

SYMPTOM SEVERITY AND RADIOGRAPHIC STAGE ARE UNRELATED IN THUMB BASILAR JOINT OSTEOARTHRITIS**Ram Prasath P^{1*} and Dalton J²**

¹Associate Professor, Department of Orthopedics, Sri Lakshmi Narayana Institute of Medical Sciences Pondicherry - 605502

²Assistant Professor, Department of Orthopedics, Sri Lakshmi Narayana Institute of Medical Sciences, Pondicherry – 605502

*Corresponding Author

Dr. P. Ram Prasath,
Associate Professor,
Department of Orthopedics,
Sri Lakshmi Narayana Institute of Medical Sciences,
Osudu, Agaram Village,
Pondicherry – 605502

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ABSTRACT

There is no correlation between TBJA radiographic stage and symptom severity, according to our hypothesis. Study participants were prospectively enrolled in the study after completing the eleven items Quick DASH survey and the SF-12 health survey (short form), physical and mental component surveys. Radiographic stages were assigned according to the *Eaton-Littler* system for each patient. The radiographic score was correlated with the disease stage based on an analysis of the radiographic score. This study consisted of 31 patients (7 men, 24 women; average age, 60 years old). Stage 1 patients had an average Quick DASH score of 20.4; stage 2 patients had an average score of 26.8; stage 3 patients had an average score of 20; and stage 4 patients had an average score of 28.3. *Eaton-Littler* stage and *Quick DASH* score were not significantly correlated. Neither the Physical Component nor the Mental Component were correlated with the TBJA stage on the SF-12. Patient-reported symptoms and radiographic severity do not correlate in TBJA. TBJA metrics that link radiographic and subjective aspects may improve surgical decision-making and treatment monitoring.

KEYWORDS: Osteoarthritis, Quick DASH, Thumb basilar joint osteoarthritis, Radiographic

INTRODUCTION

The thumb basilar joint osteoarthritis (TBJA) affects about 7% of men over 30 years old. [1]. Asymptomatic patients may experience symptoms of unremitting pain and significant disability, while those suffering unremitting pain may exhibit no symptoms at all. There is a common presence of deformity, movement loss, and weakness. The most common method for diagnosing TBJA radiographically is using a staging system [2], which indicates more advanced osteoarthritis. There has been evidence that non-surgical treatment in arthritis patients increases

symptoms regardless of the stage of the disease [3-5]. Patients' reported symptoms of TBJA do not correlate with the radiographic stage of the disease, although there is some evidence to the contrary [6,7]. Patients who suffer from TBJA present with symptoms that are correlated with their radiographic stage. A validated outcome survey shows no correlation between radiographic stage of TBJA and severity of symptoms reported by patients.

METHODS

As part of this cross-sectional study, the protocol was approved by the IRB (Institutional Review Board). Four fellowship-trained orthopedic hand surgeons who have presented with unilateral thumb TBJA between June 2018 and March 2019 were prospectively enrolled. It was decided that the diagnosis was to be made after a thorough review of the clinical history, physical examination, as well as radiographic evaluations. Our study excluded patients with bilateral disease, concomitant ipsilateral upper extremity diagnoses, and unwilling participants. Data was collected about the patient's age, gender, and dominant hand. In addition to the Medical Outcomes Study 12-Item Short-Form Survey (SF-12), all patients completed the Quick disabilities of the hand, arm as well as shoulder (Quick-DASH). Short form 12 had 2 variables: physical as well as mental components. According to a national norm, each patient's Eaton-Littler score was determined by the treating physician without knowledge of the questionnaire results. In order to assess the reliability of the staging system between the four treating hand surgeons, an interobserver agreement analysis was performed on a subset of 10 randomly selected radiographs. Fleiss kappa has been used to evaluate agreement based on the intraclass correlation coefficient (ICC). Survey results and demographic data were correlated using Spearman rank analysis. We performed a power analysis to determine whether our sample size was sufficient to detect clinically meaningful correlations. For the evaluation of *Eaton-Littler* stages and gender, logistic regression has been used. Using a 2-way ANOVA, this study sought to determine if patients with dominant-hand involvement reported a lesser quality of life. P values greater than 5% were considered significant. Post hoc power analysis indicates that we have eighty percent power to detect a correlation with $\rho = 0.31$. At least 0.3. [9] ρ is required for a clinically significant correlation

RESULTS

In this study, 31 patients presenting with unilateral thumb TBJA were examined. Among the participants, there was 7 men's and 24 women's, whose mean age was 60. Radiologically, there were 11.8% Stage I patients ($n = 4$), 21.2% Stage II patients ($n = 10$), 34.1% Stage III patients ($n = 14$), and 8.6% Stage IV patient ($n = 3$). In this study, ρ and *Eaton-Littler* stage ($P = 0.03$) correlated weakly, but ρ and gender did not ($P = 0.11$). Twelve patients (30.2%) involved their dominant hand. PCS-12 ($P = 0.62$), MCS-12 ($P = 0.82$), or QuickDASH ($P = 0.50$) scores were not significantly affected by dominant-hand involvement. An ICC of 0.70 (95% confidence interval [CI]) indicates significant interobserver agreement for arthritis staging. According to Fleiss kappa statistics, it was 0.62 (95% CI). In Table 1, the median QUICK DASH score, PCS-12 score, and MCS-12 score are shown along with their standard deviations. There was no significant correlation between Eaton-Littler MRI stage 2 scores and Quick DASH scores ($\rho =$

19.07; P = 0.81), PCS-12 scores (rho = 0.135; P = 0.15), and MCS-12 scores (rho = 0.018, P = 0.88) (Table 1).

