

Determinants of risk of fall among knee osteoarthritis patients in Malang, Indonesia

Sri Sunaringsih Ika Wardojo,¹ Rakhmad Rosadi,¹ Haidzir Manaf²

Department of Geriatric Physiotherapy, ¹Faculty of Health Science, University of Muhammadiyah Malang, Indonesia, ²Center for Physiotherapy Studies, Faculty of Health Sciences, Universiti Teknologi MARA, Selangor, Malaysia

Objective: To analyse the determinants of risk of falls among knee OA patients in Malang, Indonesia.

Methodology: This cross-sectional study was conducted using purposive sampling techniques. Inclusion criteria were diagnosed with knee OA and aged above 55 years old. There were 53 respondents recruited from Puskesmas Rampal Celaket and Posyandu Lansia Samaan Malang from April to September 2023. We used Morse Fall Scale (MFS) to measure the risk of fall, a lower limb-matching task measuring knee proprioception, Visual Analogue Scale (VAS) measuring knee pain, and sociodemographic questionnaires. Data were analysed bivariate using analysis of variance (ANOVA)

and T-test, while multivariate linear regression used to determine significant risk of fall predictors.

Results: A multivariate linear regression analysis showed that older age, higher levels of knee pain, and reduced knee proprioception were significantly associated with an increased risk of falls. The regression model had an adjusted R² of 0.21.

Conclusion: Programs focusing on managing knee pain and improving knee proprioception through promoting proprioceptive training should be prioritized as fall prevention strategies among elderly in Indonesia.

Keywords: Pain, proprioception, osteoarthritis.

INTRODUCTION

Osteoarthritis (OA) is a degenerative joint disease that primarily impacts weight-bearing joints such as hip, knee, and ankle.¹ It also regarded as one of the factors cause lower limb disabilities among elderly.² One of the serious effects of knee OA is an increased risk of falls. Patients experience joint pain and stiffness, which led to functional decline, and owing to these physical limitations, the fall risk is higher in this population than in healthy older adults without OA symptoms.^{3,4} A study in 2023 observed that nearly 58% of knee OA patients experienced falls.⁵ The factors increasing risk of falls include gait impairment and variability, decreased static postural control, muscle weakness, pain, impaired proprioception, and obesity.^{6,7}

Individuals who has risk of fall limit their social activities, and if this situations prolonged, it might leads to cognitive impairment and consequently, a higher risk of fall and decreasing their quality of life.^{8,9} There is lack of studies which incorporate the knee proprioception as the predictor of risk of fall, especially in Indonesia setting.^{10,11} This study aimed to investigate fall risk factors among knee OA patients, including knee proprioception, knee pain, and sociodemographic characteristics.

METHODOLOGY

This study was conducted using cross-sectional approach with purposive sampling technique. The inclusion criteria

were subjects with knee osteoarthritis, diagnosed by a physician, and aged 55 years or older. While the exclusion criteria included having a history of bone fractures and rheumatoid arthritis and diagnosed with neurological problems. There were 53 participants met the inclusion criteria. They were recruited from Puskesmas Rampal Celaket and Posyandu Lansia Samaan Malang from April to September 2023. The IRB of University of Muhammadiyah Malang Health Research Ethic (Ref. NO.E.5. a/112/KEPKUMM/V/2023) approved the study and all participants signed the informed consent form.

Variables used included risk of fall, proprioception, pain, and sociodemographic characteristics. Participants were asked to fill MFS, VAS and sociodemographic questionnaires, while researcher measure the proprioception test (lower limb-matching task).

