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RESEARCH ARTICLE
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DOES VISCERAL FAT A RISK FACTOR ASSOCIATE WITH BONE DENSITY OF BACK PAIN PATIENTS IN LUMBAR DISC DEGENERATION?

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Abstract

Background: The impact of obesity and excess of visceral fat has been linked to bone metabolism. The objective of the study was relationship between visceral fat and bone density (BD) on back pain subjects with disc degeneration.

Methods: A total of 197 low back pain subjects between 30-70 years, undergone lumbosacral MRI (1.5T) were included. Based on MRI report, subjects were grouped into disc bulging (DBG) and Nerve compression Group (NCG) depending on degree of degeneration. Body fat were analysed by bioelectrical impedance analysis. Depending on the fat distribution, subjects were also subdivided into normal, overfat and obese.

Results: The result showed that in disc bulging patients there was a significant correlation between visceral fat with bone density and it was statistically significant (p=0.0002). In nerve compression group (NCG), visceral fat and bone density were statistically highly significant (p=0.000).

Conclusion: The degree of increment of visceral fat has a negative effect on bone density. So body composition analysis is of utmost importance in clinics for the preservation of bone health and severity of degeneration.

Key Words: Back Pain , Body Fat , Bone density , Disc degeneration, MRI

Introduction

Degenerative disc disease is frequent in the lumbar spine, and Magnetic Resonance Imaging (MRI) is used to assess its severity (Powell M.C. et al.,1986). People with extensive disc degeneration had a twice as high incidence of chronic low back pain as those without structural disc abnormalities (Hicks G.E, Morone N, and Weiner, D.K.2009). Similarly, low back pain has been linked to many disc degeneration characteristics (dark nucleus pulposus, posterior and anterior bulging) (Luoma K. et al.2000). Despite the fact that degenerative disc disease is a common finding, epidemiological

studies have utilized a variety of criteria to characterize the disease. The macroscopic grading systems take into account changes in the endplate and vertebral body, as well as the nucleus and annulus (Thompson J.P. et al.,1990). While MRI investigations have focused on particular features such as annular tears, herniated nucleus, and intervertebral disc height The D.M. Urquhart, et al. (2014). (Pfirrmann's method 2001) was found to be a valid and reliable strategy for evaluating intervertebral disc degeneration using MRI in a systematic examination of existing grading systems for lumbar disc degeneration. The Pfirrmann approach provides a 5-point grading system by utilizing a range of MRI data, including the appearance of the disc structure, signal intensity, intervertebral disc height, and the differentiation between the nucleus and the annulus (Kettler A., and Wilke H.J.2006).
Several risk factors for these degenerative alterations have been found, but their relevance and impo rtance remain unknown, which was the goal of this systematic study.The connection between LDD and bone health is uncertain.As previously demonstrated, the presence of LDD correlates with incre ased spine Bone Mineral Density (BMD)(M.C.CastañBetancourt,etal.,2013).Central obesity, also kn own as visceral adipose tissue (VAT), has been close connections with metabolic diseases like arthrosclerosis, diabetes, and mortality (Mori Y., Hoshino K., Yokota K, et al., 2006) , but the association between VAT and skeletal health is far less well recognized. In studying the effect of adiposity on bone metabolism, it is important to distinguish VAT from total body fat mass or body weight. The aim of this descriptive study was to determine the associations between visceral fat and bone density on degree of intervertebral disc degeneration of back pain subjects.

Materials and methods

Radiology conducted a descriptive study from August 2019 to December 2021 with the permission of the Institutional Ethical Committee (IEC Ref. No.48/18/IEC/JMMC&RI). Body composition was determined using a manual type Inner Scan Segmental Body Composition Analyzer Tanita Bc-601, and patients with back pain who were admitted to the Department of Radiology and referred for MRI were included in the sampling technique. Those who refused to participate were excluded. After signing an informed consent form, the patient's height was measured using a stadiometer. The study was limited to those who met the inclusion criteria, and they were given a detailed explanation of the study protocol prior to participating.
197 back pain patients aged 30 to 70 underwent a lumbosacral MRI (1.5T).The following is a list of Sagittal TSET2- and T1-weighted images, as well as axial TSE T2-weighted images, were reviewed, and disc degeneration was classified based as Disc Bulging group(DBG) –MRI findings of focal annular disruption of the disc material without violation of the posterior longitudinal ligament, Disc Extrusion leads to Nerve compression group(NCG) -Disc material that violated the posterior longitudinal ligament. The whole-body fat (WBF), visceral fat (VF), subcutaneous fat and bone density were analysed. on the same individuals. The body composition analyser classified the participants as underweight, normal weight, or overweight based on their level of adiposity.

