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Obstructive Sleep Apnea Screening in Psoriasis Using the STOP-Bang Questionnaire: A Cross-Sectional Study

Diego Chemello[1,2], Luiza Metzdorf[2], Marco Aurélio Lumertz Saffi[3], Luciane Prado de Vargas[4] & Raíssa Massaia Londero Chemello[1,4]

[1] Department of Clinical Medicine, Health Science Center, Universidade Federal de Santa Maria (UFSM), Santa Maria, Rio Grande do Sul, Brazil

[2] Postgraduate Program in Health Sciences, Universidade Federal de Santa Maria (UFSM), Santa Maria, Rio Grande do Sul, Brazil

[3] Hospital de Clínicas de Porto Alegre (HCPA), Porto Alegre, Rio Grande do Sul, Brazil

[4] Dermatology Service, Universidade Federal de Santa Maria (UFSM), Santa Maria, Rio Grande do Sul, Brazil

Correspondence: Diego Chemello, Universidade Federal de Santa Maria (UFSM), Cento de Ciências da Saúde – Departamento de Clínica Médica, Av. Roraima, 1000. Prédio 26. Cidade Universitária, Bairro Camobi. Santa Maria 97105-900, RS, Brazil. Tel: +55-55-3220-8000. orcid.org/0000-0003-2051-2321. E-mail: chemello.diego@gmail.com

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Abstract

Introduction: Psoriasis is a chronic, immune-mediated inflammatory disease characterized by sharply circumscribed erythematous plaques on the trunk and limbs. Reports are suggesting low sleep quality and increased risk of Obstructive Sleep Apnea Syndrome (OSAS) in psoriasis patients.

Methods: The present study aimed to investigate the array of OSAS in psoriasis based on the STOP-Bang questionnaire. The study was cross-sectional. The sample was sequential and for convenience. The association between categorical variables was verified with Pearson's chi-square and Fischer's exact tests, and Pearson and Spearman's correlations were used to evaluate the relationships between the continuous variables. $P<0.05$ values were considered significant.

Results: A total of 104 patients were selected, 53 (51%) males, with a mean age of 51.7±14.8 years. Body mass index was 29.3±5 kg/m^2. Hypertension was present in 38 (36.5%) and diabetes in 19 (18.3%) patients. Psoriasis was controlled in 87 (83.7%) patients, determined by the PASI Score below 10 points. Regarding the risk for sleep apnea, 36 (34.6%) were at high risk, 28 (26.9%) were at intermediate risk, and 40 (38.5%) were at low risk. There was no significant correlation between the degree of severity of psoriasis and the risk of apnea by the STOP-Bang score ($p=0.6$).

Conclusions: The present study suggests an increased prevalence in high and intermediate-risk scores for OSA in the population with psoriasis. No association was observed between the degree of severity of psoriasis and apnea risk. Prospective controlled studies using the diagnosis of OSAS by polysomnography are necessary.

Keywords: sleep apnea, obstructive, psoriasis, cross-sectional Studies

1. Introduction

Psoriasis is a chronic, immune-mediated inflammatory disease characterized by sharply circumscribed erythematous plaques with silvery scales on the trunk and limbs. Its prevalence ranges from 0.5% to 11.4% in adults (Michalek, Loring, & John, 2017). Although it was formerly considered to be only a skin disease until a few decades ago, it is now considered a multisystemic disease (Kim, Jerome, & Yeung, 2017). One of the conditions associated with psoriasis is poor sleep quality, particularly obstructive sleep apnea (OSA) and snoring by triggering obesity and metabolic syndrome (Ger, Fu, & Chi, 2020).

Obstructive sleep apnea syndrome (OSAS) is considered a common sleep disorder that is observed with a prevalence of 2% - 4% in the general population (Kabeloglu Ilbay, Tas, Altuntas, Atakli, & Soysal, 2019) to even 20% of at least mild OSAS (Benjafield et al., 2019). It is characterized by episodes of recurrent upper airway

collapse, which leads to hypoxia, hypercapnia, and changes in the intrathoracic pressure (Ralls & Cutchen, 2019). It is associated with the increased nocturnal activity of the sympathetic nervous system, which results in elevated blood pressure and inflammatory and oxidative stress markers. In the clinical matter, OSAS is characterized by recurrent episodes of intermittent hypoxia, recurrent awakening, and excessive daytime sleepiness associated with recurrent partial or complete airway obstruction of the upper respiratory tract (Kabeloglu Ilbay et al., 2019).