Morse Fall Scale (MFS) was used to examine the risk of fall. It consisted of six items, namely: Fall history in the last 3 months (yes=25, no=0); having more than one medical diagnosis (yes=15, no=0); walking auxiliary (none=0, yes=15); use of special drugs (yes=20, no=0); Gait (normal =0, weak=10); and cognitive state (know your abilities =0, disturbance of consciousness =15). The total score on the scale was 125, with higher score indicated higher risk of falling.⁵

A lower limb-matching task was used to evaluate proprioception in seated and blinded patients. Each patient's unaffected leg was raised to a random height, and he/she

was instructed to maintain this position while the affected leg was raised thrice to match the position of the unaffected leg. The mean measurement error for each leg was calculated using a protractor inscribed on a vertical transparent acrylic sheet (60 cm × 60 cm × 1 cm) positioned between the legs and marked in 2° increments.¹²

Knee pain experienced during functional activity was measured using VAS. This scale is a 10 cm line divided into 1-cm notches to which patients assign a numeral value to rate their pain, with grade 0 = no pain and grade 10 = the most severe pain.⁴

Participants were also asked for their sociodemographic information by self-reported questionnaire. These questionnaires asked information about their age; sex (male/female); Body Mass Index (BMI); Marital Status (unmarried/married); Education Level (uneducated/elementary school/ junior high school/senior high school/university), and knee OA problems (right knee/ left knee/ both knees).

Statistical Analysis: Quantitative data were analysed using SPSS 20. The Independent T-test and One-way ANOVA, depending on the type of variable, were used to assess the relationship between two variables. A multivariate linear regression with backward selection was used to assess between predictors and risk of fall. The stepwise backward elimination method was used to determine the variables most strongly associated with the outcome to obtain the best model. Factors that showed a statistically insignificant association with the outcome were eliminated using a stepwise backward elimination process, therefore predictors that were statistically significant on univariate analysis ($p < 0.20$) were subjected to multivariate analysis.

RESULTS

Table 1 presents the sociodemographic characteristics of

Table 1: Patient characteristics (N=53).

Variable	N	%	M±SD	p-value
Age (years)			62.23±5.01	0.03*
BMI			25.48±3.88	<0.001*
Sex				0.23
Male	2	3.7		
Female	51	96.3		
Marital Status				0.46
Unmarried	13	24.5		
Married	40	75.5		
Education Level				0.54
Uneducated	1	1.9		
Elementary School	22	41.5		
Junior High School	11	20.7		
Senior High School	11	20.7		
University	8	15.2		
OA Problem				0.34
Right knee	23	43.4		
Left knee	11	20.8		
Both Knee	19	35.8		
Proprioception Test (Degree)			5.73±3.69	<0.001*
Knee Pain (VAS)			3.14 ± 2.33	<0.001*
Risk of Fall			54.5±4.53	–

the 53 respondents in the study. Based on bivariate analysis between sociodemographic, knee proprioception towards risk of fall, it was known that age, BMI and knee proprioception have significant correlation with risk of fall ($p < 0.05$).

Univariate linear regression showed that age ($p < 0.001$), BMI ($p = 0.14$), proprioception ($p = 0.02$), and knee pain ($p < 0.001$) were significantly associated with the risk of falls (Table 2). While multivariate linear regression with backward selection showed that age, proprioception, and knee pain were significantly associated with risk of fall. Patients with older age, having less knee proprioception, and having more knee pain were more likely to increase risk of fall (OR 0.45, 0.22, and 1.58, respectively).

Table 2: Univariate and Multivariate Linear Regression analysis predicting risk of falls (N=53).

Variable	Univariate					Multivariate (backward selection)				
	Unstandardized Coefficient		95%CI	t Stat	p-value	Unstandardized Coefficient		95%CI	t Stat	p-value
	B	SE				B	SE			
Age	0.37	0.13	0.38-0.74	0.63	<0.001**	0.45	0.18	0.41-0.83	0.71	0.04*
Body Mass Index (BMI)	0.34	0.07	0.10-0.21	0.22	0.14*	0.37	0.10	0.00-0.21	0.28	0.06
Sex (ref. Male)	0.75	0.65	0.00-2.11	0.87	0.32	N/A	N/A	N/A	N/A	N/A
Marital Status (ref. Unmarried)	0.61	0.35	0.00-0.23	0.76	0.45	N/A	N/A	N/A	N/A	N/A
Education Level (ref. Uneducated)										
a. Elementary School	0.23	0.11	0.00-0.44	0.43	0.33	N/A	N/A	N/A	N/A	N/A
b. Junior High School	0.25	0.12	0.03-0.30	0.40	0.28	N/A	N/A	N/A	N/A	N/A
c. Senior High School	0.28	0.15	0.02-0.15	0.54	0.36	N/A	N/A	N/A	N/A	N/A
d. University	0.38	0.20	0.00-0.18	0.48	0.20	N/A	N/A	N/A	N/A	N/A
OA Problem (ref. Right Knee)										
a. Left Knee	0.44	0.32	0.04-1.02	0.50	0.54	N/A	N/A	N/A	N/A	N/A
b. Both knee	0.52	0.34	0.05-2.01	0.87	0.62	N/A	N/A	N/A	N/A	N/A
Proprioception Test	0.19	0.08	0.08-1.44	0.67	0.02*	0.22	0.10	0.23-2.01	0.71	<0.001**
Knee Pain	1.44	0.54	0.10-2.76	0.87	<0.001**	1.58	0.67	0.34-3.06	0.91	<0.001**

