Dermatol Ther (Heidelb) (2023) 13:2903–2909
https://doi.org/10.1007/s13555-023-01045-4

BRIEF REPORT

Association Between Poor Sleep and Myocardial Infarction in Patients with Psoriasis: Findings from a Cross-Sectional Study with the National Psoriasis Foundation

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Received: August 10, 2023 / Accepted: September 15, 2023 / Published online: October 5, 2023

ABSTRACT

Background: Poor sleep quality occurs in patients with psoriasis at rates nearly twice that of the general population. Chronic sleep impairment is an independent risk factor for the development of cardiovascular disease. Here, we examine the association between sleep quantity and history of myocardial infarction in patients with psoriasis.

Methods: This observational, cross-sectional study utilized data from the 2020 National Psoriasis Foundation Annual Survey. Effect estimates were obtained using a multivariate logistic regression model, which controlled for prespecified covariates.

Results: Based on data from 1405 individuals with psoriasis, our analysis demonstrated a significant association between sleep quantity and history of myocardial infarction: odds ratio (OR) 0.67 [95% confidence interval (CI) 0.49–0.92], $p = 0.012$. The association was not significantly influenced by psoriasis severity (OR 1.01, [95% CI 0.99–1.03], $p = 0.38$), comorbid psoriatic arthritis (OR 1.06, [95% CI 0.48–2.38], $p = 0.88$), sleep apnea, or other traditional risk factors for myocardial infarction.

Conclusion: Our analyses indicate an association between sleep quantity and history of myocardial infarction in patients with psoriasis. For each hour increase in average nightly sleep, patients with psoriasis have a 33% decrease in the odds of having a history of myocardial infarction. The chief limitation of this study is its cross-sectional design limiting ascertainment of causality.

Keywords: Myocardial infarction; National Psoriasis Foundation; Psoriasis; Psoriatic arthritis; Sleep disturbance

Prior Presentation: This work was previously presented at the American Academy of Dermatology (AAD) Annual Meeting which occurred in Boston, MA, USA on the 25th of March–29th of March 2022.

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Key Summary Points

Patients with psoriasis are more likely to report poor sleep quality than those without psoriasis. Chronic sleep disturbance is a risk factor for the development of cardiovascular disease.

This cross-sectional study evaluated the relationship between sleep quantity and myocardial infarction in patients with psoriasis.

Multivariate logistic regression demonstrated a significant association between sleep quantity and myocardial infarction in patients with psoriasis, in which each hourly increase in average sleep quantity decreased the odds of a history of myocardial infarction.

The association between sleep quantity and myocardial infarction was not significantly influenced by psoriasis severity or comorbid conditions including psoriatic arthritis, sleep apnea, or other traditional myocardial infarction risk factors.

INTRODUCTION

Sleep is essential for a person's well-being, and its timing, duration, and quality are critical determinants of health [1]. Sleep impairment can be defined by both insufficient sleep quantity, with the American Academy of Sleep Medicine defining insufficient sleep as < 7 h of sleep per day, and/or poor sleep quality, characterized by highly fragmented sleep [2]. Chronic sleep impairment is an independent risk factor for a variety of adverse health outcomes, including the development of cardiovascular disease, hypertension, metabolic syndrome, depression, and all-cause mortality [3]. Combined with the impact on daily functioning (e.g., work performance, concentration), sleep represents a vital component of overall health and well-being [4].

Sleep disturbance is also an important consequence of psoriasis. Patients with psoriasis commonly experience sleep disruption with a prevalence of up to 85.4%, more than twice that reported in the general population [5]. Prior observational studies have also demonstrated a strong, graded relationship between disease severity and low sleep quantity in patients with psoriasis [6]. Hypothesized causes of sleep disturbance in this population include psoriasis-related pain and pruritus, symptoms related to psoriatic arthritis, or associated psychological conditions. However, studies have also shown that upregulated inflammatory processes can affect the regulation of sleep physiology and impact the depth and continuity of sleep [7, 8]. Hence, in addition to subjective symptoms leading to poor sleep, dysregulated immune responses may be further contributing to sleep fragmentation.

