



## **Relevance of Z Score in Diagnosing Osteoporosis by Dexa Scan**

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**Abstract**

**BACKGROUND:** Osteoporosis being a global health care problem involving huge costs. Our study aims at deducing relevance of DEXA generated Z scores.

**MATERIALS & METHODS:** We studied 281 subjects in the age group of 7 to 97 years, subdivided into age groups from 0 to 30 years, from 31 to 60 years and above 61 years with 80 male and 201 female subjects during August 2007 to August 2009. With the data collected using the McNemars and the Chi Square test we have tried to prove the relevance of Z score.

**RESULTS:** We analysed the data collected using 1994 WHO criteria and 2005 ISCD DEXA criteria with T scores among which 46 % were diagnosed as osteoporotic whereas with Z scores we found to have 24.9 % of the subjects being Osteoporotic by using our GE, Lunar DPX DEXA Scan. We further analysed the significance of Z score using the Chi Square and McNemars test to confirm the sensitivity of the results which resulted in Z score being an important tool in diagnosing Osteoporosis.

**CONCLUSION:** Substitution of DEXA Z Scores resulted in significantly fewer subjects being reclassified as osteoporotic in the study group when compared to the T Scores.

**KEY WORDS:** Osteoporosis, DEXA Scan, Z Score, T score.

**INTRODUCTION**

Osteoporosis is a condition characterised by low bone mineral density and microarchitectural deterioration of bone tissue, leading to enhanced bone fragility and a consequent increase in fracture risk<sup>1</sup>

It is termed as a 'silent disease'. According to WHO osteoporosis is second only to cardiovascular diseases as a global health care burden<sup>2</sup>. According to World Population Prospect, 2004, Revision UN, total number of aged in world is increasing, expected to increase from 672 million in 2005 to 1.9 billion by 2050. Nearly estimated 30 million women of our country are suffering from osteoporosis<sup>3</sup>. In India it may affect at age 50 to 60 years compared to western population. A panel convened by WHO defined osteoporosis as BMD,

with T score more than 2.5 SD below the young adult mean and osteopenia as BMD between 1 and 2.5 SD's below young adult mean using T score. With Z score of less than -1 to -2.5 SD as osteopenia and less than -2.5 as osteoporosis reflecting amount of bone mass compared to other people in the same age group, same size and gender. Using DEXA Scan for diagnosing Osteoporosis has been a gold standard based on the bone density measurements standardised using T and Z scores. As all these years BMD and T score has been a gold standard in diagnosing osteoporosis which are based on the reference values in comparison to the normal young adult, whereas in our study we trying to prove that using Z score which is based on the age, size, gender criterias would be a more reliable and will give the real picture of the prevalence of osteoporosis. Hence diagnosing Osteoporosis is highly dependent on these values.

Several problems remain with the use of the criteria. Most of the clinical centre use reference data supplied by the manufacturers of various densitometers, incorporated in the accompanying software.

As osteoporosis is becoming such a global health concern in view of its prevalence based on these studies we require to look back and try to understand the real picture and reduce the economic burden on the country and also the patient been labelled as osteoporotic and really treat osteoporosis.

The aim of our study is to derive the relevance of Z score in Osteoporosis using DEXA Scan with the reference values provided by the manufacturers of the densitometers with additional aims to estimate the prevalence of Osteoporosis and Osteopenia among our study group.

## **STUDY DESIGN AND METHODS**

Our study population included 281 patients presenting to our hospital basically from the coastal areas ranging from the age group from 7 years to 97 years who were subdivided into age groups between 0 to 30 years, 31-60 years and more than 60 years with 80 men and 201 women between August 2007 to August 2009. The above study group had underwent Total Body DEXA Scan using GE, Lunar DPX NT +150687. The scanner was calibrated daily against the standard calibration block provided by the manufacturer with Phantom measurements showing no drift in the readings. The data collected following these study was analysed using the 1994 WHO criteria and the 2005 ISCD DEXA criteria and the relevance of Z Score was derived.

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**STATISTICAL ANALYSIS**

The data collected following the DEXA Scan was analysed with study group involving 281 patients with 201 females and 80 male subjects which included 49 subjects in the age group of 0 to 30 years, 79 subjects in the age group of 31 to 60 years and 152 subjects in the age group above 61 years. Using McNemars test and Chi Square test the study was analysed.

With T scores 46 % of the study group was diagnosed as Osteoporotic whereas using Z score only 24.9% of the subjects were found to be in the osteoporotic range. Using the McNemars test and Chi Square test with  $p < 0.001$  the sensitivity of the result were proved.

Additional information that the study derived is the prevalence of osteoporosis was more among the middle aged group of females. And using Z score showed significantly lesser subjects being reclassified as Osteoporotic.

**Descriptive Statistics**

	N	Minimum	Maximum	Mean	Std. Deviation
AGE	281	7.00	97.00	57.1601	22.87121

**SEX**

	Frequency	Percent
F	201	71.5
M	80	28.5
Total	281	100.0

**Descriptive Statistics**

	N	Minimum	Maximum	Mean	Std. Deviation
BMD	281	.20	1.98	.9076	.22515
T SCORE	237	-6.60	4.80	-2.0789	1.86617
Z SCORE	237	-4.90	6.40	-.9882	1.64976

