Sleep quality and nocturnal pain in patients with hip osteoarthritis

Riley Martinez, BS[a], Nisha Reddy, BA[a], Edward P. Mulligan, PT, DPT[a], Linda S. Hynan, PhD[b], Joel Wells, MD, MPH[a],*

Abstract

Osteoarthritis (OA) is a common condition of the hip. Patients with hip OA often report nocturnal pain, yet little is known how it affects sleep quality. The purpose of this paper was to assess how hip arthritis affects sleep quality. We hypothesized that hip pain caused by hip OA affects sleep quality in adult patients.

This is a prospective, cross-sectional study of patients who were diagnosed with hip OA. Patients were evaluated using Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), hip outcome score (HOS), and modified Harris hip score (mHHS). Sleep quality was assessed using Pittsburgh Sleep Quality Index (PSQI). A multiple regression model was used to assess factors associated with poor sleep quality.

A total of 106 patients were analyzed. All patients had a Tonnis grade of 2 or 3 and American Society of Anesthesiologists (ASA) classification of 2. WOMAC, HOS, and mHHS were significantly and negatively correlated with PSQI. The multiple regression model, WOMAC, short form health survey vitality, ASA classification, and history of obstructive sleep apnea were associated with poor sleep quality (R = 0.60, $P < .001$).

Patients with hip OA, who report a symptomatic hip, are susceptible to reduced sleep quality. There is a correlation between worsening HOSs and sleep quality. The WOMAC score is a significant predictor of poor sleep quality. Patients with poor hip metrics should be screened for sleep disturbance.

Abbreviations: ASA = American Society of Anesthesiologists, BMI = body mass index, EQ-VAS = visual analogue pain scale, HOS = hip outcome score, mHHS = modified Harris hip score, OA = osteoarthritis, PSQI = Pittsburgh Sleep Quality Index, SD = standard deviation, SF-12 = short form health survey, WOMAC = Western Ontario and McMaster Universities Osteoarthritis Index.

Keywords: hip, osteoarthritis, Pittsburgh Sleep Quality Index, sleep quality

1. Introduction

Over 30 million United States adults are estimated to have a diagnosis of osteoarthritis (OA), which is the most common form of arthritis.[1] The hip is a frequent site for OA and the lifetime risk for developing symptomatic hip OA is 1 in 4 people.[2] It is a multifactorial degenerative joint disease and patients usually endorse pain, stiffness, and a diminished quality of life.[3] Their symptomatic hip not only affects function but has a negative impact in other areas including mental health, vocational ability, and overall energy level.[4] Furthermore, nocturnal pain in OA may increase as the disease progresses.[5,6] Total hip arthroplasty has been shown to decrease pain, improve physical functioning, and quality of life.[7–9] Recent work supports that majority of patients seeking total joint arthroplasty desire better sleep quality.[10] Sleep has been well documented as a vital element of our daily lives and its importance in mental and physical health[11,12] and disruption in sleep habits, leading to poor quality or less hours asleep, can have detrimental effects on disability, depression, pain, and overall health.[13]

It is widely accepted that pain has a negative effect on sleep quality,[14,15] but little is known how hip pain specific to OA affects sleep. There is a lack of research-based evidence on clinical populations, describing disturbances in sleep habits using hip specific self-report outcome tools and a validated sleep quality metric. Most studies group different types of arthritis pain into a single category as opposed to individualizing affects on sleep. Additionally, current publications have looked at symptomatic OA, but lacked the detail to identify specific joint affect. OA can damage any joint, which requires studies to investigate each joint's unique impact on sleep quality. Instead of grouping OA found in multiple joints into a single category we isolated the disease strictly to the hip.

This is a prospective study assessing sleep quality in patients with hip OA measured using self-reported preoperative outcome questionnaire. We hypothesized that hip pain caused by hip OA affects sleep quality in adult patients.

2. Methods

2.1. Study design

This is a prospective, cross-sectional study of 106 consecutive patients that presented to the senior author from November 2016 to September 2017 with a chief complaint of hip pain and who were diagnosed with hip OA as their main source of symptoms before undergoing total hip replacement. Study was performed through the Department of Orthopaedic Surgery at the University of Texas Southwestern Medical Center, with institutional review board approval on November 2016, STD 122016–058. All patients were provided informed consent and voluntarily completed validated outcome measures to assess their hip function, pain, and sleep quality. The patient reported outcome metrics utilized were the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), hip outcome score (HOS), modified Harris hip score (mHHS), visual analogue pain scale (EQ-VAS), short form health survey (SF-12) and the Pittsburgh Sleep Quality Index (PSQI) were analyzed.

