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ORIGINAL ARTICLE

Association between Vitamin-D Deficiency and Knee Osteoarthritis

TANVEER AFZAL[1], SAFDAR IQBAL[2], SAIF UR REHMAN[3], ABRAR-UL-HAQ[4], MUHAMMAD ZAIN-UL-ABIDIN[5], FARHAN ASLAM[6]
[1]*Associate Professor of Orthopedic Department Fatima Jinnah Medical University, Lahore*
[2]*Clinical fellow at HULS Combined Military Hospital, Lahore*
[3]*Senior Registrar of Orthopedic Surgery, Sir Ganga Ram Hospital, Lahore*
[4,5,6]*Post Graduate Resident (PGR) at Orthopedic Department of Sir Ganga Ram Hospital, Lahore*
Correspondence to: Tanveer Afzal, Email: tanveer_afzal1@yahoo.com, Cell: +92 3004299217

ABSTRACT

Objectives: To determine the association between vitamin-D deficiency and knee osteoarthritis.

Design and Settings: It was a case-control study performed at Sir Ganga Ram Hospital Lahore over 9 months from September 2020 to May 2021.

Study Procedure: This study involved 60 both male and female patients aged between 30-70 years presenting with either osteoarthritis of knee (taken as cases, n=30) or healthy attendants of patients without osteoarthritis of knee (taken as controls, n=30). Serum vitamin D level was acquired in all the study participants and vitamin D deficiency was labeled if it was ≤20ng/ml. Frequency of vitamin D deficiency was then compared between cases and controls and odds ratio was determined. An informed on paper consent was acquired from every study participant.

Findings: The mean age of the patients was 52.2±10.5 years. We observed a female predominance (M:F; 1:1.4). 22 (36.7%) patients were obese while 26 (43.3%) patients belonged to middle socioeconomic class. Majority (n=33, 55.0%) of the patients had rural residence. The rate of vitamin D deficiency was considerably higher in patients with OA knee as compared to controls (70.0% vs. 16.7%; p-value<0.001; 95% CI OR=11.67).

Conclusion: In the current study, we recognized statistically significant association between vitamin D deficiency and knee osteoarthritis regardless of patient's age, gender, BMI and socioeconomic and residential status which advocates routine assessment of vitamin D among patients presenting in orthopedic outdoor so that timely identification and anticipated management of vitamin D deficiency may improve the outcome of such cases in future orthopedic practice.

Keywords: Osteoarthritis, Vitamin D, Vitamin D Deficiency

INTRODUCTION

Osteoarthritis is a chronic, slowly progressive degenerative join disease which is characterized by gradual loss of articular cartilage and narrowing of joint space along with formation of osteophytes.[1] In later stages, sclerosis of the articular edges and subchondral cysts formation is also seen.[1,2] It mainly affects the weight bearing joints particularly the knee joint followed by hip and ankle joints.[1-3] Knee joint osteoarthritis is a fairly common presentation in orthopedic outdoors affecting mainly middle aged to elder citizens.[2,3] Existing research has identified a number of factors attributable to the development and severity of OA knee including but not limited to positive family history, female gender, overweight and obesity, occupations involving repeated microtrauma, previous accidents and joint injuries as well as infections.[4,5] However many of these risk factors are non-modifiable and can't help in disease prevention and management. Therefore, there is an ongoing research to identify modifiable risk factors of osteoarthritis as knowing the risk factors associated with the disease can help in preventing or at least slowing down the progress of disease. It can also improve patient's response to treatment.[5]

In a recent Indian study, Rao et al.[6] (2020) stated that the frequency of vitamin D deficiency was considerably higher among patients with osteoarthritis of knee joint (61.0% vs. 8.0%; p-value=0.001) as compared to controls. In the light of this evidence, vitamin D deficiency might be associated with OA knee and therefore warrants routine screening of such patients so that timely identification and anticipated management by prescribing vitamin D supplements in addition to routine practice of analgesics only may improve the outcome of patients with OA knee. However before concluding, it's worth mentioning that Anari et al.[7] (2019) in another similar study reported only insignificantly higher frequency of vitamin D deficiency in Iranian patients with OA knee (27.8% vs. 24.0%; p-value=0.36) negating any such association. A possible explanation for this conflict among studies can be the overall high prevalence of vitamin D deficiency in Indo-Pak.[8]

Thus the existing evidence on association between vitamin D deficiency and knee osteoarthritis contained controversy while there was no such published research in local population which compelled the current study with a hope that if the results of the present study revealed association between vitamin D deficiency and knee osteoarthritis, it will warrant routine screening that will enable timely identification of patients with OA knee having vitamin D deficiency allowing better management of such cases in future orthopedic practice.

