American Journal of Psychiatric Rehabilitation

Expert Opinion Article

Assessment of Bone Mineral Density by CT Hounsfield Units in Lumbosacral Spine

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Abstract

Background: Osteoporosis, a condition leading to reduced bone mineral density (BMD) and increased fracture risk, remains a significant public health concern. While dual-energy X-ray absorptiometry (DXA) is the standard for BMD assessment, its limitations include limited accessibility and inability to provide localized bone quality data. Computed tomography (CT), through Hounsfield Unit (HU) analysis, has emerged as a viable alternative for evaluating BMD in the lumbosacral spine. This study investigates the utility of routine CT imaging in estimating BMD using HU values.

Methods: Conducted as a prospective, cross-sectional study on 193 subjects at Teerthanker Mahaveer Hospital, Moradabad, U.P., this research involved patients undergoing CT scans for clinical purposes, specifically of the abdomen and KUB region. Multiplanar reconstruction (MPR) was utilized to examine the lumbar spine in axial, sagittal, and coronal planes. HU measurements were obtained from the trabecular regions of T11, T12, L1, L2, L3, and L4 vertebrae. Correlations between HU values and DXA-derived BMD measurements were analyzed, alongside factors influencing HU variability, including age, sex, and spinal pathologies.

Result: The mean age of participants was 40.72 years (SD = 14.96), with 53.8% males and 46.2% females. Results demonstrated a decrease in HU values with increasing age for most vertebrae, except L1. The highest HU value was observed at T11 (156.80), while L3 exhibited the lowest (137.03). A statistically significant positive correlation ($p < 0.05$) was found between HU values across vertebrae.

Conclusion: This study highlights the potential of CT-derived HU values as a cost-effective, accessible tool for opportunistic osteoporosis screening. By incorporating HU analysis into routine CT protocols, clinicians can enhance early osteoporosis detection and management without additional patient burden. The findings emphasize CT's role in improving bone health outcomes and reducing fracture risks.

Keywords: Quantitative Computed Tomography (QCT); Bone Mineral Densitometry (BMD); Osteopenia; Osteoporosis;

Introduction

Bone mineral density is a measurement of the bone health, which tells us about the health of bone of an individual. This is done by measuring the amount of minerals (especially calcium and phosphorus) in a certain volume of bone. It changes as per age and sex of the individual and as puberty begins, the BMD levels start increasing in the body and are maximum at the 3rd decade of life. As the age increases body starts losing the bone density as hormones like testosterone in males and estrogen in females drop down which play an important role in the maintenance of the bone health. On the basis of this result the bone is categorized as normal, osteopenia and osteoporosis **(Kranioti et al., 2019).** Osteopenia is a condition in reference to the bone mineral density, which indicates that the bone have started losing their density and are getting weaker **(Karaguzel and Holick, 2010).** Osteoporosis is a term used to describe the loss in bone density which results in decreased bone strength and the bone becomes prone to fracture (T Sözen et al., 2017).

In the early days of the radiographic cortical morphometry of the second Meta carpal of the non-dominant hand were measured by single and dual energy photon absorptiometry which uses a radionuclide source. In 1980s, DXA (dual energy x-ray absorptiometry) became the replacement for radionuclide source **(Engelke et al., 2008a).** After the development of CT scanner which uses ionizing radiation to produce cross sectional images of an object, QCT (Quantitative Computed Tomography) began to develop, but due to the lower ionizing radiation in DXA and its use in epidemiological and pharmaceutical studies, QCT was not used any longer. With the development in new software and lower radiation doses in CT scanner, the use of QCT in musculoskeletal studies increased. **(Engelke et al., 2008b; Goldman, 2007).** QCT is used to measure the bone mineral density (BMD) in the tibia, forearm, proximal femur and spine along with the advantage

of being a three-dimensional and non-projectional method **(Rüegsegger et al., 1974)**.

QCT uses transmitted x-rays from the patient body to know the linear attenuation coefficient in reference to the water HU (0). The denser area has higher attenuation as they absorb more radiation like bone so their HU value is more, whereas areas like soft tissue have lesser density and have low x-ray attenuation and have low HU values. Now to use this HU into bone mineral equivalent (mg/cm^3) **(Engelke et al., 2008b)**

However, as per WHO, DXA is the best modality available today for the assessment of BMD and help on scanning of Osteoporosis and Osteopenia. This modality works by emitting 2 low dose of X-ray which are differently absorbed by bone and soft tissue. The different in attenuation is used to calculate the BMD. The radiation dose in DXA is very low as low as 10% of a normal chest radiograph. Hip and Lumbar spine are usually used which takes about 5-10 min. the result of DXA appears as T-score and Z-score**.(Lorente-ramos et al., 2011)**

The aim of this study is to investigate the usefulness of routine CT for the estimation of BMD using CT HU values by finding correlation between QCT values and HU values. Thus, BMD of patients can be measured during undergoing CT abdomen, KUB or other examination that cover the lumbar region. So, BMD can be measured without the use of any expensive software or DXA modality which can make it economical for general public.

Material and methods

Sample

This was a clinical based prospective and cross-sectional study conducted on total of 193 patients, out of which 156 patients (including both genders) were in the inclusion criteria and 37 were in the exclusion criteria. The duration of the study was March 8, 2021 to March 9, 2021, which was conducted at Department of Radio-diagnosis imaging, Teerthanker Mahaveer Hospital (TMU), Moradabad, U.P. The source of the data are the patients that are referred to Radiology department for CT examination of abdomen and KUB region. Both OPD and IPD patients along with the patients with back pain are included in the study. The sampling criteria used in this study was convenient sampling. The exclusion criteria were the patients with different deformities related to the spine, mainly on the lumbar region and patients below the age of 18 years. Some of the major findings in the exclusion criteria are Lordosis, Potts disease, Lumbar fracture, HNP (herniated nuclear pulposes), Lumbar spine stenosis (LSS), Scoliosis and patients with Vertebroplasty.

Method of Data Collection

The patients were informed about the study and consent was also signed. Phillips Ingenuity core 128 slice CT modality is used for the research. The patients who came to the radiology department for the CT examination of KUB, Abdomen or the scan which covers the lower thoracic and lumbar region are selected for the research. History of the patients is taken which include questions like.

