

# Surgical Outcome of Oblique Lateral Interbody Fusion for Adult Spinal Deformity in Geriatric Patients with Obesity

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**Objective:** The objective of this study was to evaluate surgical outcomes of oblique lateral interbody fusion (OLIF) surgery in obese patients.

**Methods:** Medical records of geriatric patients who underwent OLIF for adult spinal deformity (ASD) from January 2017 to December 2018 were reviewed retrospectively. Obesity was defined as body mass index (BMI) was 25 or more. Surgical outcomes were compared between obese patients (BMI  $\geq 25$ ) with non-obese patients (BMI  $< 25$ ).

**Results:** Among total of 101 patients (31 males and 70 females) with a mean age of  $69.8 \pm 9.6$ , 53 patients (52.5%) was classified to obesity group. Mean OLIF level ( $2.9 \pm 0.8$  and  $3.0 \pm 0.8$ ,  $p=0.41$ ) was not different between obese patients and non-obese patients. Regarding surgical time, mean time of first stage operation ( $167.7 \pm 50.2$  min vs.  $160.7 \pm 47.9$  min,  $p=0.48$ ), and second stage operation ( $180.1 \pm 57.4$  min vs.  $172.8 \pm 50.0$  min,  $p=0.50$ ) showed no significant differences between groups. Also, mean time for anterior retroperitoneal procedure was not different between groups ( $74.8 \pm 21.2$  vs.  $72.6 \pm 20.7$ ,  $p=0.59$ ). The amount of surgical bleeding was also similar between groups. The incidence of postoperative ileus (49.1% vs. 35.4%,  $p=0.23$ ) and complication rates (32.7% vs. 20.8%,  $p=0.27$ ) were not different between groups, either.

**Conclusion:** There showed no significant differences regarding operation time, surgical bleeding, and perioperative complications between obese patients and non-obese patients who underwent OLIF for ASD.

**Key Words:** Spinal Diseases/surgery, Abdomen/surgery, Lumbar Vertebrae/surgery, Spinal fusion/adverse effects, Spinal fusion/methods, Obesity

## INTRODUCTION

The prevalence of obesity is rapidly increasing in Korea, and the rates of obesity became 32.4% in 2015<sup>17</sup>. Obesity is associated with various diseases including hypertension (HTN), diabetes mellitus (DM), dyslipidemia, metabolic syndrome, and coronary artery diseases<sup>11</sup>. Moreover, obesity is known to be associated with worse clinical outcomes in spinal surgeries.

The anterior approach of lumbar spine is widely accepted procedure as it allows excellent exposure and access to the intervertebral space, and allows insertion of larger cages than the posterior access, which allows sufficient restoration of lumbar lordosis<sup>3,4</sup>. Recently, oblique lateral interbody fusion

(OLIF) gained popularity. Utilizing oblique corridor, anterior to the psoas muscle, could avoid many of the anatomic structure-associated complications with the anterior or lateral approaches<sup>9</sup>. We utilize OLIF to treat patients with adult spinal deformity (ASD) that require multi-level interbody fusion and long-level instrumentation<sup>5</sup>. Although there exist lots of studies about perioperative complications of anterior lumbar interbody fusion (ALIF) or minimally invasive OLIF in obese patients, perioperative complications of OLIF for patients with ASD have not been evaluated yet.

The objective of this study was to evaluate surgical outcomes of OLIF regarding surgical time, intraoperative bleeding, and postoperative complications in obese patients with ASD.

## MATERIALS AND METHODS

### 1. Patients Demographics

A retrospective study of medical records of patients (>60 years old) who have been treated with OLIF for adult spinal

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deformity from January 2017 to December 2018 at our institution were reviewed. Patients who operated due to infection, malignancy, or acute spinal trauma were excluded. We evaluated data regarding age, sex, body mass index (BMI), diagnosis, history of previous spine surgery, ASA (American society of anesthesiologists) physical status classification, and comorbidities including hypertension (HTN), diabetes mellitus (DM), and others. Other comorbidities were defined as having chronic kidney disease, adrenal insufficiency, or history of stroke or coronary artery disease. Patients with defined as obese if BMI was 25 or more, then compared with non-obese patients whose BMI was less than 25<sup>18)</sup>. Operative records and progression notes were reviewed for evaluation of operation time, surgical bleeding, and perioperative complications. Operation time was divided and evaluated in terms of first stage (posterior instrumentation and facet release/decompression), second stage (OLIF + posterior rod assembly), and OLIF only. Postoperative ileus was defined as radiographic evidence of small and/or large bowel dilatation for more than three days after surgery.