Patients with psoriasis are at increased risk of developing cardiovascular disease, type 2 diabetes, metabolic syndrome, and all-cause mortality—the same comorbidities associated with chronic sleep impairment [9]. However, the impact of sleep disturbance on cardiovascular risk in patients with psoriasis has not been studied in a US population. This study aims to explore this potential association and evaluate whether there is a relationship between sleep quantity and myocardial infarction in patients with psoriasis.

METHODS

Our protocol is reported in line with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement checklist for cross-sectional studies. This observational, cross-sectional study utilized data from the 2020 National Psoriasis Foundation (NPF) Annual Survey, an online survey of patients with psoriasis. Institutional review board (IRB) approval for the 2020 NPF Annual Survey was obtained from Genetic Alliance. This study conformed with the Helsinki Declaration of 1964, as revised in 2013, concerning

human rights. A random-stratified sample of individuals 18 years of age or older with psoriatic disease who contacted the NPF between 2018 and 2020 were emailed invitations to participate. Survey questions included information about demographics, psoriasis diagnosis, disease severity, comorbid diagnoses, and sleep quantity. The Patient Reported Extent of Psoriasis Involvement (PREPI), a validated instrument, was used to assess psoriasis severity based on psoriasis body surface area (BSA) involvement at the time of data collection [10]. Psoriasis severity was defined as mild (< 3% BSA), moderate (3–10% BSA), or severe (> 10% BSA). Sleep quantity was derived from survey questions asking about hours of sleep per day on average. Diagnosis of psoriatic arthritis, sleep apnea, and risk factors for myocardial infarction (hypertension, atherosclerosis, hypertriglyceridemia, or hypercholesterolemia) by a healthcare provider were determined by survey questions.

A multivariate logistic regression model was utilized, using sleep hours as the predictor and history of myocardial infarction (MI) as the outcome, controlling for pre-specified covariates including age, sex, BMI, race, annual household income, psoriasis severity, presence of psoriatic arthritis, myocardial infarction risk factors, and diagnosis of sleep apnea. Analysis outcomes, reported as odds ratios (ORs) with 95% confidence intervals (CIs), were deemed significant when p values < 0.05 were calculated.

Compliance with Ethics Guidelines

This research project involving survey data has been conducted in compliance with the relevant ethical guidelines and principles including informed consent, confidentiality and privacy, risk assessment, and data protection and security.

RESULTS

A total of 1495 individuals diagnosed with psoriasis completed the 2020 NPF Annual Survey. A summary of demographic information, psoriasis severity at the time of survey completion, presence of comorbid psoriatic arthritis, sleep apnea, and MI risk factors, as well as sleep quantity and history of myocardial infarction, is detailed in Table 1.

Results from multivariate logistic regression analysis are detailed in Table 2. Our results demonstrate a statistically significant association between sleep quantity and a history of myocardial infarction (OR 0.67, [95% CI 0.49–0.92], $p = 0.012$) in patients with psoriasis, after adjusting for co-variates (age, sex, BMI, race, annual household income, psoriasis severity, psoriatic arthritis, myocardial infarction risk factors, and sleep apnea). Male gender (OR 2.91, [95% CI 1.18–7.18], $p = 0.02$) and older age (OR 1.06, [95% CI 1.02–1.11], $p < 0.001$) were found to be significant predictors in the model. Psoriasis severity (OR 1.01, [95% CI 0.99–1.03], $p = 0.38$), psoriatic arthritis (OR 1.06, [95% CI 0.48–2.38], $p = 0.88$), sleep apnea (OR 1.76, [95% CI 0.76–4.06], $p = 0.18$), the presence of traditional MI risk factors (OR 2.00, [95% CI 0.64–6.23], $p = 0.23$), BMI (OR 1.15, [95% CI 0.50–2.64], $p = 0.736$), and annual household income (OR 1.00, [95% CI 0.44–2.28], $p = 0.997$) were not significant predictors.

