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Original Research

Relationship Between Preoperative Psoas Major Muscle Quality and Forgotten Joint Score-12 in Patients After Total Hip Arthroplasty

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ABSTRACT

Background: There are limited reports on the factors affecting the Forgotten Joint Score-12 (FJS-12) in patients after total hip arthroplasty (THA). Therefore, this study aimed to determine whether the quantity and quality of the preoperative psoas muscle are related to the FJS-12 in post-THA patients.
Methods: This retrospective cohort study used mailed questionnaires and medical records. Questionnaires containing the FJS-12 were mailed to 752 patients who underwent THA at our hospital between April 2015 and August 2020. The quantity and quality of the psoas major muscle were measured by computed tomography. The association between FJS-12 and the quantity and quality of the psoas major muscle was assessed by logistic regression analysis adjusted for potentially relevant factors.
Results: In total, 484 patients were included in the analysis. The FJS-12 score of the analyzed subjects was 75 points. Poor psoas major muscle quality was associated with a poor group of patients scoring <50 on the FJS-12. This association was independent of the adjustment factors. However, the quantity of psoas muscle was not associated.
Conclusions: The quality of the psoas major muscle is associated with FJS-12. In the rehabilitation of patients undergoing THA, focusing on the quality of the psoas major muscle may help achieve the ultimate goal.

Introduction

Postoperative evaluation of total hip arthroplasty (THA) greatly interests healthcare providers and patients. Patient-reported outcome measures are commonly and routinely used for postoperative evaluation [1,2], the Forgotten Joint Score-12 (FJS-12), was developed to assess patients' ability to forget the presence of an artificial joint [3]. Loss of prosthesis awareness is the ultimate goal of functional improvement and maximizes patient satisfaction. It represents a higher level of function, with the ability to perform necessary tasks of daily living without pain. The FJS-12 has been translated and validated in many languages, proving its validity and reliability [4,5]. It is especially recommended as a patient-reported outcome measure for long-term evaluation after undergoing THA [4].

However, information on factors affecting joint awareness is scarce, and several previous studies have shown that joint awareness is influenced by the invasive method of surgery [6,7], social background [3,8], presence of comorbidities [9], and condition of the opposite hip [10].

Patients with hip osteoarthritis (OA) have been shown to experience atrophy of the hip joint muscles as the disease progresses [11,12]. Preoperative muscle atrophy around the hip joint has been shown to persist in the long term [13,14] and may negatively impact outcomes after THA. Computed tomography (CT) is more commonly used to evaluate skeletal muscle, quantify skeletal muscle, and assess skeletal muscle quality, including fatty muscle

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degeneration [15,16]. Among them, the psoas major muscle is often used as a surrogate indicator of sarcopenia [15,16], and it has been shown that the quantity and quality of the psoas major muscle can be a prognostic factor for malignancy, trauma, and heart failure [17–20]. The psoas major muscle plays an important role in hip and pelvic stability and mobility in patients with hip OA [21]. Cross-sectional studies in such patients suggest that decreased psoas muscle mass is associated with pain and decreased quality of life [22,23]. Impacts after THA have been found to be related to the frequency of complications [24], gait speed [25], and joint perception [26]. However, the association with FJS-12 has not yet been investigated. This study aimed to clarify whether the quantity and quality of the preoperative psoas major muscle are associated with FJS-12.

Methods

Ethics statement

This study was approved by the institutional review board of our institution before implementing the study methods (No. 5360-00).

Study design and study group

This retrospective cohort study included female patients who underwent primary THA at our hospital between April 2015 and August 2020. The study was conducted by extracting patient information from medical records recorded during THA admission and mailing questionnaires to these subjects. The inclusion criteria for this study were an age of ≥40 years when the questionnaire was mailed and OA of the hip as the primary disease. Patients with a history of knee arthroplasty, those who had undergone other joint arthroplasty after September 2020, and those whose death after discharge was verified in the medical record were excluded. A self-administered questionnaire was mailed to all the participants in October 2021. If THA of the contralateral hip was performed during this period, the medical records from the contralateral surgery were treated as the baseline. For bilateral THA, the most recently performed side was defined as the operative side.

