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Impact of body mass index in spinal surgery for degenerative lumbar spine disease

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ABSTRACT

Background: Obesity is a factor for degenerative lumbar spine disease (DLSD), with increasing prevalence worldwide. Consequently, patients who are overweight or obese have benefited from surgical treatment for DLSD, despite their anatomical and clinical differences.
Objectives: To analyse the effect of body mass index (BMI) in spinal surgery for degenerative lumbar spine disease (DLSD).
Patients and methods: A retrospective analysis of 100 patients who underwent surgery for DLSD was performed. The study time was 13 months (January 2013–January 2014). The patients were first evaluated with regard to their BMI and were subsequently divided into four groups of patients: BMI <25, BMI between 25 and 30, BMI between 30 and 35, and BMI above 35. The same patients were assessed for their results regarding the extent of surgery in four groups: patients undergoing surgery for treatment of one segment, two segments, three segments, and four or more segments of DLS. The aspects evaluated were surgical time, bleeding, surgical complications, surgical site infection (SSI), and re-operation due to failure of the first procedure.
Results: A total of 118 surgeries were performed on 100 patients (52 male/48 female), mean age 52.77 years old (52.77 ± 14.45), range between 26 and 85 years old, and a mean BMI of 29.43 kg/m^2 (29.43 ± 5.54). The surgical time averaged 258.1 min (258.1 ± 82.79); the bleeding was 660 millilitres (ml) (660 ± 509.1); complications that were related to the surgical procedure occurred in 38% of cases; SSI occurred in 5% of cases, and re-operations or SSI due to complications occurred in 12% of cases. After analysis of all variables, it was observed that the groups were homogeneous without statistical variation when divided by the BMI; however, it was also observed that the extent of surgery was the factor responsible for the increased rate of SSI ($p = 0.05$) and increased potential of re-operation due to complications ($p = 0.003$).
Conclusion: BMI is not a complicating factor for the outcome of patients undergoing surgery for DLSD in terms of SSI, surgical complications, and re-operation rates. Furthermore, the extent of surgery was associated with increased postoperative SSI and the need for a second surgery due to the failure of the first procedure.

1. Introduction

Obesity has become a dominant public health epidemic with increasing prevalence [1]. Increased loads may place an increased demand on the musculoskeletal system, particularly the lumbar spine [2]. In obese patients, normal anatomy and physiology is altered to accommodate excess mass. When excess weight is carried, the spine is forced to sustain increased or altered stress, which may result in advanced degeneration [3].

Obesity is becoming a common entity in patients undergoing elective thoracic and lumbar spinal surgery. Obese patients have an increased risk of complications after spine fusions, including SSI [4,5].

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A direct correlation of obesity to perioperative adverse events and complications has not been defined. However, some studies have reported a correlation between the degree of obesity and the occurrence of postoperative complications [6–9]. The authors of other well-designed reviews have reported no correlation between the degree or presence of obesity and perioperative complications [10,11].

In this study, we found no related articles, and thus we will compare the results of treatment after surgery for DLSD, among groups according to their BMI, and those with normal weight (BMI between 18 and 25) compared with those with morbid obesity (BMI ≥ 35). After correlating these same patients by evaluating the extent of surgery and by observing the results, we will analyse them using the same variables.

2. Patients and methods

A detailed, retrospective analysis of 100 patients who underwent surgery for DDLS was performed. Data on these patients were prospectively entered into a computerised database. The study time was 13 months (January 2013–January 2014).

The estimated blood loss was estimated from the anaesthesia record; this value was cross-referenced based on the total fluids suctioned minus irrigation.

Surgical site infections (SSIs) are defined by the Centers for Disease Control (CDC)'s National Nosocomial Infection Surveillance system (NNIS) as superficial, deep, or organ space infections, which occur within 30 days after surgery (or within one year of hardware implantation) [12].

The National Institutes of Health guidelines categorise weight status using BMI. BMI is reported in kilograms divided by height in metres squared (kg/m^2). Underweight patients had a BMI of 19 kg/m^2, ideal weight patients had a BMI of 19–24.9 kg/m^2, and overweight patients had a BMI of 25–29.9 kg/m^2. Patients with a BMI of 30–39 kg/m^2 with no significant comorbidity were considered obese [13]. Morbidly obese patients had a BMI of 35–39 kg/m^2 with a significant comorbidity or a BMI of 40 kg/m^2 or higher [13]. The presence of significant comorbidity included having any one of the following disorders: hypertension, diabetes, anticoagulation, asthma/bronchitis, hyperlipidaemia, thyroid disease, psychiatric disorder, angina, alcohol consumption, shortness of breath, sleep apnoea, and myocardial infarction [13]. We placed patients with a BMI > 35, independent of whether they had co-morbidities, and those with a BMI > 40 who had similar DLSD and for whom surgery would be difficult due to their weight, in the same group.

