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Impact of Vitamin D Status on Psoriasis Disease Activity: A Case Control Study from Central India

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ABSTRACT
Psoriasis is known as a chronic immune-mediated inflammatory skin condition with well-defined erythematous plaques covered with silvery white scales. In 2014, the World Health Organization recognized psoriasis as a serious noncommunicable disease and pointed out the distress associated with mis diagnosis, inadequate treatment and the indictment of the disease. Vit D modulates the immune system and reduces the inflammation in psoriasis. Addressing vitamin D deficiency is crucial component of psoriasis severity and its management and present study will be helpful for this less explored interrelation. A total of 100 patients presenting to dermatology OPD with psoriasis were studied. Also 100 healthy controls from the hospital were also enrolled. Detailed history was taken and clinical examination of psoriasis cases was done. The degree of the illness was determined using the Psoriasis Area Severity index (PASI) and body surface area (BSA). All cases and controls were subjected to routine laboratory investigations and serum vitamin D (25-hydroxyvitamin D) levels. Our study showed that the max. number of patients of psoriasis belonged to the 41-50 years old age group (M: F-1.7). 46% of psoriasis cases had a vitamin D deficiency. In our study, we observed a significant correlation between low serum 25(OH) D level and PASI score, defining the severity of psoriasis. Our study shows that vitamin D deficiency is strongly related to psoriasis disease activity. Maintenance of serum 25-hydroxy vitamin D levels above 30ng/ml could contribute to a better outcome in psoriasis.

INTRODUCTION

Psoriasis is known as a chronic immune-mediated inflammatory skin condition with well-defined erythematous plaques covered with silvery white scales and having variable subtypes such as flexural, guttate, pustular and erythrodermic. The scalp, face, nails, genitalia, palms and soles are some of the high-impact and difficult-totreat psoriasis sites that require long-term treatment. In 2014, the World Health Organization recognized psoriasis as a serious noncommunicable disease and pointed out the distress associated with mis diagnosis, inadequate treatment and the indictment of the disease[1]. In the immunopathogenesis of psoriasis, Th17 and Th1 cells are involved. It is believed that the interaction between innate immunity (especially dendritic cells and keratinocytes) and adaptive immunity (T lymphocytes) is involved in the pathogenesis of psoriasis[2,3]. Morbidities such as risk of cardiovascular diseases, metabolic syndrome like obesity, hypertension, insulin resistance and dyslipidaemia as well as depression and anxiety are prevalent among people with psoriasis and have a profound impact on quality of life due to functional impairment, economical burden and stigma due to visible nature of diseases. 5-hydroxyvitamin D is the most stable form with a half-life of 2-3 weeks, hence it is a reliable medical indicator of vitamin D status[4]. It acts on calcium homeostasis and bone metabolism and has immune-regulating functions that have been recently recognized[5]. Vitamin D (25-hydroxyvitamin D) is a hormone whose synthesis is stimulated by cutaneous exposure to ultraviolet B radiation[6]. Some studies have demonstrated a relationship between vitamin D deficiency and immune dysregulation, abnormal keratinolytic differentiation and increase inflammatory responses in psoriasis, eventuating increased severity of psoriasis with extensive skin involvement and potential reduced therapeutic efficacy[7,8]. Also, Vit D modulates the immune system and reduces the inflammation in psoriasis along with its benefits on psoriatic arthritis, which has detrimental effect in the form of inflammation, stiffness and pain, osteoporosis and reduce bone density. Addressing vitamin D deficiency is crucial component of psoriasis severity and its management and present study will be helpful for this less explored interrelation as the two contribute to the current demography and behavioural aspects of the population.

MATERIALS AND METHODS

A hospital-based case control study was conducted in a tertiary care center in central India on 100 clinically diagnosed psoriasis patients, attending the Outpatient Department or admitted to the Dermatology ward and 100 healthy controls over a period of 24 months from August 2021 to July 2023. Clinically diagnosed cases of psoriasis were included in the study, also 100 healthy individuals without psoriasis were included as control. Patients with underlying diseases such as diabetes, hypertension, thyroid illness, liver disease, kidney disease, inflammatory bowel disease, malabsorption syndromes, malignancy, or acute and chronic infections were excluded from our study. Pregnant women, smokers and alcoholic patients were also excluded. Patients on vitamin D therapy or any medication that alters vitamin D levels were too excluded from our study. In present study, a total of 100 patients presenting to dermatology OPD with psoriasis were studied. Also 100 healthy controls of medical students, nursing and hospital staff were enrolled for comparative evaluation. Written consents were obtained from all the subjects who participated in the study before the study was started. Institutional ethics committee reviewed the study proposal for ethical consideration and approval was given. A detailed history of disease onset, progression, duration and distribution was taken and clinical examination of psoriatic cases was done in the form of morphology, site predilection, sub types of psoriasis being involved. The degree of the illness was determined using the Psoriasis Area Severity index (PASI) and body surface area (BSA) of patients. All cases were subjected to routine laboratory investigations and serum vitamin D (25-hydroxyvitamin D) levels. 100 healthy individuals were also subjected to vitamin D assessment. Specific investigations like skin biopsy and dermoscopy were conducted wherever necessary and conclusion was established on the grounds of all findings. Data was analyzed using appropriate statistical software and appropriate statistical tests (t test, chi square test etc.) were applied for significance, wherever necessary

