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EFFECTS OF OBESITY ON ELECTIVE SPINAL SURGERY

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ABSTRACT

Background: Obesity (Body Mass Index ≥ 30 kg/m^2) is currently a public health problem with increasing incidence. Obesity increases the challenges and complications of surgery in all surgical branches. In this study, we aimed to evaluate the intraoperative and perioperative complications of obesity encountered in spinal surgery.

Materials and Methods: All patients undergoing elective spinal surgery in one orthopedic surgery practice between 2017 and 2018 were included in this study. Patient demographics, body mass index (BMI), preoperative hemoglobin and hematocrit values, volume of blood transfused, incision lengths, number of surgical levels, operational time, and amount of bleeding were retrospectively identified. Patients were divided into two groups according to BMI levels (Group A, < 30kg/m^2; Group B ≥ 30 kg/m^2), and statistical analyses were performed using the Student's t and Mann-Whitney U tests.

Results: Seventy-seven patients with a mean age of 57.8 years (range, 19–72) were included in this study. Their mean BMI was 29.3 kg/m^2 (19.9–39 kg/m^2). The mean BMI of Group A was 25.7 kg/m^2 and that of Group B was 34.6 kg/m^2. The amount of bleeding, number of surgical levels, and skin-incision length were statistically significantly different between the two groups. The mean values of all of these parameters were higher in Group B.

Conclusion: Although numerous factors play roles in operational success, we believe that identifying obesity in a patient is important for pre- and postoperative surgical preparation by the operation team.

Keywords: Obesity, Body Mass Index; Orthopaedic Surgical Procedures; Surgical blood loss; Operative Time.

Level of Evidence: Retrospective Clinical Study, Level III

INTRODUCTION

Obesity is defined as having a body mass index (BMI) ≥ 30 kg/m^2, and its importance among public-health problems is increasing worldwide [25]. In the USA, obesity has become a health problem affecting one-thirds of the population, and it is defined as a crucial factor in development of musculoskeletal diseases. Even in Turkey, the importance of obesity and accompanying comorbidities is increasingly being recognized. Obesity is responsible for the clinical findings of hip and knee osteoarthritis [10]. In addition, it has been proven in the literature that obesity is among the factors forming a basis for degenerative spinal disease [1,21].

The number of spinal surgeries has increased in recent years. Spinal surgeries increasingly involve more complex cases, including patients with a high BMI. Obesity, which is a cause of comorbidity in spinal diseases, may also cause an increase in the rate of complications encountered following spinal surgery [4,8,9,17,23].

In the literature, obesity has been associated with prolonged operation time and higher rates of hemorrhage and revision in patients undergoing spinal surgery [13,20,24,27,30]. The objective

of this study was to retrospectively compare perioperative data of obese patients with that of non-obese patients undergoing elective surgery, and to evaluate operative complications in obese patients, who constitute an increasing proportion of the patient group undergoing spinal surgery in recent years.

MATERIALS AND METHODS

Approval of the ethics committee was taken with document dated 02.04.2018 and numbered E.4899. The informed consent forms were obtained from all patients included in this study. The records of 106 patients aged over 18 years who had undergone elective spinal surgery for spinal disorders between 2017 and 2018 were retrospectively studied. Eight patients who had been operated due to infection or malignancy and 21 patients who had undergone cervical spinal surgery were excluded from the study. A total of 77 patients were included in the study.

Preoperative radiologic examinations of the patients included anteroposterior and lateral plain radiographs, computed tomography (CT), and magnetic resonance imaging (MRI) (Fig.1a-d).

General anesthesia was performed by the same team with the same standardized protocol in each patient. Surgery was performed by a single surgeon and the same surgical team in all patients. Patients' sex, age, preoperative hemoglobin and hematocrit values, volume of blood transfused, operational time, amount of bleeding, number of surgical levels, and skin-incision lengths were extracted from the records. BMI was calculated by dividing patients' weight in kg by the square of their height in m. Patients with BMI $\geq$ 30 kg/m^2 were recorded as obese according to the WHO classification [29]. Patients were divided into two main groups: Group A having a BMI < 30 kg/m^2 and Group B with a BMI $\geq$ 30 kg/m^2. Parameters including hemoglobin and hematocrit values, volume of blood transfused, operation time, amount of bleeding, number of surgical levels, and skin-incision lengths were compared between Group A and Group B.

Statistical Analysis

Descriptive statistics (mean ± standard deviation, minimum, median, maximum) were used to define continuous variables. Comparison of two independent variables with a normal distribution was made with Student's t test. Comparison of two independent variables with non-normal distribution was made using the Mann-Whitney U test. The level of statistical significance was set at $p < 0.05$. Statistical analyses were performed using MedCalc Statistical Software version 12.7.7 (MedCalc Software bvba, Ostend, Belgium; http://www.medcalc.org; 2013).

