Factors Associated With Pain and Function Before Medial Patellofemoral Ligament Reconstruction

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Background: Medial patellofemoral ligament (MPFL) reconstruction is performed to treat recurrent patellar instability. Measurement of joint pain and function at the time of surgery has been demonstrated to be a predictor of the final outcomes in many surgical procedures.

Purpose/Hypothesis: The purpose of this study was to evaluate the relationship between baseline patient characteristics, mental health, and intraoperative findings and patient-reported knee pain and function at the time of MPFL reconstruction. We hypothesized that patient characteristics and associated pathology would be associated with the degree of pain and dysfunction.

Study Design: Cross-sectional study; Level of evidence, 3.

Methods: Included were skeletally mature patients who underwent unilateral open MPFL reconstruction between 2015 and 2020 at a single institution. Baseline descriptive information was collected, and the following outcome measures were administered preoperatively: the Veterans RAND 12-Item Health Survey Mental Component Score (VR-12 MCS) and the Knee injury and Osteoarthritis Outcome Score (KOOS) Pain, Physical Function Short Form (PS), and Quality of Life (QoL) subscales. Intraoperative findings were collected in a standardized format. Patient characteristics, preoperative variables, intraoperative findings, and VR-12 MCS were used as risk factors, and multivariate analysis was conducted to assess for relationships with the KOOS subscale scores.

Results: In total, 201 patients with patella dislocations were included in this analysis. Intraoperatively, 122 patients (60.7%) had either normal cartilage or grade 1 or 2 cartilage injury, 79 patients (39.3%) had grade 3 or 4 cartilage injury, 35 patients (17.4%) had a loose body, and 3 patients (1.49%) had evidence of synovitis. Younger age ($P = .012$), male sex ($P < .001$), never having smoked ($P = .029$), and lower baseline VR-MCS ($P < .001$) were significantly associated with higher baseline KOOS Pain scores. Older age ($P = .035$), female sex ($P = .003$), higher body mass index ($P = .005$), and lower baseline VR-12 MCS ($P < .001$) were significantly associated with higher baseline KOOS PS scores. Younger age ($P = .003$), male sex ($P < .001$), lower baseline VR-12 MCS ($P < .001$), and no dysplasia ($P = .023$) were significantly associated with higher baseline KOOS QoL scores.

Conclusion: Patient age, sex, and baseline VR-12 MCS were associated with all 3 baseline KOOS subscale scores, whereas intraoperative findings outside of trochlear dysplasia were not associated with any of the KOOS subscale scores.

Keywords: medial patellofemoral ligament; patellofemoral; subluxation; instability; dislocation; reconstruction

Surgical procedures to address lateral patellar instability aim to prevent recurrent patellar dislocation and improve patient function. Recently, medial patellofemoral ligament (MPFL) reconstruction has been popularized for the treatment of recurrent patellar instability. The baseline measurement of joint pain and function at the time of surgery has been demonstrated to be a predictor of the final outcome in many surgical procedures.[11,16,26,36] It is important to understand which patient-specific factors (including mental health) and intra-articular factors (assessed during

arthroscopic surgery) in patients undergoing MPFL reconstruction contribute to knee pain and function. Although similar studies have investigated these findings in shoulder,[37] knee,[6,8,11,16,18,25] and hip arthroscopy,[36] no study inclusive of patient-specific factors and intra-articular findings has been performed to assess baseline predictors of knee pain and function among patients undergoing MPFL reconstruction for lateral patellar instability.

Recurrent patellar dislocations can lead to pain and disability due to arthritic progression of the patellofemoral joint.[3,9,34] Previous studies have demonstrated that the risk of recurrent instability increased with younger age, history of a contralateral patellar dislocation, skeletal immaturity,

increased lateral patellar tilt, increased tibial tubercle–trochlear distance, trochlear dysplasia, and patella alta.[¶] Although many authors have demonstrated that these anatomic abnormalities and patient characteristics can be associated with increased risk of recurrence, currently, no study has investigated the relationship between patient characteristics, mental health, and intraoperative findings and patient-reported outcome measures (PROMs) at the time of MPFL reconstruction.

