

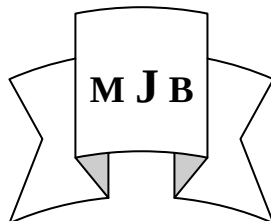
Quantitative CT Scan in Diagnosis of Osteoporosis in High Risk Patients in Babylon, IRAQ

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Abstract

The measurement of bone marrow density is one of best ways for diagnosis and monitoring of bone health, the bone mineral density of hip and spine is most commonly used because they are of great risk of fractures

For analysis of the bone density T score and Z score are used ,T score is derived by comparing BMD to BMD of healthy adult of the same sex[25 years age],and Z score with same age group .

for evaluate the bone density measurement by Cat scan densitometry as alternative tool of DEXA machine for diagnosis of osteoporosis in Babylon province in different age groups and risk groups 120 patients from both sex had been evaluated for osteoporosis in Merjan teaching hospital between 2009 and 2010 using quantitative CT Scan densitometry all were at risk of osteoporosis because the post menopause age or with other risk factors ,steroid usage patients ,connective tissue disorders or other illness that result in osteoporosis.

The female patients were [90]75% and the male were[30]25% All the patients that exposed to the test lumbar spine between L3 and L5 with average result of T and Z score ,the age was range from 18-84 years and the mean age was 63+ -,53[44.1%] of them were without any risk factors [only female post menopause age above 60 ,35[29.1%] patients were on steroid drugs at least was for one year period ,21[17.5%] patients were suffer from connective tissue disorders ,15[12.5%] were rheumatoid arthritis,5[4.1%] patients were lupus and 1 patient was Sjogerns disease.

The result of T score for all patients was 45.4%was less than-2.5, 48%of them were between -1 to -2.5and only 6.6% was less than-1. The CT for detection of osteoporosis is important tool for diagnosis of osteoporosis and its structural changes in the vertebral spine.

Keyword: Osteoporosis, QCT scan, Babylon, bone mineral density [BMD].

الخلاصة

قياس كثافة العظام من الطرق الجيدة لدراسة صحة العظام ومراقبتها وخصوصا لمنطقة الحوض والفقرات القطنية لأنها الأكثر تعرضا للإصابة بالكسور ،ولتحليل كثافة العظام تستخدم نتيجة عوامل T و Z ولغرض قياس هذه العوامل يستخدم جهاز المقياس الكمي بدلا عن جهاز قياس كثافة العظم الشعاعي الثنائي عند المرضى المعرضين بالإصابة بترقق العظام ومضاعفاتها في العمود الفقري في مستشفى مرجان التعليمي في محافظة بابل ولقد تم فحص ١٢٠ مريضا من كلا الجنسين في عامي ٢٠٠٩ و ٢٠١٠ ولقد تم فحص مرضى معرضين للإصابة بخلوطة وتم فحص ٩٠ امرأة و ٣٠ رجلا وتم قياس كثافة العظام في الفقرات القطنية والكشف عن التغيرات التركيبية وتراوح عمر المرضى بين ١٨ إلى ٨٤ سنة مع معدل عمري ٦٣-١٠،٤٤%من المرضى كانوا نساء في سن اليأس و ٢٩،١%من المرضى يستخدمون علاجات الستيرويدات لمدة لا تقل عن عام و ١٧،٥%كانوا يعانون من الأمراض الروماتيزمية وكانت النتائج للمرضى بشكل عام ،عامل T أقل من -٢.٥ اثر ٤٥،٤%من المرضى ووبين -١ الى -٢.٥ اثر ٤٨%من المرضى وواقل من -١ اثر ٦،٦%منهم المرضى وان استخدام فحص المقياس الكمي أكثر دقة في تشخيص التغيرات التركيبية للفقرات القطنية والكسور الانكسارية لمرضى ترقق العظام من أجهزة فحص العظام الشعاعي الثنائي.

Introduction

Osteoporosis is disease defined by [WHO]women with bone density 2.5 standard deviations below peak bone mass [20 years old healthy female averaged]as measured by DEXA ,the term established osteoporosis include the presence of fragility fracture[1].

It is most common in women after menopause and it is called post menopausal osteoporosis but it may be developed also in men and it can occur at any age when a particular hormonal disturbance or other chronic illness or result from medications specially corticosteroids, it may be affect the life expectancy and quality of the life because the fractures [2].