The OSA plays a role in the pathogenesis of psoriasis. The sleep disorder causes changes in the microvascular structure through inflammatory activation. As a consequence, interactions between these two conditions may worsen the pathogenic course of each disease (Cohen, Jackson, Li, Wu, & Qureshi, 2015). The bidirectional relationship is demonstrated epidemiologically with an increased frequency of psoriasis in OSA patients and vice versa (Ger et al., 2020). One of the best pieces of evidence so far published consists of a meta-analysis of case-control and cross-sectional studies. It found 2.6-fold greater odds for prevalent OSA in relation to psoriasis and 13-fold increased odds for prevalent psoriasis about OSA (Ger et al., 2020).

Due to the growing number of patients suspected of having OSA being referred to sleep clinics, screening methods have become increasingly important. The gold standard for diagnosis of OSA is an overnight polysomnogram (PSG). However, PSG is time-consuming, labor-intensive, and costly. The PSG also requires the expertise of sleep medicine specialists, which may not be readily available at many centers. Therefore, a simple and reliable method of identifying patients at high risk of OSA and triaging them for prompt diagnosis and treatment is clinically relevant.

The STOP-Bang questionnaire was first developed in 2008 (Chung et al., 2008). It is a simple, easy to remember, and self-reportable screening tool, which includes four subjective (STOP: **S**noring, **T**iredness, **O**bserved apnea and high blood **P**ressure) and four demographic items (Bang: **B**MI, **a**ge, **n**eck circumference, **g**ender) (Chung et al., 2008). The STOP-Bang questionnaire was validated initially to screen for OSA in the surgical population. The sensitivity for the STOP-Bang score ≥3 as the cut-off to predict any OSA (apnea-hypopnea index (AHI) >5), moderate-to-severe OSA (AHI >15) and severe OSA (AHI >30) was 83.9%, 92.9% and 100% respectively (Chung et al., 2008).

Due to its ease of use and high sensitivity, the STOP-Bang questionnaire has been widely used in preoperative clinics (Chung et al., 2008; Nunes et al., 2015), sleep clinics (Boynton, Vahabzadeh, Hammoud, Ruzicka, & Chervin, 2013), the general population (Silva, Vana, Goodwin, Sherrill, & Quan, 2011) and other special populations (Nicholl et al., 2013) to detect patients at high risk of OSA.

In our psoriasis outpatient clinic, located in a tertiary public center of a teaching hospital in Brazil, the investigation of sleep disorders is lacking, mainly because of limited resources, particularly the absence of overnight PSG for investigation. The present study aimed to investigate the array of OSAS in psoriasis based on the STOP-Bang questionnaire.

2. Methods

2.1 Study Design

The design was a cross-sectional study. The local ethics committee gave its approval before the initiation of the study. The study was conducted according to the principles of the Declaration of Helsinki.

After obtaining written informed consent, 104 subjects (53 male and 51 female) with psoriasis were enrolled in our dermatology clinic between January and September of 2019.

The diagnosis of psoriasis was performed with both clinical and histopathological examinations. All subjects were at least 16 years old. Exclusion criteria included cognitive impairment, psychiatric and other dermatological disorders. Body weight was measured in kilograms (Kg), and height was measured in meters (m). The body mass index (BMI) was then calculated as follows: weight in kilograms divided by height in meters squared (kg/m^2). Neck circumference was measured with a 150 cm tape measure, whose smallest markings were at 0.01 cm intervals, and was determined at the level of the cricothyroid membrane.

The severity of psoriasis was evaluated using the Psoriasis Area and Severity Index (PASI). Measurements for the PASI include mean redness, thickness, and desquamation of lesions (0–4°), weighted by the area of involvement, with the total score ranging from 0 (disease-free) to 72 (maximal disease). The patients also completed the STOP-Bang questionnaire. The four initial questions - those corresponding to the “STOP” portion of the questionnaire - were answered by the patients themselves. The responses to the questions corresponding to the “Bang” portion of the questionnaire were collected by the researcher on a standardized form. Factors that may cause sleep disorders were investigated. Neurological examinations were performed when considered necessary,

as per physician discretion.