- History of Back pain.
- History of any injury to the spinal region(lumbar)
- If the patient is vegetarian or not
- History of TB

Technique of Measurement

The collected data of the patient was viewed on the MPR (multi planar reconstruction) for proper visualization of the lumbar region in the 3 planes (Axial, Sagittal, and Coronal). This also helps in easy location of the exact vertebral column. Bone window was selected for better enhancement of the spine. 5 vertebras T11, T12, L1, L2, L3 and L4 are selected individually one at a time. An oval ROI (region of interest) was selected and drawn at the trabecular anterior part of the vertebrae. The ROI was of exact $100mm^2$ and was kept the same for all the measurements. The software shows the Area, Average, and standard deviation of the selected ROI. These readings were noted down and further taken into consideration for the evaluation of the research. Similarly ROI are placed at the vertebrae and readings are taken.

Statistical Analysis

All the data collected is compiled in Microsoft Excel work sheet. The statistical analysis is calculated by using SPSS (statistical package for the social services) version 23. Total mean and SD of the T11, T12, L1, L2, L3 and L4 regions are calculated respectively. Independent t test, one way ANOVA and Pearson correlation coefficient of different parameters was calculated. The significance level was (P=0.05).

Results

This cross-sectional prospective study was done on total 156 patients which were referred to the radiology department at Teerthanker Mahaveer Hospital under the aegis of College of Paramedical Sciences, Teerthanker Mahaveer University, and Moradabad.

The Table 5.1 shows the frequency and percentage of male and female which are total 156 patients. The mean age was 40.72 years [SD=14.96] in which 84 (53.8%) were males and 72 (46.2%) were females. The value of percentage and frequency is shown as a pie chart in graph 5.1

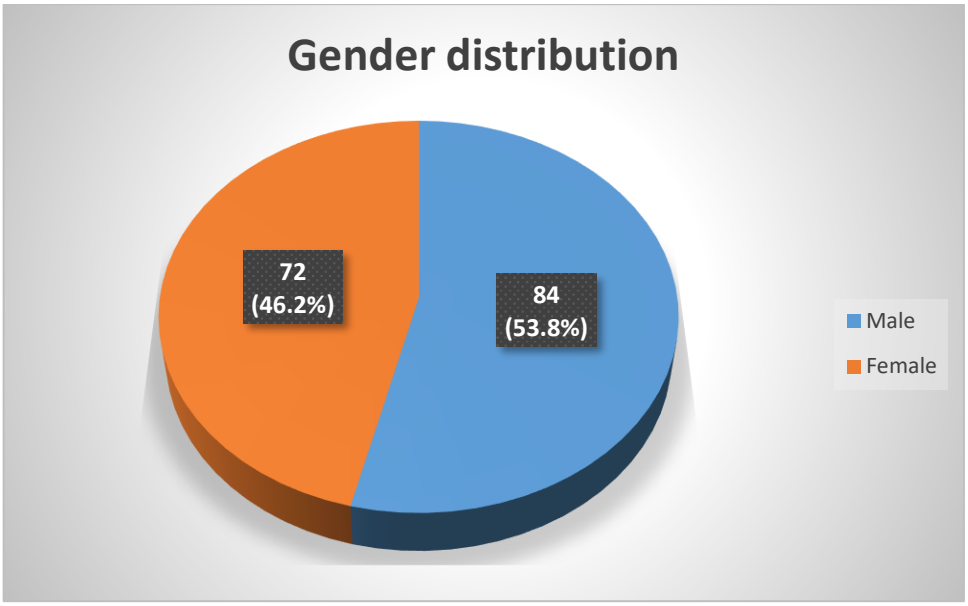
Table5.1:
Tables

(n = 156)		Frequency	%
Gender	Male	84	53.8
	Female	72	46.2

(n = 156)	Mean	S.D.
Age	40.72	14.96

Table5.1: Representation of males and females

Graph 5.1:



Graph 5.1: Represents the total distribution of males and females.

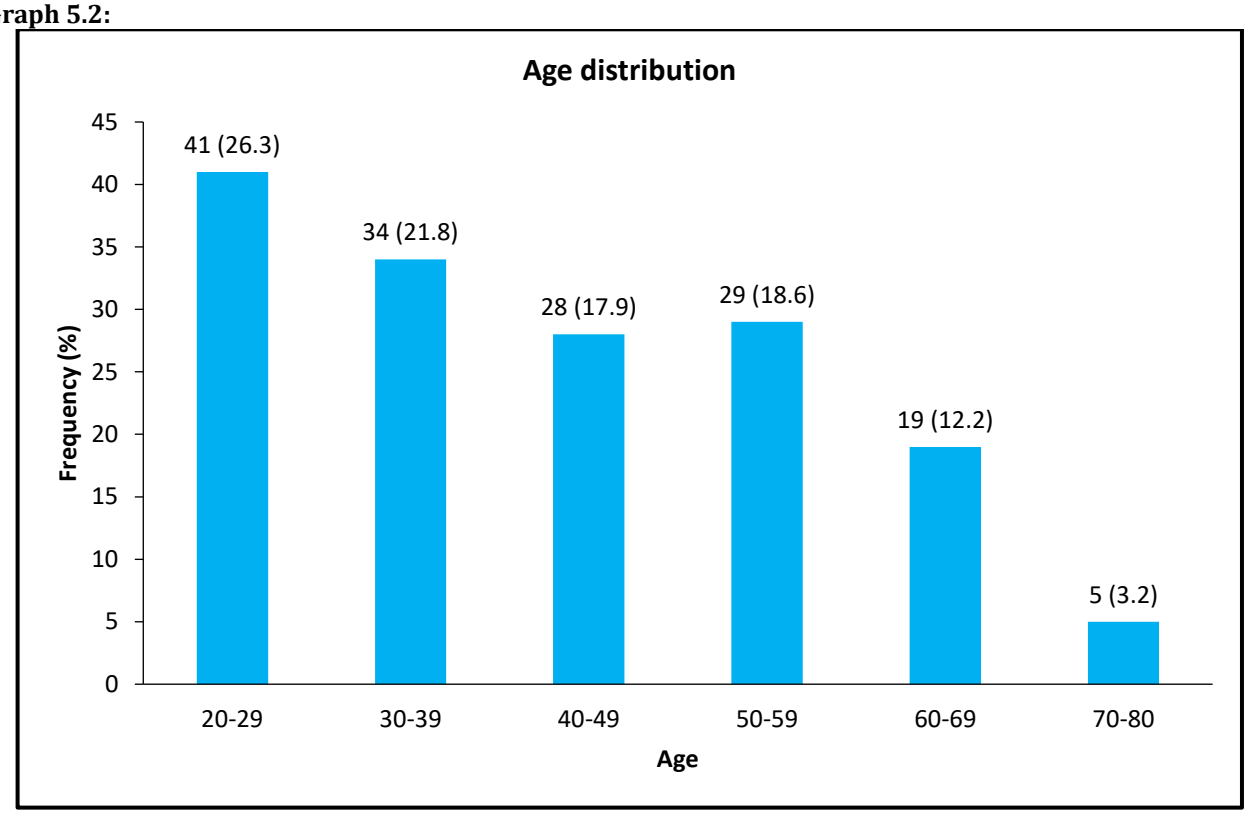
The data collected was divided into different age groups with an equal class interval of 9 years (Table 5.2). The youngest patient was of 21 years and the oldest was of 80 years. Age group 20-29 years have the highest number of patients 41 (26.3%) out of 156. While age group 70-80 years have the lowest count of patients 5 (3.2%). The graphical representation of age distribution is shown in Graph 5.2.