DISCUSSION

Patient-reported symptoms are correlated with the severity of radiographic TBJA in this study. Symptom severity is not correlated with radiographic stage, based on prospective studies. According to Eaton-Littler radiographic stages², the *PCS-12* and *MCS-12* components of short form-12 did not correlate with Quick DASH.

With the Quick DASH, Upper extremities function and symptoms are assessed. Questionnaires ask about pain, neurological symptoms, and sleep disturbances. A minimal important difference (MID) of 18 points is the minimum for Quick DASH. The MID is a measure of a positive change in health status that indicates a minimum improvement. Therefore, one should use the metric whenever comparing the same patient or patients in the same cohort over time. In a longitudinal study, this magnitude of difference between stages would not be relevant, however, as the maximum difference between stages was 6.8 points. A study of the PCS-12 was conducted on patients with congenital wrist fractures and carpal tunnel syndrome, among other diagnoses.

Table 1: Radiographic stages of Thumb Basilar Joint Osteoarthritis based on patient-reported scores

SURVEY	1^b	2^c	3^d	4^e Value	Coefficient Rho	
QUICK DASH	20.4	26.8	20	28.3	19.07	0.803
<i>PCS-12</i>	30.6	30.2	32.3	32.8	0.073	0.150
<i>MCS-12</i>	47.2	41.0	42.4	48.0	0.018	0.775

This configuration results in a MID of 7.3 points for the PCS-12. [11]. Again, in this study, MID helps to explain the maximum difference between stages of 2.5 points. Longitudinal studies would not be able to detect any clinically meaningful differences. It is likely that there are no clinically significant differences between MCS-12 scores between radiographic stages, either. A study was conducted to determine MCS-12 responsiveness when used to diagnose upper extremities. The *PCS-12* and *DASH* scores reached higher levels and disability decreased over three months, while the MCS-12 score remained the same. Accordingly, the MCS-12 may not be sensitive to changes in upper extremities symptoms among patients. Comparing patients' grip strength with MCS-12, [12] found a correlation. According to these data, Eaton- Littler radiographic stages cannot predict clinically significant differences (MCS-12 score) that can be detected. It is likely that there is a lack of agreement between observers and poor correlation between patient-reported symptoms and radiographic staging. Most authors report moderate interrater reliability for Eaton-Littler radiographic stages, with kappa values between 0.386 and 0.45, [13-16] but another study [17] found it to be poor with kappa = 0.16. There is an intraclass

correlation of 0.45 and kappa 0.42-0.43 in recent studies of interrater reliability [18]. The four hand surgeons had substantial agreement with kappa = 0.62 and ICC = 0.70 in our study. This study shows higher agreement between observers than what is reported in the literature, but our CIs at the lower end are within the range of what is reported in the literature. Our measurements fall within the range of literature values, despite our higher reliability values [19]. There is no correlation between Eaton-Littler radiographic stage and Quick DASH, PCS-12, or MCS-12 scores, suggesting two possible explanations. First, Eaton-Littler staging relies on radiographic features that are not predictive of severity of symptom reported by patients. It has been reported that TBJA changes trabecular connectivity, trabecular number, dorsal subluxation, [21] and trapezial inclination [22]. Staging may be improved by specific radiographic views, according to some authors. In addition, different radiographic views may be able to provide more precise measurements of osteoarthritic joints. [22] It is also possible that these validated questionnaires do not adequately measure the symptoms and function of the thumb basilar joint as reported by patients. The Nelson score has recently been developed by investigators to assess the thumb basilar joint. [23] Patients treated with thumb basilar joint surgery showed significant correlations with visual analog pain scores and high test-retest reliability. There were no reported MIDAs or minimal detectable changes. TBJA, distal radius fractures, carpal tunnel syndrome, rheumatoid arthritis, and distal radius fractures are included in the Brief Michigan Hand Questionnaire (Brief MHQ). [24] TBJA had the lowest sensitivity out of the four diagnoses, as measured by the standardized response mean. In terms of radiographic staging, it is not yet known whether these newer surveys correlate with Eaton-Littler stages. TBJA stage was not correlated with gender or hand dominance reported by patients. A weak correlation was found between age and Eaton-Littler stage, suggesting that radiographic progression has a small role to play in determining aging and senescence. In women and men aged 75 years, osteoarthritis of the thumb base was present in almost 27% and 37%, respectively. Researchers found in the current study that osteoarthritis severity increased with age, similar to the results in the current study. In this study, the size of the sample and the size of the subgroups is limited. Particularly, we have a small number of patients in stages 1 and 4. Although our data have low power to detect correlations with rho of 0.31, we can detect moderate to strong correlations with our data. [9] There should be a minimum rho of 0.3 for a clinically significant correlation. [9] In the absence of a correlation, there is likely to be no clinical significance. A limitation of this survey is that none of its metrics can be applied to thumb function specifically. The study also included patients with concomitant upper extremity osteoarthritis that might not be discussed in a traditional hand surgery clinic. Patients with significant glenohumeral joint osteoarthritis may notice that their shoulder is as or more restrictive than TBJA. An orthopaedic surgeon may not know about it specifically.

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