It can be prevented by change in the life style and some time medications; the osteoporosis is a component of fragility syndromes [3]

The underline mechanism in all causes is imbalance between bone resorption and bone formation, in normal bone 10% got remodeling at any time in any point[4].

Three mechanism for the development of osteoporosis that include inadequate peak bone mass ,excessive bone resorption and inadequate formation during remodeling ,the interplay of these lead to the development of the fragile bone [3],in addition estrogen and calcium play significant role in bone formation.

Bone mineral density [BMD]test is one of the best and the most common way to monitor bone health ,[BMD]help doctors to predict the like hood of having fractures and repeated test will allow fallow up ,The BMD of the hip and spine is most common used because they are of great risk of fractures[4] .

For the analysis of the bone density T score and Z score are used ,a T score is number derived by

comparing the BMD of the patient to the average score for healthy adult of same sex and race who had reach their peak bone mass (usually around the age of 25).

The T score signifies how far the patient from normal, it can become low as one standard deviation [SD] a statistical term] below the normal and still considered healthy patient with T score between 1SD-2.5SD have osteopenia and considered at high risk.

The risk factors for osteoporosis may be modifiable or non, the non modifiable are advance age in both sex, female sex, estrogen deficiency, family history and heritability [5]

The potentially modifiable include alcohol excess, vitamin D deficiency, tobacco smoking, malnutrition, high protein diet heavy metals excess physical activity and soft drinks and caffeine [4, 5].

There are certain disease such as endocrine disorder and rheumatological disorder and renal and hematological disorders also risk factors [6].

DEXA[dual energy x ray absorobmetry] entails extremely low radiation doses at between 1 and 6 μ Sv per site examined, equivalent to about 3 hours of background equivalent radiation (BER approximately 2400–7200 μ Sv, depending on geographic area). The radiation dose from QCT is higher but still compares favorably with conventional radiographic exposures. Using a low kV, the dose for QCT (including the initial scout view) will be approximately 90 μ Sv [7]

QCT uniquely allows for the separate estimation of trabecular and cortical BMD and provides a true volumetric density in g l⁻¹ (mg cm³), rather than the 'areal' (mg cm⁻²) of DEXA. QCT is therefore not size dependent; it is of particular relevance

in children and in diseases which result in small stature (Turner's syndrome, growth hormone deficiency, ill health). The technique is generally applied to the lumbar spine. A lateral projection radiograph is obtained, and for 2D QCT a plane is selected (10 mm slice) through the middle of each vertebra, generally T12-L3, parallel to the end-plates [8]. If vertebral fractures are present, thinner (5 mm) sections may be required to avoid including the vertebral end-plate in the section, which will cause overestimation of BMD(9). A low dose technique (80kV, 70 mA, 2 seconds) can be used to reduce patient radiation dose[9] The entry of the basivertebral vein on the transverse axial section confirms the section to be in the mid plane of the vertebral body ,An oval region of interest to include as much of the vertebral trabecular bone as possible, without including the cortical rim or basivertebral vein, is selected for analysis.

The WHO has established the following diagnostic lines for the diagnosis of osteoporosis

***T score-1.0 or greater is normal**

***T score-between -1.0 and -2.5is low bone mass or [osteopenia]**

***T score -2.5 or below is osteoporosis** [3]

The international Society for clinical densitometry takes the position that a diagnosis of osteoporosis in men under 50 years of age should not be made on the basis of densitometric criteria alone ,for premenopausal women ,Z score should used rather T score [10]

The preventive services task force in USA [USPSTF] recommended in 2002 that all women 65 years of age or older should with bone densitometry and women between the age of 60-64 who at increased risk like lower body weight [weight<70 kg] with less

evidence for smoking or family history and the clinical prediction rules are available to guide this screening [11]

For men screening where reported prior fracture began at age 65 years and for men 80 years and older with no prior fracture[12].

Aim of the Study

To evaluate the bone density measurement by Q CT Scan densitometry as alternative tool of DEXA machine for diagnosis of osteoporosis in Babylon province in different age groups and to find the structural changes in the parts of the lumbar spine result from osteoporosis.

