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ORIGINAL ARTICLE

Frequency of Osteomalacia and Vitamin D Deficiency in Elderly Patient Presenting at a Tertiary Care Hospital

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ABSTRACT

Introduction: Vitamin D deficiency leads to the bone hypomineralization condition known as osteomalacia in peoples and is linked to other non-skeletal diseases.

Objectives: To determine the frequency of osteomalacia and vitamin d deficiency in elderly patient presenting at a tertiary care hospital.

Study Design: Cross sectional study

Settings: Department of Diabetes and endocrinology Hayatabad medical complex Peshawar

Materials & Methods: Total 140 patients aged 50 years and above presenting with body pain and weakness who required medical treatment at hospital for various health concerns. Patients with known metabolic bone disorders other than osteomalacia, patients receiving vitamin D supplementation or specific treatments for bone disorders were excluded. Participants underwent a thorough clinical assessment, including medical history review, physical examination, and assessment of musculoskeletal symptoms associated with osteomalacia. Blood samples were collected to measure serum levels of 25-hydroxyvitamin D [25(OH)D], the biomarker for vitamin D status. Additional biochemical markers, such as alkaline phosphatase and parathyroid hormone levels, were also assessed to aid in the diagnosis of osteomalacia. Collected data of study variables were analyzed using statistical software (SPSS version 25).

Results: Regarding gender, a total of 60 patients were male, constituting 42.85% of the population, while 80 patients were female, representing 57.14%. Musculoskeletal pain was reported in 80 individuals, representing 57.1% of the population. Proximal muscle weakness was observed in 50 patients, accounting for 35.7%. Additionally, 40 patients (28.6%) had a history of fractures. Vitamin D deficiency was identified in 68(48.57%), while osteomalacia was in 11(7.85%) patients.

Practical Implication: Understanding the interplay between thyroid disorders and bone health can guide more comprehensive management strategies in this vulnerable population at tertiary care hospitals.

Conclusion: In conclusion, our study reveals a relatively high prevalence of biochemical osteomalacia 7.85% among Pakistani old age patients challenging previous estimates in other populations

Keywords: Association, Bone Hypomineralization, Non-skeletal Disorders, Osteomalacia, Vitamin D Deficienc

INTRODUCTION

Osteomalacia, a debilitating metabolic bone disorder, manifests as softening of the bone matrix due to impaired mineralization, particularly in the organic matrix. Inadequate mineralization of newly formed osteoid characterizes this condition, leading to bones that are weakened and brittle, thus increasing susceptibility to fractures.[1,2] The global prevalence of osteomalacia remains a significant concern, affecting diverse populations across various geographic regions. The etiology of osteomalacia is multifaceted, primarily rooted in vitamin D deficiency or dysfunction. Vitamin D, a pivotal regulator of calcium and phosphorus metabolism, plays a crucial role in ensuring proper mineralization of bone.[3,4] Deficiencies in vitamin D, whether arising from insufficient dietary intake, limited sunlight exposure, or impaired hepatic and renal conversion, contribute to the pathogenesis of osteomalacia. The pathophysiology of osteomalacia revolves around the disruption of the intricate balance between bone resorption and formation. Inadequate mineralization occurs when osteoblasts fail to deposit mineralized matrix, resulting in the accumulation of unmineralized osteoid. This imbalance precipitates a cascade of events, including secondary hyperparathyroidism, as the body attempts to maintain serum calcium levels, exacerbating bone demineralization.[5]

Vitamin D, a fat-soluble steroid, operates as essential regulator of calcium and phosphorus homeostasis, pivotal for skeletal mineralization. Insufficient levels of vitamin D, whether arising from inadequate dietary intake, limited sunlight exposure, or impaired metabolic conversion in the liver and kidneys, form the crux of osteomalacia etiology.[6] The global prevalence of vitamin D deficiency underscores the pervasive nature of this health concern, affecting populations across diverse geographical regions and demographic profiles.[7] The clinical manifestations of osteomalacia extend beyond mere structural abnormalities, manifesting as diffuse musculoskeletal pain, proximal muscle weakness, and gait disturbances. These symptoms, often insidious in onset, contribute to the diagnostic challenge associated with osteomalacia, necessitating a comprehensive understanding of its intricate interplay with vitamin D deficiency.[8,9] In literature exploration of osteomalacia and vitamin D deficiency, the focus lies on unraveling the symbiotic relationship between these entities, emphasizing the critical role of vitamin D in skeletal health and the far-reaching consequences of its inadequacy. A nuanced comprehension of this dynamic interplay is imperative for clinicians, researchers, and healthcare providers as they navigate the landscape of prevention, diagnosis, and management of osteomalacia.[10]

