Correlation Between Degree of Pain and Radiographic Findings in Patient with Hip Osteoarthritis at Haji Adam Malik General Hospital

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ABSTRACT

Osteoarthritis (OA) is a non-inflammatory degenerative joint disease that most often occurs in elderly, which often causes pain. One study showed that radiography is associated with pain severity in hip OA. This study aims to assess the correlation between the degree of pain and radiographic findings in patients with hip OA. An observational analytic study conducted at H. Adam Malik General Hospital from April to July 2022. The study sample were hip OA patients who met the inclusion and exclusion criteria. Data were collected and analyzed using the Shapiro Wilk test and the Spearman correlation test. Most patients with hip OA were dominated by men, most commonly found in 50-59 years old patients. Based on the degree of pelvic pain, most were on VAS score 4 (42.2%). Based on the classification of the radiographic appearance of the hip based on Croft and Tonnis classification the score was 5 (28.9%) and 3 (46.7%), respectively. The value of r between VAS and degrees of Croft is 0.664, while the average value of VAS and degrees of Tonnis is 0.476. In addition, the lower the MJS (Minimal Joint Space), the higher it is correlated with VAS score. There is a significant correlation between degree of pain and radiographic findings in patients with hip OA.

Keywords: *Osteoartritis, Pain degree, Radiograph*

INTRODUCTION

Osteoarthritis (OA) is a non-inflammatory degenerative joint disease that was most commonly found in the elderly, with cartilage damage, bone hypertrophy, and synovial membrane abnormalities as the clinical manifestations. OA often results in pain that often follows overexertion, and stiffness mostly happen in the morning or after rest.[1,2]

OA occurs in more than 32 million people in the United States. Based on radiographic criteria for OA, more than 50% of adults over 65 years old have this disease. Primary OA is a common disorder in the elderly and can even be asymptomatic. Approximately 80-90% of individuals over 65 years old have radiologic evidence of OA.[3]

OA results from the failure of chondrocytes to maintain homeostasis between the synthesis and degradation of extracellular matrix components. Until now, it is unknown what causes the imbalance between cartilage degradation and repair. Changes in the subchondral bone are closely related to increased levels of cartilage oligomeric matrix protein (COMP) and bone sialoprotein (BSP). OA has also been found to be associated with synovial membrane abnormalities.[4,5]

Identification and degree of OA based on radiographic findings can be evaluated based on 1) Croft's OA classification (grades 3-5)[6], 2) Tonnis classification (grades 0-3)[7], and 3) minimal joint space (MJS) 2 mm, regardless of other OA findings.[8] MJS was measured at three locations: 1) at the lateral edge of the subchondral sclerotic line, 2) apical transection of the weight-bearing surface with a vertical line through the center of the femoral head, and 3) at the medial edge of the weight-bearing surface adjacent to the fovea.[9]

OA can result in cartilage damage, bone hypertrophy, and abnormalities in the synovial membrane. It causes a narrowing of the hip joint space and affected in limited movement. Pain is one of the clinical symptoms of patients with OA even though cartilage does not have nerve end, these receptors are present in bones, blood vessels, nerves, muscles and others.[9,10]

The Visual Analogue Scale (VAS) can be used measure the degree of pain. VAS is a 10 cm (100 mm) scale on which the patient was asked to give a mark that corresponds to their current intensity of pain. This measurement is subjective. The line is then measured from the baseline to the sign indicated by the patient, and this distance is translated into a pain intensity score ranging from 0 to 10.[11]

Studies examining the correlation between the degree of pain and radiographic findings in patients with hip OA have been conducted previously. Research by Nese Olmez Sarıkaya and Fazil Gelal shows that there is a correlation between degree of joint space narrowing and degree of pain in patients with hip OA. The study found that radiographic findings were associated with pain severity in hip OA were MJS<2.5 mm.[12] Similarly, study of F. Birrell et al. found that the severity of OA based on radiology has an effect on the patient's pain degree.[13] However, in the studies that have been conducted, not all classification systems or radiographic findings specifically correlate with the patient's pain degree. This is shown by the findings in a study by Kim et al. and Jacobsen et al. that did not find a significant relationship between radiographic features of the OA hip joint and the patient's degree of pain.[7]

