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ORIGINAL ARTICLE

Potential Role of Dexa Scan in Predicting Osteoporosis Risk in Epileptic Patients

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ABSTRACT

Background: Abnormalities of bone health are common among epileptic patients. A Dual-energy x-ray absorptiometry (DEXA) scan is the gold standard for diagnosing osteoporosis and low bone mass.

Material and Methods: The design of this study was across-sectional study. This study was carried out from 8th March 2019 to 7th September 2019 in the Department of Neurology, Jinnah Postgraduate Medical Centre, Karachi. We included a total of 400 patients. The diagnosis and classification of epilepsy were according to history, neurological examination, electroencephalography, and neuroimaging (CT or MRI). All the patient sunders went a DEXA scan to calculate T-score, Z-score, and Bone mineral density. Descriptive statistics were calculated. Stratification was done using the student t-test, and P value ≤ 0.05 was taken as significant.

Results: There were 66.3% male and 33.8% female patients. Total 62% cases had chronic, and 38% had acute epilepsy. Mean T-Score and Z-score were -1.15±0.53 and -1.04±0.46, respectively. The results showed significant mean difference of T and Zs core among the status group (P=0.000). Thus, there were significant mean differences of T-score and z-Score (P=0.040).

Practical implication : The aim of this work is to evaluate bone mineral density (BMD) in patients with idiopathic epilepsy under anti-epileptic drugs and to determine the effect of the type and the duration of drug administration on BMD.

Conclusion: The T-score and Z-score of the DEXA scan showed that abnormalities of bone health are common among epileptic patients.

Keywords: Bone Mineral Density, Epilepsy, Dual Energy X-Ray Absorptiometry Scanner,

INTRODUCTION

Nearly 50 million individuals worldwide are affected by epilepsy, a persistent brain illness. Epileptic seizures are a prevalent medical and social problem that characterize it (1). Electrical signal disturbances in the brain are the cause of these seizures. Seizures are brought on by these interruptions, which temporarily interfere with nerve cell transmission. Among epilepsy patients, problems in bone health are widespread. Antiepileptic medications (AEDs), particularly enzyme inducers, have been used for a long time and are linked to these problems (2).

The majority of patients need ongoing, perhaps permanent, treatment with AEDs. The radiographic signs of rickets, reduced bone mineral density (BMD), altered bone turnover (3), and increased fracture risk are the only severe adverse effects of an antiepileptic medicine. Compared to the general population, patients with epilepsy had a two-fold higher risk of pathological fracture and a five-fold higher risk of hip and spine fracture (4).

There is a lot of individual variation, 80% of which is genetic and includes sex and race. Reduced BMD is also linked to low levels of physical activity, smoking, drinking, and hormonal state (postmenopausal women and males with low testosterone levels) (5). Using the Bone Densitometer, Dual-Energy, DMS Lexxos DR, and represented as grammes per square centimeter and as T-and Z scores, bone mineral density was measured in a variety of methods. he current gold standard for the diagnosis of osteoporosis and low bone mass is the dual-energy x-ray absorptiometry (DEXA) scan (6,7). It is a quick and affordable way to determine BMD. It employs a low-energy X-ray to assess bone density in the lumbar spine, hip, and wrist regions, making it one of the favoured methods for determining BMD. The Z-score compares the patient's bone density to that of adults of the same age, whereas the T-score compares the patient's bone density to the peak bone density of young adults (8).

At a tertiary care hospital in Karachi, we set out to conduct prospective cross-sectional study over a six-month period to evaluate the bone health of epileptic patients (9). It was sought, separately, the outcome of interest in the form of T and Z scores and their association with the qualitative and quantitative demographic values of newly diagnosed and chronically ill patients.

PATIENTS AND METHODS

This study was across-sectional study carried out between 8th March 2019 to 7th September 2019 in the Department of Neurology, Jinnah Postgraduate Medical Centre, Karachi. Software by WHO In health research, sample size was established using this method. Our predicted sample size was at least 400 patients taking into account the confidence level of 95%, the mean and standard deviation of the Z score on the Dexa scanner in epileptic patients, and the absolute precision of 10%. Consecutive non-probability sampling was the sampling method. This study covered all individuals with epilepsy, regardless of gender, between the ages of 20 and 60, with or without prior epilepsy diagnoses.

Patients who had previously fractured, were pregnant, nursing, menopausal, or had a family history of bone problems, endocrine abnormalities, chronic illnesses, or who were using medications that could impair bone health were excluded from the study. A resident in neurology who was the research associate examined all patients with newly diagnosed or persistent epilepsy who came to the neurology department. The patient underwent a comprehensive clinical examination, and a history about their ailment and background was taken.

