



Frequency of Low Bone Mineral Density (BMD) in Patients with Liver Cirrhosis

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Authors' contributions

This work was carried out in collaboration among all authors. Author IR designed the study, wrote the protocol, and wrote the first draft of the manuscript. Authors NA and NK review literature and participated in manuscript writing. Author PK managed the literature searches. Authors KR and MAB participated in manuscript writing and analysis. All authors read and approved the final manuscript.

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ABSTRACT

Objective: The objective of this study was to evaluate the low bone mineral density (BMD) in patients with liver cirrhosis.

Methodology: This cross sectional study on 151 Liver cirrhotic patients was conducted at Liaquat University Hospital Hyderabad/Jamshoro. This study duration was 6 months, July 2015 to December 2015. The Assessment of bone mineral density (BMD) for each relevant patient was done using ultrasound impedance Dual Energy X-ray Absorptiometry (DEXA) by senior pathologist having ≥ 05 years of experience, across the calcaneum, at lumbar spine (LS) and femur neck (FN), were computed by using computer supported device. The BMD was expressed in terms of T score. The WHO standard value was utilized to define the low BMD / osteoporosis is T score -1.5.

Results: The mean age of subjects was 31.32 ± 6.18 years. Out of all, 62.9% were males whereas 37.1% were females. About 21% patients had low/abnormal bone mineral density (BMD). Among these, 17.9% had bone mineral density (BMD) of -1.5 to -2.5 and 4% had BMD of < -2.5 . Rest of 78.1% patients had a normal (> -1.5) bone mineral density (BMD). Majority of patients, 63.6% had a CTP grade B of liver cirrhosis, whereas 22.5% had A grade and 13.9% had C grade of liver cirrhosis.

Conclusion: Conclusively, the risk of low bone mineral density (BMD) was evidently high for patients with hepatic cirrhosis. Male gender and age above 30 years were found at greater risk and CTP grade B of cirrhosis was most common.

Keywords: Liver cirrhosis; bone mineral density; metabolic disease.

1. INTRODUCTION

Worldwide, Liver cirrhosis continues to be a significant factor of mortality and morbidity as well as the 12th most common factor of death within United States [1]. In Pakistan, It is among the most common factor of hospitalizations, which presents a significant burden on healthcare system [2]. Chronic hepatitis B and hepatitis C virus infections in Pakistan are the most frequent factor of hepatic cirrhosis [2]; whereas, the most prevalent factor of liver cirrhosis in developed nations is alcoholism [3]. The physical evaluation of cirrhotic patients can show different results that involve gastrointestinal or hepatic work-up for establishing the etiology [4]. A few studies reported 52%, 55% and 51% of prevalence for hepatic cirrhosis [5-7]. Well-established extra-hepatic complication of chronic hepatic disorder is the bone manifestation [8]. Most cases of osteoporosis are defined by low bone mass as well as bone microarchitecture deterioration, leading to greater bone fragility as well as a raised risk of fracture. [9]. Osteoporosis may trigger fractures, failure to engage in regular everyday activities, deformities, social isolation, cognitive decline and depression [10]. Osteoporosis could be a crippling disorder. Low BMD is a most significant risk factor of osteoporotic fractures [11]. The chronic disabling disorder of cirrhosis is correlated with significant mortality and morbidity because of different complications [12]. Hepatic osteodystrophy along with concomitant osteoporosis are the common bone disease, among chronic hepatic disorder patients, and a raised risk of fracture is among the complications recently examined. [12] It is uncertain about the pathogenesis of hepatic osteodystrophy. Many factors have been assumed to be accountable, such as malnutrition, hormonal disruptions and immobilization. [13] These variations are believed to be accountable for the deterioration of bone metabolism leading to imbalance between the osteoblastic and osteoclastic activity [14]. One of

the studies estimated a 26% of incidence of low BMD or T-score (osteoporosis) among cirrhotic patients [15]. Metabolic bone disorder is though yet underestimated as a factor of mortality and morbidity in cirrhotic patients [16]. Thus, it is vital to identify these patients because of noteworthy prognostic implications. This study was conducted at Liaquat University Hospital Hyderabad/Jamshoro, a tertiary care teaching hospital for the evaluation of frequency of low bone mineral density (BMD) variations and to assess their prevalence in patients with liver cirrhosis. The study will also provide the knowledge to the health care workers as far as management strategy is concerned.