RESULTS AND DISCUSSIONS

In present study, out of total 100 enrolled cases of psoriasis, males were 63 (63% of total cases) and the females were 37 (37% of total cases) with male to female ratio of 1.70 :1. Male to female ratio was found to be highest (2.40:1) in the age range of 21-30 years while it was marginal (1-1.2:1) in age range of 51-70 years. Patients with all age group were included, ranging from 8 years to 76 years. Maximum number of patients with psoriasis (24%) was in the age group of 41-50 years followed by 23 % in 31-40 years while least number of cases was observed in the age range of 71-80 years **(See table 1)**. The mean age was found to be 36.01 years in present study.

Distribution of Psoriasis Subtypes: Among 100 cases, the most prevalent kind of psoriasis was chronic plaque psoriasis in 51 cases (51%), with 31 males and 20 females, followed by 13 cases of palmoplantar psoriasis (13%), guttate psoriasis in 11 cases (11%), scalp psoriasis in 10 cases (10%) and the least common

Table 1: Age and Sex Vise Distribution of Cases and Controls

Age Range	Male Cases	Female cases	Male female cases Ratio	Total Cases	Male control	Female control	Male female control Ratio	Total control
0-10	2	1	2	3	4	0	4:0	4
11-20	10	7	1.43	17	12	5	2.4	17
21-30	12	5	2.40	17	14	4	3.5	18
31-40	16	7	2.28	23	21	5	4.2	26
41-50	15	9	1.67	24	14	7	2	21
51-60	6	5	1.2	11	6	4	1.5	10
61-70	2	2	1	4	2	2	1	4
71-80	0	1	-	1	0	0	-	0
Total	63	37	1.70	100	73	27	2.7	100

Table 2: Distribution of Various Types of Psoriasis

Type of Psoriasis	Male	%	Female	%	Ratio	Total	%
Plaque	31	49.2	20	54.05	1.55	51	51
Guttate	6	9.52	5	13.51	1.20	11	11
Palmoplantar	9	14.29	4	10.8	2.25	13	13
Scalp	7	11.11	3	8.10	2.33	10	10
Palmopustuler	2	3.17	1	2.70	2	3	3
Generalized pustular	1	1.59	1	2.70	1	2	2
Erythrodermic	5	7.93	2	5.40	2.5	7	7
Inverse	2	3.17	1	2.70	2	3	3
Total	63	100	37	100	1.70	100	100

Table 3: Disease Activity (PASI Score)

	Deficient (<20ng/dl)	Insufficient (20-30ng/dl)	Sufficient (>30ng/dl)
Mild (n-21)	4 (19%)	10 (48%)	7 (33%)
Moderate (n-43)	21 (49%)	6 (14%)	16 (37%)
Severe (n-36)	21 (58%)	8 (22%)	7 (20%)
Cases of psoriasis (n-100)	46 (46%)	24 (24%)	30 (30%)
Control (n-100)	21 (21%)	15 (15%)	64 (64%)

type was generalized pustular psoriasis in 2 cases (2%). While male and female patients had high preference for plaque psoriasis, females were least inclined to palmoplantar, pustular and inverse psoriasis (1 case each) and males had least affinity towards pustular (1 case) followed by inverse psoriasis (2 cases). Interestingly male to female ratio was higher in erythrodermic psoriasis (2.5) and substantially lower in generalized pustular psoriasis (1) and guttate psoriasis (1.2). **(See table 2)**. Among all 100 patients with psoriasis, 64 cases had duration of disease lasting <5 years, while 36 had psoriasis for >5 years. Longer duration of lesions was associated with plaque psoriasis and erythrodermic psoriasis while shorter duration of illness was associated with pustular and guttate psoriasis. We observed 18 cases of psoriatic arthritis in our study. Seven cases had a longer duration of psoriasis, five cases had psoriasis affecting the nails and 11 cases had severe plaque psoriasis. Psoriatic arthritis was more common in males (Male: Female ratio of 11:7) and was most frequently observed in patients aged 30-50 years (10 patients). After calculating the PASI score, 21 patients had a PASI score <3 (mild), 43 patients had between 3-10 (moderate) and 36 patients had a PASI score greater than 10 (severe). Higher PASI score was found in erythrodermic (7%), generalized pustular (2%) and plaque psoriasis (27%), while low PASI score was found in guttate psoriasis (7%) and inverse psoriasis (3%).