Results

Table:1 Correlation of visceral fat distribution with bone density on disc bulging group

	Visceral fat(VF)	**N=123**	**Mean ± SD**	**Median (IQR)**	**p Value**
Bone Density (BD)	Normal	98	2.32± 0.43	2.2 (2.0-2.6)	0.006
	Over fat	6	2.77 ± 0.31	2.65 (2.55-3.13)	
	Obese	19	2.55 ± 0.43	2.6 (2.2-3.0)	
***P<0.05 Significant, ** p<0.01-Highly significant**					

In table 1 result showed that out 123 disc bulging group ,due to the distribution of fat they were come under three categories including 98 patients were normal visceral fat with disc degeneration,6 patients were under overfat and 19 were belonged in obese group.in between these group, statistical analysis pointed out that bone density was a significant correlation with visceral fat (p=0.006).

Table 2: Correlation of visceral fat with bone density on nerve compression group(NCG)

	Visceral fat (VF)	N	Mean ± SD	Median (IQR)	p Value
Bone Density (BD)	Normal	48	2.32 ± 0.44	2.30 (2.02-2.7)	0.000
	Overfat	7	2.50 ± 0.53	2.30(2.1-3.1)	
	Obese	19	3.13 ± 0.41	3.10 (2.9-3.4)	
***P<0.05 Significant, ** p<0.01-Highly significant**					

From the above table 2 revealed that in total of 197 subjects 74 were nerve compression group. Based on their fat distribution percentage 48 subjects were normal visceral fat ,7 were come under overfat and 19 were under obese fat group. (NCG), visceral fat (VF) and bone density were statistically highly significant(p=0.000). So increase in visceral fat has a negative effect on bone density.

Discussion

This descriptive study of 123 disc bulging group observed that a positive correlation existed between visceral body fat and bone density (BD). Notably, a visceral adipose index (VAI) saturation value (3.3) in the total femur BMD for all subjects was found (Eastell R..O. et al.,2016). (10). As visceral fat expanded above the saturation limit, the degree of lumbar degeneration and bone density (BD) naturally reduced, which is crucial for maintaining BD at an optimal level. As a result, the current study finds VF a useful biomarker for clinically assessing total BD. Low bone mineral density (BMD) is an important diagnostic indicator of osteoporosis.

Osteoporosis is a metabolic disorder that weakens and brittles bones over time, increasing the probability of fracture. According to the World Health Organization (WHO), osteoporosis is indicated by a BMD that is 2.5 SDs or less below the mean maximum BMD. (Estell E.G. and Rosen C.J. 2021). The current investigation discovered a positive connection between total BD and visceral adiposity as evaluated by a body fat analyzer. Obesity is defined by changes in adipose tissue distribution and increased body mass. There are two types: visceral obesity, which refers to excess fat accumulation in the abdominal area, and subcutaneous obesity, which refers to fat accumulation beneath the skin (Calder P.C. et al.2011). Several studies, however, have shown that after correcting for various variables, visceral adiposity measured by CT has a larger correlation with bone mineral density (BMD) than subcutaneous adiposity (Zillikens M.C., et al. 2010). Determining the degree of abdominal obesity is a highly dependable and accurate instruments making it a better predictor than other approaches. Visceral fat is strongly associated with general health in most people, and provide useful insights into an individual's health status .

The findings reinforced the relationship between obesity and low BD, which was observed primarily in the nerve compression group, and the underlying mechanism is still unclear. Several potential mechanisms could have contributed to this connection. Fat gain may improve the skeleton's static mechanical compliance, resulting to bone tissue changes(Zi-hao Chen,et al.2023). The proliferation of adipocytes in the bone marrow microenvironment may enhance inflammatory chemicals that increase osteoclast creation and activation, inhibit osteoblast differentiation, and stimulate osteoclasts. Adipose depots augmenting inflammatory cytokines secretion synergizing bone deterioration and its density of overweight or obese people may be due to increases the release of endocrine hormones that influence insulin resistance may have a major contribution to bone health.

Conclusion

Regarding the results of the current research, there was a positive correlation between VF and BD Consequently, the present study suggests that increase in visceral fat may have accelerate gradual decline of density in bone which in turn lead to progress of degree of lumbar disc degenerative diseases and intensity of back pain. So body composition analysis is of utmost importance in clinics for the preservation of bone health and preventing degree of severity of degeneration and intensity of pain.

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