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Incidence of Recurrent Low Back Pain as a Side Effect of Decompressive Surgery for Lumbar Spinal Stenosis in Obese Versus Non-Obese Patients

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Abstract

Studies have reported an increased incidence of recurrent post-decompression-associated lower back pain (LBP) among obese patients after Lumbar spinal stenosis (LSS) surgery. Higher prevalence of lower back pain (LBP) associated with post-decompression surgical treatment among obese or overweight female patients compared to male patients. The current study has aimed to examine the relationship between body composition and long-duration consequences of post-spinal decompression among the Saudi population. This retrospective, longitudinal study was conducted at Taif Hospital, Kingdom of Saudi Arabia (KSA), throughout ____2010-till 2015 ____. Chronic pain grade questionnaire for assessing lower back pain and any disability among post-decompression participants. The chi-square test was used to analyze independent variables, and an independent t-test was employed to detect variances between mobility, age, education, body composition, and emotional disorders. The adjustment of age, education, mobility, emotional disorder, and BMI was examined through multivariate analysis. Highly a statistically substantial difference between obese and non-obese with regard to age, emotional distress, low mobility, Body mass index (BMI), mean estimated flow of blood (p-value <0.000), and hospitalization (p-value <0.002). The results showed a statistically substantial relationship between the degree of pain and disability with patient weight (p-value: 0.05), body mass index (p-value: 0.03), and Fat mass/fat-free mass ratio (p-value: 0.05). Clinical improvement is observed in obese patients post decompression surgical intervention, but the percentage of improvement was significantly higher among the male gender compared to female obese patients.

Keywords: body mass index, decompression, obesity, spinal surgery

1. Introduction

Decompression is a well-established spinal surgery intervention for Lumber spinal stenosis (LSS) among geriatrics (Giannadakis et al., 2015). Studies have reported an increased incidence of recurrent post-decompression-associated lower back pain (LBP) among obese patients after LSS surgery, in addition to its equivalent clinical outcomes (Onyekwelu et al., 2017; Licht et al., 2015). LBP is an extensive public health issue, with approximately 80% population exposed to one episode of lower back pain in a lifetime (Christe et al., 2021). The prevalence of LBP in underdeveloped countries is 60-70% (Awwad et al., 2020). The global incidence of spinal trauma ranges between “16 and 64 out of 100000” population (Choi et al., 2017). In Saudi Arabia, the prevalence of lumber spinal injury was 30%, and 22.6% of life loss was due to traumatic injuries (Bakhsh et al., 2020). In some cases, the structural cause of LBP and its transition to chronicity are not known adequately due to a weak connection between neurological, structural abnormalities, and degenerative symptoms (Goubert et al., 2017).

The potential risk factors for LSS include the elderly population with degenerative alterations, inflammatory spine disease, traumatic injuries, vertebral osteoporotic compression fracture, herniated disk, and tumors (Wáng et al., 2018). One of the predominant risk factors for lumber deterioration in obesity due to excessive mechanical loading in the thoracolumbar spine (Patel et al., 2020). Obesity causes progressive spinal weakening due to chronic inflammation, biochemical alterations, and excessive mass accumulation that influence clinical improvement after lumbar decompression (Basques et al., 2019). Recent literature reported use of a minimally invasive spine decompression approach to perform posterior lumbar surgery among obese patients resulted in poorer outcomes concerning postoperative complications and reduced estimated flow of blood in comparison to conservative approaches and non-obese patients (Carrol et al., 2021). Worst scores for backache postoperative lumbar decompression surgery were reported after two years in obese patients without fusion (Onyekwelu et al., 2017). The comparison of obese and non-obese patients' post-decompression surgical intervention for LSS showed more pain for three to twelve months for obese patients (Elsayed et al., 2017). Hareni et al. (2022) evaluated the occurrence of obesity on a national level after central lumbar spinal stenosis (CLSS). The data was collected from the National Swedish Quality Registry. The inclusion criteria were limited to patients with age above 50 undergone laminectomy surgery during the years 2005-2018. The records included patient satisfaction 1 year after surgery, leg pain rated on the Numerical Rating Scale [NRS], any incapability experienced in limbs after surgery rated on Oswestry Disability Index [ODI], and any complications faced during that period. The outcome displayed satisfaction among obese patients after surgery as compared to patients with normal weight (Hareni et al., 2022).