Correlation Between Serum Vitamin D and Psoriasis Activity: In Our case control Study, 46% cases of psoriasis inclusive of all types and both genders were vitamin D deficient and 11% were Vitamin D insufficient. On vitamin D assessment of 100 healthy control, 21% were Vitamin D deficient and 15% controls were Vitamin D insufficient. **(See table 3).** Out of 36 patients with a high PASI score, 21 cases (58%) had a deficient vitamin D level and 8 cases (22%) had an insufficient vitamin D level. In contrast, out of 21 cases with a low PASI score, only 4 cases (19%) had vitamin D deficiency. Additionally, sufficient vitamin D levels were found in only 30 cases and among them, only 7 cases had a severe PASI score. We found p-value is much smaller than the typical significance level of 0.05, we can reject the null hypothesis. This suggests that there is a significant association between the disease activity (PASI score) and the group (psoriasis cases vs. control). 48% of cases with a lower PASI score were significantly associated with insufficient vitamin D, whereas 20% of cases with a higher PASI score were inversely related to sufficient vitamin D levels.

Our study observed a higher prevalence of psoriasis in males, with a male-to-female ratio of 1.7. This finding aligns with the results of Mehta *et al.* and Hassan R *et al.*, who reported male-to-female ratios of 4:1 and 3:2, respectively, in psoriasis patients[9,10]. In our study, the maximum number of patients (24%) belonged to age group 41-50 years and maximum numbers of controls (26%) belonged to 31-40 years of age group. M Ardakani *et al* in their study found mean age of psoriasis cases to be 39.01 years and control to be 39 years respectively[11]. Opposed to our finding, onset at ≤40 years has been reported in approximately 75.0% of psoriasis patients globally. In the present study, 64% of patients had a duration of illness of 36%. Similarly, a study conducted by Bhat *et al.* with 285 psoriasis

patients found that 62.1% of them had symptoms for <5 years[12]. We found that 18% of psoriasis patients had psoriatic arthritis. Similarly, a study conducted by Alinaghi F *et al*, reported that 23.8% of psoriasis patients had psoriatic arthritis[13]. In the present study, 46% of psoriasis cases had a vitamin D deficiency compared to 21% of healthy individuals. Additionally, 24% of psoriasis cases had insufficient vitamin D levels compared to 15% of healthy individuals. Only 30% of psoriasis cases had sufficient vitamin D levels, whereas 64% of healthy individuals had sufficient levels. Bhat *et al.* in their study observed 40.7% 28.4% and 30.9% psoriasis patients had sufficient, insufficient and deficient 25-hydroxy vitamin D levels respectively, compared to 82.0%, 18.0% of healthy controls having sufficient and insufficient vitamin D levels respectively[12]. In our study, we observed a significant correlation between low serum 25(OH) D level and PASI score, defining the severity of psoriasis. Similar observations have been made in a study conducted by Chandrasekhar *et al,* where PASI was found to be correlated with inflammatory and oxidative parameters[14]. Our observation was in consistency with the studies of Ricceri *et al.* along with majority of other studies, wherein they showed low levels of serum 25-hydroxy vitamin D in psoriasis patients, 68% and 97% patients being vitamin D deficient and insufficient respectively as compared to control subjects[15]. Findings of our study points out that low vitamin D levels in psoriasis could be attributed to dysfunctional skin barrier due to scaly plaque of psoriasis, inflammatory cytokines disrupting normal metabolism of vitamin D and genetic predisposition in psoriasis influencing the effective metabolism and utilization of vitamin D. Avoidance of sun exposure and comorbid condition like obesity may also complicate vitamin D metabolism.

CONCLUSION

Our study and the current available data show that 25-hydroxy vitamin D deficiency are strongly related to psoriatic disease activity, characteristics and severity of psoriasis. Maintenance of serum 25-hydroxy vitamin D levels above 30ng/ml could contribute to a better outcome in psoriasis. This study analyzes the vitamin D status considering the fact that a decrease in vitamin D level in psoriasis patients was associated with increased risk of metabolic syndrome and other comorbidities and this bidirectional relationship is important to delineate the risk to further provide adequate dietary intake of vitamin D. Large randomized controlled trials in the given population should be accomplished in providing this less explored interrelation to further contribute to the current demographic and behavioral aspects of the population and also to see whether increase in 25-hydroxy vitamin D levels would result in a statistically significant clinical improvement.

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