Study Procedure: This was a case-control study performed at Sir Ganga Ram Hospital Lahore over 9 months from September 2020 to May 2021. Sample size of 60 patients (30 cases and 30 controls) was estimated taking power of test as 80% and significance level as 95% while considering anticipated frequency of vitamin D deficiency as 61.0% among patients with knee osteoarthritis and 8.0% among controls.[6] Non-probability, consecutive sampling was performed and patients of 30-70 years age from both genders presenting with osteoarthritis of knee (cases, n=30) or health attendants of patients without osteoarthritis of knee (controls, n=30) were included. Obese patients and those with chronic renal failure or history of vitamin D supplementation were excluded. We also excluded pregnant and lactating females and those taking drugs which could affect vitamin D metabolism. Serum vitamin D level was acquired and vitamin-D deficiency was labelled if it was ≤20ng/ml. Patients with vitamin D deficiency were managed as per department protocols.

RESULTS

Patient's age ranged from 30 to 70 years with a mean age of 52.2±10.5 years. There were 25 (41.7%) males and 35 (58.3%) females with a female to male ratio of 1.4:1. Patient's BMI ranged from 21.8 to 34.5 Kg/m^2 with a mean BMI of 28.4±3.4 Kg/m^2 and 22 (36.7%) patients were obese. 26 (43.3%) patients belonged to middle socioeconomic class followed by 23 (38.3%) patients from lower class and 11 (18.4%) patients from upper class. Majority (n=33, 55.0%) of the patients had rural residence. Both the study groups were comparable in terms of demographic characteristics as shown in Table 1.

Vitamin D deficiency was noticed in 26 (43.3%) patients. The rate of vitamin D deficiency was considerably higher in patients with OA knee as compared to controls (70.0% vs. 16.7%; p-value<0.001; 95% CI OR=11.67) as shown in Table 2.

Table 1: Demographic Characteristics of Studied Groups n=60

Characteristic	Cases n=30	Controls n=30	P-value
Age (years)	52.3±10.2	52.1±11.1	0.942
• <50 years	12 (40.0%)	13 (43.3%)	0.943

• 50-60 years	11 (36.7%)	11 (36.7%)	
• >60 years	7 (23.3%)	6 (20.0%)	
Gender			
• Male	12 (40.0%)	13 (43.3%)	0.793
• Female	18 (60.0%)	17 (56.7%)	
BMI (Kg/m^2)	28.4±3.6	28.3±3.3	0.909
• 20-25 Kg/m^2	6 (20.0%)	7 (23.3%)	0.943
• 25-30 Kg/m^2	13 (43.3%)	12 (40.0%)	
• 30-35 Kg/m^2	11 (36.7%)	11 (36.7%)	
Socioeconomic Status			
• Lower Class	11 (36.7%)	12 (40.0%)	0.866
• Middle Class	14 (46.7%)	12 (40.0%)	
• Upper Class	5 (16.6%)	6 (20.0%)	
Residence			
• Rural	16 (53.3%)	17 (56.7%)	0.795
• Urban	14 (46.7%)	13 (43.3%)	

Insignificant difference was observed on Independent sample t-test and Chi-square test

Table 2: Comparison of Vitamin D Deficiency between Patients of OA Knee and Controls n=60

Vitamin D Deficiency	Cases (n=30)	Controls (n=30)	P-value	95% CI OR
Yes	21 (70.0%)	5 (16.7%)	<0.001*	11.67
No	9 (30.0%)	25 (83.3%)		
Total	30 (100.0%)	30 (100.0%)		

