



## Association Between Lumbar Spine Disorder and Genovarum: A Population-Based Cross-Sectional Study

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### Abstract

**Background:** It is becoming increasingly important to study pathology at the knee and spine because of their role in causing pain and deformity in one another. Compression of the lumbar nerve root can disrupt innervation to the thigh muscles, cause an imbalance of muscle and result in varus deformity. In this study, we try to figure out the relation between lumbar spine disorders and genu varum and realize if lumbar spine disorders can cause varus deformity in a patient.

**Methods:** In this cross-sectional study, the number of 53 patients with knee varus greater than 20 degrees who visited the orthopedic clinics of Rasoul Akram and Moheb Mehr hospitals affiliated to Iran University of Medical Sciences between 2020 and 2022 were investigated in terms of association with lumbar disorders. The demographic characteristics and clinical findings of the patients were recorded and collected using a checklist by referring to the patient's medical profiles. Radiographic findings were evaluated by referring to the imaging department and using the Pacs system. The diagnosis of the patients was based on the history and findings of the knee graph, which was measured with a goniometer to measure the knee angle. The frequency of lumbar disorders caused by pressure on the lumbar nerves in patients with genu varum deformity including canal stenosis, osteoarthritis, spondylolisthesis, and disc herniation was investigated. To investigate lumbar problems, patients' history and radiographic images as well as lumbosacral and knee MRI of patients were used.

**Results:** The mean age was  $66.3 \pm 7.66$  years. 40 (75.5%) cases were female and 13 (24.5%) cases were male. Lumbar canal stenosis with 28(52.8%) and disc herniation with 32(60.4%) were the most common lumbar disorders in patients with knee varus more than 20 degrees. The mean age of patients with varus of more than 20 degrees with lumbar disorders was significantly higher than that of patients without lumbar disorders. ( $P: 0.001$ ) There was no significant difference between gender distribution and lumbar disorders in patients with varus more than 20 degrees. Significant positive correlation between genu varum with lumbar canal stenosis ( $r: 0.53, P: 0.001$ ), osteoarthritis ( $r: 0.38, P: 0.004$ ), spondylolisthesis ( $r: 0.39, P: 0.002$ ) and disc herniation ( $r: 0.46, P: 0.001$ ) was reported.

**Conclusion:** An association between lumbar disorders and varus more than 20 degrees was found to be considerable.

**Keywords:** Genovarum, Lumbar Disorders, Canal Stenosis, Osteoarthritis, Spondylolisthesis, Disc Herniation

**Conflicts of Interest:** None declared

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### Introduction

Since knees and spine can cause pain, deformity, or degeneration in one another, there has been growing interest in pathology at these sites (1-5).

Genevarum implies a varus deformity characterized by a bowing of the lower leg from the hip to the ankle joint (6).

As a result of these deformations, people are at higher risk of increased complications such as damage to the patello-femoral joint, tibiofemoral joint osteoarthritis, compensatory changes in ankles and feet, and stress fractures of the tibia (7-9).

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#### ↑What is “already known” in this topic:

There is a possibility that knee pathologies and spinal pathologies are related in some way.

#### →What this article adds:

Based on this study, patients with greater than 20 degrees of genu varum are more likely to have lumbar spine disorders including Spinal Canal Stenosis, Spondylolisthesis, Osteoarthritis, and disc herniations.

60-90% of adults experience low back pain (LBP) at some point in their lives (10). The prevalence of low back pain is 20-30%, and it represents the most common cause of activity limitations among those under 45 (11, 12). Due to the large sensory innervation of the spine, it is able to cause pain from multiple anatomical structures, such as radicular, discogenic, sacroiliac, musculoligamentous, and facet pains.

The most common pathologies in the spinal column in adults include Lumbar spinal stenosis, spondylosis, disc herniation, and Spondylolisthesis which may cause lumbosacral nerve or nerve root compression (13-15). A lumbar nerve damage and compression can result in disruption of innervation to the thigh muscles and cause varus deformity due to an imbalance of medial and lateral muscles of the thigh that can control coronal force on the knee joint. Lumbar spine stenosis (LSS) is one of the common causes of back pain and dysfunction. LSS refers to an anatomical condition that includes narrowing of the central spinal canal, lateral recess, and neural foramen (16, 17). Spondylosis or degenerative arthritis that affects the spinal column and facet joint, is the most common cause of LBP and usually occurs in people over 60 years old (16, 18-20). The term spondylosis refers to a general degenerative disease of the spine including: intervertebral discs, vertebral bodies, facet joints, capsules and ligamentous complex of the spine (21). Disc herniation can also cause low back pain and dysfunction of the neuromuscular axis L4-5 and L5-S1 are the two most likely levels of disc herniation. Spondylolisthesis is defined as a displacement or non-anatomic alignment between vertebral segments in the sagittal plane (22). It has Multiple causes; however, genetic and mechanical factors are commonly implicated (23). In this study, we examined lumbar problems causing lumbosacral nerve damage or compression in patients older than 50 with genu varum deformity over 20 degrees.