The purpose of this study was to comprehensively evaluate patient and operative factors that contribute to pain and dysfunction in patients undergoing MPFL reconstruction because of lateral patellar instability. We hypothesized that baseline patient-specific factors, including smoking and mental health, would more strongly correlate with validated PROMs of knee pain and function as compared with the presence or extent of the intra-articular pathology (eg, cartilage status, presence of damage to the cartilage, presence of a loose body, trochlear dysplasia).

METHODS

Setting and Study Population

The protocol for this study received institutional review board approval. All patients provided informed consent. All skeletally mature patients undergoing primary unilateral MPFL reconstruction are prospectively enrolled as part of the Outcomes Measurement and Evaluation (OME) cohort at our orthopaedic department. The OME database contains descriptive data, physical examination findings, and intraoperative findings on all patients who undergo surgery. This information is stored in a deidentified fashion in REDCap (Vanderbilt University, TN, USA). Details regarding the OME cohort have been published previously.[29]

We identified 206 patients in the OME database who underwent unilateral open MPFL reconstruction between March 1, 2015, and September 30, 2020. Patients were excluded from this study if the index surgery was a revision MPFL reconstruction or if they had any prior nonarthroscopic surgery on the knee. They were also excluded if they had missing baseline PROMs or were undergoing any significant concomitant procedures (eg, ligamentous repair or reconstruction, tibial tubercle osteotomy, trochlear procedure, microfracture of the cartilage, autologous
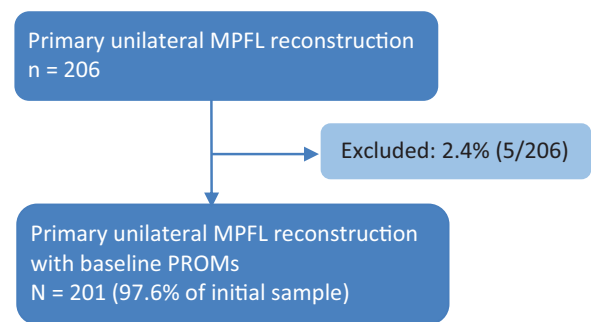
Figure 1. STROBE (STrengthening the Reporting of OBservational studies in Epidemiology) diagram of patient inclusion. MPFL, medial patellofemoral ligament; PROM, patient-reported outcome measure.

chondrocyte implantation, or osteochondral autograft or allograft transfer). Based on our inclusion and exclusion criteria, 201 of the 206 patients (97.6%) completed their full preoperative PROMs and were available for analysis (Figure 1).

Data Sources and Measurement

On the day of surgery, patients were asked preoperatively to complete a questionnaire encompassing descriptive information as well as the Veterans RAND 12-Item Health Survey Mental Component Score (VR-12 MCS) and the Knee injury and Osteoarthritis Outcome Score (KOOS) subscales for Pain, Physical Function Short Form (PS), and Quality of Life (QoL). VR-12 MCS values are derived using an algorithm that is referenced to a metric with 50.0 as the mean. Scores for each KOOS subscale range from 0 to 100, where 100 means better outcome. The validity, reliability, responsiveness to clinical change, and minimal clinically important differences of these instruments have been previously documented (VR-12 MCS,[7,33] KOOS[28,30,31]).

Each surgeon documented physical examination findings and intraoperative findings, including the presence or absence of a loose body, synovitis, grade (if any) of cartilage injury according to Outerbridge classification, and all concomitant surgical procedures.

Beginning in November 2020, a retrospective review of our OME database was conducted by 2 independent board-certified orthopaedic sports medicine surgeons (R.M.C., J.R.) to obtain the number of self-reported lateral patellar

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[¶]References 1, 2, 4, 5, 10, 18–24, 32, 38.

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dislocations and the presence or absence of a J-sign observed on physical examination of the operative knee. The sports medicine surgeons also calculated the Caton-Deschamps index (CDI) for each patient based upon the preoperative radiograph and classified whether trochlear dysplasia was present. In cases of trochlear dysplasia, the degree of trochlear dysplasia was documented using the Dejour classification.[13,14] In cases of disagreement on CDI and trochlear dysplasia classification for a patient, the same 2 surgeons reviewed radiographs and agreed on the final decision.