DISCUSSION

This cross-sectional study establishes an association between sleep quantity and history of myocardial infarction in patients with psoriasis. Our analyses indicated that for each hour increase in average nightly sleep, patients with psoriasis have a 33% decrease in the odds of having a history of MI. These results are consistent with studies evaluating sleep disorders and cardiovascular disease incidence in the general population. In a study by Bertisch et al., patients without psoriasis who had insomnia or short sleep duration had a 29% higher risk of incident cardiovascular disease compared to the reference group (hazard ratio (HR) 1.29, [95%CI 1.00–1.66]) [11]. Previous studies in the general population have also demonstrated significant associations between short sleep duration and all-cause mortality (relative risk (RR) 1.12, [95%

Table 1 Patient demographics from the 2020 National Psoriasis Foundation Annual Survey

Category	Demographic	Patient demographics, *N* (%)
Age (*N* = 1374)	< 35 years	146 (10.6%)
	35–49 years	330 (24.0%)
	50–64 years	545 (39.7%)
	≥ 65 years	353 (25.7%)
Race (*N* = 1388)	White/Caucasian	1,203 (86.7%)
	Asian/Asian American	58 (4.2%)
	Black/African American	43 (3.1%)
	American Indian/Alaska Native	15 (1.1%)
	Native Hawaiian/Pacific Island	4 (0.3%)
	Other	14 (1.0%)
	Two or more races	37 (2.7%)
	Unsure	14 (1.0%)
Gender (*N* = 1394)	Male	634 (45.5%)
	Female	760 (54.5%)
BMI (*N* = 1339)	Underweight (< 18.5)	26 (1.9%)
	Normal weight (18.5–24.9)	364 (27.2%)
	Overweight (25–29.9)	407 (30.4%)
	Obese (≥ 30.0)	542 (40.5%)
Annual household income (*N* = 1192)	< $75,000/year	664 (55.7%)
	≥ $75,000/year	528 (44.3%)
Psoriasis severity (*N* = 1319)	Mild psoriasis (< 3% BSA)	690 (52.3%)
	Moderate psoriasis (3–10% BSA)	385 (29.2%)
	Severe psoriasis (> 10% BSA)	244 (18.5%)
	Mean BSA % (SD)	7.27 (14.8)
Psoriatic arthritis (*N* = 1405)	Yes	763 (54.3%)
	No	642 (45.7%)
MI risk factors[a] (*N* = 1495)	Yes	799 (53.4%)
	No	696 (46.6%)
History of MI (*N* = 1405)	Yes	43 (3.1%)
	No	1362 (96.9%)
Sleep apnea (*N* = 1405)	Yes	280 (19.9%)
	No	1125 (80.1%)

Table 1 continued

Category	Demographic	Patient demographics, *N* (%)
Sleep quantity (*N* = 1405)	Average hours sleep per night (SD)	6.403 (1.399)

BMI body mass index, *BSA* body surface area, *MI* myocardial infarction, *SD* standard deviation
[a]Health Care Provider diagnosis of at least one of the following: hypertension, atherosclerosis, hypertriglyceridemia, hypercholesterolemia

CI 1.08–1.16], $p = < 0.005$), cardiovascular disease (RR 1.16 [95% CI 1.10–1.23], $p = < 0.005$), coronary artery disease (RR 1.26 [95% CI 1.15–1.37], $p = < 0.005$), and hypertension (RR 1.17 [95% CI 1.09–1.26], $p = < 0.005$)). Given these results, we hypothesize that sleep may further contribute to cardiovascular disease risk in patients with psoriasis. This is supported by a population-based cohort study in Taiwan, which found that patients with concomitant psoriasis and sleep disorders had higher risk of ischemic heart disease compared to patients with psoriasis and no sleep disorder (adjusted hazard ratio (aHR) 1.25, [95% CI 1.22–1.28]) [12].

Limitations regarding the design of this study warrant consideration. First, given the observational and retrospective study design, our data lacks information regarding the timing of myocardial infarction in relation to sleep disturbance and psoriasis diagnosis. As such, our cross-sectional assessment of these variables does not enable us to establish any causal relationship between sleep disturbance and myocardial infarction. Next, our assessment of sleep was subjective and quantitative in nature, using the hours per sleep per day on average. Given that sleep disturbances may be quantitative or qualitative, objective measurements of these parameters including the use of polysomnography (PSG), Insomnia Severity Index (ISI), and Pittsburgh Sleep Quality Index (PSQI) should be considered in future evaluations [2, 13]. Next, the patient population which was sampled includes a disproportionate number of females. Furthermore, this sample

Table 2 Multivariate logistic regression analysis of predictors of history of myocardial infarction in patients with psoriasis

