Unilateral Biportal Endoscopy Versus Tubular Microendoscopy in Management of Single Level Degenerative Lumbar Canal Stenosis

A Prospective Study

Hayati Aygun, MD* and Khaled Abdulshaﬁ, MD†

Study Design: Prospective clinical study.

Summary of Background Data: To the authors knowledge, there are no previous prospective studies to test the feasibility of the unilateral biportal endoscopic (UBE) technique in management of lumbar canal stenosis.

Purpose: The study was conducted to compare clinical results of the UBE technique with the tubular microendoscopic (TME) surgery for management of degenerative lumbar canal stenosis.

Methods: One hundred fifty-four cases of single level degenerative lumbar canal stenosis were randomly divided into 2 groups. Each group consisted of 77 cases: one group underwent UBE and the other TME. Clinical outcome was assessed periodically: early postoperative, at 1, 3, and every 6 months for 2 years. Clinical outcome assessment operatives included the Oswestry Disability Index (ODI), Zurich Claudication Questionnaire (ZCQ), and patient satisfaction using Modiﬁed Macnab Criteria (MMC). In addition, the admission period, operative time, and estimated blood loss were compared.

Results: In UBE cases, ODI and ZCQ were statistically superior to TME for all periods (P < 0.05). For both approaches, values presented progressive improvement until the 24th month. Regarding ODI, UBE and TME had an 84% and 79% success rate, respectively. In ZCQ, UBE and TME had a 79% and 73% success rate, respectively, at the end of the 24th month. Regarding the MMC, UBE and TME had 63% and 29% excellent results, respectively. UBE also has shorter admission period (days: 1.11 vs. 1.28), operative time (minutes: 57.74 vs. 65.31), and less estimated blood loss (mL: 49.47 vs. 53.57).

Conclusions: Given its demanding learning curve, UBE is considered an effective alternative to TME with a higher clinical success rate.

Key Words: unilateral biportal endoscopy, tubular microdiscectomy, lumbar stenosis

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For lumbar canal stenosis, minimal invasive spine surgery is considered an alternative to open lumbar spine surgery.1 Minimal invasive approaches include tubular microdiscectomy as well as the percutaneous lumbar endoscopic discectomy (PLED). The tubular approach can be performed with minimal muscle dissection and carrying, comparable to standard microdiscectomy outcomes.2,3 PLED has limitations due to its technically demanding learning curve.4 Requiring proper patient selection, PLED outcomes are comparable to those achieved by the METRIX-MD.3–7

Post-unilateral biportal endoscopic (UBE) development, in which the arthroscopic discectomy technique was first reported by Kambin and Brager,5 the UBE is an alternative for the management of spinal stenosis.9,10 Here, we are reporting the 24-month clinical results utilizing UBE versus tubular microendoscopic (TME) surgery for management of lumbar spinal stenosis.

METHODS

The study involved 154 patients with single level lumbar stenosis (Table 1). After the Institutional Review
Board was obtained, patients were randomly assigned to the UBE group (77 patients), and the TME group (77 patients). All patients were followed at 1, 3, and every 6 months until 2 years had passed. To eliminate the risk of minor variations in clinical outcomes due to the surgeon’s technique and expertise, all cases were performed by 1 surgeon.

Patient data included: the Oswestry Disability Index (ODI), Zurich Claudication Questionnaire (ZCQ), Macnab score along with operative time (OT), estimated blood loss (EBL), and admission period (AP).

A clinical researcher, who was blinded to the allocation during the study, collected all assessment databases. The data analysis program, SSPS 22 (IL), was used for statistical evaluation. All data were scrutinized with the Kolmogorov-Smirnov test, whereas the Friedman and Wilcoxon signed rank test were utilized to compare ODI and ZCQ between groups over the various time periods [refer to the supplementary file for further details, Supplemental Digital Content 1 (http://links.lww.com/CLINSPIE/A164)].

| TABLE 1. Biographic Distribution of the Selected Cases Including Age, Sex, BMI, as Well as the Percentage of DM, HTN, ID, and Smokers Among Both Groups |
|---------------------------------------------------------------|
| **Variables** | Surgical Technique | Data |
|----------------|--------------------|------|
| Age            | UBE (n = 77)       | 64.64 ± 10.09 |
|                | TME (n = 77)       | 65.01 ± 9.24 |
| Sex (%)        | UBE                | M 57 |
|                | TME                | F 43 |
|                |                    | M 65 |
|                |                    | F 35 |
| BMI            | UBE                | 27.69 ± 4.5 |
|                | TME                | 27.69 ± 3.8 |
| DM (%)         | UBE                | 22 |
|                | TME                | 17 |
| HTN (%)        | UBE                | 22 |
|                | TME                | 19 |
| ID (%)         | UBE                | 8 |
|                | TME                | 9 |
| Smoker (%)     | UBE                | 39 |
|                | TME                | 31 |

BMI indicates body mass index; DM, diabetes mellitus; HTN, hypertension; ID, inflammatory disease; TME, tubular microendoscopic; UBE, unilateral biportal endoscopic.
SURGICAL TECHNIQUE

All surgeries were performed under general anesthesia in the prone position over a Jackson spinal table.

