Minimally Invasive Transforaminal Lumbar Interbody Fusion: A Comparison Study Based on End Plate Subsidence and Cystic Change in Individuals Older and Younger than 65 Years

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■ OBJECTIVE: **To compare the outcomes between patients older and younger than 65 years who underwent single-level minimally invasive transforaminal interbody fusion (MI-TLIF) surgery.**

■ METHODS: **This study is a retrospective analysis of 76 patients who underwent MI-TLIF between April 2012 and June 2016. Group A consisted of 35 patients (<65 years) and group B consisted of 41 patients (≥65 years). Intraoperative data were recorded. The evaluation of clinical outcomes was based on the visual analog scale for back and leg pain and the Oswestry Disability Index. Radiologic outcomes including cage subsidence, end plate cyst formation, and fusion rate were assessed.**

■ RESULTS: **The mean age of the study subjects was 65.3 years, and the mean duration of follow-up was 18.98 months. Group B had a higher rate of comorbidities compared with group A (90.24% vs. 57.14%, respectively; $P < 0.05$). There was no statistically significant difference in the rate of complications between the groups (group A, 14.29%; group B, 17.07%). Clinical outcomes significantly improved in both groups postoperatively ($P < 0.05$). Although bony fusion in group A was slightly higher than that in group B, the fusion rate was not statistically different according to age. There were no statistically significant differences in the rates of cage subsidence or positive cyst sign between the groups.**

■ CONCLUSIONS: **MI-TLIF presented similar safeness and acceptable outcomes and complication rate in both groups. Cyst formation may be aggravated by cage subsidence, because cage subsidence was a useful potential predictor of cyst formation.**

INTRODUCTION

Degenerative lumbar spine disease is a highly prevalent and debilitating illness in the elderly population. The number of surgeries performed to treat it is expected to increase along with its prevalence. Previous studies[1-4] reported that elderly patients could present with comorbidities in multiple systems that can determine the perioperative and postoperative risks of complications.

Recently, minimally invasive transforaminal lumbar interbody fusion (MI-TLIF) has gained popularity for the surgical treatment of degenerative lumbar spine disease. In several studies comparing the MI-TLIF technique with conventional techniques, it has shown better outcomes, such as reductions in intraoperative blood loss,[5,6] soft tissue trauma,[5,7,8] postoperative pain,[6,9] length of hospital stay,[10,11] complications,[7,9] and recovery time.[9-11] Phan et al.[9] performed a systematic review comparing MI-TLIF with open TLIF. Although significant differences were found in intraoperative blood loss, the length of hospital stay, and operation parameters in favor of MI-TLIF, no significant difference in the total rate of complications was reported (14.9% in MI-TLIF, 20% in open TLIF).

The surgical outcomes and complications among the elderly who underwent MI-TLIF have been addressed in the literature.[12,13] However, not enough studies have compared outcomes between younger and elderly patients who have undergone MI-TLIF. The

Key words
- Cage subsidence
- Elderly
- End plate cyst
- Minimally invasive
- Spine surgery
- Transforaminal interbody fusion

Abbreviations and Acronyms
BMD: Bone mineral density
CT: Computed tomography
MI-TLIF: Minimally invasive transforaminal interbody fusion
ODI: Oswestry Disability Index
VAS: Visual analog scale

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Table 1. Patient's Demographic Characteristics

	Group A (<65 Years)	Group B (≥65 Years)	*P* Value
Number of patients	35	41	
Male/female (ratio)	11:24	14:27	0.9898
Age (years), mean ± standard deviation	57.03 ± 5.96	72.27 ± 4.41	< 0.0001
Body mass index, mean ± standard deviation	24.88 ± 3.02	25.2 ± 2.36	0.6056
Bone mineral density, mean ± standard deviation	−1.1 ± 1.13	−2.05 ± 1.71	0.0142
Diagnosis			
Spondylolisthesis	19	21	>0.05
Spinal stenosis	14	16	
Herniated nucleus pulposus with instability	2	4	
Fusion level			
L3-L4	3	2	>0.05
L4-L5	23	27	
L5-S1	9	12	
Type of cage			
Banana-shaped	15	12	>0.05
Straight	20	29	
Side of approach			
Right	19	18	>0.05
Left	16	23	

aim of this study is to compare the clinical and radiologic outcomes between those older and younger than 65 years who underwent a single-level MI-TLIF surgery as their first fusion lumbar surgery.

METHODS

Patient Population

A retrospective study in a single institution was carried out. The data from April 2012 to June 2016 were collected and evaluated. A total of 132 patients underwent the MI-TLIF procedure, and all procedures were performed by a single senior surgeon. The inclusion criteria were: 1) single-level lumbar spine disease, 2) no history of lumbar spine surgery, 3) symptomatic spinal stenosis, low-grade (Meyerding grade I or II) spondylolisthesis, or herniated nucleus pulposus with segmental instability, 4) persistent clinical symptoms associated with radiologic findings, 5) failure of conservative treatment for at least 6 weeks preoperatively, and 6) at least a 6-month follow-up period postoperatively. Fifty-six patients were excluded from our study because they underwent multilevel fusion surgery, revision surgery, or were lost to follow-up.

Only 76 patients met the inclusion criteria. These patients underwent single-level MI-TLIF using a unilateral approach with a single cage inserted into the intervertebral space and percutaneous transpedicular screw fixation. These 76 patients were divided into 2 groups based on age: group A, <65 years old ($n = 35$); and group B, ≥65 years old ($n = 41$).

Surgical Procedure

Single-level decompression and a single cage were used for the MI-TLIF procedure, which was performed with a unilateral

Table 2. Intraoperative Data

	Group A (<65 Years), Mean ± Standard Deviation	Group B (≥65 Years), Mean ± Standard Deviation	*P* Value
Operation time (minutes)	190.83 ± 36.23	172.56 ± 48.99	0.0727
Anesthesia time (minutes)	238.03 ± 42.13	230.68 ± 44.86	0.4668
Estimated blood loss (mL)	304.29 ± 179.2	290.24 ± 120.53	0.6952
Postoperative hospital stay (days)	7.69 ± 4.42	8.22 ± 3.94	0.5800