The effect of patient position to dexa measurement

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Abstract

Aim: The aim was to compare and contrast the lumbal area DEXA measurements made in lateral and front-back positions in the clinically diagnosed female patients with osteoporosis.

Material and methods: From the female patients that were referred to our clinic due to low energy fractures that occurred in areas other than the vertabrae, whom were thought to have osteoporotic fractures, were postmenaposal with no known history of diseases, and medication that can lead to osteoporosis and fracture, with no known previous diagnosis of osteoporosis, 39 patients have been included in the study. Anteroposterior and lateral standart lumbar DEXA measurements were performed on all patients

Results: The results of our study revealed that the the laterally performed lumbar Dual Energy X-ray Absorbsiometer (DEXA) measurements have diagnostic advantage in osteoporosis over anteroposteriorly performed measurements . The antiosteoporotic treatment would have beeen prescribed to 82% of the patients if the anteroposteriorly performed lumbar region Dual Energy X-ray Absorbsiometer (DEXA) measurements were taken into account, while when laterally performed measurements were taken into account the percentage was 97.5%.

Conclusion: If lateral lumbar area Dual Energy X-ray Absorbsiometer (DEXA) measurements are used in diagnosing osteoporosis more patients would receive the required treatment and the risk of the osteoporotic low energy fractures could be lowered.

Keywords: Bone Mineral Density; Dual X-Ray Absorptiometry; Osteoporosis; Lateral Vertebral DEXA.

INTRODUCTION

Osteoporosis is a progressive metabolic skeletal disease, that is characterized by the loss of bone strength, and that causes an increased risk of bone fractures. It is a serious public health issue, that is also the cause of significant morbidity and mortality in the elderly population. (1-3). With the increase in the avarage life expectancy at birth, the ascend of the percentage of the elderly population in regard to the total population, habits such as a sedantary life style and inadequate nutrition, osteoporosis and osteoporosis related fractures ratio tend to escalate.(1-8). About 9 million new cases of osteoporotic fractures are seen per year world-wide. (9).

Advances in early diagnosis and treatment of osteoporosis has become a center of interest in recent years and therefore, the years 2000-2010, has been proclaimed as "Bone and Joint Decade" by World Health Organization to draw attention to bone and joint diseases (10). Osteoporosis is a disease that remains silent unless it is complicated by a simple low energy trauma fracture. Thus; many patients are either diagnosed late or recieve inadequate treatments (2,4). Because of the importance of the measures that can be taken before this fracture occurs, early diagnosis is very valuable. (11,12).

The main purpose of screening for osteoporosis is to prevent fractures that may occur. Evaluation of the patients with suspected osteoporosis is done by Bone Mineral Densitometry (BMD) measurement.

BMD is the most important indicator of the physiological and pathological conditions of the bone and it is considered the most valuable data demonstrating the risk of fracture. As an inexpensive and easy to apply method, BMD measurement is considered a golden standard procedure in diagnosing osteoporosis. (5).

Most commonly used method is Dual Energy X-ray Absorbsiometer (DEXA).The diagnosis of osteoporosis that is a systemic disease, is made by lumbal and proximal femur BMD measurements. Osteoporosis diagnose is made when the patients BMD value is below 2.5 standart deviation (T score ≤-2.5). Osteoporotic fractures are classified as fractures occuring with a low energy in patients with no systemic diseases or additional pathologies that can lead to fractures. With BMD values; osteoporotic fracture risk can be calculated. Low energy fractures that occur especially in vertebrae, proximal humerus, wrist and pelvis are accepted as osteoporotic fractures, even without a BMD T score ≤ -2.5. (13).

As a standart, DEXA measurements of the lumbar vertabrae are made from antero-posterior position. During a BMD measuremen in anteroposterior position, the bone loss can be masked by the the superposition of the posterior elements, calcified facet joints and ligaments, osteophytes and abdominal aorta calcifications, thus decreasing the accuracy of the BMD test. (14,15).

Because of these structures, false high measurement can be made in the lumbar vertebrae DEXA. DEXA measurements can also be made in lateral in order to to exclude these structures. There are even differences reported in some studies conducted in supine and prone positions. In this study our main goal was to compare and contrast the lumbal area DEXA measurements made in lateral and front-back positions in the clinically diagnosed female patients with osteoporosis.

MATERIAL and METHODS

From the female patients that were referred to our clinic due to low energy fractures that occurred in areas other than the vertabrae, whom were thought to have osteoporotic fractures, were postmenaposal with no known history of diseases, and medication that can lead to osteoporosis and fracture, with no known previous diagnosis of osteoporosis, 39 patients have been included in the study. Anteroposterior and lateral standart lumbar DEXA measurements were performed on all patients.