2.2 Statistical Analysis

All statistical analyses were performed using the Statistical Package for Social Sciences 21.0 *(IBM Corp.; Armonk, NY, USA)* software package program. The Shapiro-Wilk test was used to confirm the normal distribution of all data in the present study. The continuous variables were expressed as means ± SD, and Student's t-tests were used to compare the means between the two groups. The Chi-square test was used for categorical variables to test the differences between groups.

The Variance analysis, the ANOVA, and the Kruskal-Wallis tests were used to compare the measurements between the apnea risk categories. The association between categorical variables was verified with Pearson's chi-square and Fischer's exact tests. Pearson and Spearman's correlations were used to evaluate the relationships between the continuous variables. Unless otherwise stated, $p<0.05$ was set as the significance level.

3. Results

A total of 104 patients were included in the study. The mean age was 51.7 ± 14.8 years, ranging from 18 to 82 years, with a slight majority of males (51%). The mean abdominal circumference was 100.5 ± 12.3 cm, the mean weight was 80 ± 15.5 kg, and the mean body mass index was 29.3 ± 5. Hypertension was presented in 38 (36.5%) patients, and diabetes mellitus (DM) in 19 (18.3%). Active smoking was reported by 29 (27.9%) patients, and smokers in abstinence were 38 (36.5%) patients. Regarding alcohol consumption, 94 (90.4%) patients stated that they did not use alcohol regularly.

Regarding the psoriasis, 87 (83.7%) patients presented PASI score below 10 points. Vulgar psoriasis was the most frequent subtype of the disease, corresponding to 84 cases (80.8%). The mean age of psoriasis diagnosis was 38.6 ± 16.8 years, and the median disease time was 9.5 years (interquartile range of 5.0-19.5 years).

Table 1 presents the demographic, anthropometric, psoriasis characteristics, severity and lifestyle of the patients included in the study.

Table 1. Demographic, anthropometric, lifestyle and psoriasis characteristics in the sample of patients under consultation at the dermatology outpatient clinic of the University Hospital of *Santa Maria* from January to September 2019 (N=104)

Characteristics	**FrequencyN (%)**
Demographic	
Age in years	51.7±14.8
Gender	
Male	53 (51)
Female	51 (49)
Anthropometric	
Weight (kg)	80±15.5
Body Mass Index (kg/m^2)	29.3±5
Abdominal circumference (cm)	100.5±12.3
Neck circumference (cm)	39.1±4
Lifestyle	
Smoking	
No	37 (35.6)
Ex-smoker	38 (36.5)
Smoker	29 (27.9)
Alcoholism	10 (9.6)
Psoriasis	
PASI (median II)	5 (3-8.2)
PASI Classification	

<10	87 (83.7)
≥10	17 (16.3)
Age of diagnosis (years)	38.6±16.8
Time of diagnosis (years)	9.5 (5-19.5)
Type of psoriasis	
Skin	84 (80.8)
Cutaneous + arthritis	13 (12.5)
Cutaneous + nail	6 (5.8)
Psoriatic arthritis	-
Ungueal	-
Nail + Arthritis	-
Cutaneous + nail + arthritis	1 (1)
Comorbidities	
Hypertension	38 (36.5)
Central obesity	82 (78.8)
Systolic blood pressure (mmHg)	131.8±18.5
Diastolic blood pressure (mmHg)	82±11.9
Heart rate (beats/sec)	76.8±13.3
Diabetes	19 (18.3)
Asthma or chronic obstructive pulmonary disease	7 (6.7)
Chronic kidney disease	4 (3.8)
HIV-AIDS human immunodeficiency virus	2 (1.9)
Hypothyroidism	8 (7.7)
Hyperthyroidism	1 (1)

Data are mean ± SD; number (%) or interquartile range of patients. PASI = Psoriasis Area and Severity Index.

Regarding medical treatment, 80 patients (76.9%) used immunosuppressive medication. Among them, methotrexate was the most frequent, being used by 73 patients (70.2%), followed by immunobiological agents (adalimumab by seven patients and ustekinumab by four patients). The list of immunosuppressive drugs is described in Table 2.

