Comparison between the gold standard DXA and bone marker for patient at risk of osteoporosis in Tabuk, Saudi Arabia

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The main reason of our research is to investigate the skeletal disorders such osteoporosis by using different methods in order to recognize bone loss in early stages and start treatment before it becomes too late for people who have compromised bone strength predisposing and may have bone fracture. Cross-sectional study is conducted at King Fahd Specialist Hospital in Tabuk, Saudi Arabia. The researchers included faculty members at the University of Tabuk during (2019). So, any participant who reported spinal fractures in the last (52) weeks, as with thyroid disease, diabetes, kidney failure, or liver disease in line with pregnant women was completely excluded.No statistically significant differences were found for the following variables: BMI, cigarette smoking, rheumatoid, or hyperparathyroidism. Remarkably, between patients with normal bone measurements (T-score > −1.0 SD), previous fractures were found 5.7% (n=4) among participants. Moreover, bone markers blood tests were compared to the participants with and without osteoporotic fractures (OF), p-values were not statistically significant for all tests. The major limitation of our study was the small size of the participants included. Further studies are needed to analyse the potential of this alternative and promising technique.

Keywords: Osteoporosis; Bone Marker; DXA; Gold Standard; Bone Loss

INTRODUCTION

The World Health Organization (WHO) has found out the Osteoporosis disease and then became known as systemic disease described by micro-architectural deterioration of bone tissue and low bone mass as well. This leads to a consequential increased in fracture probability and increased bone breakability. In Saudi Arabia, for instance, the prevalence of osteoporosis in men has been increased to (23%). So, both the activity level, which was low, and poor intake of oral calcium were the main reasons (Alzaheb and Al-Amer, 2017). While for women in the same country, it has been found that the Osteoporosis and Osteopenia were shared between their postmenopausal (Blake and Fogelman , 2007

and El-Desouki , 2003).

Bone fracture is the key symptom of osteoporosis disease. Generally, fractures of osteoporosis might be common such as in the wrist, hip, and pressure that does not affect the bones of ordinary people. Also, one study conducted in the UK revealed that one out of five men and one out of two do suffer from fracture above aged (50) and above. Thus, the life time of risk of vertebral, forearm, and hip fractures is about (40%) which is similar to cardiovascular disease which leads to life risk (Choi , 2016, El-Desouki and Sulimani , 2007, Leigh et al., 2019, Tlt et al., 2016, Darout et al., 2017, Khan et al., 2019 and Jawad , 2016)).

Furthermore, (BMD), the current standard method of assessing, is designed to measure double-x-ray energy absorption (DXA) for the hip and / or spine, and in fact the T-score values for osteoporosis and osteoporosis are only validated by the World Health Organization once they are measured by DXA. Although fractures associated with osteoporosis are a major health problem, osteoporosis is still not diagnosed.

Bone markers, however, play a significant role in detecting bone loss with laboratory blood tests in calcium, vitamin D, as well as magnesium. Upon using normal blood tests without being acknowledged to radiation department, this method definitely helps identify the bone loss and may also be used as a frontline to determine osteoporosis (Gilbert and McKiernan 2005,El Maataoui et al., 2015, Khattab and Al-Saadoun , 2016. Ebid and Thabet , 2017, Morris et al., 2017 and Miura and Satoh , 2019.

Additionally, this study aims at investigating and doing comparison between the gold standard DXA and bone marker for patient vulnerable to osteoporosis in Tabuk area, Saudi Arabia so that establishing new guidelines for osteoporosis patients via laboratories blood tests can be designed.

MATERIALS AND METHODS

Upon being illustrated above, this cross-sectional study is conducted at King Fahd Specialist Hospital in Tabuk, Saudi Arabia. The researchers included faculty members at the University of Tabuk during (2019). So, any participant who reported spinal fractures in the last (52) weeks, as with thyroid disease, diabetes, kidney failure, or liver disease in line with pregnant women was completely excluded.

On the other hand, patients who met inclusion and exclusion criteria were involved in this study. And a questionnaire specifically designed for this study was answered by all participants answered and the weight and length of every participant were recorded in line with venous blood samples (3 ml) which were taken from them in tubes. Moreover, the scores of all participants were recorded and diagnosed with DXA along with all earlier data.