Hip OA was diagnosed by clinical and radiographic evaluation. Clinical diagnosis was based on the American College of Rheumatology criteria for OA of the hip.[16] Diagnosis was made if the patient endorsed hip pain, diminished hip flexion, limited internal hip rotation, pain with internal rotation of the hip, and had radiographic evidence of hip OA. Standing anteroposterior radiograph of the pelvis was assessed for Tonnis grade by the senior surgeon without prior knowledge of the patient's self-reported pain, loss of function or sleep quality. The Tonnis classification of OA was graded as 0 (no changes), 1 (widened sclerotic zone and minimal osteophyte formation), 2 (moderate loss of joint space and cyst formation), and 3 (<1 mm of joint space or no joint space).[17] Patients were excluded from the study if they were not diagnosed with hip OA as their primary pathology or had previous hip surgery in the past year.

The PSQI is a self-reported questionnaire that evaluates sleep quality and disturbance in patients during the previous month. Patients respond to 19 self-reported questions that are collectively used in evaluation of their sleep. Their responses to the questions are used to formulate 7 individual component scores as well as a final composite score that helps differentiate their sleep quality as "poor" or "good". The 7 component scores consist of subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. Each of the 7 components is scaled on a 0 to 3 interval. The sum of the components produces a global score ranging from 0 to 21, where a higher score indicates poorer sleep quality. A global score greater than or equal to 5 characterize patients as poor sleepers with a diagnostic sensitivity of 89.6% and specificity of 86.5% (kappa = 0.75, $P < .001$).[18]

Activity, pain, and health-related quality of life outcomes were performed with use of the UCLA activity score, EQ-VAS, mHHS, WOMAC, HOS, and SF-12. All of these are validated outcome scores for assessing patients with hip OA.[19–23]

2.2. Data analysis

Continuous measures are described as either mean and standard deviation or medians and range. Categorical measures are described using frequency and percentage and ordered categorical measures described as median and range. Pearson product moment correlations were performed between hip specific reported instruments and PSQI measures. Multiple regressions

were used to predict PSQI from demographic and clinical characteristics, hip specific reported instruments, and SF-12 measurements. The variables used in the multiple regression analysis included the hip reported outcome measures and were adjusted for other significant covariates. All statistical tests were checked for violations of statistical assumptions including information on outliers, normality, multicollinearity, homoscedasticity, and independence. All analyses were conducted using IBM SPSS V25 (IBM, North America, New York, NY) and significance was set at $P < .05$.

3. Results

One hundred six patients were analyzed of which 63 were female. The mean age was 63 years (20–82). All patients had a Tonnis grade of 2 or 3. The median and mode for ASA physical status classification was 2 (Table 1). Concurrent comorbidities were assessed with low back pain and hypertension being the most common. Twenty percent of patients also suffered from obstructive sleep apnea and 14% had a diagnosis of depression (Table 2).

The mean mHHS, WOMAC, and HOS were 43, 41, and 44, respectively, indicating significant hip pain and diminished function (Table 3). On the SF-12, the average scores for physical function, bodily pain, role limitation due to physical health, and vitality were below 50, while scores of general health perception, social function, and mental health were above 50. The mean PSQI was 9.37, with 83% having a score of 5 or greater. The majority

Table 1

Patient demographics.

Characteristic	Hip osteoarthrosis patients, n = 106
Age (years), mean ± SD (range)	62.7 ± 11.77 (20–82)
Gender, female, n (%)	63 (59.4%)
Side, n right/left/bilateral	64/39/3
BMI, mean ± SD (range)	29.01 ± 5.88 (16.6–44.6)
Tonnis grade, n (%)	
2	23 (21.7%)
3	83 (78.3%)
ASA classification, n (%)	
1	28 (26.4%)
2	56 (52.8%)
3	22 (20.8%)

ASA = American Society of Anesthesiologists, BMI = body mass index, SD = standard deviation.

Table 2

Comorbidity prevalence.

Patient comorbidities	Hip osteoarthrosis patients, n = 106 n (%)
Low back pain	59 (55.7%)
Hypertension	49 (46.2%)
Obstructive sleep apnea	21 (20.0%)
Depression	15 (14.2%)
Cancer	13 (12.3%)
Heart disease	9 (8.5%)
Anemia	8 (7.5%)
Lung disease	6 (5.7%)
Kidney disease	6 (5.7%)
Ulcer/stomach disease	4 (3.8%)
Liver disease	2 (1.9%)

Table 3

Patient characteristics and hip reported outcome measures.