RESULTS

Of the 77 patients (36 male, 43 female) included in the study, 67 patients (38 Group A, 29 Group B) were diagnosed with lumbar spinal stenosis, and 10 patients (6 Group A, 4 Group B) with de novo scoliosis (Table-1).

The total number of patients was 44 in Group A and 33 in Group B. The mean age was 57.8 (range, 19 – 72) years. The mean BMI of all patients was 29.3 kg/m^2 (range, 19.9 – 39 kg/m^2). The mean BMI value was 25.7 kg/m^2 in Group A and 34.6 kg/m^2 in Group B. The mean volume of blood transfused was 2.9 IU in Group A and 3.8 IU in Group B. The mean amount of bleeding was 883.2 mL in Group A, and 1124.1 mL in Group B. This was a statistically significant difference ($p < 0.05$).

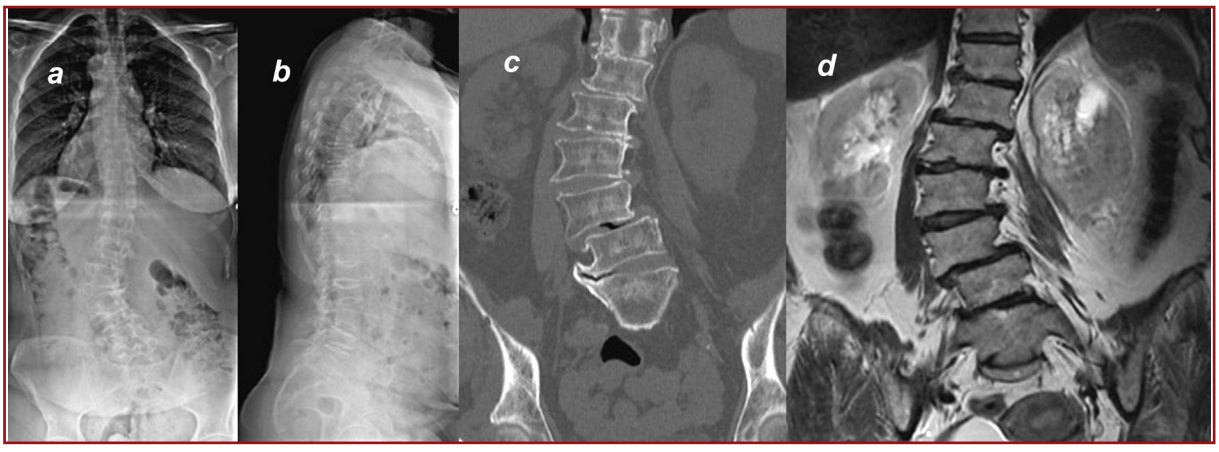

Figure-1. Preoperative radiologic examination of a patient with de novo scoliosis. **a.** Anteroposterior and **b.** Lateral plain radiograph. **c.** Coronal view of Computed tomography (CT). **d.** Coronal view of magnetic resonance imaging (MRI).

The mean preoperative Hgb value was 12.8 g/dL in Group A and 12.6 g/dl in Group B. The mean Hct value was 38.7% in Group A and 38.6% in Group B. The number of surgical levels of the patients in Group B was higher, with a mean value of 6.6, compared with 4.9 for patients in Group A. The difference was statistically significant ($p < 0.05$).

The difference in the skin-incision length was also statistically significant between groups. The mean skin incision was 13.275 cm long in Group A, and 18.225 cm in Group B ($p < 0.05$) (Table-2). No complications were encountered during any of the operations. Nine patients developed superficial wound-site infection. Two of these patients were in Group A, and seven in Group B. Superficial wound-site debridement was applied in 4 of the 9 patients, and all these patients were in Group B.

DISCUSSION

Obesity is becoming a major problem in people with orthopedic disabilities. The incidence of obese people requiring surgery is also increasing among persons with orthopedic disabilities. Spinal surgery is important among obese patient groups. In a study by As Saeed *et al.*, MRIs of 214 patients were evaluated, and degenerative disc diseases were found to be more common in obese than in non-obese patients [1]. In another study, degenerative spondylolisthesis was reported to be more common in obese patients [22]. Other studies report common facet-joint problems related to obesity [6,16]. The effect of obesity on outcomes of patients undergoing spinal surgery is still controversial [14].

Andreshak *et al.* argued that obesity has no significant effects on the rates of complications seen during surgery or on surgical outcomes, but the authors stated that obesity should not be overlooked [2]. More recent studies underline that obesity has negative effects on both intra- and post-operative surgical outcomes [7,12,18]. Obese patients are prone to medical complications due to accompanying comorbidities.