Surgical procedure and postoperative protocol

During this period, THA was performed by 10 experienced surgeons. The surgeons had 23.7 (standard deviation, 7.9) years of surgical operation experience. During this period, posterolateral, anterolateral, and direct lateral approaches were performed at the hospital. Although THA implants were diverse, acetabular sockets consisting of the SQRUM HA Acetabular Cup System (Kyocera Medical, Osaka, Japan) and stems consisting of the J-taper Total Hip System (Kyocera Medical, Osaka, Japan) were used in most patients. After THA, standard rehabilitation was provided with the goal of discharge, usually 2 to 3 weeks if there were no special perioperative complications.

Investigation and measurement items

Forgotten Joint Score-12

The FJS-12 is a questionnaire that asks the respondent to answer the question "How much do you care about your operated hip joint?" on 12 daily activities, such as sleeping, walking, climbing stairs, getting up from the floor, and during sports activities [3–5]. Each item is scored on a Likert scale ranging from 0 to 4. The total sum of the scores was converted into a scale ranging from 0 to 100, where higher scores reflect less joint awareness during activities of daily living. In this study, a response was considered valid if the number of missing items was 3 or fewer. Moreover, to identify subjects with worse FJS-12 scores, the lowest quartile of patients in the analysis was defined as the poor FJS-12 group.

Quantity and quality of psoas major muscles

The psoas major muscle was evaluated using noncontrast radiograph CT images (Aquilion Prime SP; Canon Medical Systems, Otawara, Japan) obtained during a detailed preoperative examination (Fig. 1). All images were obtained within 3 months presurgery. CT was performed using a slice thickness of 1.0 mm (125 kV, 370 mA). The CT system was routinely calibrated to display water as 0 and air as −1000 using a phantom provided by the manufacturer to ensure measurement consistency.

Measurements of the psoas major muscle were performed by a blinded examiner. The psoas major muscle was recorded at the midlevel of the L3 vertebra [27]. The contour of the psoas major muscle was manually traced as the region of interest and analyzed using an image analysis software (SYNAPSE Fujifilm). The cross-sectional area (CSA) of the psoas major muscle was divided by the square of its height to calculate the psoas major muscle index (PMI), which is defined as the skeletal muscle quantity [15,16]. Radiation density (RD) derived from the mean CT values (in

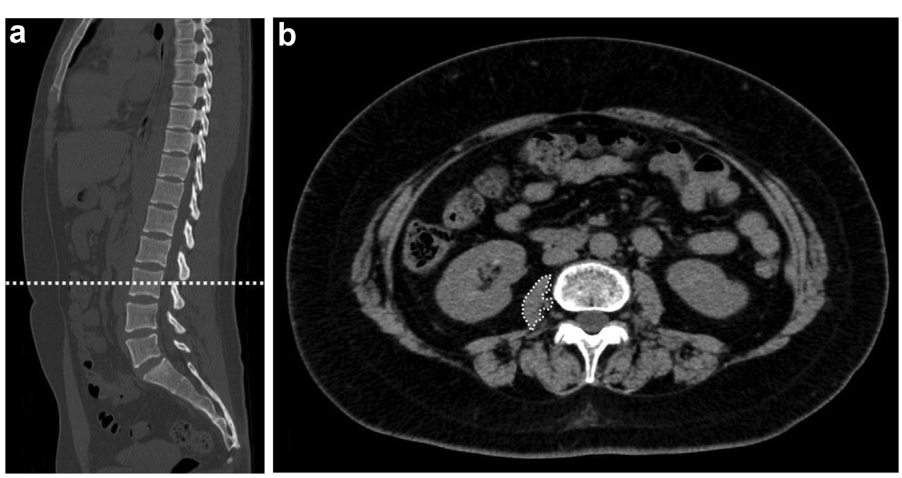

Figure 1. Measurement of the quantity and quality of the psoas major muscle. (a) Psoas muscle index (PMI) and radiation density (RD) were measured at the mid-level of the L3 vertebra. (b) The cross-sectional area and average computed tomography (CT) values (RD) in the psoas major muscle (dotted lines) were calculated. The figure shows a CT image taken before total hip arthroplasty on the right side.

