Comparison of Microscopic and Biportal Endoscopic Spinal Surgery in the Treatment of Lumbar Canal Stenosis and Herniated Disc: A One-year Follow-up

Introduction

Over the past few decades, minimally invasive spine procedures have developed very extensively with numerous researches demonstrating their superiority over conventional open surgeries. Endoscopic procedure in minimally invasive spine surgery (MISS) was firstly described by Kambin et al. in 1988 and now has become a very popular approach in the management of lumbar spinal problems with less injury to the muscles and other normal structures in the spine by directly going to the affected region by advanced technology. Consequently, less postoperative pain, shorter hospital stays, and quicker recovery are expected. MISS has gained its popularity for the treatment of lumbar stenosis (LCS) with various techniques being adopted (unilateral vs. bilateral decompression) [7], [8], [9]. More recently, biportal endoscopic spine surgery (BESS), which combines the concept of endoscopic surgery (BESS), which combines the concept of endoscopic surgery (endoscopic removal of the herniated disc in the lumbar canal) and anterior lumbar interbody fusion (ALIF), has been used with good results. Although both groups can achieve adequate lumbar decompression, there is still a lack of evidence regarding their comparison.

METHODS:

This is a retrospective study in 100 consecutive patients with symptomatic lumbar spine compression due to herniated nucleus pulposus and lumbar canal stenosis that was treated by either BESS or MD. Clinical evaluations using Visual Analog Score (VAS), Oswestry Disability Index (ODI), and SF-36 questionnaire were obtained. Objective data, such as surgery duration, amount of postoperative drain production, and hospital length of stay were recorded. The outcome of LCS surgery using minimally invasive systems along with a microscope or endoscope and the conventional open laminectomy have been compared. The present study aimed to compare the outcomes of both techniques in a 1-year follow-up.

RESULTS:

Both procedures were comparably effective to treat lumbar stenosis. Although this study shows that MD permits safe microscopic decompression (MD) for the herniated nucleus pulposus (HNP) as well as in degenerative lumbar canal stenosis (LCS), with various techniques being adopted (uniportal vs. biportal, unilateral vs. bilateral decompression) [7], [8], [9].

CONCLUSIONS:

This research did not receive any financial support. The authors have declared that no competing interests exist. This is an open-access article distributed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (CC BY-NC 4.0).
Librianto et al. Comparison of Microscopic Decompression and Biportal Endoscopic Spinal Surgery. The most common level was L5-S1 (47%), followed by L4-5 (28%). There were 46 out of 100 patients (46%) treated with MD, while the rest were treated with BESS.

### Methods

#### Patient selections

There were 147 patients with lumbar stenosis and herniated disc (HNP) in Pondok Indah Hospital, Jakarta, Indonesia, with a minimum 1-year follow-up, to compare the clinical efficacies between two procedures. STROBE guideline was used in this manuscript.

#### Outcomes measurement

Outcomes measurement was performed using 36-Item Short-Form Health Survey (SF-36) questionnaire. These outcomes were collected in a minimum of 1-year follow-up. The primary outcomes assessed were hospital length of stay, and complication.

#### Surgical technique

In the BESS group, a 1 cm incision for each working portal was made, 1 cm lateral to the lamina, generally on the side of the worst symptom and then extended across the contralateral side if the symptom is unilateral. In bilateral cases, the portal was made on the side of the worst symptom and then extended across the contralateral side if the symptom is unilateral.

#### Statistical analysis

A meta-analysis by Chen et al. in 2022 suggested that the biportal endoscopic technique is a viable option to evidence of its advantages compared to other MISS procedures within the same time frame of the learning curve. Tubes were used before the introduction of the Kerrison Rongeur and curette to expose the outer margin of the dural sac. The nerve root and dural sac were retracted to allow access to the pathologic disc or dry endoscopic view on the pathological side only.