Patient reported outcome measures	Hip osteoarthrosis patients, n=106 Mean ± SD
UCLA activity score	6.7 ± 2.1
EQ-VAS	5.2 ± 2.9
mHHS	43.3 ± 16.4
WOMAC	41.0 ± 16.6
HOS	43.8 ± 17.5
SF-12 physical function	29.5 ± 32.0
SF-12 role limitation due to physical health	38.8 ± 26.3
SF-12 bodily pain	32.1 ± 24.6
SF-12 general health perception	64.5 ± 24.1
SF-12 vitality	42.9 ± 24.4
SF-12 social function	65.9 ± 31.8
SF-12 role limitation due to emotional health	83.0 ± 25.9
SF-12 mental health	69.1 ± 21.5

EQ-VAS = visual analogue scale, HOS = hip outcome score, mHHS = modified Harris hip score, SD = standard deviation, SF-12 = short form health survey, UCLA = University of California at Los Angeles, WOMAC = Western Ontario and McMaster Universities Arthritis Index.

had some degree of dysfunction in their subcomponent scores, except for the use of prescribed or over the counter medication to aid in sleep as 53.8% denied any use in the past month. This patient cohort did report 100% of some degree of sleep disturbance. Habitual sleep efficiency was split evenly with 50% reporting issues. However, in sleep quality (88.7%), sleep latency (59.4%), sleep duration (68.9%), and daytime dysfunction (76.4%) the majority reported some level of difficulty (Table 4).

Patients with worse hip pain and dysfunction as measured by the mHHS (P=.002), WOMAC ($P<.001$), and HOS (P=.013) also significantly reported poor sleep quality. Pearson product moment correlation coefficients are designated as small (0.10–0.29), medium (0.30–0.49), and large (≥0.50).[24] The PSQI correlation for mHHS, WOMAC, and HOS were −0.301, −0.382, and −0.296, respectively (Table 5). Based on the multiple regression model, WOMAC, SF-12 vitality, ASA classification, and presence of obstructive sleep apnea were significant predictors of poor sleep quality (R=0.60, $P<0.0001$; P=.019, $P<.001$, $P<.001$, P=.004, respectively) (Table 6). All other multiple regression models utilizing HOS or mHHS with the model predictors resulted in nonsignificant outcomes.

4. Discussion

Pain and symptoms from hip OA affect sleep. All 3 patient reported outcome metrics for the hip were significant for poor sleep quality when symptomatic hip OA was present. The average total PSQI score, 9.37, was slightly under twice the indicator for poor sleep. Five or greater is the recommended benchmark for poor sleep and the majority of this patient population met the criteria at 83%. We investigated potential confounding variables, described as the patient's demographics, comorbidities, and characteristics listed in Tables 1–3, to identify if the symptomatic hip was the true reason for poor sleep and a poor WOMAC score remained an independent predictor of a high PSQI. This supports symptomatic hip OA as a major factor in reduced sleep quality. These findings are novel as it guides management for patients suffering from the chronic ailments.

Allen et al[25] found patients with hip or knee OA to be independently associated with increased odds of reporting sleep

Table 4

Pittsburgh Sleep Quality Index total and subcomponent scores.

PROM	Hip osteoarthrosis patients, n=106
Sleep quality, n (%)	
0	12 (11.3%)
1	54 (50.9%)
2	33 (31.1%)
3	7 (6.6%)
Sleep latency, n (%)	
0	43 (40.6%)
1	19 (17.9%)
2	18 (17.0%)
3	26 (24.5%)
Sleep duration, n (%)	
0	33 (31.1%)
1	48 (45.3%)
2	19 (17.9%)
3	6 (5.7%)
Habitual sleep efficiency, n (%)	
0	53 (50.0%)
1	27 (25.5%)
2	12 (11.3%)
3	14 (13.2%)
Sleep disturbance, n (%)	
0	0 (0.0%)
1	23 (21.7%)
2	76 (71.7%)
3	7 (6.6%)
Use of sleep medication, n (%)	
0	57 (53.8%)
1	3 (2.8%)
2	9 (8.5%)
3	37 (34.9%)
Daytime dysfunction, n (%)	
0	25 (23.6%)
1	56 (52.8%)
2	19 (17.9%)
3	6 (5.7%)
PSQI Total, mean ± SD	9.37 ± 4.82

PROM = Patient Reported Outcome Measures, PSQI = Pittsburgh Sleep Quality Index, SD = standard deviation.

issues (odds ratio 1.25, 95% confidence interval 1.02–1.54). They risk adjusted for fair/poor health and depression finding joint OA to be independently associated with sleep problems, which support our findings that focused solely on the hip. There was no differentiation between which joint was the root cause for sleep disturbance as knee and hip OA were grouped. We aimed to delineate this uncertainty by utilizing orthopedic clinical and radiographic evaluation in diagnosing patients and specific hip outcome metrics to ensure our results were verified.

