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Original Research Article

Relation of bone mineral density with severity of liver cirrhosis

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ABSTRACT

Background: Osteoporosis is commonly associated with chronic liver disease. Pathologic fracture in osteoporotic patients affects quality of life as well as decrease life expectancy. Around 40% of patients with chronic liver disease may experience osteoporotic fracture. The present study was undertaken to observe the relation of bone mineral density (BMD) with severity of liver cirrhosis along with effects of smoking and alcohol.
Methods: A total of 187 liver cirrhosis patients who were admitted in SMS Hospital were taken for study and were classified into class A, B, C as per Child Turcot Pugh's classification, after applying inclusion and exclusion criteria. All patients underwent standard laboratory testing and bone densitometric studies of the lumbar spine using dual X-ray absorptiometry (DEXA) scan. Statistical analysis done.
Results: The bone mineral density was significantly low in Class C. Class C have 41 patients of osteoporosis out of 62 whereas only 16 patients have osteoporosis in Class B and only 1 case of osteoporosis in class A. Hypocalcemia and hypophosphatemia were more in class C as in comparison to class A and B. Also, chronic smoking and alcohol intake were strongly associated with the severity of cirrhosis.
Conclusions: The prevalence of osteopenia and osteoporosis is higher in cirrhotic patients and significantly increases with severity. Hypocalcemia and hypophosphatemia are also associated with the cirrhosis. Thus, patients should undergo routine bone densitometry assessment and, if necessary, to be treated for osteoporosis.

Keywords: BMD, Cirrhosis, Liver cirrhosis, Osteoporosis

INTRODUCTION

Osteoporosis is commonly associated with chronic liver disease. Pathologic fracture in osteoporotic patients affects quality of life as well as decrease life expectancy. Around 40% of patients with chronic liver disease may experience osteoporotic fracture.[1]

The term ''hepatic osteodystrophy'', including osteoporosis and osteomalacia, was commonly used for years to express the bone disorders in patients with liver disease. Osteomalacia is defined as defect in bone mineralization, however, is less in liver patients. It has been seen only in isolated cases with severe cholestasis and malabsorption, from geographical areas with less sunlight exposure.[2] The mechanisms resulting in osteoporosis in liver disease have not been completely known. Some studies indicate an increased bone resorption, although most research points towards a decreased bone formation. Indeed, defect in osteoblast function results in lower mean wall thickness and a defect in matrix synthesis as well as a low bone formation rate have been reported.[3,4]

Densitometry tests are required in patients with chronic liver disease to estimate the absolute risk of fracture.

Dual energy X-ray absorptiometry can also be used to obtain data about bone quality by assessing the trabecular bone score as well as analysis of hip structure.[5] In present study we aim to determine the difference in BMD level in three groups of cirrhosis using Child Turcotte Pugh's classification and also to determine the corelation of BMD score with Child Turcotte Pugh's score.

METHODS

A total of 187 liver cirrhosis patients who were admitted in SMS Hospital were taken for study.

Out of which 142 were male and 45 were females. The patients were classified into class A, B, C as per Child Turcot Pugh's classification, after applying inclusion and exclusion criteria.

Inclusion criteria

- All newly and previously diagnosed cases of liver cirrhosis irrespective of etiology, age, sex.

Exclusion criteria

- Acute hepatic failure
- Fulminant hepatic failure
- Patient on steroids
- Hematological malignancy
- CKD (Chronic Kidney Disease)
- Known case of osteoporosis

Continuous data was summarized in the form of mean and standard deviation. The difference in mean of three groups of severity analysed using ANOVA Test.