Based on the patient's medical history, a neurological examination, electroencephalography, and neuroimaging, epilepsy was diagnosed and classified (CT or MRI). All of the patients got DEXA scans at L1–L4 utilizing the Hologic Explorer QDR series (S/N90797, Hologic Inc, Waltham, USA), which were carried out by consultant radiologists with at least five years of experience. After calculating the T-score and Z-score, the bone mineral density was assessed.

An already created proforma was used for data collection. The inclusion criteria were closely adhered to in order to eliminate confounders and biases. All patient data were assembled and examined using SPSS Version 21's statistical programmes for social sciences. For quantitative data, such as age, height, weight, BMI, T-score, Z-score, and bone density mass, we calculated the

frequency and % for qualitative factors like gender as well as the mean ±SD.

The study groups were contrasted in terms of bone density mass using a student t-test. The stratification was completed based on gender, age, and basal metabolic rate. A student t-test was performed to compare the bone density mass in the two research groups for post-stratification based on effect modifiers. In all analyses, a P-value of 0.05 was regarded as significant.

RESULTS

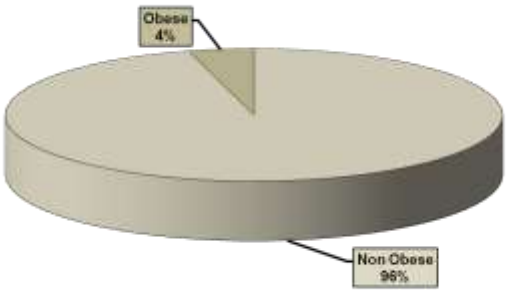
Out of 400 patients, 66.3% were male and 33.8% were female. Of the 400 patients, 62% had chronic epilepsy and 38% had just been diagnosed with it. Patients' ages ranged from 26.19 to 8.67 years on average. Table 1 compiles the age-specific descriptive information in detail. The frequency and percentage of patients among these two categories, which were further divided by age, are shown in Graph-1.

Graph–1: Percentage of Patients According to Age Groups (n=400)

Table–1: Descriptive Statistics of Age, Height, Weight and BmI (n=400)

	Age	Height	Weight	Bmi
Mean	26.19	152.09	50.93	21.98
SD	8.67	11.21	13.61	5.26
Median	24.00	149.50	48.00	20.50
Range	38	50	67	28.10
Minimum	20	132	33	15.60
Maximum	58	182	100	43.70

The average weight was 50.93 kilograms and the height was 152.09 centimeters, respectively (Table-1). The comprehensive descriptive statistics are shown in Table 1 and the mean BMI for the entire population was 21.98 5.26 kg/m2. Two categories were created based on the BMI. The definition of obesity was defined as a BMI of 30 kg/m2 or higher. Graph-2 displays the frequency and proportion of patients in each of these groups.



Graph–2: Percentage of Patients According to Bmi Groups (n=400)

In our study, the mean T-Score and Z-score were found -1.15±0.53 and -1.04±0.46, respectively detailed descriptive statistics are presented inTable-2.

Table–2: Descriptive Statistics of T and Z Score (n=400)

Mean	-1.15	-1.04
SD	0.53	0.46
Median	-1.00	-0.90
Range	2.10	2.00
Minimum	-0.20	-2.10
Maximum	-2.30	-0.10

Stratification for the study group was done to gender, age, and BMI to control the effect of these factors on the outcome (T-score and Z- score). A comparison of the mean was made through a t-test. P-value <0.05 will be taken as significance. The results showed a significant mean difference of -1.27 and -0.95 and SD of 0.64 and 0.09 for T-score among the status group (p=0.000) in chronic and newly diagnosed epileptic patients, respectively. Likewise for stratified categories of gender a mean difference -1.26 with SD of 0.64 and -0.95 with SD of 0.09 in male patients of chronic and newly diagnosed Epilepsy, respectively while in female patients a mean difference of -1.28 and -0.94 and SD of 0.65 and 0.08 in chronic and newly diagnosed Epilepsy patients, respectively. Age was further been categorized in 2 groups in patients of age less than 25 years mean difference for BMDT-score were found -1.29 and -0.96 with SD of 0.65 and 0.09 in chronic and newly diagnosed epilepsy patients, respectively. Those patients who were older than 25 years, a mean difference of -1.12 and -0.89 with SD of 0.61 and 0.09 were found in both chronic and newly diagnosed Epilepsy, respectively. Similarly, in non-obese (chronic and newly diagnosed epilepsy patients) and obese (chronic and newly diagnosed epilepsy), a mean T score difference of -1.27, -0.95, -1.37, -0.95 and SD of 0.65,0.09,0.53,0.05 were found, respectively.