UBE Summary

Surgery was achieved through 2 entry portals in one side of the midline with ∼1 cm skin and a fascia sharp incisions: one portal for endoscopic viewing and the other for insertion and manipulation of the surgical tools (Fig. 1). Within the caudal portal, targeting the intersection of the lower lamina margin and a line 1 cm lateral to the spinous process, the muscles were bluntly dissected using serial dilators. Meticulous hemostasis using radiofrequency probe is essential to maintain clear visualization of the operative field. Ipsilateral laminotomy, flavectomy, foraminotomy, and discectomy were executed. Lastly, the working cannula repositioned to access the contralateral side for further decompression (Fig. 4).

A surgical drain was inserted followed by closure using skin sutures. Postoperative pain control was provided with intravenous acetaminophen administration.

TME Summary

An entry portal was created under fluoroscopy control targeting the inferior edge of the superior lamina. This was followed by, ∼2 cm skin and fascia incision, and blunt muscles dissection using serial dilators. A 22-mm working cannula was inserted and fixed in place using a holder system (Fig. 3). Ipsilateral laminotomy, flavectomy, foraminotomy, and discectomy were achieved. Lastly, the working cannula repositioned to access the contralateral side for further decompression (Fig. 4).

RESULTS

Both groups demonstrated comparable overall health. The reoperation rate was 0/77 for the UBE versus 4/77 for the TME patients (ie, due to incomplete decompression).

The UBE scores were better than the TME scores throughout the entire period (Figs. 5, 6). Regarding ODI, UBE and TME had 84% and 79% success rates, respectively. In ZCQ, UBE and TME had 79% and 73% success rates, respectively (Figs. 7A, B).

Modified Macnab Criteria was used to measure the 24 months postoperative patients’ satisfaction. UBE and TME had 63% and 29% excellent results, respectively (Table 2) (Fig. 7C).

When comparing the AP, OT, and EBL, a difference existed between the 2 groups: UBE patients had a shorter AP.
FIGURE 3. Intraoperative pictures for tubular microendoscopic surgery (A) depicting the tubular system and working channel, (B) presenting operative view via the working cannula using a diamond high-speed drill for laminotomy, and (C) adjusting the tubular system to work on the contralateral side.

FIGURE 4. Radiographic pictures for a case performed with tubular microendoscopic technique of (A) preoperative axial magnetic resonance images (MRI) cut, (B) postoperative axial MRI cut depicting completed neural decompression utilizing TM, and (C) axial computed tomography cut depicting the extent of bony decompression.
ODI MEAN

Preop Immediate post operative 1st month 3rd month 6th month 12th Month 18th month 24th month

FIGURE 5. Diagram illustrating clinical outcomes over a 24-month period using the Oswestry Disability Index (ODI).

ZCQ MEAN

Preop 1st month 3rd month 6th month 12th Month 18th month 24th month

FIGURE 6. Diagram illustrating the clinical outcomes over a 24-month period using the Zurich Claudication Questionnaire (ZCQ).

FIGURE 7. Diagrams representing (A) unilateral biportal endoscopic (UBE) and (B) tubular microendoscopic (TME) success rates regarding Oswestry Disability Index (ODI) and Zurich Claudication Questionnaire (ZCQ). C, The UBE and TME clinical outcomes according to the Modified Macnab Criteria.

TABLE 2. UBE Versus TME Patients Satisfaction Using Modified Macnab Criteria

| Successful Macnab Criteria | UBE (%) | TME (%) |
|----------------------------|---------|---------|
| Excellent: no pain, no restriction of mobility, and return to normal work and level of activity | 63      | 29      |
| Good: occasional nonradicular pain, relief of presenting symptoms, and able to return to modified work | 29      | 43      |
| Fair: some improved functional capacity and still handicapped and/or unemployed | 5       | 13      |
| Poor: continued objective symptoms of root involvement, and additional operative intervention required at index level irrespective of postoperative follow-up length | 3       | 15      |

TME indicates tubular microendoscopic; UBE, unilateral biportal endoscopic.
Bilateral decompression of lumbar spinal stenosis involving a unilateral approach with a microscope and tubular retractor system is a current feasible option for patients with acquired spinal stenosis. The advantages of UBE in lumbar spine surgery include the ability to achieve complete bilateral neural decompression throughout 2 small (<1 cm) portals: one portal for continuous irrigation and endoscopic viewing, and another portal to manipulate instruments used in decompression procedures.

Kim et al. compared a 1-year clinical outcome of UBE to open lumbar microdiscectomy (using tubular and Caspar retractor) in the management of single level lumbar canal stenosis, excluding cases of bilateral foraminal stenosis. This study was conducted to acquire the feasibility of UBE regarding a wider spectrum of single level lumbar spine pathology including bilateral foraminal stenosis. The results were compared with the tubular system; to the knowledge of the authors, no similar prospective study was previously conducted.

UBE provides a clear visualization of neural elements, degenerative surrounding structures, and congested epidural venous plexus, which are crucial for achieving the best operative results. Although previous reports regard the tubular system for contralateral neural decompression, TME has its limitations attributable to changing the working cannula direction, narrow visualization field, difficulty in bleeding control, and inadequate achievement of contralateral neural decompression. Furthermore, 4 TME cases required reoperation due to poor operative visualization.

For both groups, a 6-month postoperative follow-up was found to be a sufficient time frame to assess the mean surgical success rate. Hence, an extended follow-up period is not deemed necessary unless the patient develops new complaints.

CONCLUSION
The findings of this study represent the superiority of UBE over TME in management of single degenerative lumbar canal stenosis.

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