Adjusted R2 = 0.21; *p<0.05; ** p<0.001

DISCUSSION

This research focuses on analysing predictors of risk of falls among knee OA patients in Malang, Indonesia, and findings reported that older age, greater knee pain, and reduced knee proprioception were significantly associated with higher risk of fall. This is in line with previous research^{5,13} which stated that among older adults, risk of fall is known to increase with increasing age, and compared with adults aged 65-69 years-old, adults aged above 80 years-old were having at about 50% increased risk of fall-related injury.⁷

As increasing age were also increasing the risk of non-vertebral osteoporotic fractures which resulted from combination of reducing bone strength and increased fall risk.^{14,15} Increasing knee pain also plays an important role on increasing risk of fall, as previous study review about pain and risk of falls.^{10,16} Studies also reported that severe knee pain when coupled with pain in at least one additional site were significantly increases risk of falls.¹⁷

This study results are in line with a previous study, which found that proprioception is one of the predictors of risk of falls.¹⁸ Over time proprioceptive degeneration of the knee increases with worsening osteoarthritis.¹⁰ Decreased knee proprioception is related to weakness of the capsule, ligaments that occur due to cartilage and bone loss in osteoarthritis.^{1,19} Bozkurt et al,¹² stated that proprioceptive disorders are the result of the pathological process of OA which disrupts the function of mechanoreceptors in

joints, capsules, ligaments, meniscus, muscles and tendons.

Receptors located in the joint components are disturbed, producing abnormal proprioceptive sensory signals, so that information about the joint motion sense and joint position sense is disturbed.¹⁸ Decreased proprioception can change joint biomechanics and neuromuscular control of the extremities resulting in impaired balance and a higher risk of falls.²⁰ Thus, maintaining knee proprioception will have a significant effect on minimizing risk of falls among elderly, as knee proprioception plays as a protective factor against falls.¹⁰

As improved knee proprioceptive control increased single-stance stability and made safer ground interactions possible, both of which decreased the incidence of falls.⁷ Therefore, promoting proprioceptive training will have beneficial effect on relieving pain and improve physical function during activities of daily living.⁴

This study has limitations as it involved a relatively small number of participants. Thus, it will be better for future studies should use larger samples to enhance internal validity. Moreover, as this study only use single geographic location, it is suggested for future studies should include diverse geographic locations to improve generalizability.

CONCLUSION

Being older age, having more knee pain, and having lack

of knee proprioception were associated with increasing risk of fall. Therefore, optimal management focusing on managing knee pain and improving knee proprioception through promoting proprioceptive training should be prioritized as fall prevention strategies among elderly in Indonesia.

Author Contributions:

Conception and design: Sri Sunaringsih, Haidzir Manaf.
Collection and assembly of data: Sri Sunaringsih, Rakhmad Rosad, Haidzir Manaf.
Analysis and interpretation of the data: Sri Sunaringsih, Haidzir Manaf.
Drafting of the article: Rakhmad Rosad.
Critical revision of the article for important intellectual content: Rakhmad Rosad.
Statistical expertise: Haidzir Manaf.
Final approval and guarantor of the article: Sri Sunaringsih.
Corresponding Author Email: Sri Sunaringsih Ika Wardoyo: srisunaringsihika@gmail.com
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