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The Correlation Between The Degenerative Changes and Osteoporosis in The Lumbar Spine of Elderly Patients

Yaşlı Hastalarda Lomber Degeneratif Değişikliklerin Osteoporoz İle İlişkisi

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Abstract

Background Both of Osteoporosis and spinal degeneration are in the etiology of the low back pain in elderly person but their correlation is not entirely clear. The aim of the study is to explore the relationship between osteoporosis and spinal degeneration and effects of osteoporosis on components of spinal degeneration. .

Material and Method We studied on eighty two patients older than 55 years old who had low back pain. The patients were divided in two groups which were osteoporotic and osteopenic according to the bone mineral index. Criteria of lumbar degenerative changes were evaluated for all patients, which were disc pathologies, facet arthrosis and morphological changes of vertebral body such as vertebral fracture, osteophytes and concavity index. Grading systems were used for classification of degenerative changes.

Results Mean BMI of subjects in two groups were not different but a significant difference between groups according to the disc degeneration ($p< 0.001$), facet arthrosis ($p=0,009$), discopathy degree ($p<0,001$) was found. We found that disc degeneration, discopathy and facet arthrosis were negatively correlated with osteoporosis but there was no difference in morphological changes of vertebral body.

Conclusion The result of the present study showed that osteoporosis could have a protective role against some kind of degenerative changes in vertebral column. It decreased the risk of disc degeneration and facet arthrosis in elderly patient. The formation of vertebral fractures and osteophytes were not always associated with disc degeneration and facet arthrosis in osteoporosis

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Keywords Osteoporosis, Bone mineral density, Facet joint, intervertebral disc, Spinal fractures.

Öz

Amaç *Bel ağrısı etiyolojisinde osteoporoz ve omurga dejenerasyonunu rol oynamakta, ancak bu ikisinin arasındaki ilişki tamamen belirgin değildir. Bu çalışmanın amacı osteoporoz ve omurga degenerasyonun arasındaki ilişkiye açıklık getirmek ve osteoporozun omurga dejenerasyonun üzerindeki etkisini araştırmak.*

Materyal ve Metod *Bu çalışmaya bel ağrısı olan 55 yaş üstü 82 hasta alındı. Hastalar kemik mineral indeksine göre osteoporotik ve osteopenik olarak iki gruba ayrıldı. Lomber dejeneratif değişiklik kriteri olan disk patolojisi, faset artrozu ve vertebra cisim kırığı gibi morfolojik değişiklikler,osteofitler, konkavite indeksi tüm hastalar için değerlendirildi. Dejeneratif değişikliklerin sınıflaması için gradleme sistemi kullanıldı. .*

Sonuç *İki grup arasında vücut kitle indeksinde farklılık saptanmadı. Ancak iki grup arasında disk dejenerasyonu ($p< 0.001$), faset artrozu ($p=0,009$), diskopati derecesinde ($p<0,001$) anlamlı farklılık saptandı. Faset artrozu, disk dejenerasyon ve diskopati osteoporoz ile negatif korelasyon gösterdiği görüldü. Ancak vertebra cisim morfolojik değişiklikleri ile ilgili farklılık saptanmadı.*

Çıkarım *Mevcut çalışma osteoporozun bazı dejeneratif değişiklikler üzerinde koruyucu etki olabileceğini gösterir. Yaşlı hastalarda disk dejenerasyonunu ve faset artrozunu azaltmaktadır. Osteoporotik hastalarda osteofitler ve omurga kırıklarının disk degenerasyonu ve faset artrozu ile ilişkili olmadığı gösterildi. **(Sakarya Tıp Dergisi 2016, 6(4):207-211)**.*

Anahtar Kelimeler *Osteoporoz, Kemik mineral yoğunluğu, Faset eklem, intervertebral disk, vertebra kırığı*

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INTRODUCTION

Spinal degeneration is the most common cause of low back pain in the elderly. Morphological changes of bony structures in spinal column, intervertebral disc degeneration and facet arthrosis play an important role in spinal degeneration.[1,2,3] Dysfunction, instability and stabilization are the biomechanical stages of the spinal degeneration.[4] Osteoporosis and degenerative changes affect mostly elderly population. Osteoporosis induced structural changes alters the load-bearing response of vertebral column and may cause instability which accelerates the degeneration process.[3]

The correlation between the degenerative changes of spine and osteoporosis is not clear.[5] The purpose of this study was to examine the correlation between osteoporosis and the components of spinal degeneration such as intervertebral disc degeneration, facet arthrosis, and morphological changes of lumbar vertebra.