Table 5

Pearson product moment correlation of hip metrics and Pittsburgh Sleep Quality Index change.

Hip scores	PSQI correlation (r)	P
mHHS	−0.301	.002
WOMAC	−0.382	<.001
HOS	−0.296	.013

Correlation coefficients are designated as small (0.10–0.29), medium (0.30–0.49), and large (≥0.50).
HOS = hip outcome score, mHHS = modified Harris hip score, WOMAC = Western Ontario and McMaster Universities Arthritis Index.

Table 6

Multivariable model predicting Pittsburgh Sleep Quality Index.

Unstandardized coefficient

Model predictors	B	SE	Beta	P
WOMAC	−0.344	0.143	−0.229	.019
SF-12 vitality	−0.074	0.018	−0.382	<.001
ASA classification	−2.559	0.664	−0.391	<.001
OSA	3.448	1.167	0.305	.004

ASA = American Society of Anesthesiologists, B = model coefficient, OSA = obstructive sleep apnea, SE = standard error, SF-12 = short form health survey, WOMAC = Western Ontario and McMaster Universities Arthritis Index.
Model R = 0.604, P < .0001.

OA in other large joints has been studied to identify affect on sleep quality. Symptomatic knee OA has been found to be significantly associated with sleep disturbance, but the sleep–pain relationship was explained by baseline depressive symptoms.[26] Interestingly, when looking at symptomatic hip OA our results found a poor WOMAC score to be an independent predictor of poor sleep quality even when risk adjusted for depression. More research is needed to delineate if location of the symptomatic OA plays a critical role in depressive symptoms or other variables.

The implications of these results are an opportunity for physicians to not only address their patient's symptomatic hip OA, but potential sleep problems that can affect health and outcomes. This allows providers to take a more holistic approach when treating patients. Opening a door for the medical team to provide complete and comprehensive care instead of only treating the chief complaint and expecting the multifaceted ailments like symptomatic hip OA and poor sleep quality to resolve. Those with poor hip metrics should be screened for sleep disturbance. The positive effects of total hip arthroplasty may include a benefit to sleep quality in addition to pain control and activity. This has potential to impact patient satisfaction as it is becoming a larger component of the healthcare system's measurement of care assessment.[27] Patient's with pain show greater satisfaction about their care when the provider is more involved and offers proactive treatment options.[28] Orthopedic surgeons who spend more time counseling their patients over expected sleep quality due to their current pathology, could result in higher patient satisfaction. The more patients understand and are advised about their current health, the more autonomy over their illness they attain.

Potential limitations to this study include the use of self-reported metrics, like PSQI, to measure sleep disturbance as a more objective instrument like polysomnography or actigraphy, could possibly report different outcomes. This is important as inconsistencies are documented between subjective and objective measurements of sleep.[29] There is potential for recall bias when the patients filled out the questionnaires. Future studies should look at hip OA treatment and their affect on sleep quality. The level and type of therapy, if any, the patient is receiving for their reported comorbidities should be further investigated and stratified to see if results are affected. Furthermore, the patients should be followed longitudinally to document change in sleep quality as the disease progresses and comorbidities and patient demographics change.

5. Conclusion

Patients with hip OA, reporting a more symptomatic and painful hip, are susceptible to reduced sleep quality. There is a direct correlation between worsening patient reported HOSs and poor sleep quality. In particular, the WOMAC score is an independent predictor of poor sleep quality. Patients with poor hip metrics should be screened for sleep disturbance.

Author contributions

Conceptualization: Edward P. Mulligan, Joel Wells.
Data curation: Nisha Reddy.
Formal analysis: Linda S. Hynan.
Methodology: Linda S. Hynan, Joel Wells.
Project administration: Joel Wells.
Supervision: Joel Wells.
Writing – original draft: J. Riley Martinez.
Writing – review & editing: Edward P. Mulligan, Joel Wells.
J. Riley Martinez orcid: 0000-0001-7106-2012.

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