Variables were chosen based on common risk factors of outcomes seen in other studies involving sports medicine knee surgery.[10,12,26] Groupings were made of similar intraoperative and preoperative association values in order to decrease the number of independent variables and decrease the chance that meaningful associations would be subject to type 2 error. Some categorical variables had levels with small numbers; these levels were combined to create 2 distinct categories. For example, smoking was classified as "never" or "ever," number of dislocations was classified as first-time or recurrent ($\geq$2 self-reported lateral patellar dislocations), and trochlear dysplasia was classified as none or A/B/C/D according to Dejour type. Cartilage lesions were grouped into distinct categories based on the similarity of the lesions, including the presence or absence of grade 3 or 4 lesions. Patients with grade 1 or 2 lesions were not included in this study based on the outcomes of earlier studies conducted at our institute demonstrating that grade 1 and 2 lesions did not affect pain and function.[11,36]

Statistical Analysis

Continuous variables were summarized using medians and interquartile ranges, and categorical variables were reported using counts and percentages. With the baseline KOOS Pain, KOOS PS, and KOOS QoL scores used as outcome variables, multivariate analyses were conducted using patient descriptive data, preoperative variables, and intraoperative findings as variables. Multivariable linear regressions were built to model baseline KOOS Pain, KOOS PS, and KOOS QoL scores. Model results were shown using coefficient estimates and their respective 95% CIs. For continuous variables, coefficient estimates were rescaled to reflect interquartile range increase (ie, increase from first quartile [Q1] to third quartile [Q3]).

The performance ability of the model was calculated using bootstrapped bias-corrected R^2 (values range from 0 to 1, where higher values reflect better fit). Variables were ranked based on their relative contribution to the models as assessed via increase in Akaike information criterion (AIC) upon removal of the variable from the full model. An AIC increase of $\geq$2 justifies a statistically better model. Missing data were imputed using multiple imputation by chained equation (*mice* package in R). Data management and analysis were performed using R (Version 4.0). All tests were 2-sided, assuming an alpha level of .05.

RESULTS

Study Population

The baseline patient characteristics, physical examination findings, and intraoperative findings for the 201 study participants are shown in Table 1. The median patient age was 18 years (range, 13-62 years), and the median body mass index (BMI) was 24.8 (range, 15.9-47.3). The number of female patients was 128 (63.7%). Intraoperative findings demonstrated that 122 patients (60.7%) had either normal cartilage or grade 1 or 2 cartilage injury, 79 patients (39.3%) had grade 3 or 4 cartilage injury, 35 patients (17.4%) had a loose body, and 3 patients (1.49%) had evidence of synovitis. Because synovitis was evident in a small number of patients, it was not included as a variable in the multivariate analysis.

Risk Factors for Baseline Pain

Table 2 displays multivariable model results for baseline pain ($R^2 = 0.27$). When controlling for other covariates, the model indicated that younger age ($P = .012$), male sex ($P < .001$), never having smoked ($P = .029$), and lower baseline VR-12 MCS ($P < .001$) were significantly associated with higher (better) baseline KOOS Pain scores (refer to the column for omnibus tests of the variables in Table 2). The variable importance ranked by AIC increase is shown in Figure 2. The coefficient estimates can be interpreted as follows: For patients aged 24 years (Q3), the average baseline KOOS Pain was 4.01 points lower than that of patients aged 16 years (Q1) after we controlled for other risk factors in the model. In other words, the older the patient, the lower the baseline KOOS Pain score (the more pain they would have) after we accounted for other risk factors. On average, the baseline KOOS Pain score in male patients was 11.49 points higher than that of female patients after we controlled for other risk factors.

Risk Factors for Baseline Physical Function

Table 3 displays multivariable model results for baseline KOOS PS ($R^2 = 0.21$). When controlling for other covariates, the model indicates that older age ($P = .035$), female sex ($P = .003$), higher BMI ($P = .005$), and lower baseline VR-12 MCS ($P < .001$) were significantly associated with higher (better) baseline KOOS PS scores (refer to the column of omnibus tests of the variables in Table 3). The variable importance ranked by AIC increase is shown in Figure 3. For patients aged 24 years (Q3), the average baseline KOOS PS was 2.84 points higher than that of patients aged 16 years (Q1) after we controlled for other risk factors in the model. On average, the baseline KOOS PS in male patients was 6.94 points lower than that of female patients after we controlled for other risk factors.