Table 5.2:

(n = 156)		Frequency	%
Age	20-29	41	26.3
	30-39	34	21.8
	40-49	28	17.9
	50-59	29	18.6
	60-69	19	12.2
	70-80	5	3.2

Table 5.2: Representation on the basis of different age groups.

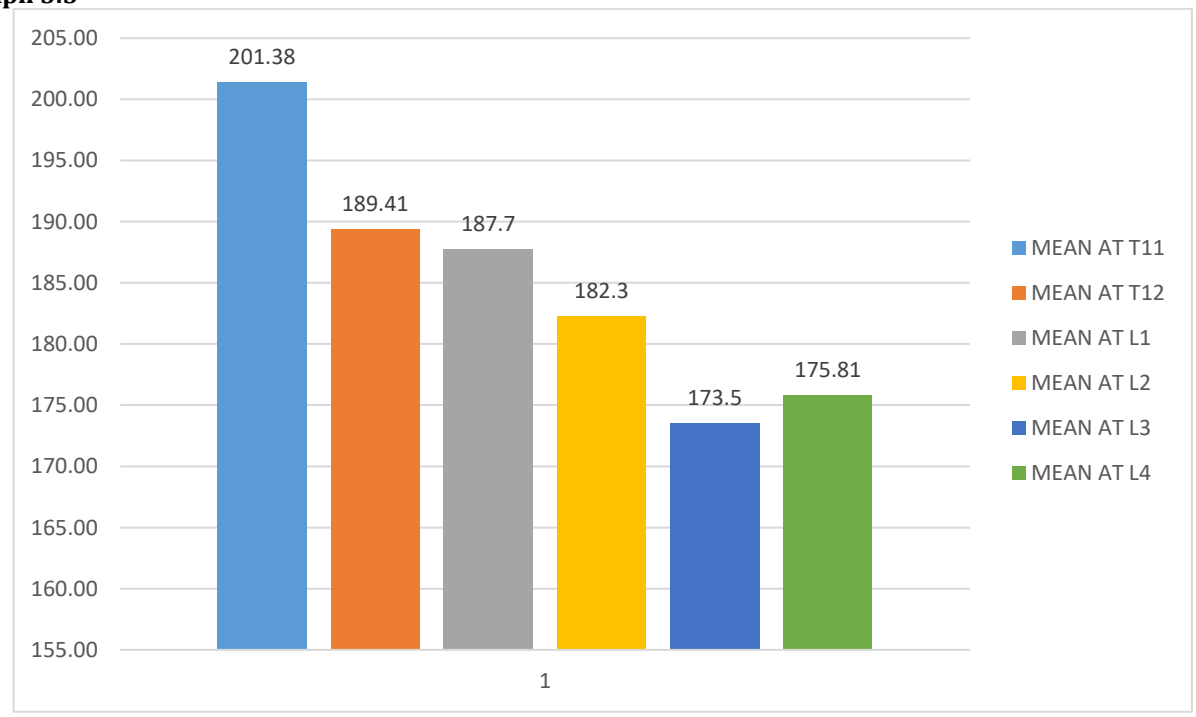
Graph 5.2:



Graph 5.2: Representation of age distribution

The mean value of HU was calculated for T11 to L4 vertebrae. The results showed that the T11 has the highest value of 201.38, whereas L3 has the lowest value 173.5. It can be clearly seen in Graph 5.3 that the values decrease as we go down to the vertebral column. The HU values of L4 shows a slight increase in comparison to the L3.

Graph 5:3



Graph 5:3 Representation of mean HU values for different vertebral bodies

As per the data collect, we have taken the values of HU at different vertebral levels like T11, T12, L1, L2, L3 and L4.

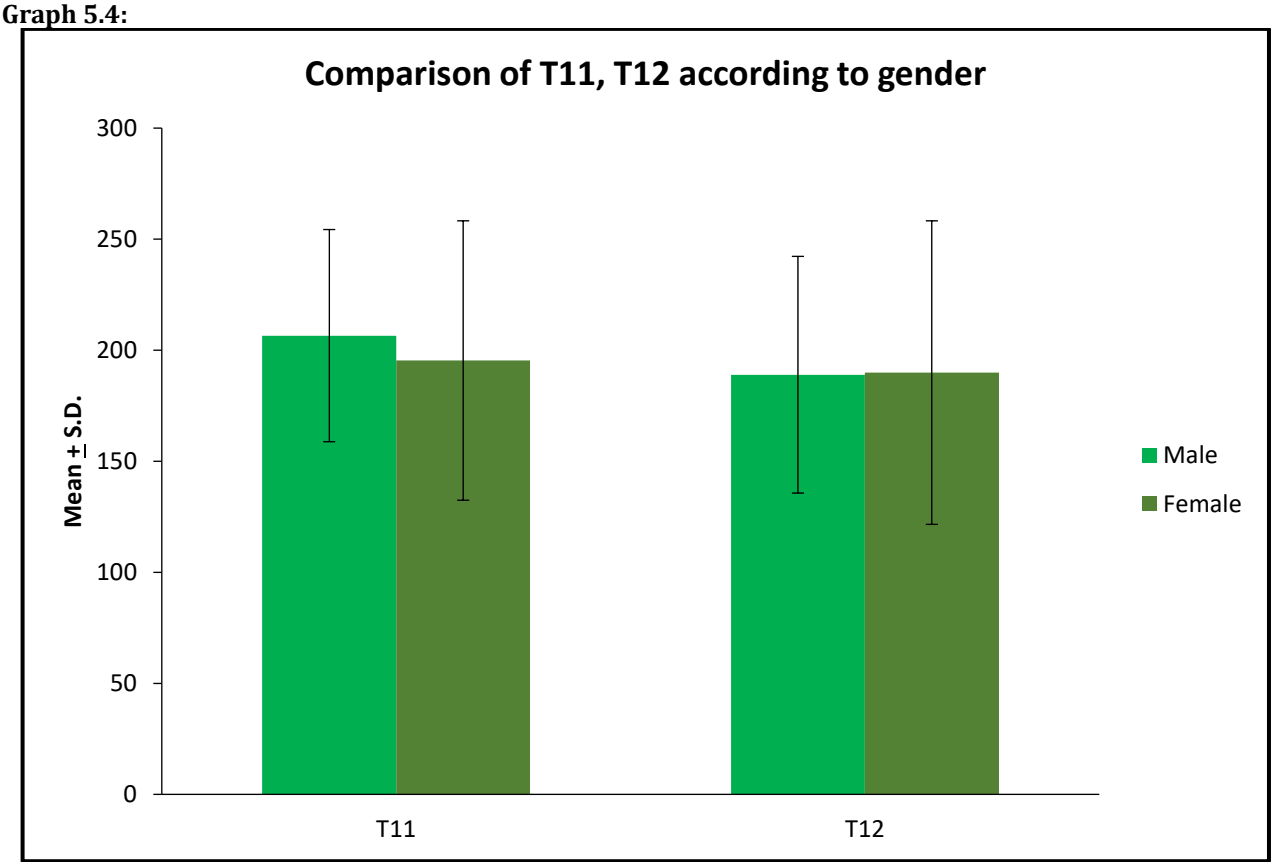
Table 5.3:

