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Original Research

The effect of comorbid anxiety and major depression on functional outcomes in meniscectomy

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ABSTRACT

Introduction: Psychiatric disorders such as depression and anxiety are prevalent but often unrecognized in orthopedic settings. While psychiatric conditions are known to affect functional outcomes in a variety of orthopedic procedures, limited data exist on their impact after meniscectomy.
Objectives: To evaluate the influence of comorbid anxiety and depression on pain and functional outcomes following meniscectomy.
Methods: Between August 2016 and January 2018, 141 patients scheduled for arthroscopic meniscectomy were prospectively recruited. Preoperatively, they completed the Computerized Adaptive Testing-Mental Health (CAT-MH) questionnaire, screening for major depressive disorder (MDD), anxiety, and mania. Functional outcome measures (IKDC, KOOS, SF12, VR12, and VR6D) were collected preoperatively and 6 months postoperatively. Outcomes were compared between patients with and without MDD, and symptoms of anxiety and mania were correlated with outcome scores.
Results: Of the 141 patients, 120 completed the study. Thirteen patients (10.9%) screened positive for MDD, 10 (76.9%) of whom were female. Women reported lower levels of function on almost all measures. MDD-positive patients reported lower outcomes preoperatively and postoperatively. Higher anxiety levels were linked with lower baseline and postoperative scores. Both MDD-positive and -negative cohorts showed significant improvements in most outcome measures postoperatively. There was no difference in the extent of improvement between groups. Mania had no impact on outcomes.
Conclusions: Comorbid anxiety and depression were associated with worse preoperative and postoperative functional outcomes after meniscectomy, though both groups show similar improvement. These findings highlight the need for better mental health screening tools in orthopedics, as psychiatric conditions may disproportionately influence patient-reported outcomes.

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Introduction

Mental health and psychosocial factors play a critical role in clinical outcomes of orthopedic surgery.[1] However, these disorders are often underrecognized and undertreated by providers who do not specialize in mental health.[2] Psychiatric disorders are relatively common, affecting nearly 20% of Americans in 2017.[3] Orthopedic literature has found that diagnoses such as depression, anxiety, and mania affect outcomes after arthroplasty,[4,5] hand surgery,[6] trauma surgery,[7] and other subspecialty fields. Within sports medicine, there is growing evidence to suggest that trait-specific psychiatric factors can impact athletes' ability to return to play after anterior cruciate ligament (ACL) reconstruction.[8] However, there is a general paucity of data on the impact of mental illness on short-term functional and pain outcomes after arthroscopic knee surgery. More specifically, are there certain patients for whom a relatively simple, pain-relieving arthroscopic procedure such as meniscectomy may yield suboptimal outcomes by virtue of intrinsic psychiatric illness?

In the knee, both the medial and lateral menisci function to distribute pressure between articular surfaces and function as a secondary restraint.[9] Meniscal tears may cause mechanical symptoms and pain.[10–12] However, this procedure can jeopardize the chondroprotective ability of the meniscus, which may ultimately lead to radiographic and symptomatic osteoarthritis.[12,13]

To assess baseline mental health before treatment, providers often utilize mental health screening questionnaires, however, these have been criticized for lengthiness of administration and poor adaptability to varying degrees of mental illness severity. The recent development of a validated, computerized, predictive rating scale for depression, anxiety, and mania (Computerized Adaptive Testing-Mental Health; CAT-MH) presents a novel approach to mental health screening across various medical specialties.[14–17] The CAT-MH questionnaire utilizes a bank of a thousand items, and based on user responses, adaptively selects an optimal subset of questions tailored to the individual's responses. In total, the CAT-MH takes approximately 10 items to identify a patient's psychiatric baseline. Each subset questionnaire (depression, anxiety, and mania) takes 2 minutes and can be administered anywhere, thereby alleviating survey burden for patients.

Diagnosing and ensuring that psychiatric disease is well-managed is important before orthopedic treatment commences, as this increases patient compliance, ultimately improving outcomes.[18] This has prompted many orthopedic surgeons and musculoskeletal clinicians to become increasingly aware of and attuned to the importance of mental health in patient recovery after injury and surgery.[19] If psychiatric pathology can be effectively screened for and identified preoperatively, physicians may have improved ability to counsel patients and possibly modify expected outcomes with appropriate treatments.