Risk Factors for Baseline Quality of Life

Table 4 displays multivariable model results for baseline KOOS QoL ($R^2 = 0.22$). When controlling for other covariates, the model indicated that younger age ($P = .003$), male

TABLE 1
Summary Statistics of the Cohort (N = 201)[a]

Variable[b]	Value	Variable[b]	Value
Age, y	18.0 [16.0-24.0]	No. of dislocations (n = 188)	
Sex		First	21 (11.2)
Female	128 (63.7)	Multiple	167 (88.8)
Male	73 (36.3)	J-sign (n = 124)	
BMI (n = 117)	24.8 [21.4-29.1]	No	96 (77.4)
Years of education	12.0 [10.0-13.0]	Yes	28 (22.6)
Smoking		CDI (n = 196)	
Never	159 (79.1)	<1	19 (9.69)
Ever	42 (20.9)	1-1.19	72 (36.7)
Baseline VR-12 MCS	53.6 [43.9-59.3]	1.2-1.4	65 (33.2)
Prior arthroscopic surgery		>1.4	40 (20.4)
No	157 (78.1)	Trochlear dysplasia (n = 193)	
Yes	44 (21.9)	None	147 (76.2)
Cartilage injury[c]		A/B/C/D	46 (23.8)
No	122 (60.7)	Baseline KOOS Pain	66.7 [50.0-77.8]
Yes	79 (39.3)	Baseline KOOS PS	31.8 [22.0-44.0]
Synovitis		Baseline KOOS QoL	31.2 [18.8-43.8]
No	198 (98.5)		
Yes	3 (1.49)		
Loose body			
No	166 (82.6)		
Yes	35 (17.4)		

[a]Data are presented as median [interquartile range] or n (%). Dejour classification was used for trochlear dysplasia. BMI, body mass index; CDI, Caton-Deschamps index; KOOS, Knee injury and Osteoarthritis Outcome Score; PS, Physical Function Short Form; QoL, quality of life; VR-12 MCS, Veterans RAND 12-Item Health Survey Mental Component Score.
[b]N = 201 patients unless otherwise indicated.
[c]Outerbridge grades 3 or 4.

TABLE 2
Multivariable Model Results for Baseline Score on the KOOS Pain Subscale ($R^2 = 0.27$)[a]

Risk Factor	Odds Ratio (95% CI)	P	P (Omnibus Test of the Variable)
Age, IQR increase	–4.01 (–7.13 to –0.9)	**.012**	**.012**
Sex, male (vs female)	11.49 (6.11 to 16.87)	**<.001**	**<.001**
BMI, IQR increase	–3.07 (–6.79 to 0.64)	.104	.106
Education, IQR increase	–0.24 (–3.02 to 2.54)	.866	.866
Smoking, ever (vs never)	–7.21 (–13.65 to –0.77)	**.028**	**.029**
Baseline VR-12 MCS, IQR increase	9.4 (5.81 to 13)	**<.001**	**<.001**
Prior surgery, yes (vs no)	–2.7 (–9.05 to 3.64)	.404	.404
Cartilage injury, yes (vs no)	–1.06 (–6.44 to 4.32)	.700	.701
Loose body, yes (vs no)	–6.93 (–14.15 to 0.28)	.060	.061
No. of dislocations, multiple (vs first)	–6.18 (–14.94 to 2.58)	.166	.168
J-sign, yes (vs no)	–4.25 (–10.82 to 2.33)	.206	.207
CDI			.453
1.1-1.19 (vs <1)	0.99 (–7.83 to 9.81)	.826	
1.2-1.4 (vs <1)	0.37 (–8.6 to 9.33)	.936	
>1.4 (vs <1)	5.49 (–4.01 to 14.98)	.258	
Trochlear dysplasia, A/B/C/D (vs none)	1.25 (–5.1 to 7.61)	.700	.700

[a]Boldface P values indicate statistical significance (P < .05). Dejour classification was used for trochlear dysplasia. BMI, body mass index; CDI, Caton-Deschamps index; IQR, interquartile range; KOOS, Knee injury and Osteoarthritis Outcome Score; VR-12 MCS, Veterans RAND 12-Item Health Survey Mental Component Score.