2. MATERIALS AND METHODS

This cross sectional descriptive study was conducted at department of Medicine, Liaquat University Hospital Hyderabad/Jamshoro; during six months, using Non - probability consecutive sampling. Known cases of liver cirrhosis for one year duration present at Liaquat University Hospital having age 18 to 40 years and either of gender were included. The known cases of malignancy, autoimmune hepatitis and renal impairment, on corticosteroid or hormonal therapy, bone fractures, postmenopausal women, malabsorption, pregnant ladies, hypoparathyroidism, hyperparathyroidism, gout, rheumatoid and psoriatic arthritis, on calcium and vitamin D supplements, taking bisphosphonates or on chemotherapy, osteomalacia, Paget's disease of bone, Addison's disease, multiple myeloma and the patients not cooperating or those who denied to give consent or not interested to participate in the study were excluded. The clinical examination was performed, the liver span was measured by localizing the upper and lower border of the liver through percussion and the distance between these two points was measured with measuring tape, the ascites was detected through shifting dullness maneuver

and the splenomegaly was detected through palpation and percussion. For biochemistry 5 ml venous blood sample was collected, of which 3 ml was shifted in the PT bottle while 2cc in the syringe for the prothrombin time (PT) and serum albumin level. The ultrasound was performed by expert sonologist having an experience of ≥ 5 years. A written consent was taken from the patients. The bone mineral density (BMD) was assessed for each relevant patient using Dual Energy X-ray Absorptiometry (DEXA) by senior pathologist have ≥ 05 years of experience across the calcaneum, at lumbar spine (LS) and femur neck (FN) were calculated using computer supported device. The BMD was expressed in terms of T score. WHO slandered value was used to define the low BMD / osteoporosis as T-score -1.5 . The data of all patients was entered and analyzed in SPSS version 20.

3. RESULTS

In our study, the mean age of subjects was 31.32 ± 6.18 years with minimum recorded age of 18 years and maximum age of 40 years. Out of total 151 patients, 95 (62.9%) were males, whereas the rest of 56 (37.1%) were females. The mean duration of liver cirrhosis in patients was 17.40 ± 2.836 months with minimum duration observed as 12 months and maximum duration of 23 months (Table 1).

Table 1. Descriptive statistics of demographic characteristics n=151

| Variables | Frequency | Percent |
|-----------------------------|-------------------|---------|
| Male | 95 | 62.9 |
| Female | 56 | 37.1 |
| Total | 151 | 100.0 |
| Age (mean+SD) | 31.32+6.18 years | |
| Duration of liver cirrhosi: | 17.40+2.83 months | |

The bone mineral density (BMD) of patients was recorded in terms of T-score. It was found that

about 21% patients had low/abnormal bone mineral density (BMD) (Table 2).

Table 2. Frequency of low bone mineral density (T-score) n=151

| Low BMD | Frequency | Percent |
|---------|-----------|---------|
| No | 118 | 78.1 |
| Yes | 33 | 21.9 |
| Total | 151 | 100 |

Among the 34 patients with Stage A of liver cirrhosis, 8 (23.5%) were having Low Bone Mineral Density (BMD) and other 26 (76.5%) did not have. At CTP stage B, 21 (21.9%) were having Low Bone Mineral Density (BMD) and rest of the subjects at this stage did not have, while at stage C, 4 (19%) were having Low Bone Mineral Density (BMD) and others did not have. Although there was no statistical association between Low Bone Mineral Density (BMD) and severity of disease (p-value= 0.926). (Table 3).

4. DISCUSSION

In Pakistan too, not much attention has been given to identification of possible influential elements in patients of hepatic cirrhosis that can possibly contribute to low bone mineral density (BMD). This is why we conducted this study and found descriptively interesting results, regarding status of low BMD in patients with liver cirrhosis. In our study, the mean age of subjects was 31.32 ± 6.18 years. Out of total 151 patients, 62.9% were males whereas the rest of 37.1% were females. The mean duration of liver cirrhosis was 17.40 ± 2.836 months. Our study showed high risk for males and individuals above 30 years of age to develop liver cirrhosis. These results were compatible to another study which indicated key factors that predisposed the patients to chronic hepatic disease as: male gender, age > 35 year, BMI >27, drug addiction, blood transfusion history and family history of chronic hepatic disease [17].