### Methods

A cross-sectional study was conducted after the Ethics Committee of Iran University of Medical Sciences approved the study. 88 patients with knee varus greater than 20 degrees were referred to the hospital between 2019 and 2021. We included patients with knee genu varum deformity over 20, with radiographic findings, and older than 50 years. Patients with no access to clinical and radiographic findings of their patients, other lower-limb disorders, history of knee or hip joint surgery or replacement, history of severe trauma to other body organs, or patients under 50 years of age were excluded from the study.

The data collection involved a two-part checklist, the first of which contains demographic information and the second of which includes clinical and radiographic images and MRI results from the patients. Patients were diagnosed based on their history and standing 3 join view, which was measured using knee angle goniometers. A radiologist and an orthopedic surgeon independently evaluated and classified the angle. To investigate lumbar problems, radiographic images (including standing lumbosacral radiography), history, and MRIs of the lumbosacral and knee ar-

thral joints (standing 3 join view) were analyzed. Clinical symptoms of canal stenosis include neurogenic lameness, loss of sensation, leg weakness, and back pain when the anteroposterior diameter is less than 10 mm on MRI. MRI findings of the lumbosacral spine were used to investigate disc herniation. According to MRI findings, disc herniation and protrusion were determined when the disc content moved more than 25% of its diameter into the intervertebral space. As a result of lumbar nerve compression problems, EMG-NCS was used to measure the muscle mass of the internal and external muscles of the thigh. In this area, the cutaneous, femoral, and obturator nerves innervate the muscles. After data collection, all patient information was analyzed using SPSS version 22 statistical software. To report quantitative variables, use the central indicators (mean and standard deviation). Descriptive statistics such as numbers and percentages were used to report qualitative variables. The normality of the distribution of quantitative variables such as age, was evaluated by the Kolmogorov-Smirnov test. The prevalence of lumbar disorders in patients with genu varum was more than 20 degrees based on the reported number and percentage. For assessment of the relation between qualitative variables, such as the association of low back problems with Deformity genu varum, Spearman's correlation coefficient is used. For comparing the quantitative variables (age) between the two groups with the assumption of normality of the distribution of the variables, an independent T-test was used and with the assumption of non-normality, the non-parametric Mann-Whitney test was used. Chi-square and Fisher's test were used for the statistical analysis of qualitative variables. A P-value less than 0.05 was taken as the statistical significance level.

### Results

A total of 53 patients were included in the study. the average age of the patients was  $66.3 + 7.66$  (50 to 80 years), with a mean age of 67 years. 40 (75.5%) of the cases were female, and 13 (24.5%) were male. lumbar canal stenosis in 28 patients (52.8%), was the most common lumbar spine disorder. In 13% of cases (24.5%), osteoarthritis of the knee was present. Spondylolisthesis and disc herniation were found in 13 (24.5%) and 32 (60.4%) patients, respectively. The Comparison between genu varum and lumbar canal stenosis, osteoarthritis, spondylolisthesis, and disc herniation was significant (Table 1). Measures of the relationship between gender distribution and lumbar canal stenosis, osteoarthritis, spondylolisthesis, and disc herniation were not observed in patients with varus over 20 degrees. An increase in knee varus was significantly correlated with the presence of lumbar canal stenosis ( $r : 0.53, P : 0.001$ ), osteoarthritis ( $r : 0.38, P : 0.004$ ), Spondylolisthesis ( $r : 0.39, P : 0.003$ ) and disc herniation ( $r : 0.46, P : 0.001$ ). As a result, people suffering from lumbar disorders develop more genu varum with more than 23 degrees.

### Discussion

Studies have shown that disorders of the lumbar spine can lead to disturbances in the innervation of lower limb muscles, including those in the pelvis and knees (24, 25).

