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RELATIONSHIP BETWEEN FACET TROPISM, LUMBAR DEGENERATION AND FACET DEGENERATION

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ABSTRACT

Objective: Low back pain is a very common public health problem. Lumbar degeneration, facet degeneration and facet tropism, which are common problems that can cause lower back pain, are the most common causes of lower back pain. In this study, we examined the relationship between these pathologies.

Materials and Methods: A total of 240 patients were included in our prospectively planned study. Age, gender, height, weight, smoking history and duration, duration of pain and visual analog scale (VAS) of the patients were recorded. Intervebral disc degeneration, facet degeneration and facet tropism at three lumbar levels (L3-4, L4-5, L5-S1) were evaluated using magnetic resonance imaging and computed tomography. Intervertebral disc degeneration, according to the modified Pfirrmann Grading System; facet joint degeneration was evaluated according to the Weishaup rating. Facet joint asymmetry/tropism was defined as ≥7° difference between left and right facet joint angles.

Results: Of 240 patients, 129 (58%) were male and 111 (42%) were female. Their average height was 166.5 and their weight was 77.7. Mean pain duration was 20.4 months and VAS value was 7.67. A statistically significant ($p<0.001$) relationship was found between lumbar degeneration and facet degeneration at L3-4 and L4-5 levels. A highly significant ($p<0.001$) relationship was found between facet tropism and facet degeneration at the L4-5 level. A statistically significant relationship was found between age and lumbar degeneration and facet degeneration at all levels ($p<0.001$). A statistically significant correlation was found between age and facet tropism at L4-5 and L5-S1 levels ($p<0.001$). A statistically significant correlation was found with Facet tropism at L3-4 level, weight ($p=0.001$) and length of pain duration ($p=0.002$). A statistically significant correlation was found between facet asymmetry at L4-5 level and weight ($p=0.007$).

Conclusion: Usually, we found that lumbar degeneration and facet degeneration are related to each other and this increases with age. We determined that facet tropism had no significant effect on the other pathologies.

Keywords: Lumbar degeneration, facet degeneration, facet tropism

INTRODUCTION

Low back pain affects two-thirds of adults at least once in their lifetime[1,2]. It has become one of the biggest problems for public health in the 20th century world[3]. It is a global problem that causes loss of economic productivity and the use of health resources by applying to health institutions with complaints of pain[4].

Each lumbar segment consists of 2 facet joints posteriorly and intervertebral disc anteriorly[5]. These 3 joints carry the load together[5]. Various degenerations in these 3 joints are an important cause of low back pain[6]. There are many studies in the literature on the relationship between intervertebral disc degeneration and facet joint degeneration. However, there is no consensus on which one starts first and which triggers the other. Some of the studies have adopted that there is primarily intervertebral disc degeneration and that this leads to facet joint degeneration[7-10]. There are also studies advocating the view that facet joint degeneration causes intervertebral disc degeneration[11-15]. Apart from facet joint degeneration, another pathology of facet joints is facet joint tropism. Facet joint tropism is considered as the asymmetry of the angles of the 2 facet joints in the same segment in the lumbar and lumbosacral regions[16]. The effect of facet tropism on lumbar degeneration and the relationship between them has not yet been clearly understood[17,18]. There are various studies on whether facet joint tropism causes intervertebral disc degeneration, facet joint degeneration and thus lumbar degeneration[19,20]. As it can be understood, a clear concensus regarding lumbar degeneration and its etiology has not been obtained yet.

In our study, we aimed to examine lumbar degeneration, facet joint degeneration, facet tropism and their relationship with each other and contribute to the literature.

MATERIALS AND METHODS

A total of 240 patients who applied to our hospital's outpatient clinics with the complaint of low back pain were included in the study prospectively. Patients with previous spinal surgery history, spinal tumor, infection and fracture, lumbar spondylolisthesis

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and scoliosis were not included in the study. Age, gender, height, weight, smoking history and duration, pain duration and visual analog scale (VAS) of these patients were recorded.