The aim of this study was to determine the extent to which psychiatric comorbidities affect relevant preoperative and postoperative patient-reported outcomes (PROs). We hypothesized that patients with symptoms of major depression, anxiety, and mania would differ substantially on common functional outcome scores when compared with patients without these symptoms.

Materials and methods

From August of 2016 through January of 2018, 180 patients undergoing arthroscopic meniscectomy performed by a senior fellowship-trained surgeon were contacted via telephone 1 week prior to their surgery and asked to participate in the study. Participants were asked to complete an online consent form. Appropriate IRB approval was obtained for this study (ORA #: 16050407-IRB01). Of the 180 patients that were contacted, 141 agreed to participate. Preoperatively, each of these patients filled out the CAT-MH questionnaire at their own convenience to screen for significant and current depression, anxiety, and/or mania.

Inclusion criteria consisted of (1) diagnosis of symptomatic meniscal injury; (2) isolated arthroscopic meniscectomy; and (3) appropriately completed preoperative and postoperative PROs. Patients who underwent significant concomitant procedures, such as ligamentous reconstruction or cartilage restoration, were not approached for enrollment. Patients with minor concomitant procedures such as debridement, synovectomy, or loose body removal were not excluded.

Participants were then screened for suicidality with a Columbia-Suicide Severity Rating Scale (C-SSRS) short form questionnaire added to the CAT-MH questionnaire. Upon discovering frank suicidal ideation in a study subject, a psychiatrist received email notification directly from the assessment tool as well as by the study staff via a 24-hour answering service. Patients were then risk-stratified and managed for safety via phone discussion with the psychiatrist.

Following CAT-MH testing, patients were also asked to fill out PRO surveys assigned to all patients undergoing sports medicine surgery to the knee, both preoperatively and 6 months postoperatively. These included International Knee Documentation Committee (IKDC), Knee Osteoarthritis Outcomes Score (KOOS), 12-Item Short Form Health Survey (SF12), Veterans RAND 12-Item Survey (VR12), and Veterans RAND 6 Dimensions (VR6D). Higher scores on these items indicate better function and lower levels of pain. Patients were also assessed for the presence or absence of major depressive disorder (CAD-MDD), dimensional severity of anxiety (CAT-ANX), and mania/hypomania (CAT-MANIA). Patients with MDD as assessed by the CAD-MDD were also administered the CAT-DI (dimensional measure of depressive severity). Higher scores on these items indicate a higher degree of the psychiatric outcome in question.

Aside from standard knee outcomes metrics, patients were asked about overall satisfaction (on a scale from 1-10) with their surgical procedure and about their ability to return to work or sport, if applicable. Demographic variables of each patient, including age, gender, race, ethnicity, and body mass index, were also collected.

Statistical analysis

Statistical analysis was performed in R Version 4.4.1 using RStudio 2024.04.2 Build 764 (RStudio) and Microsoft Excel (Version 2308, Microsoft Corporation) G*Power (Version 3.1.9.7, University of Düsseldorf) was used to assess study power.

Comparisons between functional measures (baseline pre-op scores, 6-month post-op scores, and 6-month versus baseline change scores) and baseline MDD (positive versus negative) were conducted using 2-tailed 2-sample *t* tests, as were any other comparisons between 2 different demographic groups. Comparisons between preoperative and postoperative scores were done with paired *t* tests. Due to pre-existing data on gender-specific differences in PROs and MDD, we used 1-tailed 2-sample *t* tests for gender comparisons.[20–22] We did not formally test samples for normality before conducting statistical analyses. As noted in established statistical literature, both *t* tests and linear regression are generally robust to mild departures from normality, and the probability of both type I and type II errors is relatively low.[23–25]

Proportions between different groups were compared using Pearson's χ^2 test. The assumption of homogeneity of variance was tested using an F statistic, and if significant, Satterthwaite's approximation was used. The association between baseline anxiety and mania severity scores and functional outcomes (baseline pre-op scores, 6-month post-op scores, and 6-month versus baseline change scores) was conducted using Pearson product-moment correlation coefficients. Time to return to work and sports were analyzed using Kaplan-Meier survival analyses and log-rank tests. Given the pilot nature of the study, results were not adjusted for multiplicity. To assess the adequacy of our sample size, we conducted a post hoc power analysis for postoperative IKDC between MDD-positive and MDD-negative cohorts using an $\alpha = 0.05$.