**Table 1.** Comparison between spinal disorders in patients with varus more than 23 degrees, age, sex, and p-value

Spinal Disorders	Condition	Age	t-Test P-Value	Sex (N %)		t-test P-value
		(Mean ±SD)		Female	Male	
Spinal Canal Stenosis	Yes	71.25±5.56	0.001	20 (71.4%)	8 (28.6%)	0.530
	No	60.8±5.59		20 (80%)	5 (20%)	
Spondylolisthesis	Yes	70.39±7.35	0.032	11 (84.6%)	2 (15.4%)	0.370
	No	64.98±7.36		29 (72.5%)	11 (27.5%)	
Osteoarthritis	Yes	73.46±4.3	0.001	12 (92.3%)	1 (7.7%)	0.140
	No	63.98±7.1		28 (70%)	12 (30%)	
Disc Herniation	Yes	69.21±6.76		24 (75%)	8 (25%)	0.920
	No	61.86±6.87	0.001	16 (76.2%)	5 (23.8%)	

In lumbar disorders, loss of inner or outer thigh muscle, leg, and hip muscles can cause imbalance and result in varus deformity of the knees. A very limited number of studies have examined the association between lumbar spine disorders and genu varum, and we have conducted the only comprehensive study to date on the association between lumbar spine problems in patients with knee varus deformity. According to our study, Patients with lumbar disorders were mostly women, and the ratio of women to men was close to 3:1. Patients with greater than 20 degrees of knee varus were most likely to have lumbar canal stenosis and disc herniation. Almost a quarter of patients with knee osteoarthritis and spondylolisthesis had a varus greater than 20 degrees. There is a significant difference in average age between patients who had lumbar canal stenosis, disc herniations, osteoarthritis, and spondylolisthesis and those who had varus greater than 20 degrees. In addition, there was no significant difference between genders and lumbar disorders. According to our study, varus knees are significantly correlated with lumbar canal stenosis, osteoarthritis, spondylolisthesis, and disc herniation in people over 50. Similar results were obtained from studies investigating the relationship between disorders with varus and disorders of the lower limbs (26-28). A study by Tsuji T et al. investigated the relationship between lumbar lordosis, sacrum deviation, and patellofemoral joint pain in 300 elderly 50-58-year-old patients. He found that at least 58% of the patients reported back pain in the last 3 months, and 16% reported pain in their patellofemoral joints. Also, patellofemoral joint pain was significantly correlated with sacrum deviation. According to these results, lumbar lordosis disorders and lower limb disorders were related, confirming ours (26, 29).

In a study, Murata Y et al. examined the relationship between lumbar lordosis and knee extension in 366 patients and found that patients with lumbar lordosis less than or equal to 30 degrees had an increased limitation of knee extension. This study showed a connection between knee extension and lumbar disorders, similar to our study. As a result of their study, the researchers concluded that degenerative changes in the knee may be responsible for lumbar spine symptoms. They called these disorders spine-knee syndromes (27). Shahrjerdi S et al. reported a significant correlation between lumbar disorders and lower limb disorders similar to our study in 2019. In this study, 30 patients were examined who had genu varum or genu valgum abnormalities, accompanied by non-specific chronic back

pain and knee abnormalities whose severity was significantly related to the type of abnormality. The degree of functional readiness and pain were correlated in non-specific chronic back pain patients, and the treatment of these deformities can significantly reduce pain and the functional index (30). One of the most important limitations of our study is the absence of a control group for comparing and estimating results. It is necessary to conduct future studies with a control group in order to obtain more data and achieve more specific results.

### Conclusion

According to the findings of this study, lumbar canal stenosis and disc herniation are the most frequent lumbar disorders in patients with varus greater than 20 degrees. It was found that lumbar disorders are significantly correlated with varus more than 20 degrees. As knee varus increases with age, lumbar disorders also increase. A larger prospective study with a suitable control group would enable a more accurate assessment of these findings.

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### Authors Contribution

The idea for this presentation was conceived by A.Y and J.K. In order to perform the calculations, A.P and M.M and H.T developed the theory. Throughout this work, all authors verified the analytical methods, supervised the results, and contributed to the final manuscript.

### Data Availability

Data will be made available on request.

### Ethical Approval

This cohort study was approved by the review board of our institute under the code IR.IUMS.REC.1401.616.

### List of Abbreviations

low back pain (LBP)  
Lumbar spine stenosis (LSS)

### Conflict of Interests

The authors declare that they have no competing interests.

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