In addition, increased subcutaneous fatty tissue can make spinal surgery technically difficult. In a study by Burks et al., the risk of dura rupture was found to be higher in obese than in non-obese patients [5]. In our study, no medical complications or surgery-related complications were observed in our patients during the operations. However, we observed that increased subcutaneous fatty tissue made some interventions technically difficult in obese patients.

Table-1. Patient's diagnosis

Diagnosis N=77	Group A (BMI* < 30kg/m²) Number of Patients	Group B (BMI ≥ 30kg/m²) Number of Patients
Lumbar spinal stenosis	38	29
De novo scoliosis	6	4

**BMI: Body Mass Index*

Table-2. Comparison of parameters according to Body Mass Index

	Group A (BMI<30) (N =44) Mean ±SD	Group B (BMI≥30) (N =33) Mean ±SD	p
Blood Used	2.9±2.1	3.8±3.4	0.224[2]
Preop Hgb	12.8±1.9	12.6±1.8	0.567[1]
Preop Hct	38.7±5.1	38.6±4.5	0.952[1]
Operational Time	3.3±1.3	3.8±1.3	0.056[2]
Amount of Bleeding	883.2±632.4	1124.1±514.8	**0.007**[2,*]
Surgical Level	4.9±4,3	6.6±4,8	**0.023**[2,*]
Skin Incision Length	13.275±0.8	18.225±0.9	**<0.001**[2,*]

*BMI: Body Mass Index, SD: Standard Deviation, p[1]: Student's t, p[2]: Mann-Whitney U, *: Statistically significant*

Babu *et al.* reported that damage to the facet joint was more common in obese patients during insertion of pedicle screws [3]. In our clinic, we perform lateral dissection more often in obese patients undergoing interbody fusion to provide more opportunity for elimination of the subcutaneous fatty tissue; thus, we avoid blocking of screw medialization by thick subcutaneous fatty tissue when inserting the pedicle screw. It has been mentioned in the literature that increased subcutaneous fatty tissue also increases the rate of surgical-site infections [11,15,19]. In our study, none of our patients developed deep surgical infection. Only nine patients developed superficial infections, and the rate of superficial infection was higher in the obese than in the non-obese group (2 patients from Group A, 7 patients from Group B). In our study, longer operational time in the obese than in the non-obese group was found, consistent with the literature [13,20,28,30]. Longer operational time in obese patients may result from both the higher need for dissection of subcutaneous fatty tissue, and from the mean skin-incision length, which is about 5 cm longer in obese patients compared with that of non-obese patients. We think that the longer incision was caused by the higher number of surgical levels of our obese patients, and also by the need for more lateral dissection to eliminate the subcutaneous fatty tissue, as mentioned above. Although no difference was found between the amount of bleeding in some studies, the opinion that obesity increases bleeding is predominant in the literature [13-14,20,30].

The amount of bleeding in our study was about 350 cc more in obese than in non-obese patients. In the literature, among patients undergoing fusion surgery, the mean amount of bleeding is 180 cc in patients who underwent laminectomy and discectomy alone, about 1000 cc in patients who underwent fusion surgery, and between 430 cc and 600 cc in those undergoing minimally invasive interbody fusion procedures [2,26]. In our study, the mean amount of bleeding was about 800 cc in non-obese Group A patients and nearly 1100 cc in obese Group B patients. Given that all patients in this study underwent posterolateral or interbody fusion, the amount of bleeding in our study does not show significant difference from the amounts reported in the literature. In direct proportion to the amounts of bleeding in obese patients, the volume of blood transfused was also higher in the obese than in the non-obese group. There were no significant differences in the preoperative hemoglobin and hematocrit values between obese and non-obese patients, suggesting that the higher amount of blood used might be due to the higher amount of bleeding.

Limitations of this study include the relatively small number of patients, the retrospective nature of patient classification, and the retrospective investigation of the records. We think that evaluating a larger number of patients would enable us classify patients with a BMI $\geq$ 30 kg/m^2 according to graded obesity values, giving a more specific evaluation of the effects of varying degrees of obesity. Effects of obesity on spinal surgery can be investigated in more detail by forming more specific patient groups.

The results of this study indicate that although obesity does not appear to increase complications during operation in patients undergoing elective spinal surgery, it may lead to higher amounts of bleeding, operational time may be prolonged, and a longer surgical incision may be required with more soft-tissue dissection. Although numerous factors play roles in operational success, we believe that recognizing accompanying obesity of the patient is important for both pre- and postoperative surgical preparation by the operation team.

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