

Relationship between Body Mass Index and Radiological Features of Spondylolisthesis

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Abstract: *Background:* Low back pain is the most common cause of spondylolisthesis. The prevalence of degenerative spondylolisthesis is very gender- and age-specific. For elderly showed degenerative spondylolisthesis was 25% in women and 19.1% in men. The female: male prevalence ratio was 1.3:1. Overweight BMI might lead to an increased axial load of the L4–L5 disc and facet joints, and enhance the risk of degenerative spondylolisthesis. *Method:* This analytical observational study used cross-sectional design to analyze the effect of BMI on radiological features of spondylolisthesis in lumbosacral vertebral photos in female patients over 50 years of age with low back pain. *Result:* The sample used in this study was 72 consisting of 59 patients (81.9%) with normal BMI and 13 patients (18.1%) with overweight BMI, and 39 patients with positive spondylolisthesis (54.2%) and 33 patients (45.8%) with negative spondylolisthesis. The chi-square test results obtained a significance value of 0.015 ($p < 0.05$) with the odds ratio obtained at 6.089. *Conclusion:* The results of data analysis proved that BMI significantly influenced the radiological features of spondylolisthesis in lumbosacral vertebral photos in patients who had overweight BMI having a greater risk of 6.089 times spondylolisthesis than patients who had normal BMI.

Keywords: spondylolisthesis, body mass index, low back pain

1. Introduction

Lower back pain (LBP) is pain that is felt in the lower back, not a disease or diagnosis but is a term for pain that is felt in the affected anatomy area with various variations in the duration of pain. The prevalence of LBP in America is 60% - 80%. The prevalence of serious LBP (occurring more than 2 weeks) is 14%. The prevalence of pain that radiates to one leg is 2%. LBP is a major cause of disability in workers under the age of 45 in America (Hills, 2014). Data for the number of LBP sufferers in Indonesia is not known with certainty, but it is estimated LBP sufferers in Indonesia vary between 7.6% to 37% of the total population in Indonesia (Lailani, 2013). In Indonesia, research conducted by the Community Oriented Program for Control of Rheumatic Disease (COPORD) shows that LBP often occurs in populations aged 40-59 years. (1)

Lower back pain is the most common symptom of spondylolisthesis. Spondylolisthesis is defined as the ventral shift of all or part of the vertebrae in the vertebrae that sit beneath. This abnormality often occurs in the lumbar vertebra (90% of cases) and most often occurs at the L4-L5 and L5-S1 levels. (2)(3)

The prevalence of degenerative lumbar spondylolisthesis in populations is very specific based on sex and age. Very few women and men experience spondylolisthesis under the age of 50 years. After the age of 50 years, women and men usually begin to experience spondylolisthesis, where women experience faster development than men. Old age shows a prevalence of 25% in women and 19.1% in men with a ratio of women: men of 1.3: 1. The data shows that the decline in estrogen during menopause is one of the factors that contribute to the development of degenerative spondylolisthesis in postmenopausal women. (4)

One risk factor for developing spondylolisthesis is an increase in BMI. Research conducted by Radovanovic et al. in 2017 regarding the relationship of BMI with

spondylolisthesis concluded that the mean BMI was significantly higher in the group of patients who were positive for spondylolisthesis than those in the negative group of spondylolisthesis. Overweight BMI can cause an increase in axial load on the L4-L5 intervertebral disc and facet joints, and cause anterior displacement of the body and increase the risk of degenerative spondylolisthesis. (5)

Plain radiographs on the lumbosacral vertebra are important to determine if there is a shift in the vertebrae underneath. In plain photos can be distinguished between spondylolisthesis that occurs with or without defects in the pars interarticularis. The form of spondylolisthesis without defects in interarticular pars is called pseudospondylolisthesis which occurs in degenerative spondylolisthesis (6).

2. Method

This observational analytic study used a cross sectional design to analyze the effect of BMI on the radiological features of spondylolisthesis of lumbosacral vertebrae in female patients over 50 years of age with low back pain. The study population was low back pain patients who were treated for outpatient and inpatient treatment at the Department of Neurology Dr. Ramelan Naval Hospital Surabaya, whose medical records recorded BMI status and the results of a vertebral lumbosacral plain photo examination that had been read by a radiology specialist

3. Results

Patients who were sampled in this study were 72 patient with female sex over 50 years of age.

Table 1: Number of Patients Based on BMI Group

BMI Group	Number	Percentage
Underweight	0	0%
Normal	59	81,9%
Overweight	13	18,1%
Obesity	0	0%
Total	72	100%

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Based on Table 1, it is known that there were no patients included in the BMI underweight and obesity group. The majority of patients included in the normal group, as many as 59 patients (81.9%), and the remaining 13 patients (18.1%) included in the overweight group. In this regard the underweight and obesity groups were eliminated, so only the normal and overweight groups were analyzed.

Radiological spondylolisthesis picture of lumbosacral vertebrae in patients with low back pain that has been described by a radiology specialist then is grouped into positive or negative groups. The number of patients according to the radiological imaging group can be presented in Table 2 as follows:

Table 2: Number of Patients Based On Radiological Features of Spondylolisthesis

Spondylolisthesis	Number	Percentage
Positive (+)	39	54,2%
Negative (-)	33	45,8%
Total	72	100%

Based on Table 2, it is known that there were 39 patients (54.2%) whose radiology was positive with spondylolisthesis, and 33 patients (45.8%) had no spondylolisthesis on their radiological features.

In this study, no samples were found that were categorized as underweight and obese IMT, so the samples were categorized into 2 namely normal and overweight.