Hounsfield units [HU]) within the region of interest of the psoas major muscle was defined as the skeletal muscle quality [15,16]. A low CT value of the skeletal muscle indicates excessive fat accumulation in the tissue and low muscle quality [28].

Before measurement, 20 patients were randomly selected and the examiner's intraclass correlation coefficient (ICC, 1.1) was calculated; ICC, 1.1 for CSA was 0.94 (95% confidence interval: 0.86-0.98, $P < .01$); ICC, 1.1 for RD was 0.9 (95% confidence interval: 0.78-0.96, $P < .01$). After obtaining PMI and RD data for all patients, the lowest quartile of patients in the analysis was assigned to the low-PMI and low-RD groups [29].

Self-administered questionnaire

The self-administered questionnaire included items on educational level and the number of people living together. Education level was categorized as junior high school, high school, and university (including junior college and graduate school); Japan has a 9-year compulsory education program for junior high school graduates [30]. Participants who completed high school had 12 years of education, and those who graduated from university had 16 years of education (14 to 15 years of education in the case of junior colleges and 17 to 22 years of education if graduate school was attended). The number of people living together was divided into 2 groups: those living together and those living alone.

Medical records information

The following information was recorded at the time of admission. Demographic factors extracted from medical records included age at surgery, height, weight, and body mass index. The comorbidities investigated were musculoskeletal diseases (spinal disease, knee joint disease, rheumatoid arthritis, history of fracture, and osteoporosis) and medical diseases (hypertension, diabetes, heart disease, stroke, and psychosis). Perioperative complications were investigated based on the incidence of periprosthetic fractures and irreversible nerve injuries.

Regarding the parameters in range of motion (ROM) of the hip multiple variables were recorded because a single variable associated with FJS-12 remains unclear (investigations included flexion, abduction, adduction, external rotation, and internal rotation).

Information related to surgery included the date of surgery and the surgical approach to THA. The date of surgery was used to calculate the postoperative follow-up duration. The postoperative follow-up duration was categorized into 4 categories (<2 years, 2 to 4 years, 4 to 6 years, and >6 years). The surgical approach in our hospital employs posterolateral, anterolateral, and direct lateral approaches, and percentage of each surgical approach was investigated.

The severity of hip OA [31,32] and leg length discrepancy [33] were measured using an anteroposterior pelvic radiograph in an upright standing position. Hip severity was contralaterally assessed. The severity of hip OA was determined based on the minimum joint space width [31]. The minimum joint space width is a binary variable with a cutoff of 2 mm [32]. If the contralateral hip underwent THA, it was classified as THA.

Statistical analyses

All data are expressed as mean (standard deviation). For between-group comparisons in the poor and nonpoor groups, the chi-squared test was used for categorical variables, and the t-test or Mann-Whitney U test was used for continuous variables. For hip ROM, principal component (PC) analysis [34] was used to create a consistent data set while reducing the number of variables in each category. PC accounting for <80% of the cumulative contribution ratio, with an eigenvalue of <1.0, was retained for logistic regression analysis as a factor. Variables in hip ROM were combined into 2 PC. The contribution ratios were as follows: 43.5%, PC1 of hip ROM; 22.1%, PC2 of hip ROM (Table 1). The association between PMI, RD, and FJS-12 was analyzed using multivariate logistic regression analysis. Only the operative side was included in the analysis of the independent variable psoas major. Potential factors associated with the FJS-12 were considered in the statistical analysis. All covariates were analyzed using the forced entry method. Variance inflation factors were calculated to account for the multicollinearity of the independent variables and covariates. Odds ratios and the corresponding 95% confidence intervals were calculated for each model. All statistical analyses were performed using EZR software (Ver1.55) [35].

Results

Self-administered questionnaires were mailed to 752 subjects (Fig. 2). A total of 484 patients were included in the analysis.