Variable	Odds ratio	95% CI	Standard error	z	*P*
Sleep quantity	0.669	0.489–0.915	0.107	− 2.52	0.012
MI risk factors	2.00	0.643–6.230	1.15	1.20	0.231
Psoriasis severity	1.010	0.988–1.033	0.011	0.88	0.381
Psoriatic arthritis	1.064	0.475–2.384	0.438	0.15	0.881
Sleep apnea	1.761	0.764–4.056	0.750	1.33	0.184
Obesity	1.15	0.504–2.635	0.486	0.34	0.736
Age	1.064	1.023–1.110	0.021	3.13	0.002
White race	1.092	0.287–4.156	0.744	0.13	0.898
Male gender	2.910	1.179–7.179	1.341	2.32	0.020
Household income	1.001	0.441–2.278	0.420	0.00	0.997tab

CI confidence interval

may not be representative of all patients living with psoriasis, as all responders are members of the NPF or individuals having previously contacted the organization. Previous studies have identified that members of the NPF may represent a group of individuals who are older, wealthier, have more extensive disease, are more knowledgeable about their condition, report their disease to be of significantly less burden, and are more satisfied with their therapeutic regimen compared to non-member patients with psoriasis [14].

This study highlights an understudied association between sleep and cardiovascular health in patients living with psoriasis. More research is needed to further evaluate this association including understanding the directionality and whether interventions aimed to improve sleep in patients with psoriasis could lead to meaningful improvements in health and quality of life.

CONCLUSION

Both psoriasis and sleep disturbance are established risk factors in the development of cardiovascular disease. We demonstrate an association between sleep quantity and history of myocardial infarction in patients with psoriasis independent of disease severity, comorbid psoriatic arthritis, sleep apnea, and other myocardial infarction risk factors. Our results are limited by the cross-sectional nature of our study design, limiting conclusions regarding the directionality of this association. Future studies are needed to assess the causality of this relationship and investigate interventions aimed at improved sleep in patients with psoriasis.

ACKNOWLEDGEMENTS

Medical Writing/Editorial Assistance No medical writing or editorial assistance (including the use of artificial intelligence (AI)) was received during the writing of this article.

Author Contributions. All named authors meet the International Committee of Medical Journal Editors (ICMJE) criteria for authorship for this manuscript, take responsibility for the integrity of the work as a whole, and have given final approval for the version to be published. All named authors contributed to the final paper as follows: Riley K Spencer contributed to the concept and design, statistical analysis, and drafting of the manuscript. Kareem G Elhage, Joy Q Jin, George Gondo, and Dr. Mitchell S Davis contributed to the statistical analysis and drafting of the manuscript. Dr. Marwa Hakimi, Dr. Tina Bhutani, and Dr. Wilson Liao contributed to the concept and design and resolution of any discrepancies in study eligibility criteria.

Funding. No funding or sponsorship was received for this study or publication of this article.

Data Availability. The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Conflict of Interest. Joy Q Jin is supported in part by research grant funding from the National Psoriasis Foundation. Dr. Tina Bhutani is a principal investigator for trials sponsored by Abbvie, Castle, CorEvitas, Dermavant, Galderma, Mindera, and Pfizer. She has received research grant funding from Novartis and Regeneron. She has been an advisor for Abbvie, Arcutis, Boehringer-Ingelheim, Bristol Myers Squibb, Janssen, Leo, Lilly, Novartis, Pfizer, Sun, and UCB. Dr. Wilson Liao has received research grant funding from Abbvie, Amgen, Janssen, Leo, Novartis, Pfizer, Regeneron, and TRex Bio. George Gondo is an employee of the National Psoriasis Foundation. No conflicts of interest are applicable to this project. Riley Kyle Spencer has nothing to disclose. Kareem Giovanni Elhage has nothing to disclose. Mitchell Sparling Davis has nothing to disclose. Marwa Hakimi has nothing to disclose.

Ethical Approval. This research project involving survey data has been conducted in compliance with the relevant ethical guidelines and principles including informed consent, confidentiality and privacy, risk assessment, and data protection and security. Institutional review board (IRB) approval for the 2020 NPF Annual Survey was obtained from Genetic Alliance and this study conformed with the Helsinki Declaration of 1964, as revised in 2013, concerning human rights.

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