Standardization of the lateral position were made to; in the full left lateral decubitus position, with the knee flexed at 90 degrees and arms, shoulders and hips standing symetrically. According to World Health Organization's criteria, DEXA scores were classified as the following: a T-score between -2.5 and -1 are cas 'osteopenia' a T-score ≤-2.5 classified as 'osteoporosis'. SPSS (version 21.0; SPSS Inc, Chicago, IL) software package was used for the purpose of statistical analysis. Statistically significant difference was evaluated with Paired Samples T Test. p <0.05 value was considered statistically significant.

This study was approved by Gazi University Faculty of Medicine Ethics Committee.

RESULTS

Mean age of the patients that were included in the study were 63,1 (55-73). With the anteroposterior lumbar area DEXA measurements(L1-4); 7(18%) patients were classified as normal, 24(61,5%) patients were classified as osteopenic, 8(20,5%) patients were classified as osteoporotic. With the lateral lumbar area DEXA measurements (L2 -4);1(2,5%) patient was classified as normal, 5(12,8%) patients were classified as osteopenic and 33(84,7%) patients were classified as osteoporotic (Table 1).

Paired T-Test (Paired Samples T-Test) was performed to lumbar vertebrae anteroposterior and lateral DEXA measurements. Second lumbar vertebrae BMD T score mean value was found to be -1,8562 in the anteroposterior position, -2,0092 in lateral position and it has been interpreted as a statistically significant difference. (p<0.05). Third lumbar vertebrae BMD T score mean value was found as -1,8164 in anteroposterior position, and as -2,6562 in lateral position and it has been interpreted as a statistically significant difference (p<0.05).

Fourth lumbar vertebrae BMD T score mean value was found to be -1,5510 in anteroposterior position, and -2,8985 in lateral position and it has been interpreted as a statistically significant difference. (p<0.05). L2-4 vertebrae BMD T score mean value was found to be -1,6931 in anteroposterior position, and -3,2103 in lateral position and it has been interpreted as a statistically significant difference. (p<0.05), (Table 2).

Table 1. T score values of patients depending on the position

Patient	Age	AP T Score	LAT T Score	Patient	Age	AP T Score	LAT T Score
TG	59	-2,04	-2,7	GY	69	-1	-3,29
BS	65	-1,61	-3,4	EK	57	-0,91	-1,88
GA	63	-3,9	-3,78	EA	63	-1,61	-2,26
HH	60	-1,33	-2,14	ES	65	-1,14	-2,55
GT	66	-0,24	-2,82	EK	61	-3,29	-4,38
BT	56	-1,41	-1,97	MB	55	-2,36	-2,84
BD	63	-3,37	-3,27	RC	62	-1,42	-3,29
FS	55	2,76	0,44	FB	61	-1,77	-3,92
HD	70	-3,62	-4,55	Pİ	56	-2,23	-2,82
AÇ	66	-3,91	-3,33	MK	59	-2,01	-3,06
AS	69	-2,31	-4,09	MT	73	0,58	-4,21
AG	59	-3,7	-2,82	ZI	66	-1	-3,77
LA	63	-3,15	-4,36	ZE	63	-1,65	-3,87
BT	72	-2,31	-4,1	MK	68	0,01	-3,99
NY	65	-2,5	-3,93	ÖÖ	56	-1,14	-3,24
TB	56	-2,17	-2,98	MA	67	-1,2	-4,27
SD	67	-1,52	-3,95	NZ	63	-1,36	-3,08
SY	70	-0,75	-3,38	ÜD	65	-1,61	-3,66
HG	55	-1,49	-2,52	SY	66	-1,45	-3,08
NS	67	-0,9	-2,09				

AP: anteroposterior   LAT: lateral

Table 2. Comparison of the scores depending on the position						
		Mean	N	Std.Deviation	Std.ErrorMean	p
Pair1	AP L2	-1,8562	39	1,31730	0,21094	P<0,05 (0,000)
	LAT L2	-2,0092	39	1,05156	0,16838	
Pair2	AP L3	-1,8164	39	1,37653	0,22042	P<0,05 (0,040)
	LAT L3	-2,6562	39	0,84652	0,13555	
Pair3	AP L4	-1,5510	39	1,61098	0,25796	P<0,05 (0,038)
	LAT L4	-2,8985	39	1,05624	0,16913	
Pair4	AP L2-4	-1,6931	39	1,27853	0,20473	P<0,05 (0,001)
	LAT L2-4	-3,2103	39	0,93940	0,15042	
(Paired Samples T-Test) AP:anteroposterior, LAT: lateral						