Forgotten Joint Score-12

The median FJS-12 score for the subjects was 75.0 (50.0, 93.2) points. The median of FJS-12 by postoperative duration was 75.0 (52.4, 89.9) for <2 years, 72.9 (47.9, 93.2) for 2 to <4 years, 75.0 (50, 93.8) for 4 to <6 years, and 64.6 (51.1, 93.8) for >6 years. Of the subjects, 3 (0.6%) scored 0 and 78 (16.1%) scored 100. In this study, the cutoff point was 50, which corresponds to the lowest quartile of the FJS-12 scores of the subjects in the analysis, and subjects below that point were defined as the poor group on the FJS-12.

Patient characteristics

The age was significantly higher in the poor group than in the nonpoor group (Table 2). Height was significantly lower in the poor group than in the nonpoor group. There were no significant differences in the rate of comorbidity and complications between the 2 groups. Preoperative hip ROM (Table 3) and factors related to surgery, the severity of hip OA on the non-operative side, and leg length difference (Table 4) showed no significant differences between the 2 groups.

CSA, PMI, and RD of the psoas major muscles

The CSA, PMI, and RD of the psoas major on the operative side were significantly lower in the poor FJS-12 group (Table 5). The proportions of low PMI in the FJS-12 groups were 32.8% and 21.7% for the poor and nonpoor groups, respectively. The proportions of patients with low RD were 50.0% and 16.0% in the poor and nonpoor groups, respectively.

Table 1
PC analysis for ROM of operative side.

Motion arc	PC1 (factor loading)	PC2 (factor loading)	Contribution ratio
Flexion	0.56	0.08	PC1: 43.5%
Abduction	0.51	0.18	PC2: 22.1%
Adduction	0.38	−0.26	
External rotation	0.22	0.83	
Internal rotation	0.48	−0.45	

PC, principal component; ROM, range of motion.

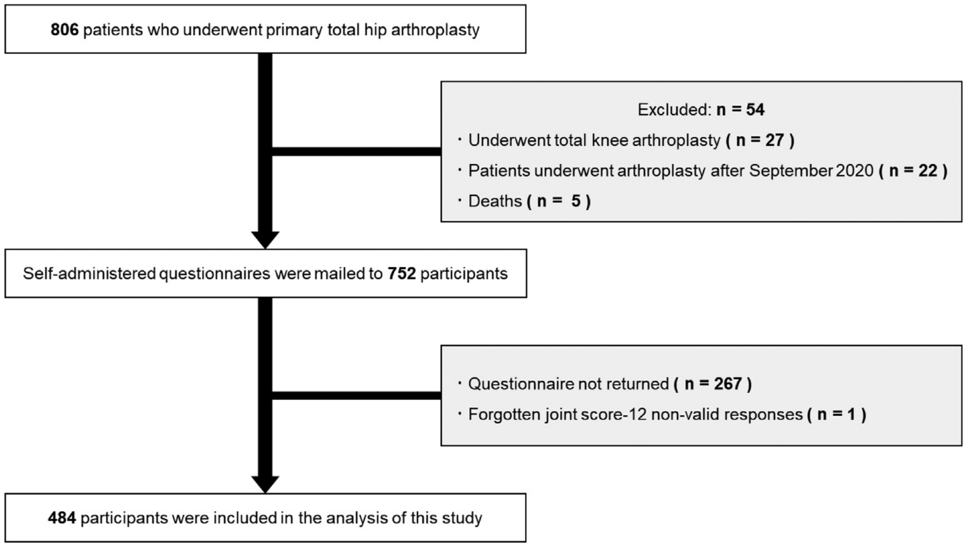

Figure 2. Flowchart of participant recruitment. A self-administered questionnaire was mailed to 752 subjects in October 2021. Eventually, 484 participants were included in the analysis.

Multivariate logistic regression analysis

In the unadjusted model, low RD of the psoas major muscle was significantly associated with poor FJS-12 scores (Table 6). After adjusting for potentially associated factors, low RD of the psoas major muscle was still associated with the poor FJS-12 group. In contrast, PMI was not significantly associated with FJS-12. In addition, none of the moderator variables entered into the model were significantly associated with FJS-12. There was no problematic multicollinearity among the independent variables or covariates entered into each model.