This is not only found in hip OA, but in other areas that are often affected by OA, the knee joint. Study of Murphy et al.,[14] female patients aged 55-88 years who were diagnosed with knee OA, showed that there was a significant relationship between degree of pain severity and age and radiographic findings. OA grade based on radiographic findings was significantly positive related to pain severity in women with knee OA. Treatment for patients with symptoms of knee OA can be optimized by addressing peripheral and central sources of pain.[14]

This study aims to find the correlation between the degree of pain and radiographic findings in patients with hip OA at H. Adam Malik General Hospital.

METHOD

On This study was an observational analytic study using a case series design conducted at H. Adam Malik General Hospital from April to July 2022. The inclusion criteria were patients >18 years old and patients with complete medical records; while the exclusion criteria were patients who had a history of having operative treatment of hip OA before seeking treatment or being referred to H. Adam Malik General Hospital, incomplete medical records, and data could not be retrieved due to damage medical record.

Data used in this study is secondary data derived from the medical records of adult patients diagnosed with hip OA at H. Adam Malik General Hospital Medan from November 2019 - November 2021. Patient's age, gender and VAS were collected then an evaluation was carried out on plain AP pelvic radiograph with 15^{o} internal rotation to obtain degrees of Croft, Tonnis, and MJS (Minimal Joint Space).

Croft degrees are divided into 6; grade 0 if there is no visible changes according to OA, grade 1 shows only osteophytosis, grade 2 only has joint space narrowing, grade 3 has 2 criteria (osteophytosis, joint space narrowing, subchondral sclerosis, cysts), grade 4 has 3 criteria (osteophytosis, joint space narrowing, subchondral sclerosis, cysts), and grade 5 as in grade 4 but with a deformity of the femoral head. Tonnis classification is divided into 4; grade 0 there is no arthrosis of the hip; grade 1 there is slight joint space narrowing, slight lipping of joint margins, and slight sclerosis of femoral head or acetabulum; grade 2 has small cysts, further narrowing of the joint space, and moderate loss of femoral head sphericity; grade 3 has large cysts, severe joint space narrowing, severe femoral head deformity, and avascular necrosis.

Analysis of the data collected was carried out, data normality test with the Shapiro Wilk test. The correlation between VAS and Croft degree, Tonnis and MJS were statistically analyzed by Spearman correlation test.

RESULT

A Total of 45 patient with hip OA at H. Adam Malik General Hospital was dominated by men, about 53.5% (Table 1). Most patients were 50-59 years old with the youngest and oldest were 31 years and 77 years old. The mean age of the entire sample is 54.93 ± 12,285 years. The most VAS is at a score of 4 (42.2%). The most common degrees of Croft and Tonnis were at scores of 5 (28.9%) and 3 (46.7%), respectively (Table 2).

Table 1. Demographic Characteristics of Research Subjects

		N	Percentage (%)
Gender	Male	24	53.3
	Female	21	46.6
Age (years)	30-39	3	6.7
	40-49	11	24.4
	50-59	16	35.6
	60-69	9	20.0
	70-79	6	13.3
VAS	1	2	4.4
	2	9	20.0
	3	15	33.3
	4	19	42.2

Table 2. Radiology Results

Parameter	Degree	Frequency	Percentage (%)
Croft Classification	2	9	20.0
	3	12	26.7
	4	11	24.4
	5	13	28.9
Tonnis Classification	1	8	17.8
	2	16	35.5
	3	21	46.7

In Table 3, the results show that there is a significant correlation between VAS and the Croft's degree ($p<0.05$). The value of $r = 0.664$ indicates a strong and unidirectional correlation between VAS and Croft's degree. In addition, a significant correlation was found between VAS and Tonnis's degree ($p<0.05$). The correlation coefficient value = 0.476 indicates a moderate and unidirectional correlation between VAS and Tonnis's degree. Data analysis also showed that there was a strong correlation between patient's MJS and VAS, but this was inversely proportional, indicating that the lower the MJS, the higher the VAS value.

