Learning Curve of Unilateral Biportal Endoscopic Microlumbar Discectomy

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INTRODUCTION: The increasing usage of endoscopic surgical techniques when treating various spine indications is an emerging trend poised towards reducing the invasiveness of the performed procedure. Specifically, unilateral biportal endoscopy (UBE) is a novel minimally invasive technique that makes use of two surgical portal along the same side of the spine for manipulation of both the endoscope and working instruments. Early studies have shown that UBE is able to provide successful treatment of lumbar disc herniation and stenosis. Given the unfamiliarity of UBE instruments and its non-traditional approach, reaching technical proficiency can be a difficult task and require further attention. Therefore, the objective of our study was to investigate the learning curve of UBE in the treatment of disc herniation.

METHODS: Patients who underwent single-level unilateral biportal endoscopic (UBE) lumbar microdiscectomy (MLD) were operated on by a single surgeon with from 2022 to 2024. All cases made use of intraoperative CT navigation for precise incision and portal localization at the targeted intervertebral disc space. Patients were retrospectively chart reviewed up to 30 days for baseline and perioperative outcomes. Pearson correlation and linear regression analysis were used to evaluate the learning curve. To determine an inflection point, consecutive UBE MLD cases were analyzed in a stepwise fashion with respect to operative time using Mann-Whitney U tests. The case number at that inflection point was then used to stratify the cohort into early and late enrolled group. Between enrollment groups, comparisons of patient, surgical, and clinical characteristics were performed using Fischer's Exact and Mann-Whitney U tests with level of significance set at $p < 0.05$.

RESULTS: A total of 37 UBE MLD patients were included in the study. All 37 patients had successful operation of UBE MLD with significant resolution of preoperative symptoms without intraoperative complication or requirement for reoperation. Pearson correlation and linear regression analysis revealed that there was a significant downward trend in operative time in relation to increasing case number ($r = -0.342$; $p = 0.038$). Furthermore, stepwise analysis revealed an inflection point at the 20th case based on a significant difference in operative time between earlier and later cases respectively (150.85 min vs. 125.29 min, $p = 0.048$). Between enrollment groups, late had a significantly lower percentage of females (4[23.5%] vs. 13[65.0%], $p = 0.020$) but had more patients with prior lumbar surgery (4[23.5%] vs. 0[0%], $p = 0.036$). No other differences were found in age, BMI, ASA, smoking status or herniation type. Outside of operative time, no other differences were found between groups.

DISCUSSION AND CONCLUSION: UBE MLD is able to achieve significant resolution of disc herniation with a low rate of complications. As observed in our results, there was a significant downward trend in operative time for each consecutive case performed with a significant drop at the 20th case. These findings highlight a learning period until mastery of UBE MLD.

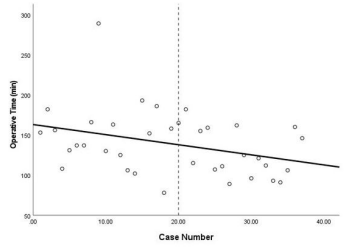

Figure 1. Scatterplot displaying downward trend in operative time. The dashed line depicts the inflection point at case number 20 in which there was an initial significant difference in operative time between early and late enrollment groups.

Table 1: Baseline Characteristics Between Early and Late Enrolled of Unilateral Biportal Endoscopic MLD Cases

	Early (≤ 20) (N=20)	Late (> 20) (N=17)	p value
Demographics			
Age (years)	53.55±25.40	48.94±28.12	0.341
Gender (%F)	13(65.0%)	4(23.5%)	**0.020**
BMI	25.40±5.61	28.12±5.08	0.167
ASA; mean	1.90±0.55	1.82±0.53	0.752
Smoking	3 (15.0%)	2 (11.8%)	1.000
Previous Lumbar Surgery	0 (0%)	4(23.5%)	**0.036**
Recurrent HNP	0 (0%)	1(5.9%)	0.459
Herniation Type			
Paracentral	19 (95%)	24(92.3%)	
Far-Lateral	1(5%)	1(5.9%)	1.000
Protrusion	7(35.0%)	5(29.4%)	
Extrusion	13(65.0%)	12(70.6%)	1.000

Table 2: Perioperative Characteristics Between Early and Late Enrolled of Unilateral Biportal Endoscopic MLD Cases

	Early (≤ 20) (N=20)	Late (> 20) (N=17)	p value
Level Operated			
L2/L3	1(5.0%)	1(5.9%)	1.000
L3/L4	5(25.0%)	1(5.9%)	0.189
L4/L5	9 (45.0%)	7(41.2%)	1.000
L5/S1	5 (25.0%)	8(47.1%)	0.188
Operative Time	150.85±44.22	125.29±29.39	**0.048**
EBL < 10	10(50.0%)	4 (23.5%)	0.173
Incidental Durotomy	0 (0%)	0 (0%)	--
Perioperative Outcomes			
Length of Stay	0.46±0.22	0.46±0.46	0.056
Postop Complications	0 (0%)	1(5.9%)	0.459
30 Day Readmission	0 (0%)	1(5.9%)	0.459
30 Day Return to OR	0 (0%)	0 (0%)	--