definitely Yes | Definitely Yes | Probably No | Probably Yes | Probably Yes | Definitely Yes | Probably No |
| 7 | Full-Endoscopic Lumbar Discectomy for Recurrent Lumbar Disc Herniation: A Retrospective Study with Patient-Reported Outcome Measures | Koichi Yoshikane | Japan | Retrospective Cohort Study | Probably Yes | Definitely Yes | Definitely Yes | Probably No | Probably Yes | Probably Yes | Probably Yes | Probably No |
| 9 | Longitudinal clinical outcomes after full-endoscopic lumbar discectomy for recurrent disc herniation after open discectomy | YunHee Choi | Korea | Prospective Cohort Study | Definitely No | Definitely Yes | Definitely Yes | Definitely No | Probably Yes | Definitely Yes | Definitely Yes | Probably No |

Source: https://methods.cochrane.org/sites/methods.cochrane.org.bias/files/uploads/Tool%20to%20Assess%20Risk%20of%20Bias%20in%20Cohort%20Studies.pdf.


https://dx.doi.org/10.21037/jss-24-47

**Table S11** Risk of bias delphi questionnaire: case series studies

| Study information | | | | | Risk of bias delphi questionnaire: case series studies | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Study No. | Title | First author | Country of origin/ region | Study design | 1. Is the hypothesis/aim/ objective of the study stated clearly in the abstract, introduction, or methods section? | 2. Are the characteristics of the participants included in the study described? | 3. Were the cases collected in more than one centre? | 4. Are the eligibility criteria (inclusion and exclusion criteria) for entry into the study explicit and appropriate? | 5. Were participants recruited consecutively? | 6. Did participants enter the study at a similar point in the disease? | 7. Was the intervention clearly described in the study? | 8. Were additional interventions (co-interventions) clearly reported in the study? | 9. Are the outcome measures clearly defined in the introduction or methods section? | 10. Were relevant outcomes appropriately measured with objective and/ or subjective methods? | 11. Were outcomes measured before and after intervention? | 12. Were the statistical tests used to assess the relevant outcomes appropriate? | 13. Was the length of follow-up reported? | 14. Was the loss to follow-up reported? | 15. Does the study provide estimates of the random variability in the data analysis of relevant outcomes? | 16. Are adverse events reported? | 17. Are the conclusions of the study supported by the results? | 18. Are both competing interests and sources of support for the study reported? |
| 6 | Surgical outcome of percutaneous endoscopic interlaminar lumbar diskectomy for recurrent disk herniation after open diskectomy | Chi Heon Kim | Korea | Retrospective case-series study | Yes | No | No | Yes | Yes | Yes | Yes | No | Yes | Yes | Yes | N/A | Yes | No | Yes | Yes | Yes | Yes |
| 8 | Clinical efficacy of transforaminal endoscopic discectomy in the treatment of recurrent lumbar disc herniation: a single-center retrospective analysis | Gang Xu | China | Retrospective case-series study | Yes | Yes | No | Yes | Yes | Yes | Yes | No | Yes | Yes | Yes | Yes | Yes | No | No | Yes | Yes | Yes |
| 10 | Endoscopic Transforaminal Discectomy for Recurrent Lumbar Disc Herniation<br>A Prospective, Cohort Evaluation of 262 Consecutive Cases | Thomas Hoogland | Germany | Prospective case-series study | Yes | No | No | Yes | Yes | Yes | Yes | No | Yes | Yes | Yes | N/A | Yes | Yes | No | Yes | Yes | No |
| 12 | The surgical outcome and the surgical strategy of percutaneous endoscopic discectomy for recurrent disk herniation | Chi Heon Kim | Korea | Retrospective case-series study | Yes | No | No | Yes | Yes | Yes | Yes | No | Yes | Yes | Yes | N/A | Yes | No | No | Yes | Yes | No |
| 15 | Full endoscopic interlaminar discectomy (FEID) for recurrent lumbar disc herniation: surgical technique, clinical outcome, and prognostic factors | Keng-Chang Liu | Taiwan | Case-series study | Yes | No | No | Yes | Yes | Yes | Yes | No | Yes | Yes | Yes | Yes | Yes | No | Yes | Yes | Yes | Yes |
| 16 | Revisional Percutaneous Full Endoscopic Disc Surgery for Recurrent Herniation of Previous Open Lumbar Discectomy | Kyung Hyun Shin | Korea | Retrospective case-series study | Yes | Yes | Yes | Yes | No | Yes | Yes | No | Yes | Yes | Yes | Yes | Yes | No | No | Yes | Yes | No |
| 18 | The Role of Full-Endoscopic Lumbar Discectomy in Surgical Treatment of Recurrent Lumbar Disc Herniation: A Health-Related Quality of Life Approach | Kapetanakis | Greece | Prospective case-series study | Yes | Yes | No | Yes | No | Yes | Yes | No | Yes | Yes | Yes | Yes | Yes | No | Yes | Yes | Yes | No |
| 19 | Percutaneous endoscopic lumbar discectomy for recurrent disc herniation: surgical technique, outcome, and prognostic factors of 43 consecutive cases | Yong Ahn | Korea | Retrospective case-series study | Yes | Yes | No | Yes | No | Yes | Yes | No | Yes | No | Yes | Yes | Yes | No | No | Yes | Yes | No |

Source: https://cobe.paginas.ufsc.br/files/2014/10/MOGA.Case-series.pdf.

**Table S12** Risk of bias questionnaire: randomized controlled trial studies

| Study information | | | | | Risk of bias questionnaire: randomized controlled trial studies | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Study No. | Title | First author | Country of origin | Study design | Domain 1: Risk of bias arising from the randomization process | Domain 2: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention) | Domain 2: Risk of bias due to deviations from the intended interventions (effect of adhering to intervention) | Domain 3: Risk of bias due to missing outcome data | Domain 4: Risk of bias in measurement of the outcome | Domain 5: Risk of bias in selection of the reported result | Overall risk of bias |
| 4 | Recurrent lumbar disc herniation after conventional discectomy: a prospective, randomized study comparing full-endoscopic interlaminar and transforaminal versus microsurgical revision | Sebastien Ruetten | Germany | Randomized controlled trial | Some Concerns | Low Risk | Some Concerns | Low Risk | Some Concerns | Some Concerns | Some Concerns |

Source: https://drive.google.com/file/d/1Q4Fk3HCuBRwIDWTGZa5oH11OdR4Gbhdo/view



https://dx.doi.org/10.21037/jss-24-47