Discussion

In the present study, the FJS-12 score was the lowest in the group followed up for >6 years post-THA. There are conflicting opinions about the change in FJS-12 over time, but in previous reports [3,36–39], the long-term prognosis was unknown because of the limited duration of the studies. The results of the descriptive statistics in this study indicate that time is not the answer to achieving superior results in the FJS-12. Patient-acceptable symptom status for FJS-12 at 1 year postoperatively in post-THA patients has been reported to range from 66.68 to 92.2 [36–38]. The median

Table 2
Characteristics of the non-poor and poor groups of FJS-12.

Characteristic	All patients (n = 484)	Non-poor group (n = 362)	Poor group (n = 122)	*P*-value	Effect size
Age at surgery (y)	65.3 (9.2)	64.8 (9.1)	66.9 (9.3)	.03	0.10
Height (cm)	153.0 (6.2)	153.6 (6.3)	151.5 (5.6)	.02	0.14
Weight (kg)	56.2 (10.0)	56.5 (10.3)	55.2 (8.9)	.24	0.06
BMI (kg/m^2)	24.0 (3.9)	23.9 (3.9)	23.9 (3.5)	.94	0.00
Education level (%)					
Junior high school	6.8	6.0	9.5	.38	0.02
High school	45.7	45.7	45.7		
University	47.5	48.3	44.8		
Living alone (%)	13.2	13.6	12.1	.76	0.00
Musculoskeletal disease (%)					
Spinal disease	27.5	26.4	31.0	.34	0.01
Knee joint disease	7.6	7.3	8.6	.55	0.00
Rheumatoid arthritis	0.6	0.0	1.7	.06	0.00
Fracture	7.9	6.8	11.2	.16	0.02
Osteoporosis	11.4	10.6	13.8	.40	0.01
Medical disease (%)					
Hypertension	36.4	35.6	38.8	.58	0.00
Diabetes	10.7	9.8	13.8	.23	0.01
Cardiovascular disease	6.0	5.2	8.6	.18	0.02
Stroke	2.3	3.0	0.0	.07	0.00
Psychosis	2.7	2.4	2.6	.97	0.00
Perioperative complications (%)					
Periprosthetic fractures	2.9	2.4	4.3	.34	0.02
Nerve injury	2.0	1.6	3.4	.26	0.02

BMI, body mass index mean (standard deviation); FJS, forgotten joint score.

Table 3
Hip ROM of the non-poor and poor groups of FJS-12.

Hip range of motion arc	All patients (n = 484)	Non-poor group (n = 362)	Poor group (n = 122)	*P*-value	Effect size
Operative side (°)					
Flexion	78.1 (21.6)	78.3 (20.9)	77.5 (23.7)	.74	0.01
Abduction	17.7 (8.7)	17.6 (8.8)	18.2 (8.4)	.52	0.03
Adduction	8.1 (5.6)	8.1 (5.3)	7.9 (6.6)	.80	0.01
External rotation	13.9 (9.2)	13.9 (9.4)	14.1 (8.6)	.82	0.01
Internal rotation	5.5 (9.9)	5.3 (10.2)	6.1 (9.2)	.46	0.03
Nonoperative side (°)					
Flexion	99.5 (17.9)	99.7 (17.4)	98.9 (19.4)	.66	0.02
Abduction	27.2 (7.9)	27.2 (7.8)	27.1 (8.5)	.95	0.00
Adduction	12.3 (5.7)	12.4 (5.6)	12.3 (6.2)	.84	0.01
External rotation	21.8 (9.2)	21.9 (9.2)	21.5 (9.1)	.62	0.02
Internal rotation	16.8 (10.5)	17.2 (10.6)	15.4 (10.6)	.11	0.07

FJS, forgotten joint score mean (standard deviation); ROM, range of motion.

FJS-12 score of the study participants was 75. About half of the subjects appeared to have exceeded the patient-acceptable symptom status value, although caution must be exercised in interpretation because of the different postoperative courses of the subjects. By contrast, in this study, the FJS-12 poor group was defined based on 50 points in the bottom 25% of the scores. We believe that this is reasonable considering past atient-acceptable symptom status values.