The same medical team in the same hospital operated on all of the patients. The patients were first evaluated with regard to their BMI and were divided into four groups of patients: BMI <25, BMI between 25 and 30, BMI between 30 and 35, and BMI above 35. The results of the same patients were assessed with regard to the extent of surgery and were also classified into four groups: patients undergoing surgery for treatment of one segment, two segments, three segments, and four or more segments of DLS. The aspects evaluated were: surgical time, bleeding, surgical complications (re-herniation, cage migration, wound dehiscence, cerebral spinal fluid (CSF) leakage, pedicle breakage, pseudoarthrosis, dural tear, neurological injury, screw repositioning, brachial neuropraxis), SSI, and re-operation due to the failure of the first procedure.

2.1. Univariate analysis

The χ^2 test for trend was used to describe the relationship between categorical variables, such as gender, complications, SSI, and re-operation rates. One-way analysis of variance examined the age, BMI, surgical time, and surgical bleeding rates. Kruskal–Wallis examined variable nonparametric factors, such as surgical extension.

3. Results

A total of 118 surgeries were performed on 100 patients (52 males/48 females), with a mean age of 52.77 years old (52.77 ± 14.45), range between 26 and 85 years old, and a mean BMI of 29.43 kg/m^2 (29.43 ± 5.54). The surgical time averaged 258.1 min (258.1 ± 82.79); the bleeding was 660 millilitres (ml) (660 ± 509.1); complications related to the surgical procedure occurred in 38% of cases; SSI occurred in 5% of cases (*Staphylococcus aureus* present in all cases, *Escherichia coli* present in combination in one case); and re-operations due to SSI or because of complications resulting from the first procedure occurred (33.34% related; cage migration and SSI, one each; 16.67% pseudoarthrosis; and 8.34% because of neurological injury and CSF leakage, one each) in 12% of cases.

3.1. Results evaluated according to the BMI

The results were evaluated and divided into four different groups according to the patients' BMI: BMI < 25, 25 < BMI < 30, 30 < BMI < 35, and BMI > 35. After analysis of these data, we concluded that these groups were homogeneous; any of the factors analysed showed no significant difference among these groups, and no statistically significant differences were observed among the groups regarding surgical time, intraoperative bleeding, complication rates, SSI indices, and number of re-operations (Table 1).

Table 1
Results evaluated according to the BMI.

Variables	BMI < 25	25 < BMI < 30	30 < BMI < 35	BMI > 35	Total	*p*	Test
No patients	22 (22%)	39 (39%)	21 (21%)	18 (18%)	100		
Gender						0.54	*Qui-Square*
Male	11 (50%)	21 (53.84%)	13 (61.9%)	7 (38.88%)	52 (52%)		
Female	11 (50%)	18 (46.15%)	8 (38.1%)	11 (68.12%)	48 (48%)		
Mean age (yo)	55.18 ± 12.87	53.10 ± 14.39	51.28 ± 14.29	50.88 ± 17.50	52.77 ± 14.45	0.97	*ANOVA*
Range	31–75	31–85	27–73	26–73	26–85		
BMI (range)	23.12 ± 1.35	27.56 ± 1.29	32 ± 1.29	38.21 ± 4.64	29.43 ± 5.54	0.95	*ANOVA*
Time	220.68 ± 76.53	268.11 ± 95.43	280.95 ± 74.81	254.72 ± 54.99	258.1 ± 82.79	0.99	*ANOVA*
Bleeding	452.77 ± 315.27	578.20 ± 452.76	804.76 ± 543.80	922.22 ± 637.83	660 ± 509.1	0.81	*ANOVA*
Levels						0.61	*Kruskal–Wallis*
One	8 (36.36%)	17 (43.58%)	5 (23.80%)	6 (33.33%)	36 (36%)		
Two	10 (45.45%)	13 (33.33%)	8 (38.09%)	6 (33.33%)	37 (37%)		
Three	3 (13.63%)	7 (17.94%)	3 (14.28%)	2 (11.11%)	15 (15%)		
Four or more levels	1 (4.54%)	2 (5.12%)	5 (23.80%)	4 (22.22%)	12 (12%)		
Complication	8 (36.36%)	12 (30.86%)	11 (52.38%)	7 (5.55%)	38 (38%)	0.84	*Qui-Square*
Infection	0	0	3 (14.28%)	2 (11.11%)	5 (5%)	0.2	*Qui-Square*
Re-operation	2 (9.09%)	3 (7.69%)	3 (14.28%)	4 (22.22%)	12 (12%)	0.83	*Qui-Square*