Results

Of the 141 patients who agreed to participate in the study, 120 patients completed both preoperative screening and surveys as well as 6-month postoperative surveys and were thus included in the analysis of this study. These patients were separated into 2 groups based on their preoperative MDD status on the CAD-MDD. In total, 107 patients (89.1%) were found to be MDD negative and 13 (10.9%) were found to be MDD positive. We then compared these 2 groups based on demographic variables such as age, body mass index, race, ethnicity, laterality of meniscectomy, and type of meniscectomy as presented in Table 1. We had no instances of suicidal ideation that warranted attention from the attending psychiatrist. In total, 9 patients had preexisting psychiatric diagnoses, 5 of whom were in the MDD-positive group. In total, 8 patients were taking psychiatric medications within 6 months before study enrollment, 4 of whom were in the MDD-positive group. No patients were noted to have intraoperative or postoperative complications that lead to exclusion. Women were significantly more likely to be diagnosed with MDD, with 10 (76.9%) of the MDD-positive patients being female and 3 (23.1%) being male ($P = .006$).

Preoperatively, patients who were diagnosed with MDD reported significantly lower scores on IKDC, KOOS Daily Living, KOOS Pain, KOOS Quality of Life, KOOS Sports, SF12 Mental, VR12 Mental, VR12 Physical, and VR6D. The KOOS Symptoms subscore and the SF12 Physical Score were lower in MDD-positive individuals, but these differences were not statistically significant (Table 2).

The same analysis was conducted 6 months postoperatively. For all 11 outcomes, MDD-positive patients reported significantly lower scores (Table 3). We found no significant difference in postoperative satisfaction scores between cohorts (MDD positive 8.58 ± 2.23, MDD negative 8.35 ± 2.37, $P = .888$).

Both the MDD-positive and MDD-negative cohorts reported an increase in scores on all reported outcomes when comparing preoperative scores and scores at 6-month postoperative follow-up (Table 4). For the MDD-negative cohort, this increase was statistically significant for all outcomes, except for the VR12 mental questionnaire. For the MDD-positive cohort, this increase was

Table 1
Demographics and intraoperative variables.

Characteristic	Total ($N = 120$)	MDD negative ($N = 107$)	MDD positive ($N = 13$)	*P* value
Age (y)	50.3 ± 11.6	51.1 ± 10.5	44.3 ± 17.5	.097
BMI	30.8 ± 6.9	31.0 ± 7.0	31.1 ± 9.7	.487
Gender				
Male	70 (58.3%)	67 (62.6%)	3 (23.1%)	**.006**
Female	50 (41.7%)	40 (37.4%)	10 (76.9%)	
Race				
White	101 (84.2%)	90 (84.1%)	11 (84.6%)	.963
Black or African American	7 (5.8%)	7 (6.5%)	0	
Asian	1 (0.8%)	1 (0.9%)	0	
Other race/patient declined	11 (9.17%)	9 (8.4%)	2 (15.4%)	
Ethnicity				
Hispanic or Latino	9 (7.5%)	8 (7.5%)	1 (7.7%)	.954
Not Hispanic or Latino	102 (85.0%)	90 (84.1%)	12 (92.3%)	
Declined/no data	9 (7.5%)	9 (8.4%)	0	
Laterality of meniscectomy				
Right	66 (53.7%)	7 (53.8%)	58 (54.2%)	
Left	57 (46.3%)	6 (46.2%)	49 (45.8%)	
Type of meniscectomy				
Medial	84 (70%)	77 (72%)	7 (53.8%)	.107
Lateral	21 (17.5%)	16 (15%)	5 (38.5%)	
Medial and lateral	15 (12.5%)	14 (13.1%)	1 (7.7%)	

Abbreviations: BMI, body mass index; MDD, major depressive disorder.
Bold indicates statistical significance ($P < .05$).

Table 2
Preoperative patient-reported outcomes between MDD-positive and -negative cohorts.