Table 2. Medications in use by patients under consultation at the dermatology outpatient clinic of the University Hospital of *Santa Maria* from September to September 2019 (N=104)

Variables	**Frequency N (%)**
Medications	
Immunosuppressor	80 (76.9)
Methotrexate	73 (70.2)
Adalimumabe	7 (6.7)
Ustekinumab	4 (3.8)
Secukinumab	1 (1)
Cyclosporine	1 (1)

Data are number (%) of patients.

3.2 Sleep Apnea Trace by STOP-Bang Questionnaire

The application of the STOP-Bang questionnaire for sleep apnea screening revealed a median of 2.0 points

(interquartile range 2.0-4.0). The patients presented more frequently low risk for OSAS, evidenced in 40 cases (38.5%), followed by high risk in 36 cases (34.6%), and intermediate risk in 28 cases (26.9%) (Figure 1).

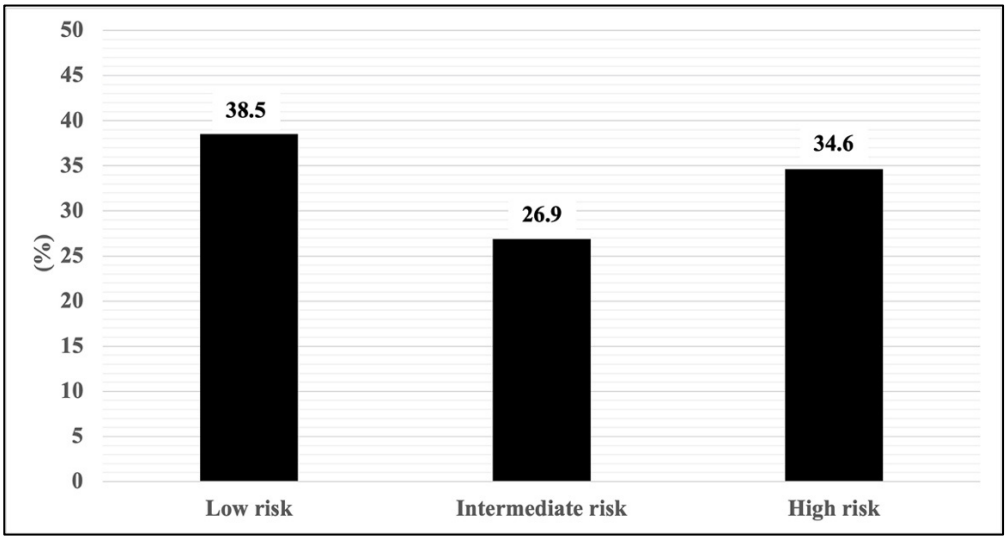

Figure 1. Frequency of risk categories defined from STOP-Bang Questionnaire in patients under consultation at the dermatology outpatient clinic of the University Hospital of Santa Maria, from January to September 2019 (N=104)

3.3 Association between Psoriasis and Sleep Apnea Risk

The *Mallampati* score revealed an average of 2.7 ± 1.0 for patients at low risk for apnea, a mean of 2.9 ± 0.8 for patients at intermediate risk, and a mean of 2.8 ± 0.9 for patients at high risk (P = 0.484).

The data evaluation according to the STOP-Bang questionnaire classification showed that patients at intermediate and high risk were older, with a mean age of 58.7 ± 10.9 years and 55.6 ± 14.8 years, respectively. On the other hand, low-risk patients had 43.3 ± 13.2 years (P < 0.001).

Men were more frequently at high risk for sleep apnea, corresponding to 27 patients (75% of the high-risk group sample), while women were more frequently at low risk of apnea, corresponding to 27 patients (67.5% of the low-risk group) (P = 0.001).

The apnea risk was higher with weight gain (P < 0.001). The measurements of body mass index, abdominal circumference, and neck circumference of individuals at intermediate and high risk were higher than those at low risk of apnea (P < 0.001).

Regarding the severity of psoriasis, the median PASI score among patients at low risk for apnea was 4.9 (interquartile range of 2.7-9.1). Among patients at intermediate risk, the median was 4.7 (interquartile range of 2.5-7.3). In the high-risk group, the median PASI was 5.9 (interquartile range of 3.5-8.6). There was no statistical difference between the groups (P = 0.6).

Patients at low risk for OSAS were diagnosed with psoriasis when younger, with a mean age of 31.5 ± 14.7 years. Patients at intermediate and high risk were diagnosed with older age. The mean age of patients in the intermediate-risk group was 41.4 years ±16 years, and the mean number of patients in the high-risk group was 44.2 years ±17.4 years (P = 0.002).