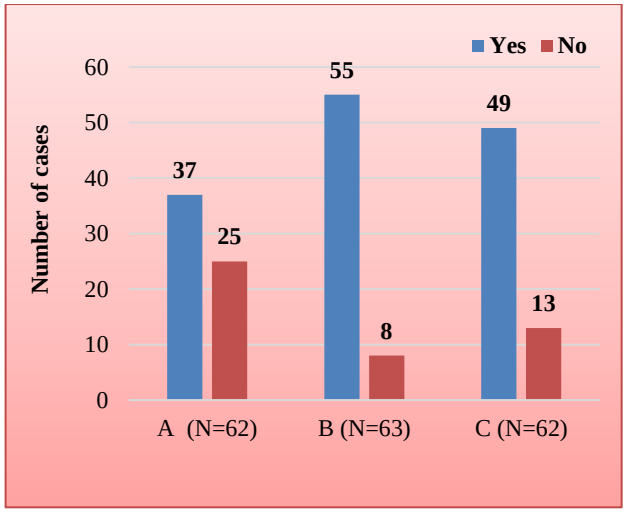
Count data was expressed, and proportions were analysed using 'Chi -square Test. The level of significance would be kept 95% for statistical analysis. Multiple linear regressions were done to predict BMD level on the basis of Age, Sex, Child' score, H/O smoking.

RESULTS

Authors enrolled total 187 patients of liver cirrhosis in which 142 were males and 45 females in which minimum age of patients was 20 and maximum was 60.

Mean age in Class A was 44.70±13.03, Class B was 47.73±9.18 and in Class C it was 55.25±12.44. The severity increases as the age increases and the result was statistically significant (p value 0.0003). In present study authors observed the patients of liver cirrhosis who were chronic smokers and its relationship with severity of cirrhosis.

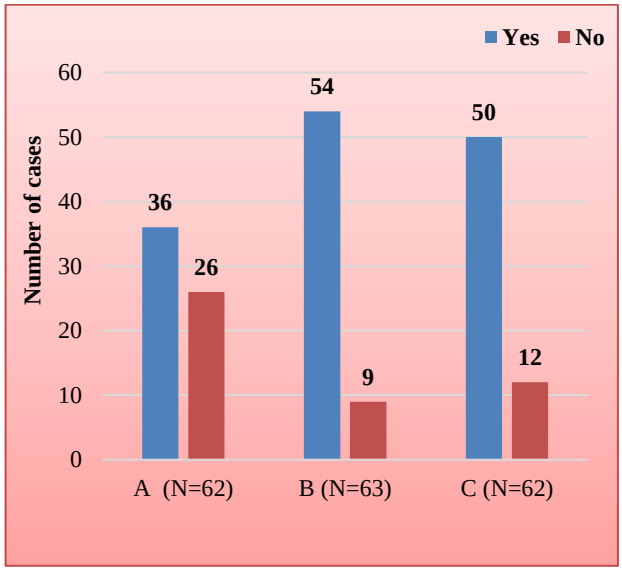
Out of total 187 liver cirrhosis patients, 141 were chronic smokers from 15 years and 46 were non-smokers. The result was statistically significant (p value 0.0011).



Test applied: Chi square test

Figure 1: Distribution of child Turcot Pugh Class according to smoking habits.

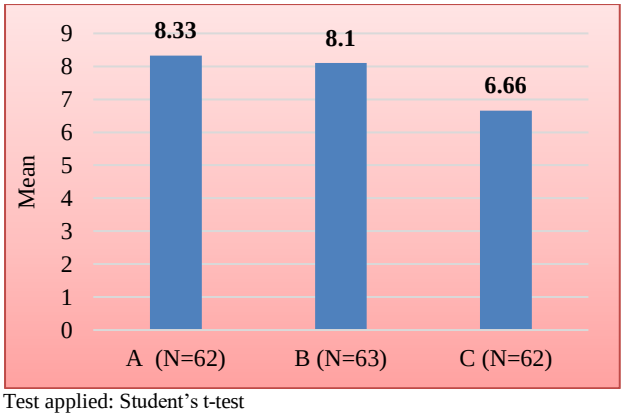
In present study authors observed the effect of alcohol on severity of liver cirrhosis. Out of total 187 patients of liver cirrhosis, 140 were alcoholic. The result was statistically significant (p value 0.0007).