Globally based on body mass index (BMI), one-third adult population is estimated to be overweight (Rambod et al., 2020). However, BMI to assess obesity gives only a primary measure of adiposity due to failure to disseminate fat-free mass from the fatty mass (Chooi et al., 2019). Additionally, men and women markedly differ in body composition, with more fat accumulation among women (Ameye et al., 2019). This provided a ground for meta-analysis concluding a higher prevalence of LBP associated with post-decompression surgical treatment among obese or overweight female patients compared to male patients (Goyal et al., 2019). Gender differentiation also relates to the perception of pain and hormonal effects in obesity-based LBP after the decompression procedure, as different fatty compositions are influenced differently (Lee et al., 2020). The fat mass intensifies backache and leads to debility among female adolescents, requiring further evaluation among the male population (Wu et al., 2020).

Previously, studies showed the impact of post-decompression surgery complications on reducing BMI in the Saudi population (Aleissa et al., 2022; Ullah et al., 2019). Not many studies have studied the occurrence of this complication particularly in Saudi Arabia. Especially with the aim to only find out about lower back pain after decompressive surgery for lumbar spinal stenosis. Only scarce data is available in the Kingdom of Saudi Arabia (KSA) to examine post-decompression surgery incidence of lower back pain among the obese population based on gender (Alnaami et al., 2021). To address this neurological injury concern, the current research has aimed to examine the effect of overweightness on decompression-associated LBP among male and female non-obese patients compared to obese patients on long-term follow-up. Several studies have been cited throughout the research to provide depth in the literature; however, the identified gap remains. For this reason, this research aims to explore the relationship between body composition and long-term consequences in post-spinal decompression among the Saudi population.

2. Method

2.1 Ethical Approval

The study was directed after approval from the Institutional Review Board (IRB), University of (Taif), KSA, and by following the guidelines declared by Helsinki, under the approval number _______.

2.2 Participant (Subject) Characteristics

The information about patient demographic characteristics, comorbidities, level of education, and lifestyle patterns was collected through a questionnaire. Participants' level of mobility was also assessed. Participants' age, body mass index, diabetic status, sex, smoking status, employment, the estimated flow of blood, hospitalization length, lumbar surgery history, and nationality were noted. In our study, obesity was classified as ≥ 30kg/m2 BMI, and non-obese were classified as <30kg/m2 BMI. The variables of obese and non-obese were compared against demographic characteristics.

2.3 Sampling Procedures

This retrospective, longitudinal study was carried out at the Department of Orthopedics, Taif Hospital, Kingdom of Saudi Arabia (KSA), from _2010___ till 2015____. The study was conducted with the approval of the Institutional Review Board, University of (Taif), KSA, and following the guidelines of the declaration of Helsinki.

2.3.1 Sample Size, Power, and Precision

The study included an age-stratified sample of 100 participants. The sample size was calculated based on the baseline study [rule of obesity in outcome result for lumbar spine stenosis surgery conducted between 2010 and 2015. A stratified sample of 100 men with regard to their age was employed from the clinic at Alamin Hospital.

This study assessed adult male members (n = 100) aged ≥ 50 years who joined in the 5-year record at the Alman clinic.

2.3.2 Inclusion and Exclusion Criteria

Thus, the 100 participants (84%) of the study population accessed from a clinical assessment. The variables included measures of body composition and completed questionnaires planned to extract demographics, back pain, and health status. The rest of the 14% of participants were in drop out due to follow-up.

The study included participants with stenosis due to disk herniation and degenerative change, both genders, aged between 50 and 70, willing to provide informed consent, with post-decompression surgery. The study excluded female patients. The detailed study objective was elaborated to enrolled participants, and informed agreement to attain consent to contribute was arranged. The baseline characteristics and follow-up at six and twelve months were maintained using questionnaires.

2.3.3 Assessment of LBP Post Decompression

The study used a "Chronic pain grade questionnaire" to assess lower back pain and any disability among post-decompression participants. The Chronic pain grade questionnaire is an authenticated tool used in population-based studies to record chronic pain severity and disability (Smith et al., 1997). The scale includes seven questions to compute the disability score (0 to 6) and pain intensity total (0 to 100). As per the scale classification, participants were divided into five groups (i) no disability and pain (disability points = 0 and pain points = 0), (ii) low disability and low-intensity pains (disability points <3 and pain points <50), (iii) low disability and high-intensity pain (disability points <3 and pain points ≥50), (iv) moderately limiting high disability (disability score 3 or 4, irrespective of pain), (v) severely limiting high disability (disability score 5 or 6, irrespective of pain). Study members were further divided into none or moderately low back pain intensity and high back pain intensity.

2.3.4 Body Mass Index

A stadiometer was used to assess height nearest to 0.001m2 and weight nearest to 0.1kg after removing shoes and heavy clothing to calculate BMI. Dual-energy X-ray absorptiometry measured body composition (DXA; WI, Madison, GE Lunar Corp, GE Lunar Prodigy). Lean tissue mass as fat-free mass (FFM) and body fat whole measurement as fat mass was calculated. The study also calculated fat mass index as fat mass divided by height^2 and fat-free mass index as fat-free mass divided by height^2, where FFM included content that has bone mineral and FFM. The ratio between fat mass and FFM was calculated.