	MDD				
	Negative		Positive		*P* value
Variable	Mean	95% CI	Mean	95% CI	
IKDC	44.2	41.8, 47.00	27.2	21.0, 33.5	**.001**
KOOS—daily living	64.1	60.8, 67.44	48.9	38.9, 58.9	**.006**
Pain	55.5	52.6, 58.3	43.2	34.3, 52.0	**.007**
Quality of life	30.6	27.1, 34.06	8.9	1.4, 16.3	**.001**
Sports	35.2	31.2, 39.2	12.1	3.5, 20.7	**.001**
Symptoms	55.2	52.0, 58.6	45.6	37.1, 54.2	.060
SF12 mental	55.6	54.2, 57.1	37.5	32.7, 42.4	**.001**
SF12 physical	37.7	36.1, 39.3	33.8	28.5, 39.1	.133
VR12 mental	58.1	56.7, 59.5	40.2	35.6, 44.8	**.001**
VR12 physical	40.0	38.3, 41.7	33.4	27.9, 38.9	**.014**
VR6D	0.69	0.67, 0.70	0.5	0.47, 0.57	**.001**
	$n = 107$		$n = 13$		

Abbreviations: IKDC, International Knee Documentation Committee; KOOS, Knee Osteoarthritis Outcomes Score; MDD, major depressive disorder; SF12, 12-Item Short Form Health; VR6D, Veterans RAND 6 Dimensions; VR12, Veterans RAND 12-Item Survey.
Bold indicates statistical significance ($P < .05$).

Table 3
Postoperative patient-reported outcomes between MDD-positive and -negative cohorts.

	MDD				
	Negative		Positive		*P* value
Variable	Mean	95% CI	Mean	95% CI	
IKDC	71.1	67.0, 75.2	50.56	35.6, 65.6	**.002**
KOOS—daily living	85.5	82.1, 88.9	69.68	56.1, 83.3	**.004**
Pain	81.3	77.9, 84.7	63.89	49.1, 78.7	**.002**
Quality of life	65.6	60.9, 70.3	35.58	18.1, 53.0	**.001**
Sports	64.0	58.5, 69.4	37.31	18.8, 55.8	**.002**
Symptoms	78.1	74.8, 81.5	64.56	51.7, 77.4	**.01**
SF12 mental	56.2	55.0, 57.5	42.6	36.5, 48.7	**.001**
SF12 physical	47.0	45.0, 49.0	39.43	33.2, 45.7	**.014**
VR12 mental	60.1	58.9, 61.3	45.32	38.5, 52.1	**.001**
VR12 physical	49.1	47.2, 50.9	40.33	33.5, 47.1	**.003**
VR6D	71.1	67.0, 75.2	50.56	35.6, 65.6	**.001**
	$n = 107$		$n = 13$		

Abbreviations: IKDC, International Knee Documentation Committee; KOOS, Knee Osteoarthritis Outcomes Score; MDD, major depressive disorder; SF12, 12-Item Short Form Health; VR6D, Veterans RAND 6 Dimensions; VR12, Veterans RAND 12-Item Survey.
Bold indicates statistical significance ($P < .05$).

statistically significant for IKDC, KOOS and all subscores, and VR6D. The increases in SF12 Mental, SF12 Physical, VR12 Mental, and VR12 Physical were not significant.

Both groups reported an increase in scores on all outcomes, and the majority of these were statistically significant increases. This prompted a further examination of whether the magnitude of this increase differs between cohorts. We therefore also evaluated the difference in score improvements between pre- and postoperative outcomes between the MDD-positive and MDD-negative cohorts. For all outcomes, there were no statistically significant differences in the absolute score increases, although the increases in MDD-negative individuals were lower across the board when looking solely at physical outcome scores (IKDC, KOOS, SF12 Physical, and VR12 Physical), and SF12 Mental approached significance (Table 5).

Analyzing the dimensional severity of anxiety (CAT-ANX) and mania/hypomania (CAT-MANIA), higher anxiety levels were associated with lower scores on preoperative questionnaires, and the same pattern held true for scores at 6 months (Table 6). All correlations were statistically significant apart from preoperative SF12 Physical and the preoperative KOOS symptom scores. We found no correlation between levels of mania and hypomania and any of the PROs preoperatively or postoperatively (Table 6).

We repeated the same analysis performed in Table 5 with anxiety scores. We found no correlation between CAT-Anxiety severity scores and absolute score increases on any outcome measures (Table 7).

We constructed Kaplan-Meier curves comparing return to work (Fig.) and return to sport (Fig.) following meniscectomy between MDD-positive and MDD-negative patients post meniscectomy. The log-rank test revealed no significant differences in survivorship between the 2 groups in either outcome (return to work, $P = .41$; return to sport, $P = .21$).