Table 3. Correlation Test Between VAS and Radiology Results ad MJS

	r (*Spearman's correlation coefficient)*	*p*
Croft;'s degree	0.664	<0.001
Tonnis's degree	0.476	0.001
MJS	-0.663	<0.001

DISCUSSION

The visual analogue scale (VAS) is one of the most frequently used pain assessments to assess pain degree in patients. In this study, a strong and unidirectional relationship was found between VAS and Croft's degree and a moderate and unidirectional relationship between VAS and Tonnis. Kijima et al., 2020 found that hip pain was related to osteoarthritis accompanied by changes in bone marrow intensity, hip instability and osteophytes.[15] According to Rondas et al., 2022 stated that there is a correlation between hip pain and radiographic osteoarthritis/ROA,[16] but according to Pereira et al., 2016 and Hattori et al., 2021 there is no correlation between hip pain and hip osteoarthritis. suggestive of osteoarthritis.[19]

In this study, there are 45 patients with osteoarthritis within population. Of the total patients in this study, the proportion of men was higher than women with a percentage of 53.3% and 46.6%, respectively. In a leading population study in the US, the

prevalence of symptomatic hip OA was reported to be 9.2% among adults aged over 45 years with 27% showing radiographic signs of disease then a slightly higher prevalence among women.

It was found that the population with hip osteoarthritis was between 50-59 years old. The prevalence of hip OA on radiographic examination shows an increase in prevalence with increasing age for men and women. Men have a higher prevalence of hip OA before age 50, whereas women have a higher prevalence after age 55. Based on data from the Indonesian Ministry of Health, the number of patients with joint disease, especially OA, is 55 million people (24.7%) consisting of the age ranging from 55-64 years is 45%, 65-74 years is 51.9% and ages over 75 year is 54.8%. Previous studies found that average age range was 60-64 years in the population with hip osteoarthritis.[20] Several risk factors associated with osteoarthritis have been reported in various studies. Obesity, dyslipidemia, osteoarthritis of the knee joint, osteoarthritis of the spine, and hypertension have been reported to be risk factors for osteoarthritis of the hip bone. These things can cause differences in findings between this study.

This study also shows that there is a strong correlation between MJS and patient's VAS, but this is inversely proportional, indicating that the lower the MJS, the higher the VAS value. This is in accordance with research conducted by Nese Olmez Sarıkaya and Fazil Gelal that based on quantitative measurements and grading of joint space narrowing showed a correlation with pain severity in patients with hip osteoarthritis.[12] This was relevant with the study of F. Birrell et al. that the severity of OA based on radiology has an effect on the patient's degree of pain.

The presence of pain in osteoarthritis can be caused by changes in joint biomechanics, subchondral bone remodeling occurs with a very fast subchondral bone turnover rate and can be manifests as increased porosity and thinning of the subchondral bone plates and trabecular bone. Simultaneously, cartilage microdamage occurs in the form of micro fissures, which span the thickness of the uncalcified areas of cartilage. These micro fissures facilitate increased vascularization and bidirectional pathways of important cytokines and growth factors across the osteochondral junction, thereby linking subchondral cartilage and bone both biochemically and mechanically. Precise signaling molecules involved in biochemical cross-communication between articular cartilage and subchondral bone thus it is hypothesized that stressed articular cartilage releases pro-inflammatory cytokines and osteoclast-stimulating molecules that reach subchondral bone to affect subchondral bone remodeling. Similarly, pro-inflammatory signaling molecules released by osteoblasts in the subchondral bone are thought to reach the articular cartilage where they trigger cartilage breakdown.[22]

CONCLUSION

It can be concluded that there is a significant correlation between the degree of pain and radiographic findings in patients with hip OA at Haji Adam Malik Hospital based on Croft (strong correlation) and Tonnis (moderate correlation) classification. In addition, there is a strong correlation between MJS and VAS, which is inversely proportional.

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