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The Severity Level of Knee Osteoarthritis is a Predictor of Falls Among the Elderly

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Abstract

Knee osteoarthritis is the most common degenerative disease that leads to the disability in elderly. Changes in the joint structure that cause pain, functional limitations, and decreased the quality of elderly life. Muscle weakness and decreased proprioception associated with the decrease of balance can cause someone with Knee OA to have an increase the risk of falling. This study aimed to determine whether the severity level of knee OA is interdependent with the risk of falls among the elderly. Cross-sectional study an observational analytic approach, carried out at University Hospital of Muhammadiyah Malang, in May 2023. The sample consisted of 30 elderly subjects recruited and used purposive sampling for a clinical trial. Oxford Knee Score (OKS) is used to measure the severity of KOA and the Morse Falls Scale (MFS) is used to measure the risk of falls of the elderly. The correlation between the severity of knee OA and the risk of falls was identified through the Fisher exact test. Among 30 subjects with knee OA. The prevalence of knee OA with poor joint function was 20%. There is a relationship between the degree of KOA and the level of fall risk. **The results of this study show that there is a relationship between the degree of KOA and the level of risk of falls in the elderly** at UMM Hospital where, the higher the degree of KOA, the higher the level of **risk of falls in the elderly**.

INTRODUCTION

The elderly population in Indonesia is predicted to increase compared to the population in other Asian countries after 2050. In 2010, Indonesia was in the top 5 largest number of elderly in the world with 18.10 million elderly population. Indonesia experienced an increase in the elderly population to 20.7 million people (8.2%) in 2014 and is expected to increase to 27 million people in 2020 (Misnaniarti, 2017). Elderly is an individual who has entered the age of 60 years and over. The elderly experience changes with age such as changes

in musculoskeletal systems, increased bone fragility, loss of cartilage resistance, reduced elasticity of ligaments, loss of muscle strength, and redistribution of fat which reduce the ability of tissues to carry out their normal function (Gheno et al., 2012). Physiological changes that happen in the elderly can lead to decreased body function, susceptibility to various kinds of diseases, problems in balance, and the risk of falling. Based on epidemiological research done in Jakarta, reported that the prevalence of falls in the elderly is 38%, and the prevalence of elderly who are not afraid of falling is 33-

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46%, while the prevalence of elderly who are afraid of falling is almost 70% (Nuruzzaman & Satyawati, 2020).

The risk of falling in the elderly is related to chronic musculoskeletal diseases such as low back pain (LBP), rheumatoid arthritis, and osteoarthritis (OA) which especially occurs in the joints of the lower extremities such as hip and knee (Dore et al., 2015). Knee osteoarthritis is a common cause of disability, especially among the elderly population (Khalaj et al., 2014). The pathogenesis of KOA is the result of interactions between mechanical loads, damage to articular cartilage, and incomplete repair mechanisms (Neelapala et al., 2018). The percentage of KOA in Indonesia started from the age of 40 years and overreaches around 5%, increases to 30% in the age group 40-60 years, and massive increases to 65% in the ages of 61 years and over. According to the Riskesdas database in 2013, diagnosis of the joint disease

in Indonesia was reported to have a prevalence of 11.9%, and prevalence based on symptoms is 24.7% (Suari et al., 2015). Pratiwi (2015) reported that the prevalence of OA in Malang reaches 21.7%, reported, women at 15.5% and men at 6.2%.

Changes in the subchondral bone, loss of hyaline cartilage, development of osteophytes, inflammation of the synovium, meniscal injuries, ligament laxity, and muscle weakness are the products caused by KOA. These joint changes cause pain, functional limitation, and decreased quality of life. Decrease quadriceps function and decreased proprioception are associated with decreased balance and may put a person with KOA at higher risk of falling (Taglietti et al., 2017). Persons with KOA have a greater risk of falling compared to groups of individuals without OA and more than half of individuals with reported falls during the previous year (Manlapaz et al., 2019).