DISCUSSION

Osteoporosis is a systemic, common disease that is also a problem that can come across with low energy fractures if not treated.. Especially in women; with the onset of menopause, osteoporosis prevelance is increased dramatically. Treatment could be given in accordance with DEXA measurement ordered by clinical suspicion. The main goal of BMD measurements is to evaluate the risk of fracture which may occur in the future. The studies showed that there are more than 200 million osteoporosis patients present in the world and about 9 million new osteoporotic fractures are diagnosed yearly world-wide, (9,16).

Routine DEXA measurements are performed from the lumbar vertebrae and proximal femur anteroposterior position, even though it can be measured from many regions. In this study results of anteroposterior and lateral lumbar vertabrae DEXA measurements of female patients whom have been clinically suspected as having osteoporosis were compared. During a BMD measurement in anteroposterior position, the bone loss can be masked by the the superposition of the posterior elements, calcified facet joints and ligaments, osteophytes and abdominal aorta calcifications, thus decreasing the accuracy of the BMD test. (14,15). Because of these structures, false high measurement can be made in the lumbar vertebrae DEXA (14,17-20).

Trabecular microstructre of the vertebrae has a critical importance in protecting the quality and strenght of bone. Trabecular bone density in central and anterosuperior region of vertebral body is decreased, and it becomes a heterogeneous structure due to osteoporosis. (19). Some studies it is emphasize that the posterior elements have more cortical bone mass than the vertebral body. The similarity in the anteroposterior and lateral vertebrae DEXA measurements is reported as no statistically important loss of trabecular bone loss with regard to the cortical bone loss. (21).

From patients whom we have clinically diagnosed as having osteoporosis and had low energy fractures; anteroposterior DEXA measurements supported our clinical diagnosis at 20,5% rate while lateral lumbar measurements supported our clinical diagnosis at 84,7% rate with a T score ≤ -2,5. In anteroposterior lumbar area DEXA measurements; 7(18%) patients were classified as normal (T score ≥-1) and in lateral lumbar area DEXA measurements; 1(2,5%) patient was classified as normal (T score ≥-1). According to these results, if we also take into account that we start treatment to the patients thought to have osteopenia too, we would have began treatment in order to prevent secondary fracture risk, to a 82% of our patients according to the DEXA anteroposterior measurements, and 97,5 percent of our patients according to lumbar area DEXA measurements. Having BDM results that match with the clinical presentation of patients is important in order to prove the diagnosis and to take preventive measures in order to avoid possible complications by giving adequate treatment to patients.

Current researches emphasize that, antero-posterior DEXA measurements don't indicate osteoporotic fragility in a right way, due to the syndesmophytes that occur at all the stages of ankylosing spondylitis (22,23) This could also be said for the degenerative vertebrae diseases in them osteophytes are present. A study has shown lateral L3 vertebrae DEXA measurements are more sensitive at diagnosing osteoporosis than anteroposterior vertebrae imaging at ankylosing spondylitis patients. In another study, in order to determine the bone loss, femoral measurements were found to be superior to antero-posterior vertebrae imaging, and lateral vertebrae DEXA measurement were found to be more sensitive than femoral measurements (24).

In literature, there are studies that even found significant differences comparing the supine and prone position measurements. Our study has shown that lomber DEXA measurements made in lateral position has diagnostic advantages. As a result if lateral lomber DEXA measurement is used, more patients will receive adequate treatment and therefore osteoporotic low energy fracture rate could be reduced. Further studies should be made in order to determine the potential advantages of routine lateral position DEXA measurements in areas other than patients with osteoporosis and fracture. Evaluated in the light of the recent studies, we can conclude that lateral lumbal region DEXA measurements are more

sensitive in measuring the vertebrae bone loss than the anteroposterior DEXA measurements.

The lack of study, DEXA in the proximal femur and vitamin D-calcium levels is not included in the study.

CONCLUSION

n conclusion: Low energy fractures can occur because of the bone loss that presents itself in osteoporosis. Due to posterior elements, calcificated facet joints and ligaments, osteophytis and abdominal aort calcifications superposing in antero-posterior imaging, BMD measurement used as a routine diagnosis procedure in osteoporosis, has a decreased accuracy and the real bone loss can be masked. To exclude these structures lumbar vertebrae DEXA measurements can be better documented in lateral position measurement.

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