Test applied: Chi square test

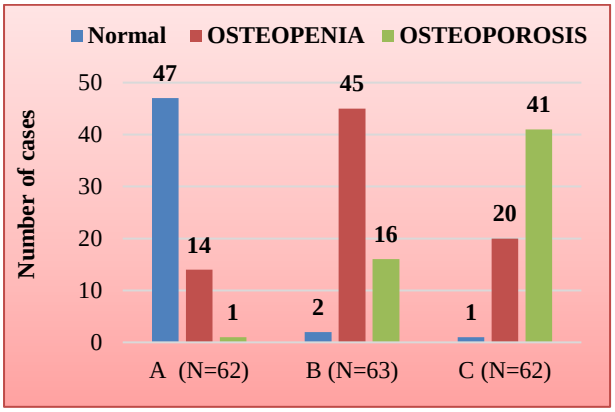
Figure 2: Distribution of Child Turcot Pugh Class according to alcoholic.

Compared the level of serum calcium with severity of liver cirrhosis. Class C has lowest serum calcium level (6.66 ±2.06) as compared to Class B (8.10±.99) and Class A (8.33±0.83) (Figure 3). The difference was statistically significant. (P value-0.0003). Compared level of serum phosphorus with severity of liver cirrhosis. Class C has lowest serum phosphorus level (1.41±.47) as compared to Class B (1.82±.19) and Class A (2.59±0.35) (Figure 4). The difference was statistically significant (p value 0.0003).



Test applied: Student's t-test

Figure 3: Distribution of Child Turcot Pugh Class according to calcium.



Test applied: Chi-square t-test

Figure 4: Distribution of Child Turcot Pugh Class according to phosphorus.

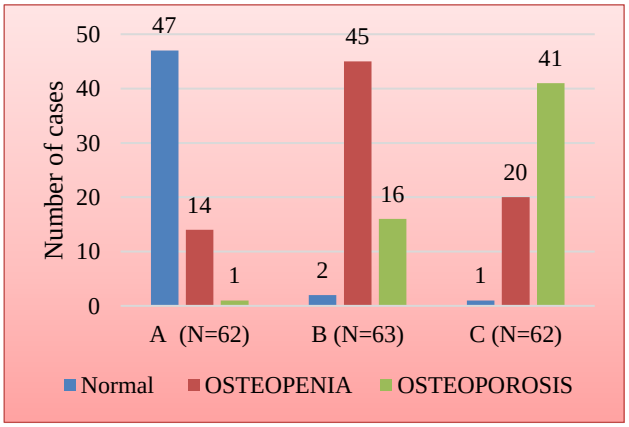


Figure 5: Comparison of Child Turcot Pugh Class according to BMD.

In present study authors compared Child Turcot Pugh class on the basis of Bone Mineral Density. Class C have 41 patients of osteoporosis out of 62 whereas only 16 patients have osteoporosis in Class B and only 1 case of osteoporosis in class A. The difference was statistically significant (p value 0.00001). Bone Mineral Density significantly decreases from Class A to Class C of Child Turcot Pugh Classification.

DISCUSSION

As the survival of patients of liver cirrhosis has increased with various treatments as well as hepatic transplantation, osteoporosis must be considered significantly as it is the most common bone disease in liver cirrhosis. It is characterized by a reduction in bone mass and deterioration of micro architecture of bone tissue with a resultant increased risk of fracture.[6,7]

In present study, minimum age of the patients was 20 year and maximum was 65. Mean age in Class A was 44.70±13.03, Class B was 47.73±9.18 and in Class C it was 55.25±12.44. It has been observed that elder patients had higher scale of severity of liver cirrhosis which leads to poor prognosis as well as poor quality of life as compared to younger.

The difference was statistically significant (p value-0.0003). Study by Younossi et al had also shown that old age had a negative impact on Quality of life of cirrhosis patients.[8] In contrast, another study by Marchesini et al reported that cirrhotic patients with younger age had a more impairment in HRQL than the elder.[9]

In present study, 142(75%) patients were males and 45 (25%) were females. There was male predominance in the study population. The distribution was similar to the study by Ashraful et.al in which 80% were males and 20% were females.[10] The difference was significant.