TABLE 1. Participants Demographics

Characteristic of Respondents	Total (n)	Percentage %
Sex		
Male n (%)	7	23%
Female n (%)	23	77%
Age (years)		
60-74 n (%)	29	97%
75-90 n (%)	1	3%
BMI		
Normal n (%)	7	23%
Underweight n (%)	1	3%
Overweight n (%)	14	47%
Obesity n (%)	8	27%
Occupation		
Housewife n (%)	14	47%
Retired persons n (%)	7	23%
Self-employed n (%)	6	20%
Etc n (%)	3	11%
Severity of KOA		
Mild to moderate n (%)	6	20%
Moderate to Severe n (%)	16	53%
Severe n (%)	8	27%
Level of Risk of Fall		
Low Risk n (%)	2	6%
Medium Risk n (%)	8	27%
High Risk n (%)	20	67%

Source: Primary Data, 2023

TABLE 2. Fisher Exact Analysis

Degree of KOA	Level of Risk of Fall		Total	P value
	Low Risk	High Risk		
Mild	6	0	6	*0.000
Moderate	4	20	24	

Source: Primary Data, 2023

The purpose of this study was to determine the relationship between the severity of KOA and the level of risk of falling in the elderly at Muhammadiyah Malang University Hospital. We hypothesized that individuals who reported having mild KOA would have a moderate to high chance of experiencing falls and worse functional performance and quality of life.

METHODS

This was a cross-sectional study that enrolled a convenience sample of patients with knee OA at the University of Muhammadiyah Malang Hospital in May 2023 to participate in this study. The ethical committee of the Faculty of Medicine University of Muhammadiyah Malang approved the study (approval number: No.E.5.a/118/KEPKUMM/V/2023.), and written informed consent was obtained from all the participants before enrollment. The inclusion criteria were as follows: (1) 60 years of age or over. (2) diagnosed with KOA confirmed by American College Criteria, (3) without cognitive impairment confirmed by Montreal Cognitive Assessment, (4) willing to be respondents. The Exclusion criteria were as follows: (1) people with cognitive impairment, (2) have been diagnosed with knee pain other than KOA. In this study, the Oxford Knee Score was used to measure the severity of KOA, and the Morse Falls scale was used to measure the level of falling. Both tests are reliable, valid, and responsive in individuals with pathological knee conditions. Fisher exact tests were used to examine the correlation between the Oxford knee score and the Morse Falls scale.

RESULTS AND DISCUSSIONS

In total, 30 participants (7 males and 23 females) met the criteria of inclusion and participated in this study. The mean age of

the participants was 60 years old. Among 30 participants, 23% (n=7) have normal BMI, 3% (n=1) have underweight BMI, 47%(n=14) have overweight BMI, and 27% (n=8) with obesity BMI. Fourteen participants (47%) were housewives, 7 (23%) participants were retirees, and 6 (20%) were self-employed, and 3 (11%) participants were having several kinds of jobs. Oxford Knee Score was used to measure the severity of KOA, and it shows that among 30 participants, 6 (20%) participants have mild to moderate KOA, followed by 16 (53%) participants have moderate to severe KOA, and lastly 8 (27%) have severe KOA. Morse falls scale was used to measure the risk of falling of the participants with the results, 2 (6%) participants have low risk of falls, 8(27%) participants have medium risk of falls, and 20(67%) participants have high risk of falls.

Table 2 shows that of the total of 30 research respondents, there were 6 people (20%) with mild KOA and 24 people (53%) with moderate KOA. 10 research respondents with mild KOA had a low risk of falling and 20 people had a high risk of falling. The Fisher exact test results are $P \text{ value} < \alpha (0.05)$ so that H_0 is rejected and H_1 is accepted. The test results show that there is a relationship between the degree of knee osteoarthritis (KOA) and the level of risk of falls in the elderly at the Muhammadiyah University Hospital, Malang. The objectives of this study were to determine the correlation between the severity of KOA with Risk of falls in mild to moderate patients. The total participants are 30 elderly people with knee OA. The severity of KOA is measured by the Oxford Knee Score and the risk of falls of the elderly is evaluated by Morse Falls Scale.

In this study, 30 participants diagnosed with KKOA at the University of

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Muhammadiyah Malang reported having a larger percentage of female than male patients. A previous study done by Szilagyi et al. (2022) the prevalence of risk factors of KOA in general is higher in females compared to male patients. The hormone stronger can be the cause of the high number of KOA sufferers in Female patients. When entering the menopause phase there is a decrease in estrogen levels in females (Ranganathan & Aggarwal, 2019). The hormone estrogen plays an important role in maintaining cartilage homeostasis, so a decrease in estrogen has an impact on damage to the collagen matrix, causing cartilage damage (Peshkova et al., 2022). Anatomically, the femur in females is smaller and the patella is thinner than in males, this can also increase the risk of KOA in female patients (Nurningsih, 2012).