### 2. Operative Technique

All patients underwent staged operation with a week-term. Posterior approach for instrumentation and facetectomy and/or laminectomy were conducted in first stage, and oblique retroperitoneal approach followed by posterior rod assembly were done in second stage. In second stage for OLIF, patients were positioned oblique laterally with right decubitus position. After single curvilinear skin incision is made, splitting of abdominal muscles and blunt finger dissection of retroperitoneal fat were followed. When the peritoneum sweeping anteriorly and psoas muscle retraction posteriorly, wide exposure of lateral aspect of disc spaces were accomplished. After discectomy and interbody fusion were performed, the abdominal fascia, subcutaneous tissue, and outer skin layer were sutured serially.

### 3. Statistics

Using SPSS version 22.0 software for Windows (IBM, Corp., Armonk, NY, USA), dichotomous data was compared using chi-square test, and independent t-test was used for comparison of parametric data. Statistical significance was set at  $p < 0.05$ .

## RESULTS

A total of 101 patients composed of 53 males and 48 females,

with a mean age of  $69.8 \pm 9.6$  years, were enrolled. Among the 101 participants, 53 patients (52.5%) were classified to obese group (BMI  $\geq 25$ ), whereas 48 patients (47.5%) were classified to non-obese group (BMI  $< 25$ ). Patients sex and age were not different between obese patients and non-obese patients (Table 1). Regarding comorbidities, the proportion of patients with HTN was significantly higher in obese group than non-obese group (77.4% vs. 56.3%,  $p = 0.03$ ). The proportion of other comorbidities was not different between groups. The proportion of patients with administration of antithrombotic agents (antiplatelets or anticoagulants) were not different between groups (24.5% vs. 31.3%,  $p = 0.51$ ). The mean score of bone mineral density was higher in obese group than non-obese group ( $-1.6 \pm 1.5$  vs.  $-2.2 \pm 1.3$ ,  $p = 0.04$ ). The proportion of osteoporosis was also lower in obese group, compared to non-obese group (22.4% vs. 46.3%,  $p = 0.02$ ). Other characteristics including history of previous spine surgery and ASA classification were not different between groups. The most common diagnosis was spinal stenosis (50 patients), followed by degenerative lumbar scoliosis (20 patients), degenerative flatback (7 patients), post-traumatic kyphosis (7 patients),

**Table 1.** Demographic data

	Obese (n=53)	Non-obese (n=48)	p-value
Age (yrs)	69.1±9.1	70.6±10.1	0.35
Male/female	13:40	18:30	0.20
Comorbidities			
Hypertension (%)	53 (77.4%)	27 (56.3%)	0.03
Diabetes mellitus (%)	19 (35.9%)	15 (31.3%)	0.67
Others (%)*	8 (15.1%)	12 (25%)	0.23
Antithrombotic agent medication (%)	13 (24.5%)	15 (31.3%)	0.51
ASA score	2.1±0.4	2.1±0.5	0.91
Previous spine surgery (%)	21 (39.6%)	22 (45.8%)	0.55
Bone mineral density	-1.6±1.5	-2.2±1.3	0.04
Osteoporosis (%)	11 (22.4%)	19 (46.3%)	0.02
Etiology			
Spinal stenosis	29	21	
Degenerative scoliosis	11	9	
Degenerative flatback	3	4	
Post-traumatic kyphosis	3	4	
Pseudarthrosis	1	5	
Spondylolisthesis	3	2	
Adjacent segment disease	2	3	
Degenerative kyphoscoliosis	1	0	

OLIF: oblique lateral interbody fusion

\*include chronic kidney disease, adrenal insufficiency, or history of stroke or coronary artery disease

and pseudarthrosis (6 patients).