Individuals at intermediate or high risk of apnea had higher systolic blood pressure measurements, with an average of 138.4 ±16.23 mmHg for the intermediate-risk group and a mean of 135.3 ± 19.1 mmHg for the high-risk group. Patients at low risk for apnea had a mean systolic blood pressure of 124.3 ± 17.3 mmHg (P = 0.003). Diastolic pressure also presented higher measurements in the intermediate-risk groups (mean of 83.9 ± 10.4 mmHg) and high risk (mean of 85.3 ± 11.1 mmHg) when compared to the low-risk group (77.8 ± 12.5 mmHg) (P=0.014).

Patients at high risk of apnea had a higher prevalence of systemic arterial hypertension (SAH) (P<0.001). In the low-risk group, only one patient (2.5%) was hypertensive; in the high-risk group, 23 patients (63.9%) had SAH. Regarding the presence of DM, the prevalence was increased in the high-risk group: 12 patients (33.3%),

compared to only one patient (2.5%) in the low-risk group (P = 0.001). Regarding the presence of central obesity, 34 patients (94.4%) in the high-risk group presented such comorbidity, compared to 23 patients (57.5%) in the low-risk group (P<0.001). The other variables evaluated were not associated with apnea risk (Table 3).

Table 3. Risk of obstructive sleep apnea according to the STOP-Bang Questionnaire associated with demographic, anthropometric, lifestyle characteristics and related to the presence of psoriasis in the sample of patients under consultation at the dermatology outpatient clinic of the University Hospital of *Santa Maria*, from January to September 2019 (N = 104)

Variables	Obstructive sleep apnea STOP-Bang score rating			P
	Low risk (N=40)	Intermediate risk (N=28)	High risk (N=36)	
Mallampati score	2.7±1.0	2.9±0.8	2.8±0.9	0.484*
Demographics				
Age in years	43.3[b]±13.2	58.7[a]±10.9	55.6[a]±14.8	<0.001*
Gender				0.001**
Male	13 (32.5)	13 (46.4)	27 (75.0)	
Female	27 (67.5)	15 (53.6)	9 (25.0)	
Anthropometric				
Weight (kg)	70.9[c]±13.9	80.7[b]±11.1	89.5[a]±14.4	<0.001*
Body Mass Index (kg/^{m2})	26.3[b]±4.1	29.7[a]±3.4	32.2[a]±5.2	<0.001*
Abdominal circumference (cm)	91.7[b]±10.5	102.8[a]±7.3	108.5[a]±11.2	<0.001*
Neck circumference (cm)	36.5[c]±3.5	39.3[b]±2.7	41.8[a]±3.6	<0.001*
Physical Examination				
Systolic blood pressure (mmHg)	124.3[b]±17.3	138.4[a]±16.2	135.3[a]±19.1	0.003*
Diastolic blood pressure (mmHg)	77.8[b]±12.5	83.9[a]±10.4	85.3[a]±11.1	0.014*
Heart rate (beats/sec)	75.6±13.7	78.0±13.0	77.1±13.2	0.753*

Data are mean ± SD or number (%) of patients.

*ANOVA test where different letters represent significant statistical association - Bonferroni Post Hoc Test; **Pearson Chi-square test; §Fischer's Exact Test; §§Kruskal-Wallis test; #Data does not allow analysis.

Note. The missing data were three for the *Mallampati* score.

The correlation between the STOP-Bang score and the parameters age, weight, BMI, abdominal circumference, and neck circumference was direct and moderate (0.5> *r* <0.7; P<0.001). The correlation with systolic blood pressure, diastolic blood pressure, and the representative variable of the patient's age when the diagnosis of psoriasis was made were direct and low (0.3> *r* <0.5; P<0.001). The other measurements were not correlated with the score evaluated (Mukaka, 2012) (Table 4).