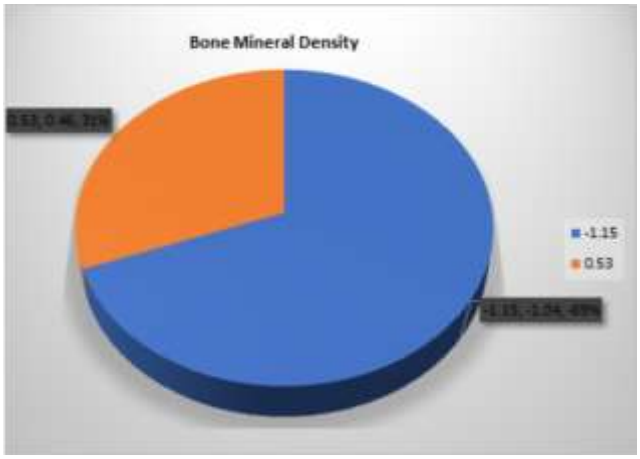
The results also showed a significant mean difference of -1.14 and -0.89 and SD of 0.56 and 0.09 for Z-score among the status group (p=0.000) in chronic and newly diagnosed epileptic patients, respectively. Likewise for stratified categories of gender a mean difference of -1.15 and -0.90 and SD of 0.57 and 0.08 were found in male patients of chronic and newly diagnosed Epilepsy, respectively while in female patients a mean difference of -1.11 and -0.88 and SD of 0.54 and 0.10 were estimated in chronic and newly diagnosed Epilepsy patients, respectively. Age was further been categorized in 2 groups in patients whom with age of less than 25 years mean difference for BMD Z-score were estimated as -1.15 and -0.89 with SD of 0.54 and 0.09 in chronic and newly diagnosed epilepsy patients, respectively. Those patients who were older than 25 years, a mean difference of -1.15 and -0.89 with SD of 0.54 and 0.09 were found in both chronic and newly diagnosed Epilepsy, respectively. Similarly, in non-obese (chronic and newly diagnosed epilepsy patients) and obese (chronic and newly diagnosed epilepsy), a mean Z-score difference of - 1.13, -0.89, -1.26, -0.91 and SD of 0.56,0.09,0.68,0.11 were found, respectively.

There were significant mean differences in T-score and z-Score (p=0.040), as presented in Table-3. The significant mean difference of T-score and z-Score was also found for patients with chronic epilepsy (p=0.021) and newly diagnosed epilepsy patients (p=0.000) as presented in Table-4 and Table-5.

Table–3: Mean Comparison of Bone Mineral Density T-Score with Z-Score (n=400)

	Bone Mineral Density		P-Value
	Mean	SD	
T-Score	-1.15	0.53	0.040*
Z-Score	-1.04	0.46	

A dependent t-test was applied. P-value ≤0.05 is considered significant. *Significant at 0.05 levels



Graph-3: Comparison of Bone Mineral Density T-Score with Z-Score

Table–4: Mean Comparison of Bone Mineral Density T-Score with Z-Score for Chronic Epilepsy (n=248)

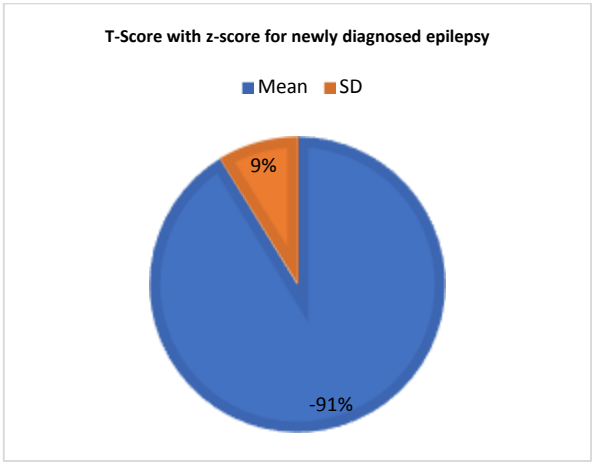
	Bone Mineral Density		P-Value
	Mean	SD	
T-Score	-1.27	0.64	0.021*
Z-Score	-1.14	0.56	

A dependent t-test was applied. P-value ≤0.05 is considered significant. *Significant at 0.05 levels

Table–5: Mean Comparison of Bone Mineral Density T-Score with Z-Score for Newly Diagnosed Epilepsy (n=152)

	Bone Mineral Density		P-Value
	Mean	SD	
T-Score	-0.95	0.091	0.000*
Z-Score	-0.89	0.093	

A dependent t-test was applied. P-value ≤0.05 is considered Significant. *Significant at 0.05 levels.