2.3.5 Experimental Manipulations or Interventions

Data were analyzed using SPSS version 22.0 (SPSS Institute, Chicago, IL). We examined the interaction between post-decompression recurrent lower back pain risk factors and evaluation of the rate of obesity, which includes body composition assessment. The standard p-value which must be less than 0.05 was considered and achieved statistically significant. A chi-square test was employed for independent variables, and an independent t-test was adopted to detect variances between mobility, age, education, body composition, and emotional disorders. The adjustment of age, education, mobility, emotional disorder, and BMI was examined through multivariate analysis.

3. Results

The study participants' demographic characteristics and clinical information are demonstrated in Table 1. The results showed a highly significant difference between non-obese and obese in terms of age (p-value <0.000), emotional distress (p-value <0.000), low mobility (p-value <0.000), Body mass index (p-value <0.000), mean estimated flow of blood (p-value <0.000), and hospitalization (p-value <0.002). The results also showed a statistically significant difference in weight (kg) among obese males and females compared to non-obese. The results showed that in the obese group, the fat-free mass, fat mass, fat-free mass index, and fat mass index were recorded more among female participants than male participants.

Table 1. Participants' demographic characteristics

Variables	Obese		Non-Obese		P value
	Male	Female	Male	Female	
No. of patients, n (%)	21 (42)	29 (58)	24 (48)	26 (52)	0.064
Age (years)	69.23	66.11	68.71	64.32	<0.000
Weight (kg)	88.3	81.02	82.65	78.4	0.021
Emotional distress	4 (19)	8 (28)	2 (8)	3 11.5)	<0.000
Low Mobility, n (%)					<0.001
Yes	18 (86)	24 (83)	7 (29)	8 (31)	
No	3 (14)	5 (17)	17 (71)	18 69)	
BMI (kg/m2)	35.2	36.41	26.31	25.64	<0.000
Diabetes n (%)	5 (23.8)	9 (31)	2 (8.3)	5 (19.2)	0.118
Smoking status					0.1647
Active Smokers	8 (38)	4 (14)	11 (46)	8 (31)	
Non-Smokers	13 (62)	25 (86)	13 (54)	18 (69)	
Employment Status					<0.041
Working	12 (57)	14 (48)	16 (67)	15 (58)	
Non-Working	9 (43)	15 (52)	8 (33)	11 (42)	
Mean EBL (mls)	298.65	145.86	97.55	120.1	<0.000
Hospitalization	2.12	1.9	1.66	1.32	<0.002
Fat-free mass (kg)	38 (12)	36 (18)	31 (22)	32 (25)	0.542
Fat mass (kg)	29 (14)	32 (23)	26 (21)	22 (20)	0.016
Fat mass index (kg/m2)	9.1	9.4	8.1	7.7	0.0034
Fat-free mass index	22.3	23.1	20.1	19.12	0.414

We also examined the response of the obese patient group using multivariate analysis on a chronic pain grade scale to identify the sternness of pain and disability among the obese group. The results exhibited a statistically significant relationship between the degree of pain and disability with patient weight (p-value: 0.05), body mass index (p-value: 0.03), and Fat mass/fat-free mass ratio (p-value: 0.05) (Table 2).

Table 2. Measurement of risk factors for obese patients using chronic pain grade scale after one year

Variables for obese patients' scores	No disability and pain (inability points = 0 and pain points = 0)	Low disability and low-intensity pains (inability points <3 and pain points <50)	Low disability and high-intensity pain (inability points <3 and pain points ≥50)	Moderately limiting high incapacity (disability score 3 or 4, irrespective of pain)	Severely limiting high incapacity (disability score 5 or 6, irrespective of pain)	p-value
No. of patients, n (%)	3 (6)	17 (34)	21 (42)	8 (16)	1 (2)	0.05
Weight (kg)	80.67	81.9	84.2	86.7	88.1	0.05
BMI (kg/m2)	27	31	34	34.4	35	0.03
Fat-free mass (kg)	34.1	34.8	35.2	35.4	35.5	0.65
Fat mass (kg)	23.6	24.5	24.8	25.6	25.9	0.21
Fat mass index (kg/m2)	7.9	8.1	8.6	9.3	9.9	0.068
Fat-free mass index	20.1	21.6	21.9	23.1	24.1	0.32
Fat mass/fat-free mass ratio	0.71	0.77	0.79	0.85	0.89	0.05