#### Results

There were 46 out of 100 patients (46%) treated with MD, while the rest were treated with BESS. There were no significant differences before treatment for every variable (p > 0.05). The demographic and clinical analyses, and correlational analyses were performed using the independent t-tests and the unpaired nonparametric Mann-Whitney test. Furthermore, Chi-square and Fisher exact tests were also used to compare categorical outcomes, and complication. There were 20 patients with more than one level of involvement.
Table 1: Demographic data

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>MD</th>
<th>BESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>58</td>
<td>59</td>
</tr>
<tr>
<td>Gender (male)</td>
<td>60</td>
<td>58</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>25</td>
<td>26</td>
</tr>
<tr>
<td>Etiology</td>
<td>Multilevel</td>
<td>Single-level</td>
</tr>
<tr>
<td>Location</td>
<td>Upper lumbar</td>
<td>Lower lumbar</td>
</tr>
</tbody>
</table>

Discussion

The minimally invasive spine surgery (MISS) aims to achieve decompression while minimizing muscle dissection, disruption of ligamentum flavum, and cerebrospinal fluid leakage. MISS procedures include MISS decompression for lumbar spine decompression and MISS fusion for the instability case.

Table 2: Immediate post-operative outcome

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>MD</th>
<th>BESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAS (0-10)</td>
<td>5.3</td>
<td>0.7</td>
</tr>
<tr>
<td>ODI (0-50)</td>
<td>16.8</td>
<td>3.7</td>
</tr>
<tr>
<td>SF-36</td>
<td>81</td>
<td>92</td>
</tr>
<tr>
<td>Reoperations</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 3: Post-operative outcome comparison

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>MD</th>
<th>BESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delta VAS</td>
<td>5.3</td>
<td>7.1</td>
</tr>
<tr>
<td>Delta ODI</td>
<td>10.7</td>
<td>3.7</td>
</tr>
<tr>
<td>SF-36</td>
<td>80.98</td>
<td>92.13</td>
</tr>
</tbody>
</table>

The minimally invasive spine surgery (MISS) aims to achieve decompression while minimizing muscle dissection, disruption of ligamentum flavum, and cerebrospinal fluid leakage. MISS procedures include MISS decompression for lumbar spine decompression and MISS fusion for the instability case.
In our study, the mean surgery duration was significantly longer (mean 76.89 vs. 53.2±32.1ml, P=0.0) compared to the BESS group in intermediate outcomes associated with theMISS technique.

In the MD group, LOS is longer than in the BESS group (mean 1.16 vs. 0.74, P=0.0). This result showed that microscopic procedure causes more muscle trauma while maintaining the aim of surgery to decrease morbidity in the elderly, primarily due to decreases in blood loss, soft-tissue injury, and postoperative pain. Intraoperative hemorrhage control with a bipolar system showed that microscopic procedure causes more muscle trauma while maintaining the aim of surgery to decrease morbidity in the elderly.

Intermediate outcomes associated with the MISS technique

- **Operative time**: The mean duration of surgery was significantly longer in the MD group (mean 76.89 vs. 53.2±32.1ml, P=0.0). This result showed that microscopic procedure causes more muscle trauma while maintaining the aim of surgery to decrease morbidity in the elderly.

- **Intraoperative hemorrhage control**: In the MD group, hemorrhage control with a bipolar system showed that microscopic procedure causes more muscle trauma while maintaining the aim of surgery to decrease morbidity in the elderly. This result also similar to findings by Zhang et al., who showed that microscopic procedure causes more muscle trauma while maintaining the aim of surgery to decrease morbidity in the elderly.
Functional outcomes and complications associated with the MISS technique

In our study, which showed that BESS had shorter surgery duration and lesser post-operative complications. We believe that every procedure that follows the MISS technique will have a risk of complication which arises from the unclear surgical field. In our study, no complications were observed in the BESS group, even in the learning phase of all minimally invasive procedures. In general, complication rates may be higher in the learning phase of this technique. A clear vision might minimize the risk of complications associated with the MISS technique.

We found a significant post-operative difference in VAS and ODI scores for BESS compared to MD, 0 versus 2 (p < 0.001) and 2 versus 16 (p < 0.001), respectively. This result is similar to Kang et al's [17] who showed a similar complication rate between biportal and microscopic techniques. However, BESS patients experienced a significantly higher reduction in the pain scale compared to the MD group. There was also a significant post-operative follow-up and lesser post-operative complications. We compared these two procedures for LCS, we found similar final (12 months) clinical outcome between the microscopic group and the endoscopic group. In our study, patients with overweight II. However, there was no association between complications and BMI in our study (r = 0.000). In Senker et al's [12], their early trial of BESS in 2016, showed complications of epidural hematoma after BESS [30]. Eum et al [29] also reported a 21.7% recurrence rate following MD surgery but with segmental instability, which was the patient with significantly reduced after revision surgery. The patient was also complaining about recurrent leg pain but despite different study populations. The leg pain was reported a 21.7% recurrence rate following MD surgery in the Chang et al [19] study, which showed that BESS had shorter surgery duration and lesser post-operative complications. We believe that every procedure that follows the MISS technique will have a risk of complication which arises from the unclear surgical field. In our study, no complications were observed in the BESS group, even in the learning phase of all minimally invasive procedures. In general, complication rates may be higher in the learning phase of this technique. A clear vision might minimize the risk of complications associated with the MISS technique.