Patients and Methods

120 patients from both sex had been evaluated for osteoporosis by Q CT by one arm study in Merjan teaching hospital between 2009 and 2010 using quantitative CT densitometry .ethical approval from all patients had been taken . The study was performed using QCT, PHILIPS Brilliance 16, using Philips calibration phantom contain water equivalent & 200 mg hydroxyapetite equivalent , A lateral topogram was obtained for slice selection, & for detection of vertebral collapse (if present this vertebra not used in the evaluation), a single 8mm slice was obtained at the mid vertebral level of each L4&L5 vertebral bodies ;the slice was obtained parallel to end plates. A single energy beam of 125 KVp & 250 mAs was employed , an average reading of all 2 vertebrae was obtained .if compression of a vertebra was evident on topogram, the L1& L2 was used instead.BMD was evaluated using PHILIPS osteoCT EVAB software. North American normative data was used as reference for BMD measurements

All were at risk of osteoporosis because the post menopause age,

steroid usage, connective tissue disorders or other illness that result in osteoporosis.

The female patients were [90]75% and the male were[30]25% ,all were got lumbar spine X ray and simple routine investigation all were screen for osteoporosis using [WHO] criteria of T and Z score ,all were screen for one time during this study ,no one had done the screen before From all 15 was on the treatment of osteoporosis depending on X ray findings or because long steroid therapy ,the patients characteristics 'are shown in table [1].

All the patients that exposed to the test lumbar spine between L3 and L5 with average result of T and Z score The patients who gets fractures with X ray were recorded and compared with patients whom found to fractures on CT densitometry .

The patients whom taking steroids were recorded and the period if more than one year or less and the cause of taking steroid.

Results

From 120 patients 90[75%] were female and 30[25%] were males ,the age was range from 18-84 years and the mean age was 63+ - [5] ,53[44.1%] of them were with primary or secondary menopause any risk factors [only female post menopause age above 60 ,35[29.1%] patients were on steroid drugs at least was for one year period ,21[17.5%] patients were suffer from connective tissue disorders ,15[12.5%] were rheumatoid arthritis,5[4.1%] patients were lupus and 1 patient was sjogerns disease.

Others cause for screen were found in 15[12.5%] patients, 2 multiple myeloma,6 patients were lymphoma ,4 patients were diabetes with complication and 3 patients were suffer from secondary malignances , 10 patients were already on treatment on bisphosphonate based X ray finding but reading before from all patients 13[10.8%] patients were found to got fractures at level between L 3-5.

The result of T and Z score for all patients were shown in table [2]

Table 1

<i>Patients characteristics'</i>	
total	120 patients
female	90 [75 %]
male	30[25%]
Body mass index average	32.2 kg\m2
Mean age	63-\+5 years
Treated patients for osteoporosis	18% form total patients
Menopause patients	44%
Inflammatory disorder patients	12.5%
Steroid ingestion patients	21%
Male above age of 70%	5%
Premenopausal female with family history of fracture	5%
Other causes	12.5%

Table 2

<i>Patients</i>	<i>Less than -2.5 %</i>		<i>-1 to -2.5 %</i>		<i>Less than -1 %</i>	
<i>total</i>	T	45.4%	T	48%	T	6.6%
	Z	13.3%	Z	53.3%	Z	33.4%
<i>Fractures patients</i>	T	100%	T	0%	T	0%
	Z	39.1%	Z	53.3	Z	7.6%
<i>Steroid ingestion</i>	T	71.4%	T	22.7%	T	5.9%
	Z	22.5%	Z	77%	Z	7.5%
<i>Postmenopausal patients</i>	T	58.4%	T	33.8%	T	7.8%
	Z	7.7%	Z	67.8%	Z	24.5%

The figures that show the relation of the bone density with groups age of the patients are shown below