Firstly, the DXA scanning of both left Hip and lumbar spine was implemented with Hologic device (Hologic, Inc., Waltham, MA, USA), andthe main criteria were to diagnose osteoporosis which is based on bone mineral density (BMD) compared to young adult mean (a T-score < 2.5 SD) whereas, (2.5) standard deviation (SD) or lower regarding the T-score which was considered to be osteoporosis. Secondly, the normal range of T-score is at (1.0) SD or above, while a T-score was between (−1.0) and (−2.5) SD –that is, to be as osteopenia. In the hospital laboratory, the assessment of blood bone markers, calcium, magnesium and vitamin D were tested.

Serum calcium, serum, and vitamin D were analyzed. Whereas correlation coefficients were applied to evaluate the relationship between DXA and blood tests among the sites. Pearson's correlation coefficient and techniques were also used to determine the tests.

The researchers performed logistic regression analysis, while VF was adopted to be as a dependent dichotomic variable and T-score values. Then, the results pointed out the odds ratio of vertebral fracture with (95%) confidence interval (CI). In line with receiver operating characteristic (ROC) analysis was performed, the researchers figured out the areas under the curve (AUC) so that the researchers may determine the ability of (DXA) and blood tests to distinguish the subjects reported with or without probable fractures.

Since this research is a comparison of two methods of measuring bone density, it is therefore considered a real experimental research, and will follow the global experimental design. Also, the researcher will use descriptive, correlational and comparative designs to get the relationships between bone density consequences and other health-related variables evaluated.

Approval for the research protocol was sought and obtained from the University of Tabuk's Committee of Research Ethics (UT-49-11-2018). Moreover, informed consent has been obtained from the participants.

RESULTS

The study sample consisted of (70) female

staff in University of Tabuk and/or their relatives who were aged (31–94) years with mean at (59.2 years). Besides, patients' characteristics are summarized in Table (1), and the number of patients who classified as "have a high risk of fracture" was varied according to the method of measurement used on one hand and to the site evaluated on the other.

Table 1: Patients' characteristic

Variable	Values (Total= 70)
Age, years [mean (min − max)]	59.2 (31–94)
High, cm [mean (min − max)]	154.6 (139-181)
Weight, Kg [mean (min − max)]	75.6 (52-128)
BMI [mean (min − max)]	31.9 (22.5-48.7)
Previous Osteoporosis	4 (5.7)
Previous fracture (n (%))	4 (5.7)
Rheumatoid (n (%))	7 (10)
Hyperparathyroidism (n (%))	12 (17.1)
Cigarette smoking (n (%))	5 (7.1)
Practicing Sports in daily basses (n (%))	47 (7.1)
Dairy products (n (%))	5 (7.1)
Vitamin D deficiency (n (%))	56 (80)

Almost (5.6%) which indicates to (n = 6) of patients were at least one way classified as at hazard for fractures. While the proportion of patients who were at risk of developing a fracture of the left hip (measured by DXA) was at (1.4%) in indicates to (n = 2). Also, the proportion of patients with a lower risk of fracture was at (28.5%) indicates to (n = 20). Thus, the average age of patients who were at risk of fractures was (64) years. On the other hand, blood tests did not show any hazard of a fracture in all participants.

Contrastively, no significant differences were detected for the variables of: BMI, cigarette smoking, rheumatoid, or hyperparathyroidism. Significantly, (degree T> −1.0 SD) at (5.7%) previous fractures (n = 4) were found among patients who reported normal bone

measurements. Table (1)shows patients' characteristics.

Table (2) indicates to lumbar spine and hip T-scores (measured by DXA) distribution according to existence of osteopenia or osteoporosis as defined by (WHO), whereas, (2.5) standard deviation (SD) or lower the T-score is considered to be osteoporosis. Hence, the normal range of T-score is at (−1.0) SD or above, while a T-score is between (−1.0) and (−2.5) SD as being stated to be as osteopenia.

Table 2: Mean, Min and Max for lumbar spine and hip T-score

Item	Mean	Min	Max
lumbar spine T-score	-2.06	-4.8	0.7
Hip T-score	-0.79	-3.4	0.7

These statistics are therefore to distinguish patients who suffer osteoporotic fractures or not.