DISCUSSION

Our study's T-score and Z-score DEXA scan results demonstrate that problems of bone health are frequent among epileptic patients and that DEXA is a reliable and accurate way to measure bone mineral density (10). Similar to this, numerous epidemiological research revealed that people with epilepsy had a two to six times higher risk of fractures than the general population. Different processes in epilepsy make fractures more likely (11). Antiepileptic drugs (AEDs) have been shown to be significant risk factors for bone damage in non-institutionalized patients and well-fed ambulatory persons with epilepsy. Studies show that the pathogenic consequences of AED use begin to manifest themselves primarily five years into AED use. In a research, epileptic patients had considerably lower bone mineral density and T-scores than healthy volunteers. This result supported the hypothesis that both sexes' reduced bone mass was a result of AED (12,13)

AEDs boosted bone turnover by increasing vitamin D catabolism via the orphan (PXR) nuclear receptor. Additionally, they directly impact bone cells. When present at levels equivalent to therapeutic dosages, enzyme inducers prevent the growth of human osteoblast-like cells (14). Hepatic enzyme inhibitors, on the other hand, increase osteoclast activity, which disrupts the balance between bone creation and resorption and results in bone loss (15).

BMD was shown to be lowest at the femur when compared to the radius and lumbar areas, according to a recent study. According to earlier research, epileptic patients have a higher incidence of pathological fractures than the normal population, which typically involve the femur (16). Since the femur is the strongest weight-bearing bone and contains the majority of the cells, it has a higher susceptibility than other bones to be adversely impacted by AEDs.

According to the research, patients with normal DEXA scans had a considerably lower mean age difference between osteoporotic and normal individuals (8). The average age of epileptics was not significantly correlated with either the BMD or T scores, however. contrasted with Pettyetal. discovered a strong inverse relationship between the DEXA scan findings and epileptic patients older than 40 years and the mean age of those with epilepsy (17).

The length of AED therapy was shown to have a substantial negative connection with both BMD and T scores. Contrarily, Kishketal, no association between the various kinds of epilepsy and anomalies in the DEXA scan was found (=0.18). While Farhatetal conducted another investigation. discovered that faulty DEXA scan findings are highly related to generalized epilepsy (5,11).

Due to their inclusion of 18 of 30 individuals with focal fits, the discrepancy may be attributable to patient selection. As opposed to Farhatetal. included a significant proportion of patients with generalized epilepsy receiving dual and triple therapy, high dosages of AEDs, and few individuals with focal fits. There was no discernible difference between the patient subgroups in terms of the number of AEDs received (10).

Numerous investigations have discovered a strong inverse relationship between BMD and the quantity of AEDs administered. These investigations involved hundreds of patients who used various AEDs for around ten years. Compared to patients receiving enzyme inhibitors, those receiving enzyme inducers had considerably lower blood levels of calcium, phosphorus, and vitamin D (18).

According to a logistic regression study, compared to non-epileptic people, the probability of a BMD anomaly is dramatically increased yearly by 1.366 by the length of the disease and the course of treatment. This result was in line with that of Dennisetal, who discovered that regardless of the medication type used, the chance of BMD abnormalities significantly increased with the length of AED use. Additionally, it was discovered that women have a little higher incidence of BMD abnormalities than men, increasing by 0.118 (6).

Valimakietal. Stephenetal, too. Additionally discovered was a higher likelihood of females developing abnormal BMD. In a separate research, BMD was used to distinguish between osteopenia and osteoporosis (T-score; 1 to 2.5vs. 2.5SD, respectively). 44.8% of patients had decreased bone density, as opposed to 16.6% of control group participants (19).

The BMD at the ribs and spine, necks of the femur, and hip has significantly decreased, according to multiple investigations using DXA on adult patients. Children and adolescents receiving AED medication have had results that are comparable to those of the control group. In a recent study, a sample of individuals with

persistent epilepsy showed a relatively high prevalence (80%) of low BMD (19).

130 consecutive patients who had been using AEDs for more than three years had their BMD evaluated by Lado et al. They found that clinically relevant low BMD was more common than predicted; 39% of individuals had osteopenia, and 16% had osteoporosis. However, in young women receiving AED immuno treatment, Pack et al. looked at changes in bone density over the course of a year (20).

They found that, over the course of a year, only phenytoin was significantly linked to femoral neck bone loss, but the research only covered few participants in each therapy group. El-Hajj Fuelihan's research shown that individuals using carbamazepine had significantly lower hip and lumbar bone mineral density (T scores) than those taking cytochrome P450 enzyme-inducing drugs at the time. According to a different research, epileptic patients' T-scores and Z-scores were greater than those of healthy controls.

CONCLUSION

The dual-energy x-ray absorptiometry (DEXA) scan measurement (T score and Z score) assesses a person's bone density and the likelihood of having a fracture; it is also helpful for deciding if medication is needed. With the study findings of T-score and Z-score of DEXA scan, it can be concluded that abnormalities of bone health are common among epileptic patients, and DEXA is an accurate and precise method for quantifying bone mineral density.

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