Revision surgery is recommended for new patients with LCS. To prevent recurrent leg pain, sufficient decompression with or without fusion should be performed, especially in patients with LCS considering the dynamic instability. One patient refused surgery and another one complicated cases underwent revision surgery including fusion surgery in one patient with LCS and dynamic instability. One patient refused surgery and another one complicated cases underwent revision surgery including fusion surgery in one patient with LCS and dynamic instability. One patient refused surgery and another one complicated cases underwent revision surgery including fusion surgery in one patient with LCS and dynamic instability. One patient refused surgery and another one complicated cases underwent revision surgery including fusion surgery in one patient with LCS and dynamic instability. One patient refused surgery and another one complicated cases underwent revision surgery including fusion surgery in one patient with LCS and dynamic instability. One patient refused surgery and another one complicated cases underwent revision surgery including fusion surgery in one patient with LCS and dynamic instability. One patient refused surgery and another one complicated cases underwent revision surgery including fusion surgery in one patient with LCS and dynamic instability. One patient refused surgery and another one complicated cases underwent revision surgery including fusion surgery in one patient with LCS and dynamic instability. One patient refused surgery and another one complicated cases underwent revision surgery including fusion surgery in one patient with LCS and dynamic instability. One patient refused surgery and another one complicated cases underwent revision surgery including fusion surgery in one patient with LCS and dynamic instability. One patient refused surgery and another one complicated cases underwent revision surgery including fusion surgery in one patient with LCS and dynamic instability. One patient refused surgery and another one complicated cases underwent revision surgery including fusion surgery in one patient with LCS and dynamic instability. One patient refused surgery and another one complicated cases underwent revision surgery including fusion surgery in one patient with LCS and dynamic instability. One patient refused surgery and another one complicated cases underwent revision surgery including fusion surgery in one patient with LCS and dynamic instability. One patient refused surgery and another one complicated cases underwent revision surgery including fusion surgery in one patient with LCS and dynamic instability. One patient refused surgery and another one complicated cases underwent revision surgery including fusion surgery in one patient with LCS and dynamic instability. One patient refused surgery and another one complicated cases underwent revision surgery including fusion surgery in one patient with LCS and dynamic instability. One patient refused surgery and another one complicated cases underwent revision surgery including fusion surgery in one patient with LCS and dynamic instability. One patient refused surgery and another one complicated cases underwent revision surgery including fusion surgery in one patient with LCS and dynamic instability. One patient refused surgery and another one complicated cases underwent revision surgery including fusion surgery in one patient with LCS and dynamic instability. One patient refused surgery and another one complicated cases underwent revision surgery including fusion surgery in one patient with LCS and dynamic instability. One patient refused surgery and another one complicated cases underwent revision surgery including fusion surgery in one patient with LCS and dynamic instability. One patient refused surgery and another one complicated cases underwent revision surgery including fusion surgery in one patient with LCS and dynamic instability. One patient refused surgery and another one complicated cases underwent revision surgery including fusion surgery in one patient with LCS and dynamic instability. One patient refused surgery and another one complicated cases underwent revision surgery including fusion surgery in one patient with LCS and dynamic instability. One patient refused surgery and another one complicated cases underwent revision surgery including fusion surgery in one patient with LCS and dynamic instability. One patient refused surgery and another one complicated cases underwent revision surgery including fusion surgery in one patient with LCS and dynamic instability. One patient refused surgery and another one complicated cases underwent revision surgery including fusion surgery in one patient with LCS and dynamic instability. One patient refused surgery and another one complicated cases underwent revision surgery including fusion surgery in one patient with LCS and dynamic instability. One patient refused surgery and another one complicated cases underwent revision surgery including fusion surgery in one patient with LCS and dynamic instability. One patient refused surgery and another one complicated cases underwent revision surgery including fusion surgery in one patient with LCS and dynamic instability.

https://oamjms.eu/index.php/mjms/index
Conclusion

Both procedures were comparably effective to achieve better immediate outcome results: lesser drain output, lesser postoperative hospitalization (LOS). However, it cannot fully replace open surgery, which may be needed in certain scenarios. This preliminary study compared two MISS techniques and has demonstrated non-inferiority of microendoscopic decompression of lumbar stenosis. BESS is potentially safe and effective as an alternative to MD, as shown in follow-up times are needed for further research.