Table 4
Comparison between preoperative and postoperative patient-reported outcomes in MDD-positive and MDD-negative cohorts.

	MDD negative					MDD positive				
	Preop		Postop		Change	Preop		Postop		Change
Variable	Mean	95% CI	Mean	95% CI	*P* value	Mean	95% CI	Mean	95% CI	*P* value
IKDC	44.6	41.8, 47.4	71.3	67.2, 75.4	**.001**	27.2	21.0, 33.5	50.6	35.6, 65.6	**.003**
KOOS—daily living	64.1	60.7, 67.4	85.6	67.2, 75.4	**.001**	48.9	38.9, 58.9	68.8	54.0, 83.5	**.008**
Pain	55.7	52.9, 58.6	81.5	67.2, 75.4	**.001**	43.2	34.3, 52.0	63.9	49.1, 78.7	**.003**
Quality of life	30.3	26.8, 33.9	66.0	67.2, 75.4	**.001**	8.9	1.4, 16.3	35.4	16.2, 54.6	**.006**
Sports	35.7	31.6, 39.8	64.5	67.2, 75.4	**.001**	12.1	3.5, 20.7	37.1	16.7, 57.4	**.015**
Symptoms	55.7	52.3, 59.0	78.0	67.2, 75.4	**.001**	45.6	37.1, 54.2	64.6	51.7, 77.4	**.003**
SF12 mental	55.9	54.3, 57.4	56.2	67.2, 75.4	.703	37.5	32.7, 42.4	42.6	36.5, 48.7	.136
SF12 physical	37.6	35.9, 39.3	47.2	67.2, 75.4	**.001**	33.8	28.5, 39.1	39.4	33.2, 45.7	.121
VR12 mental	58.2	56.6, 59.7	60.1	67.2, 75.4	**.012**	40.2	35.6, 44.8	45.3	38.5, 52.1	.161
VR12 physical	40.0	38.2, 41.8	49.2	67.2, 75.4	**.001**	33.4	27.9, 38.9	40.3	33.5, 47.1	.062
VR6D	0.69	0.67, 0.70	0.78	0.76, 0.80	**.001**	0.52	0.47, 0.57	0.61	0.53, 0.70	**.032**

Abbreviations: IKDC, International Knee Documentation Committee; KOOS, Knee Osteoarthritis Outcomes Score; MDD, major depressive disorder; SF12, 12-Item Short Form Health; VR6D, Veterans RAND 6 Dimensions; VR12, Veterans RAND 12-Item Survey.
Bold indicates statistical significance ($P < .05$).

Table 5
Mean score increases in MDD-negative and MDD-positive patients.

	MDD				
	Negative		Positive		*P* value
Variable	Mean	95% CI	Mean	95% CI	
IKDC	+23.3	9.7, 37.0	+26.7	22.9, 30.9	.569
KOOS—daily living	+19.9	6.4, 33.4	+21.6	17.7, 25.5	.785
Pain	+20.7	8.3, 33.2	+25.7	22.1, 29.4	.372
Quality of life	+26.6	9.4, 43.8	+35.7	30.7, 40.7	.249
Sports	+25.0	5.9, 44.1	+28.8	22.9, 34.7	.679
Symptoms	+19.0	7.6, 30.3	+22.4	18.7, 26.0	.536
SF12 mental	+5.1	−1.9, 12.0	+0.30	−1.2, 1.8	.053
SF12 physical	+5.6	−1.7, 13.0	+9.6	7.5, 11.7	.225
VR12 mental	+5.1	−2.4, 12.6	+2.0	0.44, 3.5	.198
VR12 physical	+6.9	−0.4, 14.3	+9.2	7.2, 11.2	.468
VR6D	+0.09	0.01, 0.18	+0.09	0.07, 0.11	.911
	$n = 107$		$n = 13$		

Abbreviations: IKDC, International Knee Documentation Committee; KOOS, Knee Osteoarthritis Outcomes Score; MDD, major depressive disorder; SF12, 12-Item Short Form Health; VR6D, Veterans RAND 6 Dimensions; VR12, Veterans RAND 12-Item Survey.