The FJS-12 poor group showed significantly lower PMI and RD. However, multivariate analysis extracted only low RD as a factor associated with FJS-12. When assessing skeletal muscle mass from CT images, CSA or PMI of the psoas muscle is often used. However, this mass estimate may overestimate skeletal muscle mass in skeletal muscles with associated adipose tissue accumulation [40]. Therefore, the increase in skeletal muscle fat mass has been reported to be an important parameter for assessing skeletal muscle quality [15,28]. Our results similarly suggest that focusing on the postoperative course of the quality, not the quantity, of the psoas major muscle is important. Previous studies have shown that preoperative CT values of the psoas major muscle on the operative side of THA patients, including men, were 35.0 HU [11]. In a report of only female THA patients, the CT value of the psoas major muscle was 35.7 HU [25]. The CT value of the psoas major muscle in the present subjects was 35.4 HU, which approximates previous reports, and we believe that it represents the CT value of the psoas major muscle in end-stage hip OA. However, CT values have been reported to vary depending on various imaging conditions, such as using contrast media and slice thickness [41]. Therefore, caution may be necessary when comparing CT values. However, the imaging conditions were the same for all subjects in this study, and we believe systematic errors are unlikely to occur when comparing them.

There have been no reports of functional impairment related to FJS-12 in patients post-THA. A cross-sectional study of total knee arthroplasty recipients reported that quadriceps strength was associated with FJS-12 [42]. A previous report suggested that skeletal muscle strength affects FJS-12, although the causal relationship is unclear due to the study's cross-sectional nature. Our study did not determine the strength of the skeletal muscle. However, fat infiltration into skeletal muscle inhibits muscle function by increasing noncontractile skeletal muscle tissue per unit area due to changes in muscle fiber alignment [43,44]. If this fatty infiltration occurs in the psoas major muscle, it becomes difficult for the hip joint and pelvis to fulfill their roles in stability and mobility. This was also true after THA. Furthermore, reports of skeletal muscle changes over time after THA have shown that fatty infiltration of skeletal muscle remains, and muscle quality is unlikely to improve [45]. Although the lack of data on changes over time in the psoas major muscle in the current study precludes mention, low muscle quality (low RD) at baseline may impede the acquisition of natural movement of the hip joint, causing the FJS-12 score to be sluggish.

The present study has several limitations. First, potential biases were associated with the study design. ROM of hip extension has not yet been investigated, regardless of patients with late-stage hip OA often having hip flexion contractures which could be a factor in

Table 4
Surgical information and radiographic parameters of the non-poor and poor groups of FJS-12.

Variables	All patients (n = 484)	Non-poor group (n = 362)	Poor group (n = 122)	*P*-value	Effect size
Follow-up duration (%)					
<2 y	17.6	18.5	13.8	.61	0.02
2 to less than 4 y	38.3	37.2	42.2		
4 to less than 6 y	35.2	35.1	36.2		
>6 y	8.9	9.2	7.8		
Surgical approach (%)					
Posterolateral approach	23.1	23.1	23.3	.17	0.04
Anterolateral approach	73.6	74.5	70.7		
Direct lateral approach	3.3	2.4	6.0		
Severity of nonoperative side (%)					
MJSW <2mm	14.2	14.7	12.9	.73	0.01
MJSW >2mm	52.8	51.6	56.0		
THA	33.0	33.7	31.0		
LLD (mm)					
Preoperative	−10.3 (11.4)	−10.0 (10.2)	−11.2 (14.5)	.34	0.04
Postoperative	5.4 (8.6)	5.2 (7.9)	5.9 (10.5)	.47	0.03

FJS, forgotten joint score; LLD: leg length discrepancy mean (standard deviation); MJSW, minimum joint space width; THA, total hip arthroplasty.

Table 5
Psoas major muscle of the non-poor and poor groups of FJS-12.