sex (P < .001), lower baseline VR-12 MCS (P < .001), and no dysplasia (P = .023) were significantly associated with higher (better) baseline KOOS QoL scores (refer to the column of the omnibus tests of the variable in Table 4). The variable importance ranked by AIC increase is shown in Figure 4. The coefficient estimates can be interpreted as follows: For patients aged 24 years (Q3), the average baseline KOOS QoL was 5.06 points lower than that of patients

aged 16 years (Q1) after we controlled for other risk factors in the model. In addition, the baseline KOOS QoL in patients with any grade of trochlear dysplasia was 7.82 points lower than that of patients with no dysplasia after we controlled for other risk factors.
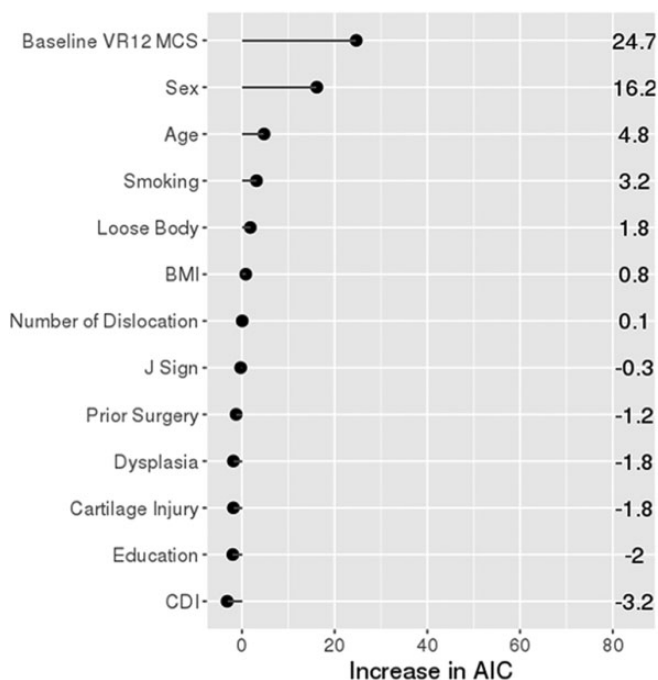
Figure 2. Variable importance ranked by AIC increase for baseline KOOS Pain score. AIC, Akaike information criterion; BMI, body mass index; CDI, Caton-Deschamps index; KOOS, Knee injury and Osteoarthritis Outcome Score; VR-12 MCS, Veterans RAND 12-Item Health Survey Mental Component Score.

DISCUSSION

Study results showed that at the time of MPFL reconstruction, younger age ($P = .012$), male sex ($P < .001$), never having smoked ($P = .029$), and lower baseline VR-12 MCS ($P < .001$) were associated with better baseline KOOS Pain scores; older age ($P = .035$), female sex ($P = .003$), greater BMI ($P = .005$), and lower baseline VR-12 MCS ($P < .001$) were associated with better baseline KOOS PS scores; and younger age ($P = .003$), male sex ($P < .001$), lower baseline VR-12 MCS ($P < .001$), and no dysplasia ($P = .023$) were associated with better baseline KOOS QoL scores. Patient age, sex, and baseline VR-12 MCS were associated with all 3 baseline KOOS subscale scores, whereas intraoperative findings including the grade of cartilage injury, presence of a loose body, number of preoperative dislocations, and presence of a J-sign were not found to be associated with any of the KOOS subscale scores. These findings indicate that a patient's level of pain and function at the time of initial presentation may not be reflective of the articular injury, and, therefore, the surgical decision regarding MPFL reconstruction should not be based solely on patient-reported pain and function. To our knowledge, this is the first study to investigate the relationship between patient characteristics, mental health, and intraoperative findings and PROMs at the time of MPFL reconstruction.