		MEAN AT T11	MEAN AT T12
N	Valid	156	156
Mean		201.3838	189.4081
Std. Deviation		55.36551	60.48646
Minimum		58.03	-3.70
Maximum		327.88	388.70

Table 5.3: Representation of mean HU of T11 and T12

The Table 5.3 shows that the mean values for T11 was 201.38 [SD=55.36] with minimum value 58.03 and maximum value 327.88. Whereas for T12 the mean value was 189.40 [SD=60.4] with minimum value -3.70 and maximum value 388.70.

Graph 5.4:



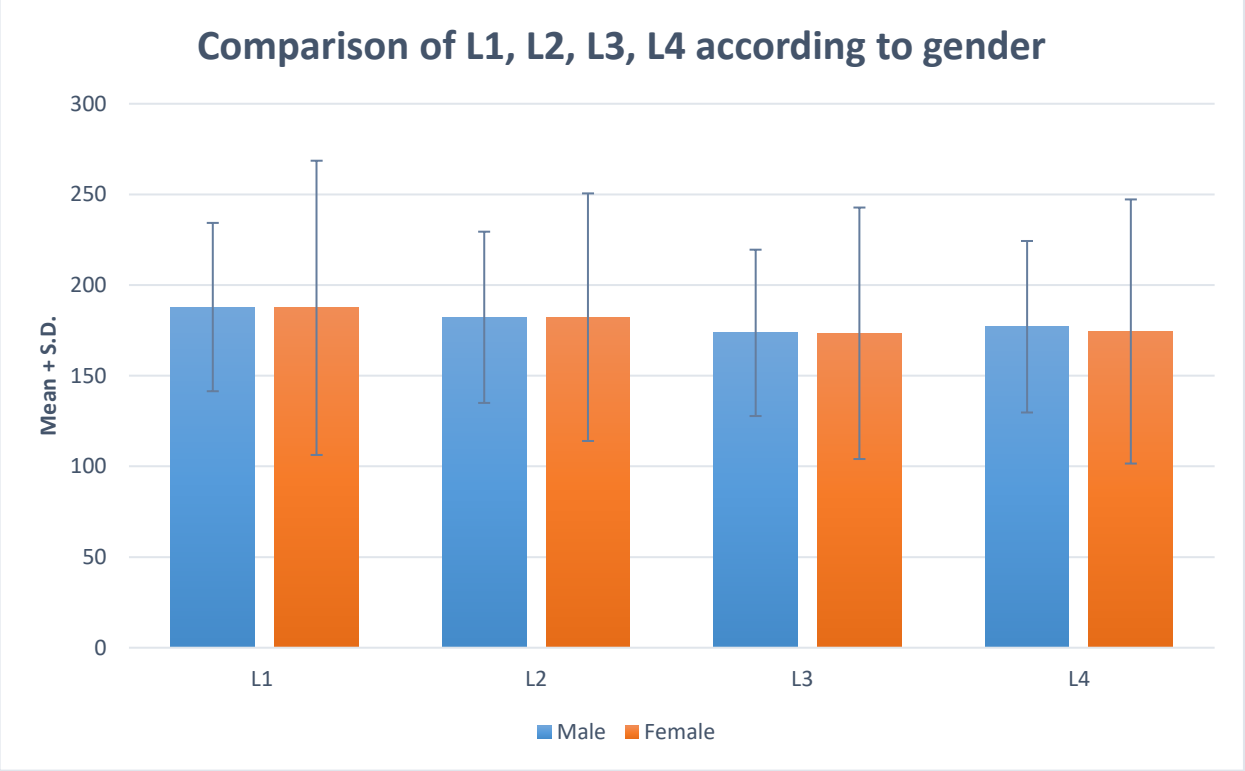
Graph 5.4: Comparison of T11, T12 according to gender.

Table 5.4: Representation of mean HU of L1, L2, L3 and L4

		MEAN AT L1	MEAN AT L2	MEAN AT L3	MEAN AT L4
N	Valid	156	156	156	156
Mean		187.6703	182.2515	173.5338	175.8101
Std. Deviation		64.57745	57.70303	57.70880	60.24802
Minimum		26.63	44.96	47.92	30.67
Maximum		593.70	321.80	312.60	314.26

The Table 5.4 shows that the mean values for L1 was 187.67 [SD=64.57] with minimum value 26.63 and maximum value 593.70, for L2 the mean value was 182.25 [SD=57.70] with minimum value 44.96 and maximum value 321.80, for L3 the mean value was 173.53 [SD=57.70] with minimum value 47.92 and maximum value 312.60 and for L4 the mean value was 175.81 [SD=60.24] with minimum value 30.67 and maximum value 314.26.

Graph 5.5:



Graph 5.5: Comparison of L1, L2, L3, and L4 according to gender.