The effect of gender on PROs

Of the demographic variables analyzed, the depressed cohort only significantly varied compared with the control group in terms of gender composition. Of the MDD-negative cohort, 67 (62.6%) were male and 40 (37.4%) were female. Of the MDD-positive cohort, 3 (23.1%) were male and 10 (76.9%) were female ($P = .006$). Comparing all scores between males and females, we found that female patients reported significantly lower outcomes on almost all questionnaires. These differences were significant for 18 of 22 outcomes, with the exceptions of the preoperative KOOS sports, postoperative KOOS Daily Living and Symptoms, and postoperative SF12 mental questionnaires (Table 8).

In order to evaluate gender as a potential confounder, we conducted a stratified analysis.

We compared outcomes in MDD-positive males and MDD-negative males only (Table 9). We repeated the same analysis looking only at female patients (Table 9). All outcomes were lower in MDD-positive cohorts, both male and female, preoperatively and postoperatively. These differences were significant in 21 out of 22 outcomes for males, and 10 out of 22 outcomes for females.

A post hoc power analysis for the difference in postoperative IKDC between MDD-positive and MDD-negative cohort revealed a calculated effect size of 0.947, yielding a power of 0.892. This exceeds the accepted cutoff of 0.80 for adequate power.

Discussion

Our study revealed 3 key findings: firstly, patients with anxiety and depression reported worse outcomes in physical functionality, pain, and quality of life both pre- and post-meniscectomy. Secondly, we found that the absolute improvement in functional outcome

Table 6
Correlations between preoperative and postoperative PROs with baseline CAT-Anxiety (top) and CAT-Mania (bottom) scores.

Variable	r	*P*	Variable	r	*P*
Preoperative			Postoperative		
IKDC	−0.34	**.001**	IKDC	−0.30	**.001**
KOOS—daily living	−0.19	**.029**	KOOS—daily living	−0.28	**.003**
Pain	−0.21	**.019**	Pain	−0.29	**.002**
Quality of life	−0.40	**.001**	Quality of life	−0.37	**.001**
Sports	−0.34	**.000**	Sports	−0.28	**.002**
Symptoms	−0.17	.056	Symptoms	−0.27	**.004**
SF12 mental	−0.58	**.001**	SF12 mental	−0.59	**.001**
SF12 physical	−0.14	.116	SF12 physical	−0.24	**.008**
VR12 mental	−0.55	**.001**	VR12 mental	−0.57	**.001**
VR12 physical	−0.21	**.017**	VR12 physical	−0.26	**.005**
VR6D	−0.45	**.001**	VR6D	−0.45	**.001**
Variable	r	*P*	Variable	r	*P*
Preoperative			Postoperative		
IKDC	−0.10	.282	IKDC	−0.12	.203
KOOS—daily living	0.04	.659	KOOS—daily living	0.00	.992
Pain	−0.04	.678	Pain	−0.06	.531
Quality of life	−0.13	.151	Quality of life	−0.15	.120
Sports	−0.10	.268	Sports	−0.05	.568
Symptoms	−0.05	.587	Symptoms	−0.05	.595
SF12 mental	−0.21	.016	SF12 mental	−0.11	.230
SF12 physical	0.01	.947	SF12 physical	0.00	.974
VR12 mental	−0.22	.013	VR12 mental	−0.10	.301
VR12 physical	−0.04	.619	VR12 physical	−0.01	.898
VR6D	−0.14	.117	VR6D	−0.08	.415

Abbreviations: CAT, Computerized Adaptive Test; IKDC, International Knee Documentation Committee; KOOS, Knee Osteoarthritis Outcomes Score; PROs, patient-reported outcomes; SF12, 12-Item Short Form Health; VR6D, Veterans RAND 6 Dimensions; VR12, Veterans RAND 12-Item Survey. Bold indicates statistical significance ($P < .05$).

Table 7
Correlations between score increases with baseline CAT-Anxiety severity score.

Variable	r	*P*
IKDC	0.07	.477
KOOS—daily living	0.10	.281
Pain	0.13	.161
Quality of life	0.06	.556
Sports	0.01	.916
Symptoms	0.12	.213
SF12 mental	0.01	.258
SF12 physical	0.14	.142
VR12 mental	0.07	.436
VR12 physical	0.08	.384
VR6D	0.06	.541

Abbreviations: CAT, Computerized Adaptive Test; IKDC, International Knee Documentation Committee; KOOS, Knee Osteoarthritis Outcomes Score; SF12, 12-Item Short Form Health; VR6D, Veterans RAND 6 Dimensions; VR12, Veterans RAND 12-Item Survey.

scores was the same, regardless of comorbid psychiatric conditions. Thirdly, we found that gender may play a complex role in these outcomes. These findings have important implications for preoperative screening and patient counseling.