Magnetic resonance imaging (MRI) and computed tomography (CT) were used to assess intervertebral disc degeneration, facet degeneration, and facet orientation/tropism. Radiological examinations were performed independently by two different senior clinicians (ÖÖ,OB.), and the average was taken. Intervebral disc degeneration, facet degeneration and facet tropism were evaluated at three lumbar levels (L3-4, L4-5, L5-S1).

Intervertebral disc degeneration is divided into 8 different grades according to the modified Pfirrmann Grading System on T2-weighted midsagittal MRI [SAG T2 FSE; repetition time (TR)=3200 ms; time of echo (TE)=100 ms; field of view (FOV)=16 cm; thickness=5 mm] (Table 1). Facet joint degeneration was divided into 4 grades according to CT scan (FOV=16 cm; thickness= 5 mm; matrix=512 512) using Weishaup grading (Table 2). Facet tropism, with the previously described technique[20,21]; the angle of the facet joint is between the anterior and posterior ends of the T2-weighted axial MRI (SAG T2 FSE; TR=3200 ms; TE=100 ms; FOV=16 cm; thickness=5 mm) articular surface and the median sagittal line of the same vertebral body. Facet joint asymmetry is defined as the difference between left and right facet joint angles ⩾7°. The measurement of facet tropism radiologically with CT sections is explained in Figure 1.

Institutional ethics approval was obtained from the Hitit University Faculty of Medicine Clinical Research Ethics Committee (decision no: 200, date no: 05.05.2020). Oral and written informed consent was obtained from all patients. The study was conducted in accordance with the principles of the Declaration of Helsinki.

Statistical Analysis

SPSS 25.0 package program (IBM Corporation, Armonk, NY) was used for statistical analysis of the findings obtained in the study. Descriptive statistical methods (frequency, percentage, mean, standard deviation) were used to evaluate the study data, and the Mann-Whitney U test was used to evaluate the normal distribution. The Mann-Whitney U test was used to compare the quantitative data between the two groups. The Kruskal-Wallis test was used to determine the significance of the difference between the mean of the three groups in non-normally distributed groups. P<0.05 was considered significant.

RESULTS

The mean age of the 240 patients we included in the study was 41.7 (minimum: 18, maximum: 80). One hundred and twenty nine (58%) were male and 111 (42%) were female. Their average height was 166.5 and their weight was 77.7. Mean pain duration was 20.4 months and VAS values were 7.67.

A statistically significant (p<0.001) relationship was found between lumbar degeneration and facet degeneration at L3-4 and L4-5 levels. No statistically significant correlation was found at L5-S1 level (p=0.118) (Table 3).

When L3-4 (p=0.317), L4-5 (p=0.223) and L5-S1 (p=0.615) levels were analyzed, no statistically significant relationship was found between facet tropism and lumbar degeneration (Table 4). There was a highly significant (p<0.001) relationship between facet tropism and facet degeneration at the L4-5 level, but no significant correlation was found at the L3-4 (p=0.268) and L5-S1 (p=0.321) levels (Table 4).

According to age; there was a statistically significant correlation between age and lumbar degeneration (p<0.001) and facet degeneration (p<0.001) at L3-4 level. A statistically significant correlation was found between age and lumbar degeneration (p<0.001), facet degeneration (p<0.001) and facet tropism (p<0.001) at L4-5 level. A statistically significant correlation was found between age and lumbar degeneration (p<0.001), facet degeneration (p<0.001) and facet tropism (p=0.001) at L5-S1 level (Table 5).

There was no significant relationship between facet tropism and gender at three levels of L3-4 (p=0.820), L4-5 (p=0.585) and L5-S1 (p=0.215).