In present study, 141 patients were chronic smokers and 46 were non-smokers. Class B had more number of smokers (55) than Class A (37) and Class C (49). The result was statistically significant ((P value-0.0011). Similar study done by Hara et al in which 209 incident cases of HCC have been taken. The odds ratios (and 95% confidence intervals) for former and current smokers relative to never smokers were 1.0 (0.6-1.7) and 2.5 (1.4-4.6), respectively. Thus, results suggest that cigarette smoking may play a crucial role in the late stage of HCC development and that CLD patients may benefit from their earliest smoking cessation.[11]

In present study 140 patients, all of were males, were regular alcoholic from 10 years and 47 were not alcohol drinkers (2 male and 45 females). Alcohol was the commonest cause of cirrhosis in present study. The relation of alcohol with cirrhosis was also significant in present study (p value 0.0007). The similar study done by Mukherjee et al done in India in which out of 4413 patients of liver cirrhosis, 1512 were caused by alcohol.[12]

In present study, serum calcium was low in all three classes. Class C has lowest serum calcium level (6.66±2.06) as compared to Class B (8.10±0.99) and Class A (8.33±0.83). Thus, as the severity of liver

cirrhosis increases, the serum calcium level decreases. The difference was statistically significant.

The difference was statistically significant. (p value 0.0003). Similar study regarding serum calcium in liver cirrhosis, done by Bin et al, in which 235 cases of liver cirrhosis were taken and classified as per CTP score. The study showed that the level of serum calcium in patients with liver cirrhosis was lower than that in the control group. The level of serum calcium was related to the impaired hepatic function. [13]

In present study serum phosphorus was compared to the severity of liver cirrhosis. The serum phosphorus was lower than normal in all class. Class C has lowest serum phosphorus level (1.41±0.47) as compared to Class B (1.82± 0.19) and Class A (2.59±0.35). The difference was statistically significant. (p value 0.0003). Similar study by Long et al in which they have taken 26 patients of liver cirrhosis with low normal phosphate. The phosphate does not increase even after giving oral supplement. It was proved that phosphate remains low in liver cirrhosis.[14]

In present study authors compared the bone mineral density with severity of liver cirrhosis. Total patients were 187.Class C have 41 patients of osteoporosis out of 62 whereas only 16 patients have osteoporosis in Class B and only 1 case of osteoporosis in class A. Although osteopenia was more in Class B having 45 patients as compared to Class A in which only 14 were having osteopenia and Class C having 20 patients. 47 patients of Class A were having normal Bone Mineral Density. Thus, it was observed that the BMD decreases as the severity of liver cirrhosis increases. The difference was statistically significant (p value 0.00001). This result was similar to the study done by Turkeli et al in which all 40 patients of cirrhotic patient had a significantly lower mean (SD) spinal BMD (-2.44±1.30 g/cm^2) than the control group (-0.54±1.40g/cm^2; P=0.001).[15]

Another study by Sokhi et al in which out of 104 cirrhotic patients, BMD at Lumbar spine in Child-Turcotte-Pugh class B and C were 1.40±0.21 and 1.13±0.20 respectively. Patient in Class C have lower BMD as compared to Class B and the result was significant (P =0.001) as similar to present study.[16]

In evaluation of patients according to WHO classification of osteoporosis authors found that 75% of cirrhotic patients had decreased bone mineral density (32% had osteoporosis and 43 % had osteopenia). Present figure is higher than the study conducted by Cijevschi et al where they found 38% of cirrhotic patients have low BMD.[17]

CONCLUSION

Osteopenia and osteoporosis are highly prevalent in individuals with class C of child turcott pugh's classification of severity of liver cirrhosis. Hypocalcemia and hypophosphatemia are also associated with cirrhosis patients. Larger studies with frequently repeated clinical measurements and more sensitive biochemical or laboratory measures of disease activity, performed over a course of many months or years, are needed to determine the precise effect of liver disease stage on BMD. Due to this high prevalence of metabolic bone disease among cirrhotic patients, these patients should undergo routine bone densitometric assessment and, if necessary, receive anti-osteoporotic therapy.

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