The associations between baseline patient-specific risk factors and clinical outcomes have been reported for several different orthopaedic procedures, including MPFL reconstruction.[10,12,24] Additionally, associations between baseline patient-specific risk factors and pain and function at the time of surgery have been identified in patients undergoing arthroscopic meniscectomy[11,35] and those undergoing hip arthroscopy for femoroacetabular impingement.[36]

The Cleveland Clinic Sports Knee Group[18] reported that sex, BMI, level of education, and smoking status were

TABLE 3
Multivariable Model Results for Baseline Score on the KOOS Physical Function Short Form ($R^2 = 0.21$)[a]

Risk Factor	Odds Ratio (95% CI)	*P*	*P* (Omnibus Test of the Variable)
Age, IQR increase	2.84 (0.22 to 5.47)	**.034**	**.035**
Sex, male (vs female)	−6.94 (−11.47 to −2.42)	**.002**	**.003**
BMI, IQR increase	4.54 (1.42 to 7.67)	**.004**	**.005**
Education, IQR increase	0.02 (−2.33 to 2.36)	.990	.990
Smoking, ever (vs never)	4.16 (−1.26 to 9.57)	.132	.134
Baseline VR-12 MCS, IQR increase	−7.36 (−10.38 to −4.33)	**<.001**	**<.001**
Prior surgery, yes (vs no)	2.87 (−2.47 to 8.2)	.292	.294
Cartilage injury, yes (vs no)	−0.45 (−4.98 to 4.07)	.844	.844
Loose body, yes (vs no)	4.94 (−1.13 to 11.01)	.110	.112
No. of dislocations, multiple (vs first)	3.6 (−3.77 to 10.97)	.338	.340
J-sign, yes (vs no)	2.88 (−2.65 to 8.41)	.308	.309
CDI			.907
1.1-1.19 (vs <1)	−0.59 (−8.02 to 6.83)	.876	
1.2-1.4 (vs <1)	−1.38 (−8.93 to 6.16)	.718	
>1.4 (vs <1)	−2.5 (−10.49 to 5.49)	.540	
Trochlear dysplasia, A/B/C/D (vs none)	−0.23 (−5.58 to 5.12)	.932	.933

*[a]Boldface *P* values indicate statistical significance ($P < .05$). Dejour classification was used for trochlear dysplasia. BMI, body mass index; CDI, Caton-Deschamps index; IQR, interquartile range; KOOS, Knee injury and Osteoarthritis Outcome Score; VR-12 MCS, Veterans RAND 12-Item Health Survey Mental Component Score.

predictors of baseline VR-12, KOOS Pain, KOOS PS, and KOOS QoL in patients undergoing arthroscopic meniscectomy. Similarly, Tornbjerg et al[35] reported that age, sex, and BMI were predictors of baseline KOOS Pain, KOOS Sport/Recreation, and KOOS Activities of Daily Living subscales
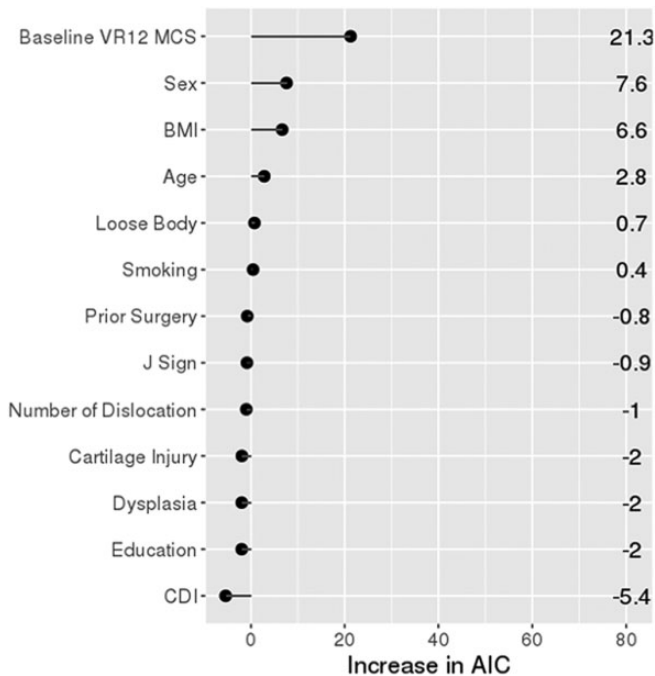
Figure 3. Variable importance ranked by AIC increase for baseline score on the Knee injury and Osteoarthritis Outcome Score Physical Function Short Form. AIC, Akaike information criterion; BMI, body mass index; CDI, Caton-Deschamps index; VR-12 MCS, Veterans RAND 12-Item Health Survey Mental Component Score.