When L3-4, L4-5 and L5-S1 levels were examined with facet tropism, it was found that facet asymmetry at L3-4 level was

Table 1. Modified Pfirrmann grading system of lumbar disc degeneration

Grade	Signal from nucleus and inner bers of annulus	Distinction between inner and outer bers of annulus at posterior aspect of disc	Height of disc
1	Uniformly hyperintense (equal to CSF)	Distinct	Normal
2	Hyperintense (>presacral fat and <CSF)	Distinct	Normal
3	Hyperintense (<presacral fat)	Distinct	Normal
4	Mildly hyperintense (slightly > outer bers of annulus)	Indistinct	Normal
5	Hypointense (=outer bers of annulus)	Indistinct	Normal
6	Hypointense	Indistinct	<30% reduction of disc height
7	Hypointense	Indistinct	30% to 60% reduction of disc height
8	Hypointense	Indistinct	>60% reduction of disc height

CSF: Cerebrospinal fluid

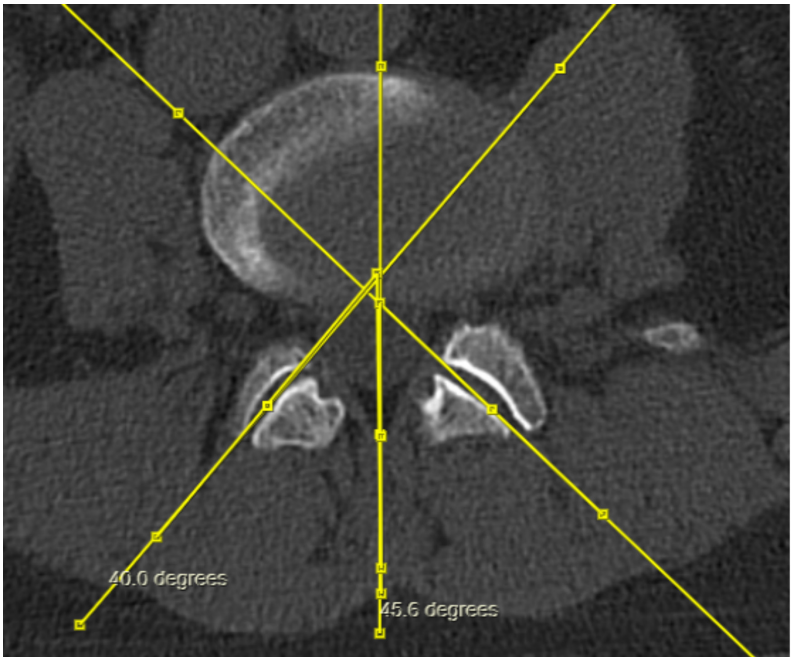

Figure 1. Two angles, one right and one left, were measured between a reference line drawn from the midline of the vertebral body in the coronal plane and the intersecting lines connecting the anteromedial and posterolateral ends of each zygapophyseal joint on the right and left sides.

Table 2. Weishaupt facet joint degeneration

Grade	Criteria
0	Normal facet joint space (2±4 mm width)
1	Narrowing of the facet joint space (`2 mm) and/or small osteophytes and/or mild hypertrophy of the articular process
2	Narrowing of the facet joint space and/or moderate osteophytes and/or moderate hypertrophy of the articular process and/or mild subarticular bone erosions
3	Narrowing of the facet joint space and/or large osteophytes and/or severe hypertrophy of the articular process and/or severe subarticular bone erosions and/or subchondral cysts

Table 3. Relationship between lumbar degeneration and facet degeneration according to levels

L 3-4	Facet degeneration p-value (r)*
Lumbar degeneration	<0.001 (0.403)
L 4-5	Facet degeneration p-value (r)*
Lumbar degeneration	<0.001 (0.355)
L5-S1	Facet degeneration p-value (r)*
Lumbar degeneration	0.118 (0.101)

*Spearman correlation test

statistically significantly correlated with weight (p=0.001) and length of pain duration (p=0.002). A statistically significant correlation was found between facet tropism at L4-5 level and weight (p=0.007) (Table 6).

DISCUSSION

Many studies have been found in the literature about pathologies such as lumbar degeneration, facet degeneration and facet tropism and their relations with each other[7-15,17-19]. In these studies, different results were obtained about the etiology of existing pathologies and the relationship between each other. While some studies have concluded that facet joint degeneration causes lumbar degeneration; in some studies, it has been concluded that lumbar degeneration causes facet degeneration[7-15]. However, the effects of the presence of facet tropism on degeneration were examined, but a clear consensus could not be reached[19-21]. Previous studies have generally been done on smaller patient populations. We studied a larger population, including 240 patients. We also examined the degeneration status according to age.