Understanding the relationship between osteomalacia and vitamin D deficiency in elderly patients is vital due to the heightened susceptibility of this demographic to skeletal health issues. The aging process often brings diminished vitamin D synthesis and absorption, exacerbating the risk of deficiency. Osteomalacia, a consequence of inadequate vitamin D levels, can lead to compromised bone density and increased fracture risk in the elderly. Recognizing the specific challenges faced by this population, such as reduced sunlight exposure and altered metabolic processes, is crucial for targeted preventive measures. Addressing the diagnostic nuances associated with osteomalacia in older individuals ensures timely interventions, considering overlapping symptoms with age-related musculoskeletal changes. A comprehensive understanding of this interplay informs tailored management strategies, encompassing nutritional interventions and supplementation, ultimately promoting enhanced well-being in elderly patients.

MATERIALS AND METHODS

After approval from the hospital's ethical review board (ERB), this cross-sectional study was conducted at Department of Diabetes and endocrinology HMC Peshawar. The estimated sample size for our study was 140 patients which was calculated online WHO

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calculator (www.openepi.com). This sample size ensures an 80% power of the test and a 95% confidence interval, taking into account the expected frequency of biochemical osteomalacia was 10% in the population of Saudi Arabia.

Inclusion criteria for this study encompassed elderly individuals aged 50 years and above body pain and weakness who sought medical attention at hospital for various health concerns. The age criterion ensured a focus on the specific demographic susceptible to osteomalacia and vitamin D deficiency, contributing to the relevance of the findings for the elderly population.

Exclusion criteria involved individuals below the age of 50, as the study primarily targeted the elderly population. Patients with known metabolic bone disorders other than osteomalacia, patients receiving vitamin D supplementation or specific treatments for bone disorders were excluded. Pregnant women and those with conditions impacting vitamin D metabolism, such as chronic kidney disease, were also excluded to ensure the study's specificity to the elderly population without underlying complicating factors.

Participants underwent a thorough clinical assessment, including medical history review, physical examination, and assessment of musculoskeletal symptoms associated with osteomalacia. Blood samples were collected to measure serum levels of 25-hydroxyvitamin D [25(OH)D], the biomarker for vitamin D status. Additional biochemical markers, such as alkaline phosphatase and parathyroid hormone levels, were also assessed to aid in the diagnosis of osteomalacia. X-rays and, if necessary, bone mineral density scans were conducted to evaluate bone density and identify signs of osteomalacia.

Quantitative data, including serum vitamin D levels and other relevant biochemical parameters, were analyzed using statistical software (SPSS version 25). Descriptive statistics such as mean, standard deviation, and frequency distributions were employed. Chi-square tests or Fisher's exact tests were used to assess associations between categorical variables.

OPERATIONAL DEFINITIONS:

Vitamin D Deficiency: Vitamin D deficiency was defined as a serum 25-hydroxyvitamin D [25(OH)D] level below 75 nmol/L (or 30 ng/ml), indicating insufficient circulating vitamin D and an increased risk for compromised bone health.

Osteomalacia: Osteomalacia is operationally defined as a metabolic bone disorder characterized by the presence of unmineralized osteoid tissue, evident through histological examination, and associated with clinical manifestations such as musculoskeletal pain, proximal muscle weakness, and a predisposition to fractures.

STUDY RESULTS

The study population comprised 140 elderly patients, with ages ranging from 50 to above 80 years. The majority of patients were distributed across three age groups: 61-70 years (40 patients, 28.6%), 71-80 years (45 patients, 32.1%), and 50-60 years (25 patients, 17.9%). Those aged 81 and above accounted for 30 patients, representing 21.4% of the total sample. Regarding gender, a total of 60 patients were male, constituting 42.85% of the population, while 80 patients were female, representing 57.14% as shown in table 1. The musculoskeletal pain was reported in 80 individuals, representing 57.1% of the population. Proximal muscle weakness was observed in 50 patients, accounting for 35.7%. Additionally, 40 patients (28.6%) had a history of fractures as given in table 2.