Moreover, table (3) shows lumbar spine and hip BMD which were applied within the Mean, Min and Max as illustrated below.

Table 3: Mean, Min and Max for lumbar spine and hip Bone Mineral Density (BMD).

Item	Mean	Min	Max
lumbar spine BMD	0.85	0.52	1.24
Hip BMD	0.92	0.4	1.35

While table (4) shows that P-values were not statistically significant when comparing those who reported osteoporotic fractures (OF) from those who did not.

Table 4: P-values for lumbar spine and hip BMD osteoporotic fractures (OF).

Item	Mean	(OF)	No (OF)	p-Value
Lumbar spine T-score	-1.21	-1,71	-1.82	0.093
Hip T-score	-1.02	-0.74	-1.43	0.214

Table 5: Mean, Min, Max for bone markers blood tests.

Item	Mean	Min	Max	Normal Range
calcium	2.6	1.2	3.2	2.2-2.7mmol/L
magnesium	1.8	0.6	2.9	1.5-2.5 mEq/L
vitamin D	16	8	32	20-50 ng/mL

On the other hand, table (5) shows that

laboratories bone markers blood tests were implemented on all participants. Mean, Min, Max as well as normal range for calcium, magnesium and vitamin D were documented.

Bone markers blood tests were compared to the participants who suffer osteoporotic fractures (OF) from those who do not, and p-values were not statistically significant for all three tests. Still, participants with normal BMD, osteopenia or osteoporosis according to hip and lumbar T-score have shown no correlation with any of the blood tests

DISCUSSION

Having investigation been done in this study, various methods for detecting osteoporosis and osteoporosis were investigated. Basically, and in particular, the researchers compared the gold standard DXA to bone marker blood tests. Furthermore, it has been assessed the association of the two tests for participants who reported fracture osteoporosis from those who did not.

No correlation between T-scores measured by DXA at all sites (hip and lumber spine) was detected, as well as DXA was unable to distinguish between participants who reported the illness from those who did not in terms of osteoporotic fracture, as previously reported in other studies.

Undoubtedly, and in fact discreetly, osteoporosis fracture may also occur with normal or decreased BMD measured by DXA in other pieces of research. In previous ones, there was a relationship among patients assessed by DXA (in both the hip and the lumbar spine) and bone marker blood tests ad well. However, the current data found nothing about any correlation between the two methods (Kanis and Glüer , 2000 and Promotion I of M (US). D of H, Prevention D, 1992.

Put it importantly, osteoporosis has been well-defined by WHO based on DXA measurements. This procedure is the most generally investigative one used for measuring BMD and T-score and the only deep-rooted for osteoporosis and osteopenia diagnoses. DXA can therefore, at clinically appropriate places in cases of major clinical moments as in fracture (Sözen et al., 2017), offer specific measurements. Dissimilarity, the DXA has significant drawbacks to being non-portable, relatively expensive, as well as uses low-dose radiation. Other bone condition assessment techniques are to be improved using blood tests to assess future fracture risks. The ability to detect fracture risks using a satisfactory way for patients who are not aware of DXA scans (Stewart et al., 2005) is being as pros of such technologies.

Upon being reported previously, there are several studies comparing DXA and blood tests, methods revealed that BMD adopting DXA correlate well with blood marker test factors. Conversely, the core of the matter is whether these bone marker factors predict the inclination for skeletal fractures or not.

CONCLUSION

Nevertheless the DXA and Bone marker tests measure various bone features, integrated data achieved by the bone marker may characterize a sensible alternative due to the quality of the bone structure may clash with the BMD measurement that only identifies bone density.

Ultimately, the foremost limitation of this study was the small-sized sample of the participants involved .Additional studies are needed to examine the possible of this alternative and promising method.

CONFLICT OF INTEREST

The authors declared that present study was performed in absence of any conflict of interest.

ACKNOWLEGEMENT

AUTHOR CONTRIBUTIONS

The research was supervised by Mahmoud Diab. M. Almatari designed experiments and reviewed the manuscript. Ali Alghamdi, Osama Almer, Magbool Alelyani and Abdullah Alasadi data collection and data analysis. All authors participated in writing the manuscript. All authors read and approved the final version

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