MATERIAL and METHOD

Subjects were selected retrospectively among women older than 55 years of age who had a complaint of low back pain. Patients with disorders known to affect bone metabolism, tumoral changes, those receiving hormone replacement therapy or taking medications for osteoporosis and had spinal operation were excluded from the study. Subjects were selected in the group of patient who had not daily sportive activity and smoking. Eighty two women who had sedentary lives in similar conditions were included in the study.

Bone mineral density (BMD) of lumbar spine by dual-energy X-ray absorptiometry (DXA)(QDR 4500 Hologic Inc. USA), lumbar magnetic resonance imaging (MRI)(Siemens Magnetom Vision 1,5-T, Siemens Medical System, Erlangen, Germany), antero-posterior and lateral rontgenography were performed for all subjects. Subjects were divided into two groups according to the DXA. "T scores" in DXA were lower than "-2,5" in group 1(osteoporotic) and higher than "-2" in group 2(osteopenic).

Degenerative changes of lumber vertebra were divided into three groups such as disc pathologies, facet arthrosis and morphological changes of vertebral body. Six parameters in three groups were evaluated for detecting the degenerative changes of lumbar vertebra. Assessments were performed by two authors for each level between L1 and L5 vertebra. The grading system was based on the literature. Grading of parameters was made according to the following protocols (Table 1).

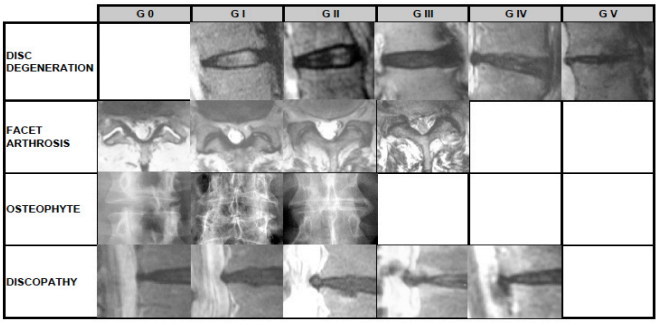

Table 1: Radiographic images showing the criteria of grading systems which is explained in text for disc degeneration, facet arthrosis and osteophyte formation.

Disc Pathologies

Disc pathologies were related with the disc degeneration and the degree of discopathy. The degeneration of each five lumbar disc (L1-L2, L-L3, L3-L4, L4-L5, L5-S1) were graded from 1 to 5 according to Thompson's classification using T2 weighted mid-sagital MRI .[3,6]

Degree of discopathy was evaluated in five grades. G0: normal disc. G1: bulging (symmetrical disc extension). G2: Protrusion (focal or asymmetrical disc extension). G3: Extrusion (extreme extension of disc beyond the vertebral border). G4: Sequestration (free disc fragment).[7]

Facet Arthrosis

Four grades (G0-G3) of arthrosis of the facet joints were defined according to the modified classification of Pathria et al. by using axial MRI. G0: normal facet joint space (2-4mm). G1: narrowing of the facet joint space (< 2 mm) and/or small osteophytes and/or mild hypertrophy of the articular process. G2: narrowing of the facet joint space and/or moderate osteophytes and/or moderate hypertrophy of the articular process and/or mild subarticular bone erosions. G3: 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.[8,9]

Morphological Changes of Vertebral Body

Three aspects of degenerative morphological changes (1-Vertebral fracture, 2-Vertebral osteophytes, 3-Concavity index) were studied for each lumbar level (L1-L5) in rontgenography. Vertebral fracture was considered to be present if at least one of three height measurements (anterior, middle, posterior) of one vertebra has decreased more than %20 by using lateral lumbar rontgenography(G0: yes, G1:no).[10,11]

Grading of osteophytes was made by using Nathan's classification.[2,12] G0: no osteophyte. G1: definite osteophyte. G2: osteophyte bridging or nearly bridging across neighboring vertebra on antero-posterior and lateral rontgenography.

Concavity index was calculated by dividing the central vertebral height to anterior vertebral height. A calliper was used for each vertebral measurement (L1-L5) on lateral roentgenogram.[13]

Statistical calculations were done by SPSS software (version 11.0). Data were analyzed and compared by the Mann-Whitney U test and x2 tests. p values < 0.05 were considered statistically significant.

RESULTS

Mean body-mass index (BMI) of subjects between two groups were not different significantly. The difference between groups according to the disc degeneration, facet arthrosis and discopathy degree was significant in various levels. The comparison of "p values" of the parameters for two groups was demonstrated in table 2.