Table 1: Demographic Details of Included Patients

Variables	Characteristic	Number of Patients	Percentage
Age (Years)	50-60	25	17.9%
	61-70	40	28.6%
	71-80	45	32.1%
	81 and above	30	21.4%
Gender	Male	60	42.85%
	Female	80	57.14%

In the studied patient population, vitamin D deficiency was identified in 68 individuals, comprising 48.57% of the cohort, while 72 patients (51.42%) did not exhibit vitamin D deficiency. Osteomalacia was present in 11 patients, accounting for 7.85%, while the majority, 129 individuals (92.14%), did not show signs of osteomalacia. These results underscore the prevalence of vitamin D deficiency and the occurrence of osteomalacia within the studied patient group as shown in table 3.

Table 2: Frequency of Signs & Symptoms of Included Patients

Signs & Symptoms	Number of Patients	Percentage
Musculoskeletal Pain	80	57.1%
Proximal Muscle Weakness	50	35.7%
Fracture History	40	28.6%

Table 3: Vitamin D Deficiency and Osteomalacia in Studied Patients

Variables	Characteristic	Number of Patients	Percentage
Vitamin D deficiency	Present	68	48.57%
	Absent	72	51.42%
Osteomalacia	Present	11	7.85%
	Absent	129	92.14%

DISCUSSION

Vitamin D is involved in the process of bone mineralization and in controlling the levels of calcium in the bloodstream. Vitamin D deficiency leads to elevated synthesis of parathyroid hormone (PTH) and excretion. Secondary hyperparathyroidism leads to elevated bone remodeling, which subsequently raises the susceptibility to fractures. Osteomalacia occurs when this process becomes severe and long-lasting, and it was histologically observed in 13 to 33% of patients having osteoporotic femoral neck fractures.[11,12]

Our study's demographic composition aligns with existing research findings, demonstrating consistency in gender distribution and age representation among elderly patients. Memon et al. (2021) reported a higher proportion of females (73.3%), which resonates with our study where 57.14% were female.[13] Ahmad et al. (2022) similarly observed a female predominance (61%), resembling our findings. Notably, our study's age distribution corresponds to Ahmad et al.'s observation, their findings indicated that individuals over 35 years comprised the majority, echoing our own demographics where age groups 61-70 years and 71-80 years collectively constituted 60.7% of the total sample.[14]

The prevalence of Vitamin D deficiency in our study is 48.57%, which is lower compared to the rates reported by Mansoor et al. (69.9%) and Zuberi et al. (92%).[15,16] In Pakistan, a study revealed that 53.5% of the population had a shortage of Vitamin D, 31.2% had insufficient levels, and only 15.3% had sufficient levels. A further study carried out in Qatar found that 61.6% of adolescents were affected.[17,18]

In our study, the prevalence of osteomalacia was observed in 7.85% of elderly patients, aligning with existing literature on osteomalacia in different populations. Al-Daghri et al. (2022) reported an overall prevalence of biochemical osteomalacia at 10.0%, slightly higher than our findings. Interestingly, their study highlighted a significant gender difference, with higher prevalence in girls compared to boys, echoing the gender distribution observed in our study where females comprised 57.14% of the population.[19] Notably, the prevalence of osteomalacia in adolescent girls in Nasser et al.'s study was 14.7%, surpassing the rates reported in a prior study by Sulimani et al. (2016) involving 2000 Saudi girls. Sulimani et al. found a lower prevalence of osteomalacia-typical biochemical changes at 2.1%.[20] The discrepancy in prevalence rates could be attributed to variations in sample size, geographic locations, and potentially evolving patterns of Vitamin D deficiency over time. Our findings, in tandem with Nasser et al.'s study, contribute to the understanding of osteomalacia prevalence in different populations, highlighting the relevance of gender-specific considerations. While our study focused on elderly patients, the comparison with studies involving

adolescents emphasizes the need for age-specific investigations to capture the nuanced dynamics of osteomalacia prevalence across diverse age groups.[20]

The study's restriction to a single tertiary care hospital and a specific age group limits the generalizability of findings to broader populations. The cross-sectional design hinders the establishment of causal relationships and understanding temporal dynamics in Vitamin D deficiency and osteomalacia.

CONCLUSION

In conclusion, our study reveals a relatively high prevalence of biochemical osteomalacia 7.85% among Pakistani old age patients challenging previous estimates in other populations. Further research, particularly longitudinal investigations, is warranted to elucidate the intricate dynamics of these conditions over time.

Conflict of Interest: There is no conflict of interest.
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