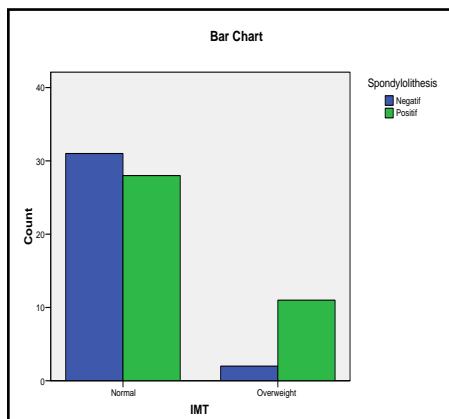


Figure 1: Bar Diagram Comparison of BMI Patients

The bar diagram in Figure 1 above shows that patients who do not suffer from spondylolisthesis occur mostly in the group of patients who have a normal BMI. Whereas patients who suffer from spondylolisthesis are mostly found in patients who have overweight BMI. This raises the suspicion that BMI can affect the radiological features of lumbosacral vertebral spondylolisthesis in female patients over 50 years of age with low back pain. Cross tabulation of BMI with radiological features can also be presented in Table 3 as follows::

Table 3: Cross tabulation BMI with spondylolisthesis

BMI	Spondylolisthesis		Total
	Negative	Positive	
Normal	31	28	59
Overweight	2	11	13
Total	33	39	72

Based on the results of the Pearson chi-square test to determine whether there is an effect of BMI on the radiological features of the lumbosacral vertebrae spondylolisthesis, a significance value of 0.015 ($p < 0.05$) was obtained. This can be interpreted that there is a significant effect of BMI on the radiological features of the lumbosacral vertebral spondylolisthesis.

The magnitude of the risk of a patient with overweight BMI to have a radiological spondylolisthesis on lumbosacral vertebrae can be determined based on the odds ratio from the chi-square test. The odds ratio is 6.089 (95% CI 1,241 - 29,888). This shows that patients who have overweight BMI have a risk of 6.089 times greater than patients with normal BMI to experience spondylolisthesis.

4. Discussion

Based on research that has been done, it is known that the average age of patients used as samples in this study is 60 years, the average height of 1.57 meters, and the average weight of 57.82 kg. In addition, it is also known that the average body mass index (BMI) in this study was 23.44.

A total of 72 samples in this study, it is known that 59 patients included in the category of normal BMI, and 13 other patients included in the category of overweight BMI. In addition the radiological picture showed that as many as 39 positive patients had spondylolisthesis on the lumbosacral vertebrae, and 33 other patients were negative.

The results of previous studies conducted by Schuller et al.(2011) in 49 patients with spondylolisthesis compared to group 77 patients with low back pain without spondylolisthesis showed that the mean body mass index of the group of patients with spondylolisthesis was significantly higher ($p = 0.030$) compared to the group of patients without spondylolisthesis.(7)

This shows that the higher the BMI value, it tends to be positive for spondylolisthesis. The results of this study are consistent with the research I did at Dr. Rumkital.Ramelan Surabaya using the chi-squared test obtained a significance value of 0.015 ($p < 0.05$) which means that there is a significant effect of BMI on the radiological features of the lumbosacral vertebral photo spine. In the discussion of the study it was mentioned that overweight IMT can cause an increase in axial load on the L4-L5 intervertebral disc and facet joints, thereby causing an anterior shift from the body and increasing the risk of degenerative spondylolisthesis.(3)

Research conducted by Nadhim et al.(2017) about spondylolisthesis risk factors states that BMI has a significant influence on spondylolisthesis with a significance value of $p < 0.001$. BMI samples in this study consisted of 55% overweight and 17% obese. This research is in accordance with the research that we did at Dr.Ramelan Naval Hospital Surabaya about the effect of BMI on spondylolisthesis which has a significant result with a significance value of 0.015 ($p < 0.05$) and an odds ratio of 6.089 which indicates that patients who have overweight BMI have a risk of 6.089 times greater positive of spondylolisthesis than patients who have BMI normal.(8)

Research conducted by Kalichman et al.(2009) about the relationship between age, sex, and BMI with features of vertebral degeneration evaluated using CT-scan shows that BMI is not significantly related to degenerative spondylolisthesis. Whereas the research I did at Rumkital Dr. Ramelan Surabaya about the effect of BMI on spondylolisthesis which has significant results. Differences in research results by Kalichman et al.(2009) with my research can occur because the radiological examination used is different. In the research of Kalichman et al.(2009) used CT scans with digital topography to diagnose spondylolisthesis so that it was more sensitive and gave clearer results. Whereas the research that I did using plain photo examination can be influenced by the X-ray radiographer. (9)(10)

According to research conducted by Jacobsen (2007) about the relationship of degenerative spondylolisthesis with general and physical epidemiological data such as age, sex and BMI which is a cross sectional epidemiological study found 254 cases of lumbar vertebral shift. In this study it was concluded that BMI and lumbar lordosis were significantly associated with degenerative spondylolisthesis in women. Whereas in men no individual risk factors were found, except increasing age. The results of this study are consistent with the research I did at Dr. Rumkital. Ramelan Surabaya obtained 39 positive spondylolisthesis patients from a total of 72 patient samples, where after the chi-square test was performed to determine the effect of BMI on spondylolisthesis showed significant results with a significance value of 0.015 ($p < 0.05$). (11)

5. Conclusion

The results of data analysis prove that BMI has a significant effect on the radiological features of lumbosacral vertebral photo spondylolisthesis with patients who have overweight BMI have a risk of 6.089 times greater positive spondylolisthesis compared to patients who have normal BMI.

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