Psoas measures	All patients (n = 484)	Non-poor group (n = 362)	Poor group (n = 122)	*P*-value	Effect size
Operative side					
CSA (mm^2)	561.9 (139.3)	569.7 (131.3)	537.1 (160.2)	.03	0.10
PMI (cm^2/m^2)	2.4 (0.6)	2.4 (0.6)	2.2 (0.6)	.03	0.10
RD (HU)	35.4 (14.3)	39.4 (13.1)	22.6 (9.7)	<.001	0.50
Non-operative side					
CSA (mm^2)	694.0 (173.3)	700.3 (170.3)	674.1 (181.7)	.16	0.06
PMI (cm^2/m^2)	3.0 (0.7)	2.9 (0.7)	2.9 (0.8)	.59	0.02
RD (HU)	42.9 (11.0)	43.3 (10.2)	41.6 (13.2)	.15	0.07

CSA, cross-sectional area; FJS, forgotten joint score; PMI, psoas major muscle index; RD, radiation density mean (standard deviation).

the loss of function of the psoas major muscles. In addition, the survey items in this study were obtained from medical records recorded at the time of admission; therefore, information after discharge from the hospital was unknown. We cannot discuss any postoperative decline in health status or the impact of these changes on the FJS-12 scores. Future research needs to the prospective study design for clarify the relationship between FJS-12 and psoas major muscle. Since the FJS-12 was surveyed by mail, it is necessary to consider the bias of patients who did not return the questionnaires. Second, only the surgical approach was surveyed for surgical information. It has been suggested, but not accounted for in this study, that all considerations regarding the design and placement of implants can affect patient outcomes [46]. Finally, the study population exclusively comprised women. Sex differences in skeletal muscles are well recognized [47,48]. Therefore, caution should be exercised when generalizing the study results to male patients undergoing THA.

Conclusions

The quality of the psoas major muscle was associated with the FJS-12. In the rehabilitation of patients undergoing THA, focusing on the quality of the psoas major muscle may help achieve the ultimate goal.

Conflicts of interest

The authors declare there are no conflicts of interest.

For full disclosure statements refer to https://doi.org/10.1016/j.artd.2023.101118.

Table 6
Multivariable logistic regression analysis.

Model variable	Model 1		Model 2		Model 3	
	OR	95% CI	OR	95% CI	OR	95% CI
Lower PMI of operative side	1.40	0.85-2.29	1.36	0.82-2.27	1.29	0.76-2.20
Lower RD of operative side	5.10	3.20-8.11	4.98	3.05-8.15	4.92	2.97-8.16
Age			1.01	0.98-1.04	1.01	0.99-1.04
BMI			0.98	0.93-1.04	0.98	0.92-1.04
Education level						
University (reference)			1.00		1.00	
High school			0.89	0.55-1.46	0.87	0.53-1.43
Junior high school			1.08	0.44-2.62	1.15	0.47-2.86
Living alone			0.81	0.40-1.63	0.81	0.40-1.63
Postoperative follow-up duration						
>6 y (reference)			1.00		1.00	
4 to less than 6 y			1.40	0.59-3.37	1.48	0.58-3.76
2 to less than 4 y			1.47	0.61-3.49	1.48	0.58-3.75
<2 y			0.88	0.33-2.34	0.92	0.33-2.57
Hip ROM						
PC1					1.04	0.89-1.23
PC2					0.96	0.77-1.20
Severity of non-operative side						
MJSW >2 mm (reference)					1.00	
MJSW <2 mm					0.87	0.42-1.79
THA					0.90	0.54-1.49
Spinal disease					1.17	0.70-1.95
Knee joint disease					1.14	0.49-2.68
Psychosis					2.02	0.52-7.94
Diabetes					1.20	0.59-2.45
Surgical approach						
Anterolateral approach (reference)					1.00	
Posterolateral approach					0.98	0.54-1.77
Direct lateral approach					2.10	0.62-6.49
Postoperative LLD					1.00	0.97-1.03

OR, odds ratio; CI, confidence interval; PMI, psoas muscle index; RD, radiation density; BMI, body mass index; ROM, range of motion; PC, principal component; MJSW, minimum joint space width; THA, total hip arthroplasty; LLD, leg length discrepancy.
Model 1 was analyzed without adjusting for covariates. Model 2 included demographic factors and the postoperative follow-up duration as covariates. Model 3 included the physical and surgical factors as covariates.
Variance inflation factors Model 1: 1.01, Model 2: 1.05-1.25, Model 3: 1.06-1.36.
Model chi-square test Model 1: <0.001, Model 2: <0.001, Model 3: <0.001.

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