Table 5.5:

(n = 156)		Mean	S.D.	"t"	p value
Age	Male	41.05	14.27	0.291	0.772
	Female	40.35	15.81		
T11	Male	206.56	47.77	1.263	0.208
	Female	195.35	62.89		
T12	Male	188.97	53.27	-0.098	0.922
	Female	189.92	68.33		
L1	Male	187.87	46.42	0.042	0.967
	Female	187.44	81.15		
L2	Male	182.23	47.22	-0.006	0.995
	Female	182.28	68.28		
L3	Male	173.64	45.88	0.024	0.981
	Female	173.41	69.35		
L4	Male	177.02	47.30	0.271	0.787
	Female	174.40	72.84		

Table 5.5: Comparison of age, T11, T12, L1, L2, L3, and L4 according to gender

The Independent sample "t" test was used to compare age, T11, T12, L1, L2, L3, and L4 according to gender. There was no difference ($p > 0.05$) in age, T11, T12, L1, L2, L3, and L4 according to gender. The results show that at T11, L1, L3 and L4 vertebra of males have greater values than females with t values of 1.263, 0.042, 0.024 and 0.271 respectively. While the T12 and L2 vertebrae of females have greater value than males with t values of -0.098, -0.006 respectively.

The One-way ANOVA test was used to compare T11 and T12 according to age groups. There was a difference ($p < 0.05$) in T11 and T12 according to age groups (Table 5.6). The result shows that as the age increases the mean values for both T11 and T12 also decreases. For the age group 20-29 the mean values are the highest 240.31 [SD=43.20] at T11 and 228.97 [SD=51.79] at T12, whereas the values are lowest for the age group 70-80 with values 147.66 [SD=38.71 at T11 and 122.30 [SD=45.06] at T12.

Table 5.6:

Age (n = 156)	T11		T12	
	Mean	S.D	Mean	S.D
20-29	240.31	43.20	228.97	51.79
30-39	229.73	40.79	220.77	34.12
40-49	192.93	41.84	187.54	57.09
50-59	167.69	40.53	151.57	37.08
60-69	144.67	50.77	126.09	52.09
70-80	147.66	38.71	122.30	45.06
"F"	21.79		21.68	
p value	< 0.001*		< 0.001*	

(* Significant)

Table 5.6: Comparison of T11 and T12 according to age groups

Table 5.7:

Age (n = 156)	L1		L2		L3		L4	
	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D
20-29	229.29	37.77	229.12	43.38	223.16	41.88	224.88	48.48
30-39	227.02	73.74	213.57	34.73	202.52	37.06	206.24	36.52
40-49	177.20	42.70	173.31	40.45	165.49	38.03	166.58	45.11
50-59	146.52	36.00	140.00	37.90	128.86	34.94	132.93	41.61
60-69	119.58	46.35	120.82	41.55	111.20	44.61	114.09	43.48
70-80	134.82	44.22	113.62	56.80	110.56	46.84	101.33	16.83
"F"	22.63		33.60		36.367		31.025	
p value	< 0.001*		< 0.001*		< 0.001*		< 0.001*	

(* Significant)

Table 5.7: Comparison of L1, L2, L3, and L4 according to age groups

The One-way ANOVA test was used to compare L1, L2, L3, and L4 according to age groups. There was a difference ($p < 0.05$) in L1, L2, L3, and L4 according to age groups. The results shown that the mean HU value for all the vertebrae decreases as the age increases, except L1. For L1 vertebrae, there was seen an increase in the mean values of the age group 70-80 with values 134.82 [SD=44.22].

Table 5.8:

(n = 156)		T11	T12	L1	L2	L3
T11	Pearson correlation	1				
	p value					
T12	Pearson correlation	0.831	1			
	p value	< 0.001*				
L1	Pearson correlation	0.737	0.77	1		
	p value	< 0.001*	< 0.001*			
L2	Pearson correlation	0.907	0.856	0.82	1	
	p value	< 0.001*	< 0.001*	< 0.001*		
L3	Pearson correlation	0.878	0.862	0.81	0.961	1
	p value	< 0.001*	< 0.001*	< 0.001*	< 0.001*	
L4	Pearson correlation	0.891	0.835	0.798	0.945	0.944
	p value	< 0.001*	< 0.001*	< 0.001*	< 0.001*	< 0.001*

(* Significant)

Table 5.8: Relation between T11, T12, L1, L2, L3, and L4

The Pearson correlation coefficient was used to find the relation between T11, T12, L1, L2, L3 and L4. There was a positive correlation ($p < 0.05$) between T11, T12, L1, L2, L3 and L4. When correlation between T11 and T12 is seen,

it shows a decrease in Pearson correlation values as going from T11 to T12. When different vertebral bodies are compared it is seen that for L1, L2, L3 and L4 the values decrease as going from L1 – L4 (Table 5.8).