Characteristics of OLIF was summarized in Table 2. Three-level OLIF was most commonly performed in the present study (n=53, 52.5%), followed by 2-level (n=23, 22.8%), and 4-level (n=20, 19.8%). Specifically, L2-5 OLIF was most commonly performed in both group (24 patients in obese group vs. 18 patients in non-obese group). The mean number of instrumentation was not different between groups ( $5.2 \pm 2.0$  vs.  $5.5 \pm 2.0$ ,  $p=0.60$ ). The mean number of OLIF level was  $2.9 \pm 0.8$  and  $3.0 \pm 0.8$  in patients with obesity and without obesity, respectively, which did not show statistical significance ( $p=0.41$ ).

**Table 2.** Characteristics of OLIF

	Obese (n=53)	Non-obese (n=48)	p- value
OLIF level			
1-level	1 (1.9%)	1 (2.0%)	
L4-5	1	1	
2-level	12 (22.6%)	11 (22.9%)	
L1-3	1	0	
L2-4	1	2	
L3-5	7	9	
L4-S1	3	0	
3-level	30 (56.6%)	23 (47.9%)	
L1-4	0	1	
L2-5	24	18	
L3-S1	6	4	
4-level	9 (17.0%)	11 (22.9%)	
L1-5	1	4	
L2-S1	8	7	
5-level	1 (1.9%)	2 (4.2%)	
L1-S1	1	2	
Mean number of OLIF level	$2.9 \pm 0.8$	$3.0 \pm 0.8$	0.41
Mean number of instrumentation	$5.2 \pm 2.0$	$5.5 \pm 2.0$	0.60

OLIF: oblique lateral interbody fusion

The mean operation time in first stage operation ( $167.7 \pm 50.2$  min vs.  $160.7 \pm 47.9$  min,  $p=0.48$ ) and second stage operation ( $180.1 \pm 57.4$  min vs.  $172.8 \pm 50.0$  min,  $p=0.50$ ) were not different between obese patients and non-obese patients (Table 3). The mean surgical time of anterior retroperitoneal procedure (excluding the time of posterior session for rod assembly) also did not show significant difference between groups ( $74.8 \pm 21.2$  vs.  $72.6 \pm 20.7$ ,  $p=0.59$ ). Estimated blood loss (EBL) in first stage operation ( $620.8 \pm 305.5$  mL vs.  $667.7 \pm 305.0$  mL,  $p=0.44$ ) and second stage operation ( $733.0 \pm 346.3$  mL vs.  $670.8 \pm 254.3$  mL,  $p=0.31$ ) were not different between obese patients and non-obese patients.

A total of 70 cases of perioperative complications were recorded. Overall, 55 participants (54.5%) of the total 101 participants experienced at least 1 case of perioperative complication while 12 participants (11.9%) experienced multiple complications. Most common complications were postoperative ileus; 43 patients (42.6%) suffered from postoperative ileus. Perioperative complications other than ileus were urinary tract infection (12 patients), pneumonia (11 patients), delirium (2 patients), and surgical wound infection (2 patient). (Table 4). There was no case of vascular injury, bowel injury, or sympathetic dysfunction. The incidence of postoperative ileus showed a trend toward higher in obese patients compared to non-obese patients (49.1% vs. 35.4%), however, which did not reach statistical significance ( $p=0.23$ ). Other postoperative complication rates were not different between groups, either (32.7% vs. 20.8%,  $p=0.27$ ).

## DISCUSSION

Obesity becomes a growing concern because overweight and obese patients continue to increase<sup>8)</sup>. There exist many literatures regarding the impact of obesity on spine surgeries, and

**Table 3.** Operative data

	Obese (n=53)	Non-obese (n=48)	p-value
Operative time			
First stage (posterior approach)	$167.7 \pm 50.2$	$160.7 \pm 47.9$	0.48
Second stage (OLIF + posterior rod assembly)	$180.1 \pm 57.4$	$172.8 \pm 50.0$	0.50
Second stage (OLIF only)	$74.8 \pm 21.2$	$72.6 \pm 20.7$	0.59
Estimated blood loss			
First stage (posterior approach)	$620.8 \pm 305.5$	$667.7 \pm 305.0$	0.44
Second stage (OLIF + posterior rod assembly)	$733.0 \pm 346.3$	$670.8 \pm 254.3$	0.31

OLIF: oblique lateral interbody fusion

**Table 4.** Summary of complications

	Obese (n=53)	Non-obese (n=48)	p- value
Postoperative ileus	26 (49.1%)	17 (35.4%)	0.23
Complications excluding ileus	17 (32.7%)	10 (20.8%)	0.27
Urinary tract infection	7	5	
Pneumonia	6	5	
Delirium	2	0	
Wound infection	2	0	

increasing evidence demonstrates higher perioperative complications in obese patients<sup>1,2,12</sup>. More recently, as anterior retroperitoneal approach becomes widely utilized, researchers have been reported surgical outcomes of anterior approach in obese patients. However, most studies focused on ALIF or minimally invasive OLIF. Here, we report the impact of obesity on surgical outcomes of oblique retroperitoneal approach for patients with adult spinal deformity.