* Significant difference was observed on chi-square test

DISCUSSION

Among, the conditions involving musculoskeletal system, osteoarthritis (OA) is the most common and can involve virtually any joint.[9] However, it mainly affects knees which are predominant weight-bearing joints.[9,10] It is appraised that it affects about 10% of men and 13% of women after 60 years of age which makes knee OA the leading causes of disability in this population group.[11] Steroidal hormone, Vitamin D has various biological actions in a variety of tissues.[12] Though it is primarily involved in calcium homeostasis; the full scope of vitamin D's actions rests undetermined.[12,13] Activated vitamin D adds to the assembly of osteocalcin, proteoglycans and alkaline phosphatase hence maintaining cartilage health.[12,14,15] Therefore, a state of vitamin D deficit may inflict a higher risk of degeneration of articular cartilage.[12-15] A recent study proposed that vitamin D deficiency was associated with increased risk of OA knee.[6] As vitamin D deficiency could be prevented as well as treated; the results of this study augured the primary prevention of osteoarthritis.[6] However, the available evidence was limited and contained controversy while there was no such published research in local population which compelled the current study.

In the current study, the mean age of the patients presenting with osteoarthritis of knee joint was 52.2±10.5 years. A comparable mean age of 52.2±9.3 years has been stated by Ghaznavi et al.[4] (2017) among patients with osteoarthritis of knee presenting at Liaquat National Hospital, Karachi. Khalid et al.[16] (2015) described similar mean age of 52.6±8.8 years at Bahawal Vitoria Hospital Bahawalpur while Kidwai et al.[17] (2016) reported it to be 50.7±10.2 years in Karachi. Our observation matches with an American study where Moseley et al.[18] (2002) reported similar mean age of 52.0±11.1 years among patients with OA knee. In similar studies involving Indian patients with OA knee, Tripathy et al.[19] (2020) and Sanghi et al.[20] (2013) described comparable mean age of 51.0±6.7 years and 53.2±9.6 years respectively while Akhter et al.[21] (2021) observed it to be 53.5±6.9 years in Bangladesh.

We observed that there was female predominance among patients presenting with OA knee with a female to male ratio of 1.4:1. Ghaznavi et al.[4] (2017) reported similar female predominance with a male to female ratio of 1:1.6 at Liaquat National Hospital, Karachi. A comparable male to female ratio of 1:1.5 has been described by Khalid et al.[16] (2015) at Bahawal Victoria Hospital, Bahawalpur while Kidwai et al.[17] (2016) described a male to female ratio of 1:1.7 in Karachi. Our observation also matches with that of similar Indian studies where Tripathy et al.[18] (2020), Rao et al.[6] (2020) and Sanghi et al.[20] (2013) observed a comparable female predominance and reported a male to female ratio of 1:1.6, 1:1.5 and 1:1.5 respectively among patients with OA knee. Akhter et al.[21] (2021) reported a male to female ratio of 1:1.5 in Bangladeshi such patients in line with the current study.

In the present study, the rate of vitamin D deficiency was considerably higher in patients with OA knee as compared to controls (70.0% vs. 16.7%; p-value<0.001; 95% CI OR=11.67). Our observation matches with that of Rao et al.[6] (2020) who conducted a similar case-control study over 200 Indian patients with osteoarthritis of knee and reported that the rate of vitamin D deficiency was ominously higher among patients with osteoarthritis of knee joint (61.0% vs. 8.0%; p-value=0.001) as compared to controls.

The current study is first of its nature in Pakistani population and expands the inadequate already published international research data on the topic. In the present study, we found statistically significant association between vitamin D deficiency and knee osteoarthritis regardless of patient's age, gender, BMI and socioeconomic and residential status. As vitamin D deficiency is simple to treat, we advocate that vitamin D status should be routinely assessed among patients presenting in orthopedic outdoor and those with vitamin D deficiency should be treated as per department protocols so that timely identification and anticipated management of vitamin D deficiency may improve the outcome of such cases in future orthopedic practice.

The strengths of the present study were its large sample size of 60 cases and strict exclusion criteria. We also randomized the study groups and stratified the data to address various effect modifiers. A very strong limitation to the present study was that we didn't correlate vitamin D levels with the severity of OA knee. We also didn't consider the effect of vitamin D deficiency and vitamin D replacement on the treatment response and outcome of such cases which could have helped in the risk stratification and management planning of such cases. Such a study is imperative and is highly recommended in future clinical research.

CONCLUSION

In the current study, we recognized statistically significant association between vitamin D deficiency and knee osteoarthritis regardless of patient's age, gender, BMI and socioeconomic and residential status which advocates routine assessment of vitamin D among patients presenting in orthopedic outdoor so that timely identification and anticipated management of vitamin D deficiency may improve the outcome of such cases in future orthopedic practice.

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