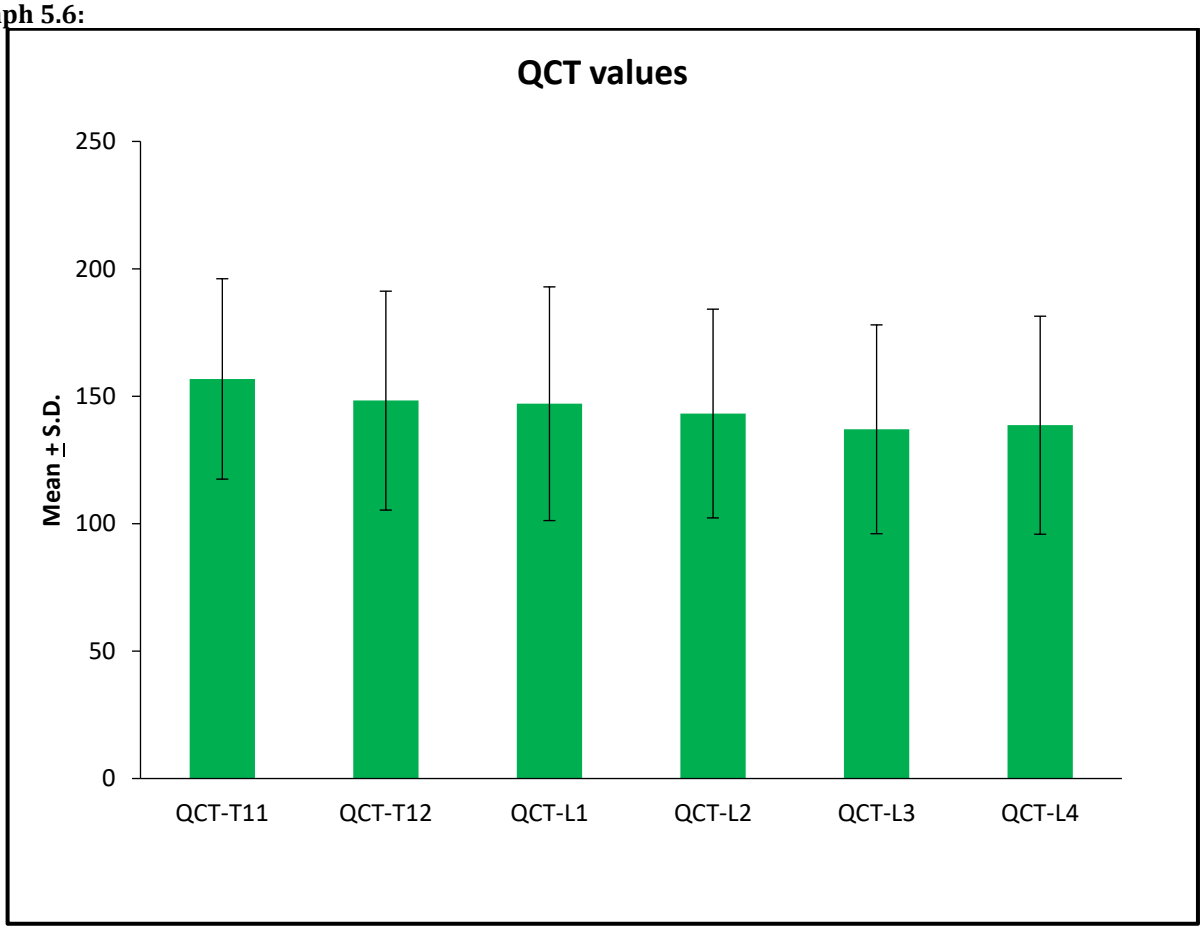
Table 5.9:

(n = 156)	Mean	S.D.
QCT-T11	156.80	39.31
QCT-T12	148.30	42.95
QCT-L1	147.07	45.85
QCT-L2	143.22	40.97
QCT-L3	137.03	40.97
QCT-L4	138.65	42.78

Table 5.9: Representation of QCT values for different values

The Table 5.9 and Graph 5.6 shows the QCT values for different vertebras from T11 – L4 respectively. The highest QCT value is for T11, 156.80 [SD=39.31]. While the lowest QCT value is for L3, 137.03 [SD=40.97].

Graph 5.6:



Graph 5.6: Representation of QCT values for T11, T12, L1, L2, L3 and L4

	Osteoporosis		Osteopenia		Normal bone	
	Frequency	%	Frequency	%	Frequency	%
QCT-T11	2	1.3	26	16.7	128	82.1
QCT-T12	8	5.1	35	22.4	113	72.4
QCT-L1	7	4.5	36	23.1	113	72.4
QCT-L2	12	7.7	39	25	105	67.3
QCT-L3	16	10.3	42	26.9	98	62.8
QCT-L4	16	10.3	39	25	101	64.7

Table 5.10: Representation of Osteoporosis, Osteopenia, and Normal bone for different vertebral bodies.

It has been depicted from the Table 5.10 that for QCT T11 out of 156 patients, 82.1% about 128 patients are in normal range for BMD, 16.7% (26) patients in Osteopenia and 1.3% (2) patients are in Osteoporosis. For QCT T12, 72.4% (113) are in normal range of BMD, 22.4% (35) are in Osteopenia and 5.1% (8) are in Osteoporosis. For QCT L1, 72.4% (113) are in normal range of BMD, 23.1% (36) are in Osteopenia and 4.5% (7) are in Osteoporosis. For QCT L2, 67.3% (105) are in normal range of BMD, 25% (39) are in Osteopenia and 7.7% (12) are in Osteoporosis. For QCT L3, 62.8% (98) are in normal range of BMD, 26.9% (42) are in Osteopenia and 10.3% (16) are in Osteoporosis. For QCT L4, 64.7% (101) are in normal range of BMD, 25% (39) are in Osteopenia and 10.3% (16) are in Osteoporosis.

Fig. 5.7:

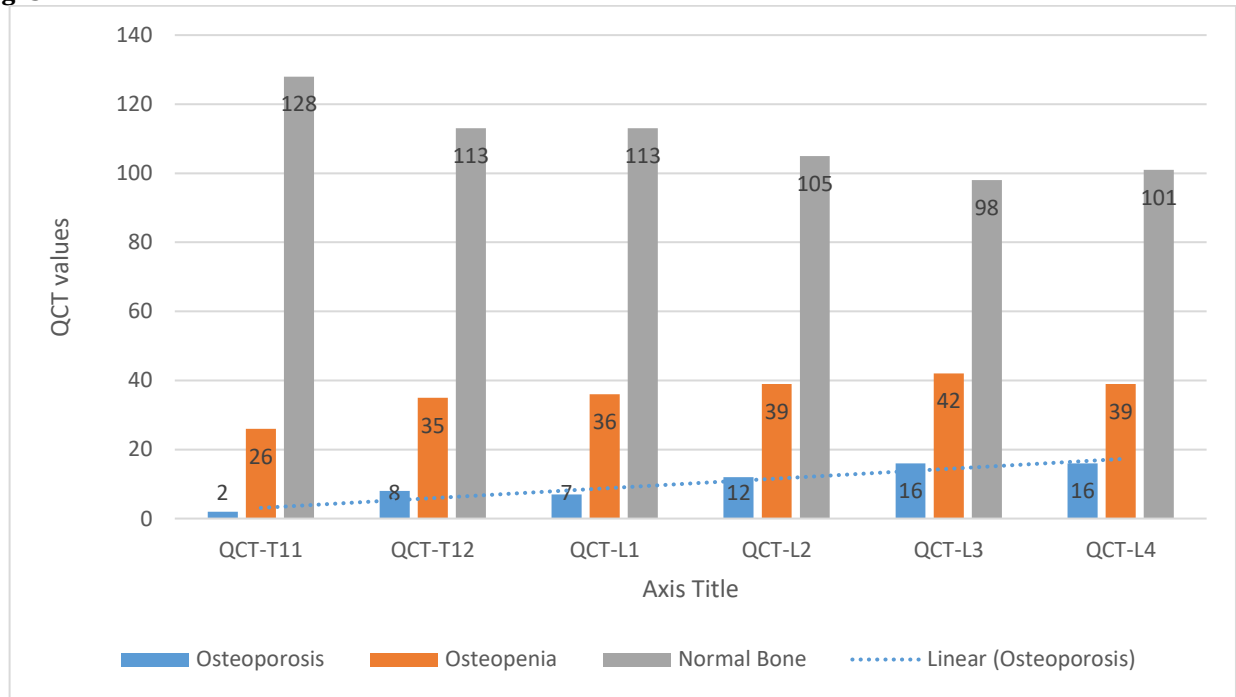


Fig. 5.7: Representation of QCT values for Osteoporosis, Osteopenia and Normal Bone.