When we examine it according to the levels; a significant correlation was found between lumbar degeneration and facet degeneration at L3-4 level. However, there was no correlation between the presence of facet tropism at this level and facet degeneration and facet tropism. Again, at the L3-4 level, age and facet degeneration and lumbar degeneration were found to be statistically significantly correlated, while facet tropism was not correlated. However, a significant correlation was found between L3-4 facet tropism at the same level and pain duration and weight. We found that the duration of pain was longer

Table 4. Relationship between facet tropism and lumbar degeneration and facet degeneration by levels

L3-4	Lumbar degeneration p-value (r)*	Facet degeneration p-value (r)*
Facet tropism	0.315 (0.065)	0.268 (-0.072)
L4-5	Lumbar degeneration p-value (r)*	Facet degeneration p-value (r)*
Facet tropism	0.223 (-0.079)	<0.001 (-0.294)
L5-S1	Lumbar degeneration p-value (r)*	Facet degeneration p-value (r)*
Facet tropism	0.617 (0.032)	0.321 (-0.064)

*Spearman correlation test

Table 5. Relationship between age and lumbar degeneration, facet degeneration and facet tropism

Rel. with age	Lumbar degeneration	Facet degeneration	Facet tropism
L3-4	p<0.001*	p<0.001*	p=0.272*
L4-5	p<0.001*	p<0.001*	p<0.001*
L5-S1	p<0.001*	p<0.001*	p=0.001*

*Kruskal-Wallis test

Table 6. Relationship parameters with facet tropism

Facet tropism	Weight	Length of pain duration
L3-4	p=0.001*	p=0.002*
L4-5	p=0.007*	p=0.151
L5-S1	p=0.214	p=0.776

*Mann-Whitney U test

in those with this level of tropism. In addition, the presence of tropism appears to cause long pain duration and an increase in weight gain. The reason for this may be that patients remain immobile due to pain and gain weight.

At L4-5 level; a significant relationship was found between lumbar degeneration and facet degeneration. We found a statistically highly significant relationship between facet tropism and facet degeneration at the L4-5 level, unlike the L3-4 and L5-S1 levels. We observed that all pathologies increased with age at L4-5 level. A statistically significant relationship was found between tropism and weight at the L4-5 level, as at the L3-4 level. It is also seen at this level that facet tropism causes weight gain.

In general, a relationship was found between facet degeneration and lumbar degeneration, and it was observed that their incidence increased. In addition, no relationship was found between facet tropism and lumbar degeneration at all three lumbar levels evaluated. A significant relationship between tropism and facet degeneration was found only at L4-5 level.

There was a significant correlation between age and 3 pathologies at 3 levels, except for tropism at L3-4 level. The increase in the degeneration process with age was an expected issue in line with the literature.

Study Limitations

Our study has several limitations. First of all, although the number of patients was larger compared to other studies, it could have been done with an even larger patient population. Apart from this, L1-2 and L2-3 vertebral segments and even lower thoracic vertebrae levels could also be included in the study since they cause low back pain.

CONCLUSION

In general, we found that lumbar degeneration and facet degeneration were associated with each other and this increased with age. We determined that facet tropism was not very effective on other pathologies. We think that the difference between the existing studies in the literature and even the different results obtained in different lumbar levels of the same patient is due to the small number of patients. We think that it would be more accurate to conduct these studies on a much larger patient population.

Ethics

Ethics Committee Approval: Institutional ethics approval was obtained from the Hitit University Faculty of Medicine Clinical Research Ethics Committee (decision no: 200, date no: 05.05.2020).

Informed Consent: Oral and written informed consent was obtained from all patients.

Peer-review: Externally and internally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: Ö.Ö., Concept: Ö.Ö., Design: Ö.Ö., O.B., Data Collection or Processing: Ö.Ö., Analysis or Interpretation: Ö.Ö., Literature Search: Ö.Ö., Writing: Ö.Ö.

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