References

7. Librianto et al. Comparison of Microscopic Decompression and Biportal Endoscopic Spinal Surgery
19. Librianto et al. Comparison of Microscopic Decompression and Biportal Endoscopic Spinal Surgery
21. Wong AP, Smith ZA, Lall RR, Bresnahan LE, Fessler RG. The rat model.
22. Librianto et al. Comparison of Microscopic Decompression and Biportal Endoscopic Spinal Surgery
23. Librianto et al. Comparison of Microscopic Decompression and Biportal Endoscopic Spinal Surgery
24. Librianto et al. Comparison of Microscopic Decompression and Biportal Endoscopic Spinal Surgery
25. Librianto et al. Comparison of Microscopic Decompression and Biportal Endoscopic Spinal Surgery
26. Librianto et al. Comparison of Microscopic Decompression and Biportal Endoscopic Spinal Surgery
27. Librianto et al. Comparison of Microscopic Decompression and Biportal Endoscopic Spinal Surgery
28. Librianto et al. Comparison of Microscopic Decompression and Biportal Endoscopic Spinal Surgery
29. Librianto et al. Comparison of Microscopic Decompression and Biportal Endoscopic Spinal Surgery
30. Librianto et al. Comparison of Microscopic Decompression and Biportal Endoscopic Spinal Surgery
31. Librianto et al. Comparison of Microscopic Decompression and Biportal Endoscopic Spinal Surgery
32. Librianto et al. Comparison of Microscopic Decompression and Biportal Endoscopic Spinal Surgery
33. Librianto et al. Comparison of Microscopic Decompression and Biportal Endoscopic Spinal Surgery
34. Librianto et al. Comparison of Microscopic Decompression and Biportal Endoscopic Spinal Surgery
35. Librianto et al. Comparison of Microscopic Decompression and Biportal Endoscopic Spinal Surgery
36. Librianto et al. Comparison of Microscopic Decompression and Biportal Endoscopic Spinal Surgery
37. Librianto et al. Comparison of Microscopic Decompression and Biportal Endoscopic Spinal Surgery
38. Librianto et al. Comparison of Microscopic Decompression and Biportal Endoscopic Spinal Surgery
39. Librianto et al. Comparison of Microscopic Decompression and Biportal Endoscopic Spinal Surgery
40. Librianto et al. Comparison of Microscopic Decompression and Biportal Endoscopic Spinal Surgery
41. Librianto et al. Comparison of Microscopic Decompression and Biportal Endoscopic Spinal Surgery
42. Librianto et al. Comparison of Microscopic Decompression and Biportal Endoscopic Spinal Surgery
43. Librianto et al. Comparison of Microscopic Decompression and Biportal Endoscopic Spinal Surgery
44. Librianto et al. Comparison of Microscopic Decompression and Biportal Endoscopic Spinal Surgery
45. Librianto et al. Comparison of Microscopic Decompression and Biportal Endoscopic Spinal Surgery
46. Librianto et al. Comparison of Microscopic Decompression and Biportal Endoscopic Spinal Surgery
47. Librianto et al. Comparison of Microscopic Decompression and Biportal Endoscopic Spinal Surgery
48. Librianto et al. Comparison of Microscopic Decompression and Biportal Endoscopic Spinal Surgery
49. Librianto et al. Comparison of Microscopic Decompression and Biportal Endoscopic Spinal Surgery
50. Librianto et al. Comparison of Microscopic Decompression and Biportal Endoscopic Spinal Surgery

PMid:12637057


PMid:26242404


PMid:32791717


PMid:29879787


PMid:24184639


PMid:29787880


PMid:16648754


PMid:29274450


PMid:32147545


PMid:26722954