Table.5.11:

Vertebral bodies	Osteoporosis		Osteopenia		Normal Bone	
	frequency	%	frequency	%	frequency	%
T11	7	4.49%	31	19.87%	118	75.64%
T12	14	8.97%	37	23.72%	105	67.31%
L1	16	10.26%	34	21.79%	106	67.95%
L2	19	12.18%	40	25.64%	97	62.18%
L3	27	17.31%	37	23.72%	92	58.97%
L4	24	15.38%	36	23.08%	96	61.54%

Table.5.11: Representation of different vertebral bodies as per BMD

- For T11 only 7(4.49%) patients are in the range of Osteoporosis and a majority of patients 118(75.64%) are in normal range.
- L3 has the highest count for Osteoporosis 27(17.31%) followed by L4.
- The result also shows that as we move from thoracic to lumbar region the count for Osteoporosis also increases.

Fig.5.8:

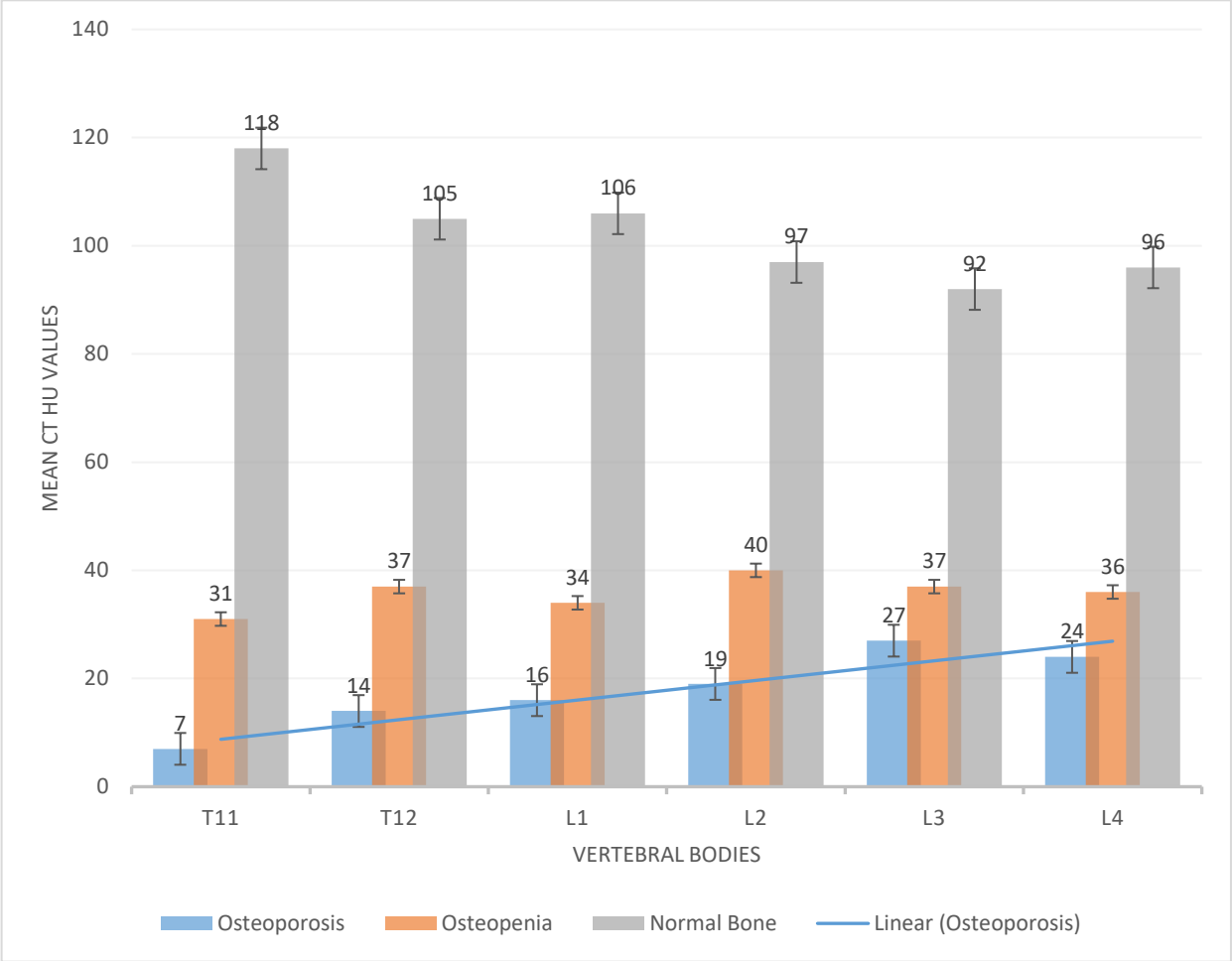


Fig.5.8: Representation of HU values for Osteoporosis, Osteopenia and Normal Bone.

Table 5.12:

		QCT-T11	T11
QCT-T11	Pearson correlation	1	
	p value		
T11	Pearson correlation	1	1
	p value	< 0.001*	

Table 5.12: Representation of Pearson correlation for QCT T11 and HU T11

• The above table shows the Pearson correlation for QCT T11 and HU T11 and shows a strong positive correlation for QCT and HU values with a p value less than 0.001

DISCUSSION

Bone health is very important for a healthy livelihood. As age increases and the body hormonal level changes, there is also a change in the bone health. Osteoporosis is a very common disease seen in old age people which mostly remains undiagnosed due to lack of awareness and availability of DXA modality which is the gold standard for the detection of bone health. If the changes in bone health can be detected at the correct time, it can be prevented from getting worse. In this study, we tried to evaluate BMD from CT scan HU values for different vertebral bodies (T11-L4) for the patient who underwent CT scan covering the lower thoracic and lumbar region. This also provide an opportunity to evaluate the BMD without any additional radiation dose to the patient. For the study HU values were taken from T11-L4 vertebral region and these values were converted to QCT values using a formula.