	L1	L2	L3	L4	L5
Disc degeneration (1-5)	(-)	(-)	0.02	0.05	0.09
Discopahty (0-4)	0.03	0.04	0.01	(-)	0.03
Facet arthrosis (0-3)	(-)	(-)	0.02	(-)	(-)
Vertebral fracture (0-1)	(-)	(-)	(-)	(-)	(-)
Vertebral osteophyte (0-1)	(-)	(-)	(-)	(-)	(-)
Concavity index	(-)	(-)	(-)	(-)	(-)

Table 2: Comparison of the osteoporotic and osteopenic groups according to "p values" for each vertebral level.

Table 2 presents the comparison of two groups for each vertebral level. Disc degeneration for three lumbar disc such as L3-L4-L5 levels ($p<0.05$) and discopathy for all level ($p<0.05$) except the level of L4-L5 disc was significantly different between group 1 and group 2. Nevertheless, there was a difference only in L3 vertebra according to facet arthrosis ($p<0.05$). Statistically difference was not observed for the morphological changes of vertebral body such as vertebral fracture, osteophyte formation and concavity.

DISCUSSION

The criterion of the WHO defines "severe osteoporosis" as low bone mass (t score below -2.5) in the presence of one or more fragility fractures.[14] DXA is currently widely used and reliable method for measuring of BMD with high degree of precision.[15] Osteoporosis could be underestimated in the presence of degenerative changes such as osteophytes and reactive vertebral sclerosis.[16] Since there was no difference between groups according to the osteophytic changes and vertebral fracture in all levels and facet arthrosis in most levels, osteoporosis and ostoepenia could have been objectively differentiated by using t scores in our study.

The degenerative changes in our series were evaluated by using MRI and roentgenography. The sensivity and specifity of MRI of intervertebral disc abnormalities are well known.[17] There is less information about the value of MRI in assessment of facet joint. Weishaupt et al has stated that although computerized tomography (CT) was more reproducible in grading of facet joint but CT is not required in the presence of an MRI examination[9] .

Spinal degeneration included disc degeneration, facet joint arthrosis, muscular and ligamentous dysfunction. The literature also demonstrated the inverse relation between osteoporosis and spondylosis.[11,18,19,20] Our results confirmed that disc degeneration, discopathy and facet arthrosis was negatively correlated with osteoporosis. Osteoporosis decreases the bone density and less dense bone could result in decreased mechanical stress on the intervertebral disc.[18] When vertebral BMD increase, the role of shock-absorbing of disc increases, resulting in an increase stress on intervertebral disc in the elderly.[3] Consequently this affects all the mobile segments

which were important for maintaining the segmental stability of the vertebral column.[8] Several investigators have reported a correlation between bone density and intervertebral disc degeneration. Harada et al showed that elevated disc degeneration was correlated with BMD of lumbar vertebra.[18] Keller et al also reported that stiffness of vertebral body increased the disc degeneration.[21] In our results, disc degeneration and discopathy rate were higher in the group which has higher lumbar BMD. This difference was significant in almost all lumbar levels. Since the other factors such as age, BMI and living conditions life were similar between the groups, the changing in spinal degeneration was more significant related to changing in BMD. Disc degeneration causes an increase of the pressure on the facet joint as a result of narrowing of disc space.[22] It was proved that disc degeneration preceded the development of the facet joint arthrosis by the several experimental models.[23,24] Gotfried et al showed that experimentally chemonucleosis–induced disc degeneration led to secondary facet arthrosis.[25] Our results were not so evident. We found that facet arthrosis was uncommon in both groups and the difference significant was only in L3 level. Predictive factors of mostly affected segments are not evident in facet joint arthrosis.

Facet arthrosis may be affected by morphological changes in vertebral body as well as in disc. The proposed mechanism is that decreased vertebral height as a result of vertebral fracture may result in facet malalignment and facet arthrosis.[2]We found no difference between osteoporotic and osteopenic groups according to the morphogical changes such as vertebral fracture, osteophyte and concavity index.

In conclusion, the result of the present study showed that osteoporosis was the risk factor of some sort of degenerative changes in vertebral column. Although the increasing BMD is one of the aims of osteoporosis therapy, it could have side affects such as increasing in some degenerative changes. Results this study demonstrated that the relationship between BMD and disc pathologies and facet arthrosis. Further studies are needed to clarify what are the important mechanisms that play role on degenerative changes of lumbar vertebra.

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