Table 4. Correlation between STOP-Bang and demographic, anthropometric and psoriasis variables in the sample of patients under consultation at the dermatology outpatient clinic of the University Hospital of Santa Maria, from January to September 2019 (N=104)

Variables	Obstructive sleep apnea STOP-Bang Score	
	r* or *s	**P**
Age	0.503	<0.001
Weight	0.578	<0.001
Body mass index	0.537	<0.001
Abdominal circumference	0.663	<0.001
Neck circumference	0.664	<0.001
Systolic blood pressure	0.415	<0.001
Diastolic blood pressure	0.367	<0.001
Heart rate	0.095	0.337
Age of diagnosis	0.396	<0.001
Diagnosis time	0.069	0.487*
PASI	0.064	0.517*

P: Pearson correlation; and *Spearman correlation.

Note. The missing data are: five for body mass index; one for Systolic Blood Pressure and Diastolic Blood Pressure. PASI = Psoriasis Area and Severity Index.

4. Discussion

It is well known that sleep disorders (including OSA) are considerably increased in patients with psoriasis (Nowowiejska et al., 2021; Saçmac & Gürel, 2019). For predicting the presence of moderate to severe OSA, the STOP-Bang questionnaire has been found to have one of the highest sensitivity and specificity. It has good methodological validity, reasonable accuracy, and easy-to-use and remembers features. Additionally, it has been developed and validated as a Portuguese-screening tool for OSAS (Fonseca, Silveira, Lima, & Rabahi, 2016).

The present study classified the risk scores for OSAS according to the STOP-Bang questionnaire in ambulatory patients diagnosed with psoriasis. It was found that 34.6% of patients were at high risk, while 26.9% were at intermediate risk for OSAS. The results follow previous studies, including a systematic review that found a prevalence of sleep apnea from 36% to 81% in the psoriatic population (Gupta, Simpson, & Gupta, 2016). These numbers are considerably higher than the prevalence of OSA recorded in the general population (Michalek et al., 2017).

Regarding anthropometric parameters, the present study shows a population with a tendency towards central obesity (mean abdominal circumference of 100.5 cm) and overweight (mean BMI of 29.3 kg/^{m2}). The presence of obesity or overweight and increased abdominal and cervical circumference were significantly more prevalent in the high-risk group for OSAS. It is known that obesity is common in patients with psoriasis and that an increased BMI is a trigger for inflammation (Cohen et al., 2015; Gabryelska, Sochal, Wasik, & Białasiewicz, 2018). Other studies also found that male gender, obesity, and neck circumference are associated with a higher risk of sleep apnea (Papadavid et al., 2017).

In the present study, the *Mallampati* classification showed no statistical difference between the three risk groups for OSAS, although this classification is usually considered an important factor in predicting moderate and severe sleep apnea (Amra et al., 2019). Among the possible mechanisms for the absence of such association, the small sample size of the study can be suggested as a potential cause. Regarding the time of the illness, patients classified as low risk for OSAHS were diagnosed with psoriasis when younger, and those at intermediate and high risk were diagnosed with older age. This result is controversial, diverging from some of the published studies. *Kabeloglu* Ilbay et al., for example, found an association between a longer disease time and an increased risk for OSAHS (Kabeloglu Ilbay et al., 2019).

We did not find a relationship between the severity of psoriasis (defined by the PASI score) and the presence of a high risk for sleep apnea. Papadavid et al., when evaluating patients with the polysomnography method, also found no association between the severity of psoriasis and the presence of sleep apnea (Papadavid et al., 2013). Kabeloglu Ilbay et al., on the other hand, found a significant impact on the development of OSAS in patients with psoriasis according to PASI score (Kabeloglu Ilbay et al., 2019). Several factors could explain the divergence of findings reported so far. Among them, we mention the methodological differences in the design of the studies, the small study samples, and patients with different disease statuses.

There are some limitations of the present study. First, we were unable to perform polysomnography or to apply different and perhaps more accurate sleep questionnaires. Second, this is a cross-sectional study, a design with several potential biases. Considering the limitations observed, the present study corroborates the data published so far, suggesting an increased risk of OSAS in the population of patients with psoriasis. Given the findings, we believe that patients with psoriasis should be evaluated for sufficient sleep time and adequate sleep quality.

5. Conclusion

The present study demonstrated that patients with psoriasis followed in a specific outpatient clinic in Brazil have a high prevalence of intermediate and high OSA risk when evaluated through the STOP-Bang questionnaire. The study also found an association between the presence of central obesity with an increased risk for OSA. The findings support the screening for OSA in patients with psoriasis.

Competing Interests Statement

The authors declare that there are no competing or potential conflicts of interest.

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