in a similar population. Westermann et al[36] reported that VR-12 MCS, sex, level of education, activity level, and smoking were predictors for Hip disability and Osteoarthritis Outcome Score (HOOS) Pain subscale, HOOS PS, and VR-12 Physical Component Score. In the present study, we identified age, sex, and baseline VR-12 MCS as risk factors for KOOS Pain, KOOS PS, and KOOS QoL. Our findings are comparable with findings of these previously listed studies.

The importance of mental health on clinical outcomes is better understood as more data are available. Previous orthopaedic literature has reported that mental health is closely associated with patient symptoms as well as patient outcomes in knee arthroplasty, knee arthroscopy, and spine surgery.[11,17,18] In our study, VR-12 MCS was associated with all 3 PROMs. This suggests an association among mental health, pain, function, and quality of life in patients undergoing MPFL reconstruction.

Interestingly, both physical examination and intraoperative findings consistently failed to predict pain and function at the time of surgery. These baseline patient-specific risk factors may guide surgeons in choosing the proper candidate for a given surgical procedure. A patient with a first-time dislocation who reports increased pain and decreased function in the absence of any articular cartilage injury seen on preoperative imaging may be counseled that MPFL reconstruction, although effective at decreasing the risk of recurrent lateral patellar instability, may not significantly alter pain and functional level. Further research is needed to investigate this thought process.

Injury to the articular cartilage after lateral patellar dislocation is a common finding at the time of knee arthroscopy.[27] The presence of cartilage injury is a structural abnormality that may predispose patients to mechanical symptoms. Previous literature has demonstrated that patients tend to have higher grade cartilage injury as age increases.[25] Interestingly, in our study, older patients reported decreased pain

TABLE 4
Multivariable Model Results for Baseline Score on the KOOS Quality of Life Subscale ($R^2 = 0.22$)[a]

Risk Factor	Odds Ratio (95% CI)	P	P (Omnibus Test of the Variable)
Age, IQR increase	−5.06 (−8.34 to −1.77)	**.002**	**.003**
Sex, male (vs female)	10.38 (4.71 to 16.05)	**<.001**	**<.001**
BMI, IQR increase	−2.05 (−5.96 to 1.86)	.306	.306
Years of education, IQR increase	−1.65 (−4.59 to 1.28)	.268	.270
Smoking, ever (vs never)	−6.81 (−13.6 to −0.03)	.048	.050
Baseline VR-12 MCS, IQR increase	7.57 (3.78 to 11.36)	**<.001**	**<.001**
Prior surgery, yes (vs no)	−0.81 (−7.49 to 5.87)	.812	.812
Cartilage injury, yes (vs no)	−1.04 (−6.71 to 4.63)	.718	.719
Loose body, yes (vs no)	−5.93 (−13.53 to 1.67)	.126	.128
No. of dislocations, multiple (vs first)	4.09 (−5.14 to 13.32)	.386	.386
J-sign, yes (vs no)	0.67 (−6.26 to 7.59)	.850	.851
CDI			.521
1.1-1.19 (vs <1)	5.37 (−3.93 to 14.66)	.258	
1.2-1.4 (vs <1)	3.43 (−6.01 to 12.87)	.476	
>1.4 (vs <1)	0.7 (−9.3 to 10.7)	.890	
Trochlear dysplasia, A/B/C/D (vs none)	−7.82 (−14.52 to −1.13)	**.022**	**.023**