**Correlations**

		T SCORE	Z SCORE
BMD	r	.929	.857
	p	.000	.000
	N	237	237
T SCORE	r		.942
	p		.000
	N		237

**TSCR \* ZSCR**

			ZSCR1		Total
			>-1.5	<-1.5	
TSCR1 >-2.5	Count		117	11	128
	%		87.3%	10.7%	54.0%
<-2.5	Count		17	92	109
	%		12.7%	89.3%	46.0%
Total	Count		134	103	237
	%		100.0%	100.0%	100.0%

a. Sensitivity=87.3% Specificity =89.3 % Positive predictive value=91.4 % Negative predictive value =84.4 %

b. X<sup>2</sup>=137.688 p<0.001 vhs

**Group Statistics**

	SEX	N	Mean	Std. Deviation	Z
BMD	M	80	.9088	.23633	.09800 p=0.922 ns
	F	201	.9072	.22116	
T SCORE	M	54	-2.0907	1.59223	.07900 p=0.937 ns
	F	183	-2.0754	1.94360	
Z SCORE	M	54	-1.2130	1.57959	.99600 p=0.317 ns
	F	183	-.9219	1.66831	

**Correlations**

			T SCORE	Z SCORE	AGE
Spearman's rho	BMD	r	.981	.905	-.210
		p	.000	.000	.000
		N	237	237	281
	T SCORE	r		.935	-.538
		p		.000	.000
		N		237	237
	Z SCORE	r			-.326
		p			.000
		N			237

**ZSCR \* TSCR**

			TSCR1		Total
			>-2.5	<-2.5	
ZSCR2	>= - 2	Count	127	51	178
		%	99.2%	46.8%	75.1%
	<- 2	Count	1	58	59
		%	.8%	53.2%	24.9%
Total		Count	128	109	237
		%	100.0%	100.0%	100.0%

- a.  $p < 0.001$  vhs (McNemar test)
- b. Sensitivity=99.2% Specificity =53.2 % Positive predictive value=71.3 % Negative predictive value =92.3 %

**Symmetric Measures**

		Value	Asymp. Std. Error	Approx. T	p
Measure of Agreement	Kappa	.543	.050	9.303	.000

**ZSCR2 \* TSCR**

AGEGROUP				TSCR1		Total
				>-2.5	<-2.5	
0 - 30	ZSCR2	>= - 2	Count	6	0	6
			%	100.0%	.0%	85.7%
		<- 2	Count	0	1	1
			%	.0%	100.0%	14.3%
	Total		Count	6	1	7
			%	100.0%	100.0%	100.0%
31 - 60	ZSCR2	>= - 2	Count	67	4	71
			%	100.0%	36.4%	91.0%
		<- 2	Count	0	7	7
			%	.0%	63.6%	9.0%
	Total		Count	67	11	78
			%	100.0%	100.0%	100.0%
>=60	ZSCR2	>= - 2	Count	54	47	101
			%	98.2%	48.5%	66.4%
		<- 2	Count	1	50	51
			%	1.8%	51.5%	33.6%
	Total		Count	55	97	152
			%	100.0%	100.0%	100.0%

**Chi-Square Tests**

AGEGROUP		p
0 - 30	McNemar Test	1.000
31 - 60	McNemar Test	.125
>=60	McNemar Test	.000

**Symmetric Measures**

AGEGROUP			Value	Asymp. Std. Error	Approx. T	p
0 - 30	Measure of Agreement	Kappa	1.000	.000	2.646	.008
31 - 60	Measure of Agreement	Kappa	.750	.118	6.844	.000
>=60	Measure of Agreement	Kappa	.421	.058	6.239	.000

**ZSCR2 \* TSCR**

SEX				TSCR1		Total
				>-2.5	<-2.5	
M	ZSCR2	>= - 2	Count	27	11	38
			%	96.4%	42.3%	70.4%
	< - 2	Count	1	15	16	
		%	3.6%	57.7%	29.6%	
Total		Count	28	26	54	
		%	100.0%	100.0%	100.0%	
F	ZSCR2	>= - 2	Count	100	40	140
			%	100.0%	48.2%	76.5%
	< - 2	Count	0	43	43	
		%	.0%	51.8%	23.5%	
Total		Count	100	83	183	
		%	100.0%	100.0%	100.0%	

**Chi-Square Tests**

SEX		p
M	McNemar Test	0.006 hs
F	McNemar Test	0.001 vhs

**Symmetric Measures**

SEX			Value	Asymp. Std. Error	Approx. T	p
M	Measure of Agreement	Kappa	.549	.106	4.352	.000
F	Measure of Agreement	Kappa	.540	.057	8.229	.000

ZSCORE			TSCORE		
	Frequency	Percent		Frequency	Percent
<- 2	59	24.9	<-2.5	109	46.0
>= - 2	178	75.1	>-2.5	128	54.0
Total	237	84.3	Total	237	84.3

## DISCUSSION

Our study of 281 subjects who underwent DEXA Scan , and with the data available the T scores and the Z scores were correlated. The relevance of of Z score was derived and proved to be more sensitive and lesser number of subjects being reclassified into osteoporotic as compared to the results available with T scores.

With increasing global and economic burden of Osteoporosis, rightly diagnosing and treating Osteoporosis is a greater challenge using the the relevant data, helps in knowing the real burden of Osteoposrosis on the the society. Hence reduces the Economic burden on the individual, their families and the country. It requires a population based study involving more study groups and research in standardising the scores for our population.

A increased number of subjects in each group our study would have strengthened the study. And with our study we have tried to provide the real picture of the osteoporosis with the available data collected.

As Z Score is a age, gender, sex, ethnicity based entity it would be more sensitive and specific for Osteoporosis Classification.

## CONCLUSION

With our study substitution of DEXA Scan Z Scores reclassified significantly fewer subjects as Osteoporotic when compared to the T Scores.

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