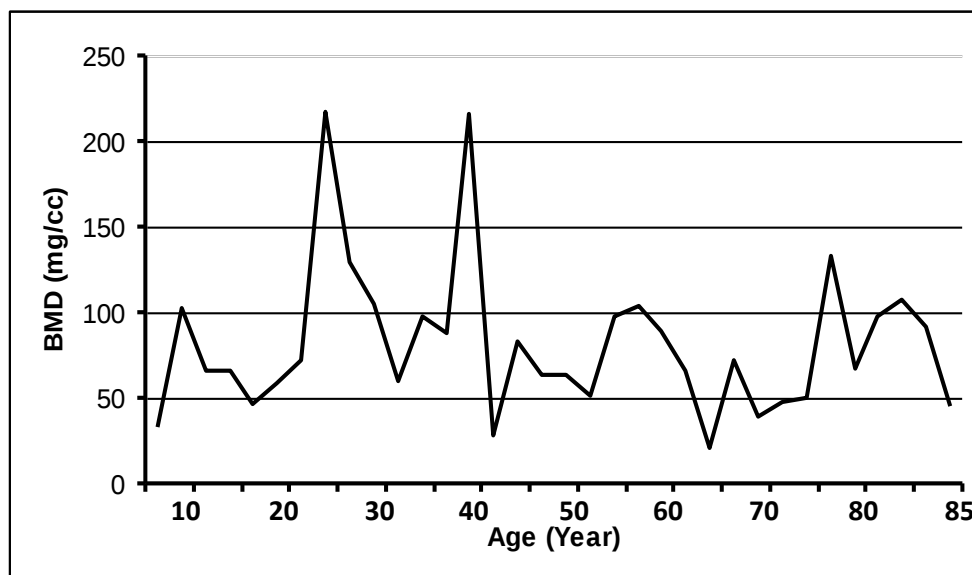


Figure 1 for total patient ,bone density in relation to age

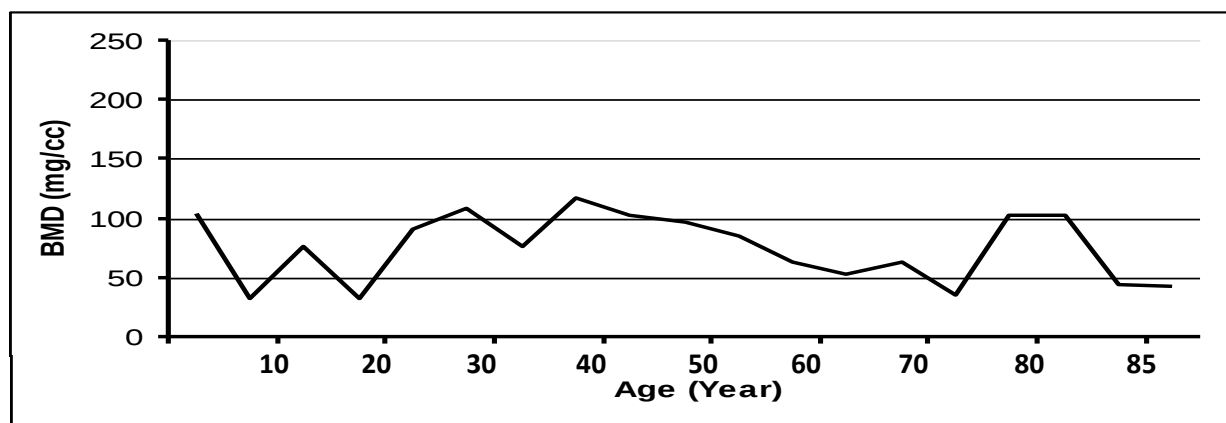


Figure 2 bone density for fractures patients group in relation to age

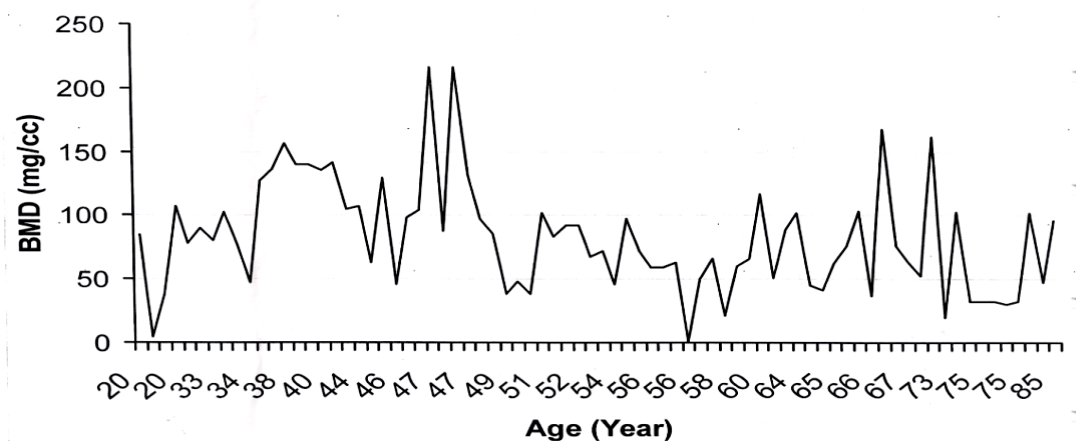


Figure 3 bone density for steroid induced osteoporosis group in relation to age

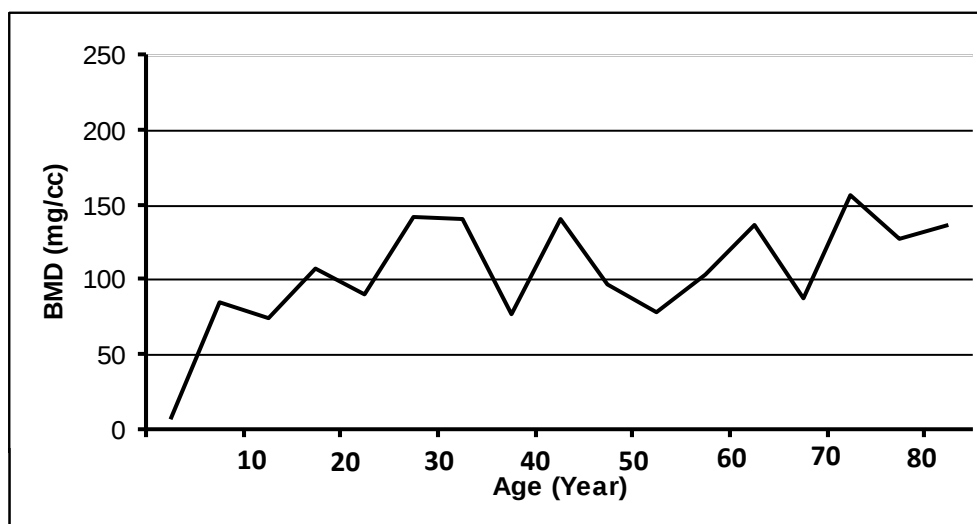


Figure 4 bone density for menopausal patients in relation to age

Discussion

This study we used the CT in diagnosis of osteoporosis in high risk groups of patients, we used the Z and T score criteria for the diagnosis, it also used for the diagnosis of the structural damages that happen in the vertebrae which is not available in DEXA machine ,this very important in cases of secondary osteoporosis

We measure the Average bone density at the level of L3-5,in this study we don't screen the general population for the of disease ,we screen those population because they at high risk of complication of the illness and not make par den on the department of radiology in hospital , There large Varsity of different modalities used in the diagnosis from plain X-ray and DEXA –based and CT and MRI haven been used to assess bone structure at micro and macro level however the most dynamic development can observed in the field is CT. they are widely available and easier to operate [13].

At the spine the cross section area of the vertebral body [macrostructure] is the area of interest in the use of the advance CT [14]

The osteoporosis cause over 700.000 vertebral fractures each year in U.S.A [2004]

The osteoporosis report as the cause for 70% of fractures for population over the age of 45 years [NIH osteoporosis &related bone disease-national recourse]

Approximately 10.29% of US population got definite osteoporosis and about 18 millions were undiagnosed cases [low bone mass] this mean that osteoporosis usually under estimated disease we try in this study to evaluate the risk groups and also got the prevalence of fractures in those [12] With increasing the age [over 80 years]70% of white females had got osteoporosis ,the disease and manifestation [fractures] that why it's important for screening the disease and its complication ,we try in the next step to do general population screen and diagnosis

In our study 53.3%of patients got definite osteoporosis and 27.6% of them got low bone density ,10.8% of patients got vertebral fractures at level of the lumbar spine that assess by C.T ,4 of them they got fractures of other site, all these cases had got established osteoporosis

Conclusion

The QCT scan measurement is important tool use in diagnosis of structural changes result from

osteoporosis in the vertebral column of patients with high risk of osteoporosis which cannot detected by DEXA machine but still carry risk of radiation.

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