4. Discussion

Lower back pain involves complex etiologies and impacts the quality of life (Zhou et al., 2022). Our study examined the effect of overweightness on decompression-associated LBP among male and female non-obese patients compared to obese patients on long-term follow-up. We also examined the association between body composition and long-term outcomes post-spinal decompression among the Saudi population. The results showed statistically significant differences among female and male obese patients in terms of age, emotional distress, mobility, and BMI (p-value <0.000). A meta-analysis reported a high frequency of complications [Odds Ratio (OR): 1.34, CI=1.13-1.58] (p-value 0.01) and elevated operation rates [Odds Ratio (OR): 1.40, CI=1.19-1.64] (p-value 0.001) among obese patients (Goyal et al., 2019). Another study reported a high incidence of lower back pain development among overweight and obese patients [obesity logged odds: 0.395, p<0.001], suggesting the addition of lower back pain burden associated with obesity (Sheng et al., 2017). Our study observed a substantial difference in the length of hospitalization (p-value <0.002) among obese and non-obese patients. Patients with obesity experience prolonged stays in hospitals postoperatively and minimal achievement in disability scores compared to non-obese patients (Patel et al., 2022). The results of our study established obesity as a substantial risk for postoperative LBP. Obesity is a potential risk factor for postoperative spinal epidural hematoma (Snopko et al., 2021).

Some complications associated with spinal decompression surgery include delayed pseudimeningocele formation and dural tears (Weiss et al., 2019). The obese population is a challenge to spine surgeons due to the risk of triggered complications post-surgery (Weiss et al., 2019). Our study showed a non-significant association between diabetes and post-decompression obese and non-obese groups. However, another study reported a statistically significant association of obesity with diabetes mellitus (p value<0.001) and lower operative scores among obese patients (p<0.001) (Katsevman et al., 2020). Our study used a Chronic pain grade questionnaire to assess lower back pain and any disability among post-depression participants. Other studies also used this scale to assess increased fat mass association with raised back pain among post-decompression surgery patients (Khan et al., 2020; Hawker et al., 2011). Goyal et al. (2019) investigated the influence of obesity on lumbar spine surgery. In this regard the study argued on the conclusions of many studies giving mixed results, either supporting the influence of obesity on lumbar spine surgery or supporting otherwise. The study performed a systematic review and a meta-analysis by adopting the godliness address by PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses). The existence of bias in the results was investigated using the Newcastle-Ottawa Scale along with strength assessment by employing Grades of Recommendation, Assessment, Development, and Evaluation (GRADE). Visual Analog Scale-Back Pain and Oswestry Disability Index was used for comparison between the two groups obese ds non-obese. The study analyzed 32 studies that hold a total of 23,415 patients. The results displayed a slightly higher rate of blood loss due to surgery, longer duration to complete surgery, complications, and reoperation in obese patients; however, the difference was not highly significant (Goyal et al., 2019). Molina et al. (2021) asserted that the matter of early complications and difference in surgery has been experienced by the two groups morbidly obese patients and non-obese patients. Records were extracted from the years 2013 and 2016 of patients undergoing posterior lumbar surgery. Factors influencing pre- and post-surgical terms had been examined such as blood loss, duration of stay, complications faced in hospitals, dispositions, etc. the study displayed a higher rate of obese patients with regard to long-duration surgery and in-hospital complications (Molina et al., 2021). Klimov et al. (2020) analyzed degenerative lumbar spinal stenosis in elderly patients influenced by somatic comorbidity. The methods follow a retrospective non-randomized sampling technique by adopting level tree evidence (OCEBM Levels of Evidence Working Group). Among many other results, the study showed significant results of body mass or obesity on lower back pain along with other complications that occur during surgery due to obesity (Klimov et al., 2020).

The response to the decompression surgical intervention among obese patients depends on the level of education and the patient's understanding of the disease to improve decision-making (Awwad et al., 2020). Our study had the limitation of an increased dropout number and a comparatively small sample size due to the limited inclusion criteria. The record extracted was for one year which could also be adjusted in future randomized control trials. Future studies on larger sample sizes must further explore decompression for LSS treatment choice.

The primary objective of the current study was to examine the association between body composition and long-term outcomes following spinal decompression among the Saudi population. Our research provides crucial baseline data, with a particular focus on gender, regarding the incidence of recurrent low back pain among the obese population in Taif City, KSA. In addition to providing this baseline information, our study has important implications for the development of local guidelines for post-decompression management and recovery of patients, particularly those who are obese. We found that clinical improvement was observed in obese patients after decompression surgery, although the degree of improvement varied based on gender. Specifically, male obese patients experienced a significantly higher percentage of improvement compared to female obese patients. Overall, our study contributes valuable insights into the association between body composition and long-term outcomes following spinal decompression in the Saudi population.

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The data that support the findings of this study are available on request.

Competing Interests Statement

The authors declare that there are no competing or potential conflicts of interest.

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