The mean age in this study was 60-74 years old which was categorized as elderly by WHO. A previous study reported that those aged over 55 years are more likely to experience KOA compared to patients aged under 55 years (ji eat all, 2023). Lespasio (2017) in their study reported that age and KOA are closely related, with KOA mostly occurring at the age of 65 years and 75% of those who are over 75 years old. The aging process results in the inability of chondrocytes to produce proteoglycans to maintain the cartilage matrix which provides compressive strength to the cartilage and failure to maintain homeostasis. Thus, the tissue tends not to heal when stressed, causing degeneration of the articular cartilage, and leading to OA (Berteau, 2022). This study reported that respondents were categorized as overweight and obese. Munthe et al. (2021) stated that patients with abnormal BMI can experience narrowing joint space and increase the load in the joint causing the bones to work harder. A previous study by Vasilic-Brasnjevic et al. (2016) stated that body weight influences the severity of KOA, every 5kg increase in body weight increases the risk of KOA by 36%. Obesity reported to increase the risk of KOA due to high joint load and changes in body composition, including decreased physical activity and decreased muscle strength (Wluka et al., 2013). The overload on the knee joint due to excess body weight causes increased mechanical stress which can

accelerate joint cartilage degeneration, thereby worsening cartilage thinning. Previous studies reported increased hip abduction and varus malalignment of the knee in obese patients to avoid thigh contact when walking thereby predisposing to damage to the medial aspect of the articular cartilage (Bliddal et al., 2014).

In this study, the participants were reported to have occupations such as housewives, retiree and only a few of the respondents worked as entrepreneurs, farmers, construction workers, and household assistants. Domestic workers and entrepreneurs are in the medium work category, retirees are in the light work category and farmers and construction workers are in the heavy/severe work category (Husnah et al., 2019). An increase in the incidence of KOA can occur due to the many activities that put pressure on the knee joints such as squatting, up and down stairs activity, lifting weight, and other activities. Repetitive squatting activities can cause meniscal or ligament damage in the knee that can lead to articular cartilage degeneration (Utomo et al., 2022). The present study found that there is a relationship between the severity of KOA and the level of risk of falls in the elderly at UMM Hospital were, the higher the level of KOA, the higher the level of risk of falls in the elderly. Kurtoglu et al. (2020) explained that KOA is a risk factor for falls so it can affect daily activities. Knee injuries can be a risk factor for KOA. Elderly people with a history of knee injury are 3 to 6 times more likely to have a KOA. Individuals with KOA are 30% more likely to fall than those without KOA (Driban et al., 2015). Hicks et al. (2020) elderly people with knee pain caused by KOA reported having twice the risk of falling, this may be related to a progressive decline in function, increased muscle stiffness, and joint pain. The high risk of falls can cause bone fractures in elderly KOA (Saelee & Suttanon, 2018).

A previous study done by Cai et al. (2022) knee pain and KOA-related symptoms caused by quadriceps muscle weakness and poor balance, thereby increasing the risk of falls. Pain can cause muscle atrophy and muscle immobilization which can lead to decreased muscle strength. Decreased muscle strength was reported to be associated with knee joint

instability, increased postural sway, inhibiting the muscle's ability to maintain postural stability (Aljehani et al., 2021). KOA leads to changes in pressure in the joint and plays an important role in balance and movement, thereby causing changes in knee biomechanics. The pressure is caused by a high load on the medial knee, which affects the severity of KOA and knee pain. A previous study reported that in KOA patients usually have an increase or decrease of the Q-angle that leads to the genu varus or genu valgus condition, a change in the angle can increase the risk factor for causing muscle weakness (Favre & Jolles, 2016). Quadriceps muscle weakness can be caused by abnormal alignment resulting in pressure on the joint. Continuous pressure on one joint results in instability in the position of the patella. Alignment abnormalities are caused by an increase in the Q-angle, this can also increase the risk of falls (Zeng et al., 2022). Increased loading in the joint or stress in the joint further exacerbates the development of KOA, and these factors are thought to create a vicious circle between muscle weakness and KOA (Bozbaş & Güreç, 2018)

CONCLUSIONS

Knee Osteoarthritis often occurs, especially in the elderly. Females were reported to have a higher possibility of having KOA than males. BMI is correlated with the incidence of KOA, Overweight is reported to have a higher chance to have KOA. KOA causes sufferers to have a high risk of falling, this is related to a progressive decline in function, increased muscle stiffness, and pain in the joints which results in weakness of the quadriceps muscles resulting in decreased proprioception. The elderly at UMM Hospital on average experience a moderate degree of KOA with a high risk of falling. The higher the degree of KOA, the higher the risk of falls in the elderly.

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