Table 3. Low bone mineral density (T-score) according to severity of liver cirrhosis n=151

| | | Severity of Liver cirrhosis | | | Total | p-value |
|------------------------------------|-----|-----------------------------|--------------|--------------|---------------|---------|
| | | A | B | C | | |
| Bone mineral density (T-score) Low | No | 26 76.5% | 75 78.1% | 17 81.0% | 118 78.1% | 0.926 |
| | Yes | 8 23.5% | 21 21.9% | 4 19.0% | 33 21.9% | |
| Total | | 34 100.0% | 96 100.0% | 21 100.0% | 151 100.0% | |

Additionally, in this study, 63.6% patients had a CTP B grade of liver cirrhosis, whereas 22.5% had A grade and 13.9% had C grade of hepatic cirrhosis in comparison to another study in which 24% patients had stage A of liver cirrhosis, 36.5% had stage B and 39.5% had stage C of liver cirrhosis.[18] Yet another study in 58 patients of liver cirrhosis assessed the effect of this disease on bone related problems and showed that, 48% patients had B class and 41% had C class of cirrhosis. They found 43% of their cirrhotic subjects with osteoporosis with a significant association of liver cirrhosis and bone disease (p=0.005) [19].

The bone mineral density (BMD) of patients was recorded by T-score in our study. It was found that about 21% patients had low/abnormal bone mineral density (BMD). Among these, 27 (17.9%) had BMD of ≤ -1.5 to -2.5 and 6 (4%) had BMD of < -2.5 . Rest of 118 (78.1%) patients had a normal (> -1.5) bone mineral density (BMD). One study showed the percentage of osteopenia in liver cirrhotic patients to be 35% and that of osteoporosis to be 12%, [19] which shows the authenticity of our results and that if not managed timely the bone disease may get worse. Another study reported the prevalence of low BMD / T-score (osteoporosis) in patients with hepatic cirrhosis as 26% [15].

In this study, it appeared from the data that in higher age groups, the disease tends to get severe, however, there was no significant association between age groups and severity of disease (p=0.092). However, there was also no statistical association between severity of disorder and gender (p=0.184). Another study reported that the patients were found to have a mean age of 54.4 ± 12.9 years, showing mean age of both males and females above 50 years. Total 55% males and 42% females had B class, whereas 45% males and 58% females had C class of CTP [19].

Out of 34 patients with Stage A of liver cirrhosis in our study, 8 (23.5%) were having Low Bone Mineral Density (BMD) and other 26 (76.5%) did not have. At CTP stage B, 21 (21.9%) were having Low Bone Mineral Density (BMD) and rest of the subjects at this stage did not have, however at stage C, 4 (19%) were having Low Bone Mineral Density (BMD) and others did not have. Although there was no statistical association between Low Bone Mineral Density (BMD) and severity of disease (p-value= 0.926).

However around 20% patients with liver cirrhosis had encountered Low Bone Mineral Density (BMD) as well, which is quite alarming and may worsen for health outcomes. Another study having the resembling objective as ours, showed results as; The absolute Z scores, T scores, and BMD values between females and males were statistically significant at lumbar vertebrae ($P = .028$, $P = .01$ and $P = .001$, respectively). At femoral neck, absolute BMD value between females and males were significant statistically ($P < .0001$), however Z scores and T scores were not. The BMD values comparison between females and males indicated that CTP grades were also different significantly. CTP grade C patients were found to have significantly lesser BMD value in comparison to the patients of grade B for both sexes [20]. Yet another study focusing on bone mass loss in patients of liver disease after liver transplant found that bone mass significantly decreased following liver transplantation during the initial 6 months of post-transplant at the lumbar spine, distal radius, and femur ($p < 0.01$) [21].

5. CONCLUSION

Conclusively, the risk of low bone mineral density (BMD) was evidently high for liver cirrhosis patients. Male gender and age above 30 years were found at greater risk and CTP grade B of cirrhosis was most common. It is therefore suggested to consider the risk of low mineral density among patients presenting with liver cirrhosis and manage this problem accompanying to the treatment of cirrhosis to avoid any advanced level of bone disease. More studies should also be conducted to reveal further in-depth aspects in this regard.

CONSENT

All patients for participation in the study and the data was collected on pre-designed preformed.

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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