Minimally Invasive Computer Navigation-Assisted Endoscopic Transforaminal Interbody Fusion with Bilateral Decompression via a Unilateral Approach: Initial Clinical Experience at One-Year Follow-Up

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OBJECTIVE: **The purpose of this study was to assess the feasibility of minimally invasive transforaminal lumbar interbody fusion (TLIF) and bilateral decompression via a unilateral approach that was performed with a novel working retractor with an endoscopic system for degenerative lumbar spondylolisthesis associated with spinal stenosis, to minimize surgical trauma without compromising the quality of the treatment outcome.**

METHODS: **In this case series, the procedure was performed in 17 patients. Patient outcomes were scored according to operating time, intraoperative blood loss, visual analog scale, Oswestry Disability Index, Japanese Orthopaedic Association scores, and postoperative imaging studies.**

RESULTS: **The follow-up period was 1 year. All patients showed clinical improvement, based on the visual analog scale, Oswestry Disability Index, and Japanese Orthopaedic Association score ($P < 0.01$). At 12 months postoperatively, all patients achieved solid bone graft fusion.**

CONCLUSION: **The use of navigation-assisted endoscopic TLIF with bilateral decompression via a unilateral approach appears safe and feasible. The endoscopic surgical procedure may be an alternative surgical option for degenerative lumbar disease.**

INTRODUCTION

Degenerative lumbar spondylolisthesis that is associated with central canal stenosis can cause low back pain, leg pain, and claudication, which may have a dramatic impact on patients' quality of life. For the treatment of spinal stenosis, less invasive surgical procedures such as a bilateral decompression via a unilateral approach have been introduced to alleviate spinal instability after conventional bilateral dissection of the paraspinal muscles and wide laminectomy.[1,2] This decompressive laminotomy technique can be modified by introducing an endoscope.[3,4] To treat degenerative spondylolisthesis that occurs alongside spinal stenosis, lumbar laminectomy plus fusion may be a superior surgical management option to other techniques.[5,6]

However, to our knowledge, there have been no reports regarding endoscopic minimally invasive interbody fusion with bilateral decompression via a unilateral approach for the treatment of lumbar spondylolisthesis that is associated with stenosis. We therefore conducted this study to propose and evaluate a novel endoscopic decompressive laminectomy with fusion procedure that uses the assistance of computer navigation.

METHODS

Patients

Between June 2015 and January 2016, the data of 17 patients undergoing minimally invasive endoscopic transforaminal lumbar interbody fusion (TLIF) with bilateral decompression via a unilateral approach, with a minimum of 1 year of follow-up, were collected and reviewed (Table 1). The study population included

Key words
- Bilateral decompression via unilateral approach
- Computer navigation
- Endoscopy
- Minimally invasive spine surgery
- Transforaminal lumbar interbody fusion (TLIF)

Abbreviations and Acronyms
CT: Computed tomography
JOA: Japanese Orthopaedic Association
L4: Fourth lumbar vertebra
L5: Fifth lumbar vertebra
ODI: Oswestry Disability Index
TLIF: Transforaminal lumbar interbody fusion
VAS: Visual analog scale

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Citation: World Neurosurg. (2017) 106:291-299.
http://dx.doi.org/10.1016/j.wneu.2017.06.174

Journal homepage: www.WORLDNEUROSURGERY.org

Available online: www.sciencedirect.com

Table 1. Clinical Data of Patients

Cases	Sex	Age (years)	Operative Time (hours:minutes)	Amount of Bleeding During Operation (mL)	Amount of Drainage (mL)	Follow-Up Time Point (months)	Pre-op VAS Score Low Back	Post-op VAS Score Low Back	Pre-op VAS Score Leg	Post-op VAS Score Leg	Pre-op ODI (%)	Post-op ODI (%)	Pre-op JOA Score	Post-op JOA Score	Operative Levels
1	Male	41	3:55	120	15	12	7	0	4	1	48.89	8.89	17	25	L4-L5
2	Male	58	3:20	100	30	12	7	0	5	0	6.67	0	22	26	L4-L5
3	Female	50	3:10	70	15	12	5	2	4	0	15.56	6.67	25	26	L4-L5
4	Male	54	3:35	120	20	12	4	0	5	2	22.22	15.5	21	25	L4-L5
5	Female	59	3:30	100	30	12	2	0	3	0	15.56	0	22	26	L4-L5
6	Female	58	2:40	80	30	12	7	0	7	0	73.33	2.22	7	24	L4-L5
7	Female	63	2:20	50	30	12	3	0	2	0	31.11	24.4	19	23	L4-L5
8	Female	48	2:45	70	25	12	6	0	6	0	40.0	33.3	17	21	L4-L5
9	Female	49	3:10	100	5	12	4	1	5	1	51.11	28.89	16	20	L4-L5
10	Female	62	2:50	80	5	12	1	0	5	0	71.11	37.78	4	19	L4-L5
11	Female	68	3:05	200	50	12	2	0	1	0	40	13.33	21	27	L4-L5
12	Male	67	2:40	100	10	12	0	0	0	0	37.78	35.56	16	19	L4-L5
13	Female	67	2:15	100	25	12	1	0	4	0	66.67	31.11	10	19	L4-L5
14	Male	65	2:35	80	5	12	5	0	5	0	46.67	24.44	15	24	L4-L5
15	Female	47	2:20	100	10	12	2	0	2	0	28.89	22.22	24	26	L4-L5
16	Female	65	2:50	90	10	12	3	0	3	0	48.89	28.89	15	21	L4-L5
17	Male	49	2:10	60	50	12	9	0	0	0	68.89	28.89	11	21	L4-L5

Pre-op, preoperative; VAS, visual analog scale; post-op, postoperative; ODI, Oswestry Disability Index.