In the present study, the mean surgical time for retroperitoneal approach was not significantly longer in obese patients, compared to non-obese patients (74.8±21.2 min vs. 72.6±20.7, p=0.59). Also, the mean operation time in first stage operation (instrumentation and neural decompression) and second stage operation (retroperitoneal approach + rod assembly via posterior approach) did not show significant differences between obese patients and non-obese patients. Our findings were consistent with most recent studies with large sample size<sup>14,16</sup>. Safaee et al. reported there was no significant difference in terms of operation time between obese patients and non-obese patients who underwent ALIF<sup>16</sup>. Phan also reported similar results regarding ALIF<sup>14</sup>. However, there also exist studies which showed increased operation time in obese patients with relatively small sample size<sup>7,13</sup>. In case of minimally invasive OLIF surgery, Wang et al. reported there showed increased operation time in patients with obesity in meta-analysis<sup>19</sup>.

Regarding surgical bleeding, no significant difference was found between obese patient and non-obese patients in the present study. Our finding was consistent with most previous studies about anterior retroperitoneal approaches including ALIF and minimally invasive OLIF. In contrast to results of literatures about conventional posterior spinal surgeries, obesity dose not seem to impact on surgical bleeding in case of anterior retroperitoneal approaches.

More than half of patients (54.5%) suffered from perioperative complications. The complication rates seems a little bit higher than most previous studies. This higher complication rates may be explained by the study population which compri-

sed of patients with adult spinal deformity. Majority of patients of this study underwent long-level instrumentation (mean 5.3 segments) and interbody fusion (mean 3.0 levels). Most other studies, on the other hand, enrolled patients underwent spinal fusion less than two level<sup>7,10,15,16</sup>. For the same aspect, the mean age (69.8 years old) of the patients was significantly higher than other studies<sup>7,10,15,16</sup>. It seems obvious that age of patients with ASD who underwent long level surgery is higher than patients with milder degenerative change who underwent one- or two-level fusion surgery. Lastly, most cases of our complication were postoperative ileus. The complication rates excluding postoperative ileus could be much decreased, which was comparable to other studies<sup>6</sup>.

The complication rates did not show significant differences regarding postoperative ileus (49.1% vs. 35.4%, p=0.23) and other perioperative complications (32.7% vs. 20.8%, p=0.27) between obese patients and non-obese patients. Although the complication rates showed a trend toward higher in patients with obesity, the difference did not reach statistical significance. These results were contrast to the study by Safaee et al. who described the postoperative complication rates were significantly higher in patients with obesity, while intraoperative complication rates did not differ<sup>16</sup>. We suppose that the small number of patients in the present study could be a reason of insignificant difference. It is noteworthy that there was no case of intraoperative complications in the present study such as bowel injury, vascular injury, or ureter injury. We utilize oblique retroperitoneal corridor with psoas muscle retraction posteriorly, which provide wide exposure of disc space with minimal vessel preparation and peritoneal retraction. This approach could be a reason of little intraoperative complications of the present study.

There are some limitations in this study. First, the retrospective design and small sample size of this study may be prone to bias. Second, the study did not include long-term postoperative complications such as pseudarthrosis, adjacent segment disease, or junctional failure. Because there exists a study reported inferior fusion rates in obese patients<sup>14</sup>, future study with mechanical complication could be necessary. Lastly, we did not evaluate clinical outcomes in the present study. Therefore, further prospective study with long-term follow-up would be warranted.

## CONCLUSION

There showed no significant differences in terms of oper-

ation time, surgical bleeding, and perioperative complications between obese patients and non-obese patients who underwent OLIF for ASD. OLIF could be performed safely in ASD patients with obesity.

#### Conflicts of Interest:

The authors have no personal, financial, or institutional interest in this article.

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