*[a]Boldface P values indicate statistical significance ($P < .05$). BMI, body mass index; CDI, Caton-Deschamps index; IQR, interquartile range; KOOS, Knee injury and Osteoarthritis Outcome Score; VR-12 MCS, Veterans RAND 12-Item Health Survey Mental Component Score.
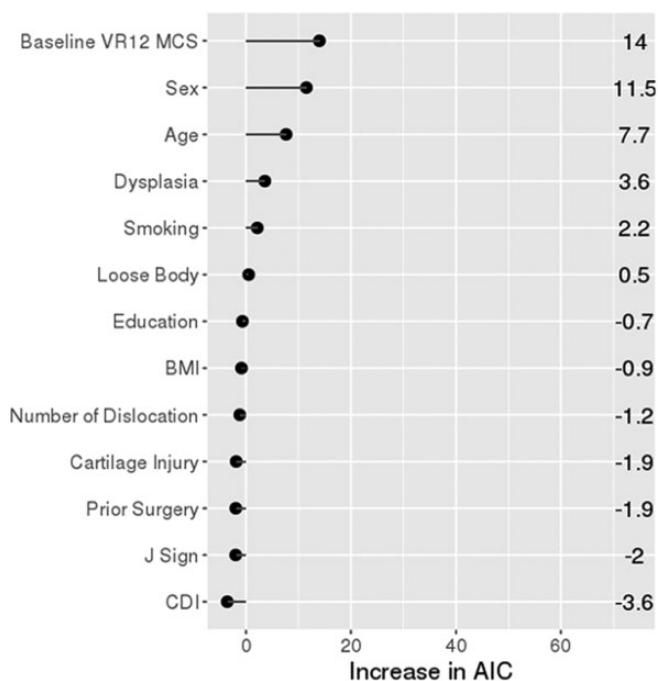
Figure 4. Variable importance ranked by AIC increase for baseline Knee injury and Osteoarthritis Outcome Score Quality of Life subscale. AIC, Akaike information criterion; BMI, body mass index; CDI, Caton-Deschamps index; VR-12 MCS, Veterans RAND 12-Item Health Survey Mental Component Score.

scores and increased functional scores. This may imply a compensation for pain and function as one ages.

The only variable in this study that affected preoperative PROMs was the presence of trochlear dysplasia, which was shown to decrease KOOS QoL. Trochlear dysplasia has been previously identified as a risk factor for recurrent lateral patellar instability.[13,15] This is the first study to identify that trochlear dysplasia may decrease the quality of life of patients undergoing MPFL reconstruction. The reason for this finding is not fully understood. Further investigation regarding the influence of trochlear dysplasia on quality of life is necessary to elucidate this finding.

Strengths and Limitations

This study has several strengths. It included a prospective cohort with 97% enrollment. We used validated PROMs to identify baseline patient-specific risk factors. We used multivariate analysis to control for important patient factors, intraoperative factors, and preoperative factors that have been previously demonstrated as risk factors for lateral patellar instability. We believe the study protocol and model could serve as a template for future MPFL studies.

This study has some limitations. We were limited to analyzing only the PROMs that were collected at the time of surgery and thus available in the OME database. Collecting PROMs on the day of surgery may raise concerns regarding the stress that patients had before the surgery.

Although one cannot deny the stress that patients experience before the surgery, this method has been used and validated for a long time and our prior reports confirm this.[6,8,11,16,18,25,36,37] This analysis was performed only on patients who had consented to undergo open MPFL reconstruction. No asymptomatic control group was included, and these results may not be applicable to patients with lateral patellar instability who did not undergo surgical reconstruction. Further, although this study measured baseline PROMs, we did not assess the influence of these factors on surgical outcomes. Further research including postoperative outcome data on this cohort would be helpful to identify whether the same risk factors of pain, function, and quality of life demonstrate the same effect on surgical outcomes. Follow-up is currently being collected on this cohort of patients. Additionally, this study was performed at a single tertiary referral hospital, and the outcomes of the study may not be extrapolated to the general population.

CONCLUSION

Patient-specific factors including age, sex, and baseline VR-12 MCS were associated with PROMs at the time of MPFL reconstruction. Intraoperative findings including the grade of cartilage injury and the presence of a loose body were not associated with any PROMs. Previously identified risk factors for lateral patellar instability, including recurrent instability, CDI, and trochlear dysplasia, were not associated with PROMs of pain and function, whereas trochlear dysplasia may decrease the quality of life of patients undergoing MPFL reconstruction. Surgeons should understand that patients' preoperative PROMs may be more closely related to patient characteristics and mental health than any anatomic abnormality, and thus surgical decision making should be based on the presence of lateral patellar instability, and not pain and decreased function, at the time of presentation.

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