A study conducted by **(Pickhardt et al., 2013)** on 1867 patients over a period of 10 years came to a result that using routine CT scan HU values patients bone health can be evaluated, this study showed that HU values above 160 are considered for a healthy bone, values from 110-160 are considered to be

Osteopenia and values below 110 are taken to be Osteoporosis. Taking these values into account and putting these values in our study we found that the HU values were decreasing from L1-L3 level, and was least for L3 vertebra. In our study the HU values were taken from T11-L4 and similarly to their study L3 is having the least HU values 173.53 [SD=57.71], and T11 was having the highest mean value 201.38[SD=55.37]. A slight increase is also seen in L4 as compared to L3 vertebral body.

(Zou et al., 2019) in their study came to a conclusion that HU values are a reliable tool for diagnosing BMD and measuring HU values is also an easy task. While conducting our study we also found that measuring HU values is an easy task.

(Schreiber et al., 2014) in there study found that apart from DXA, CT (QCT) values can also be used for evaluating BMD and their study also concluded that QCT values are more sensitive for diagnosing bone health. In our study where we correlated QCT values with HU values using Pearson correlation a strong positive correlation is seen.

(Burke et al., 2016) correlated HU values with BMD and came to a conclusion that attenuation values of <164.5 were in the range of Osteoporosis, with a corresponding specificity for this cut off point is 70%. In contrast to their study we have taken the values derived by **(Pickhardt et al., 2013)** for evaluating BMD, which shows that CT HU values above 160 (normal bone), 110-160 (Osteopenia), <110 (Osteoporosis). Using these values in our study we found that for T11 only 7(4.49%) patients are in the range of Osteoporosis and a majority of patients 118(75.64%) are in normal range. L3 has the highest count for Osteoporosis 27(17.31%) followed by L4. The result also shows that as we move from thoracic to lumbar region the count for Osteoporosis also increases. They also examined 26 patients who were injected with contrast and they compared NCCT with CECT to see if there is any change in the HU values after the injection of contrast media. They found that there was an average mean difference of -24.5.

(Jang et al., 2019b) in their study of 20374 patients used L1 for measuring the attenuation values, in case if the L1 was in the exclusion criteria they used T12/L2 instead of L1. They found that the mean of L1 HU values was 160±49, for younger patients below 30 years of age it was 226±44 and for patients above 90 years or older it was 89±38.(Jang et al., 2019a) In our study, the mean for overall HU at L1 is 187±64.57. The highest value is of T11, 201.38±55.36 and lowest for L3, 173.53±57.71. For younger patients below the age of 30 years the mean HU value at L1 is 229.29±37.77 and for patients older than 60 years it is 119.58±46.35 at L1 vertebra.

(Hendrickson et al., 2018) included the first 3 lumbar vertebrae in their study and also came with an outcome that CT attenuation for L3 was the lowest and highest for L1. In our study also for lumbar region L3 is having the lowest attenuation values 173.53±57.71 and L1 has the highest attenuation values 187.67±64.58. Whereas T11 is having the highest HU values for all the vertebral bodies 201.38±55.37.

(Buenger et al., 2022) correlated QCT and HU values by establishing a formula **(QCT value=0.71×HU+13.82),** with this formula HU values can be converted to QCT values and these derived values can be matched with the WHO guidelines for QCT values to evaluate bone health of a patient. They also showed that a significant correlation between the HU and QCT values with Pearson correlation **r=0.894(p<0.001).(Buenger et al., 2021)** In our study we used this equation to convert HU values into QCT values and then the derived QCT values were matched with the WHO guidelines values >120= normal bone, 80≥120= Osteopenia, <80= Osteoporosis. Correlating with these values for QCT L3, 16(10.3%) patients are Osteoporosis, 42(26.9%) Osteopenia and 98(62.8%) normal bone. For QCT T11, 2(1.3%) Osteoporosis, 26(16.7%) Osteopenia and 128(82.1%) normal bone is the outcome of our study. The relation between QCT and HU is also derived using Pearson correlation which showed a strong positive relation.

(Lalruatfela et al., 2020) conducted a study on 240 patients and took measurement from L1, L2 and L3 for both HU values and QCT values. Their study found a strong positive correlation between QCT and HU values (r=0.94) with a p value less than 0.001. The mean QCT was 130.33±35.77 and as per age group, for young population it was 156.36±19.13, for elderly it was 125.51±27.87, and for old age 109.13±39.53. Whereas for HU values the mean was 180.66±52.28, and as per age group, for young population it was 228±25.78, for elderly it was 173.60±39.50 and for old age 140.44±45.66.

Table 6.1:

LEVEL	Mean HU value			
	Perry J Pickhardt	**R. Lalruatfela**	**Schreiber**	**Present study**
L1	152.9	187.2	170.5	187.67±64.58
L2	143.7	181.8	169.2	182.25±57.70
L3	130.5	172.9	166.8	173.53±57.71

Table 6.1: Comparison of different studies for mean HU of vertebras

CONCLUSION

The study showed that it is easy to measure HU values of patient undergoing scan covering the lumbar region. These attenuation values can be used for evaluating BMD in reference to the Perry J. Pickhardt values or the HU values can be converted to QCT values with the formula **"(QCT value=0.71×HU+13.82)",** and then these QCT values can be matched to the WHO guidelines for QCT value to evaluate bone health of a patient. This will make it easy to evaluate bone health without any expensive software, any additional dose or DXA modality. Moreover, the patient coming for CT scan like Abdomen, KUB can have opportunistic screening of their bone health without any additional dose and with no additional cost to the patient.

LIMITATIONS

As we go from one CT scanner to the next there is a slight change in the CT number from scanner to scanner, this slight change in CT number from scanner to scanner can have minute manipulation in the final result. The values used to differentiate Osteoporosis and normal bone is done on the basis of Pickhardt study which was done in other country and BMD varies as per geographical regions, so this can also have effect in the results. The formula used for converting HU values into QCT values is also formulated in other country and may have some changes as per different locations

SCOPE FOR FUTURE STUDY

This study needs to be conducted country wise, so that more accurate values can be derived as per particular locations. The difference in CT number from scanner to scanner can be evaluated to avoid errors that are caused due to the slight changes in CT number from one scanner to another.

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