Patients frequently report pain or show relatively poor functional outcomes after orthopedic procedures, even when imaging and laboratory examinations do not show any issues and no major adverse events have occurred postoperatively. We suggest that depression and anxiety may explain part of this in a subset of patients.[26]

We also explored the relationship between mania and functional outcomes. While it may seem intuitive to hypothesize that patients with manic symptoms would have significantly different preoperative and postoperative outcomes just as patients with depressive and anxious symptoms, we found no correlation between the 2.

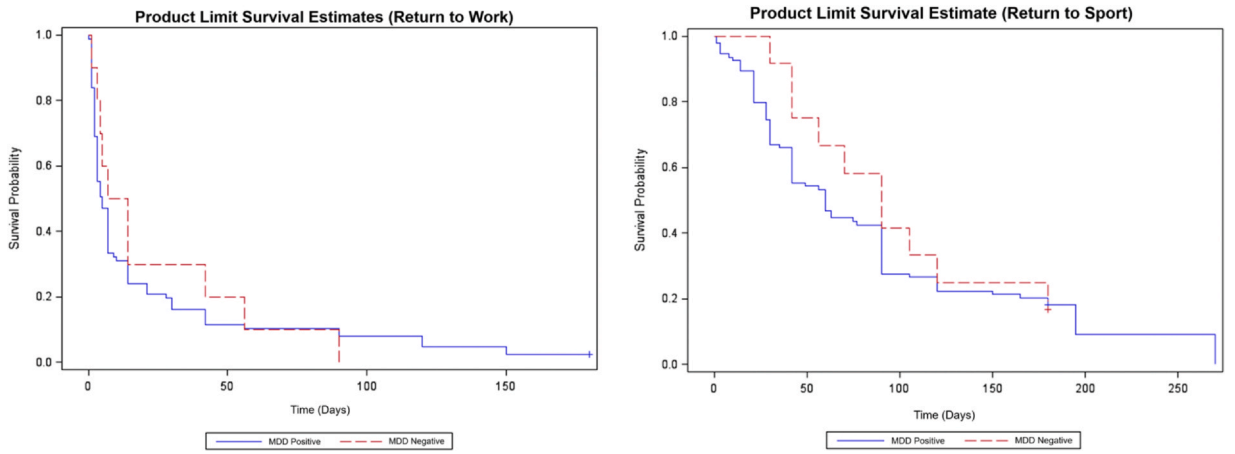

Fig. 1. Kaplan-Meier curves for MDD-positive and -negative for time (in days) to return to work (left) and return to sport (right). MDD, major depressive disorder.

Table 8
Gender differences in patient-reported outcomes.

	Preoperative					Postoperative				
	Male (N = 70)		Female (N = 50)			Male (N = 70)		Female (N = 50)		
Variable	Mean	95% CI	Mean	95% CI	P value	Mean	95% CI	Mean	95% CI	P value
IKDC	45.3	41.5, 49.1	39.0	35.1, 42.9	**.012**	72.5	67.3, 77.7	63.7	67.3, 77.7	**.017**
KOOS—daily living	66.9	62.7, 71.1	57.2	52.4, 62.0	**.002**	85.9	81.4, 90.3	86.5	81.4, 90.3	.456
Pain	57.6	54.1, 61.1	50.2	46.0, 54.4	**.004**	82.1	77.3, 86.8	75.7	77.3, 86.8	**.037**
Quality of life	31.2	26.3, 36.0	24.2	19.6, 28.8	**.024**	67.3	61.2, 73.3	55.3	61.2, 73.3	**.008**
Sports	35.0	29.9, 40.1	31.5	25.3, 37.7	.190	67.4	60.6, 74.2	52.1	60.6, 74.2	**.003**
Symptoms	57.1	53.0, 61.1	51.4	46.4, 56.4	**.038**	78.6	74.2, 83.1	73.8	74.2, 83.1	.079
SF12 mental	55.5	53.5, 57.6	51.6	48.5, 54.7	**.014**	55.7	53.8, 57.5	53.3	53.8, 57.5	.061
SF12 physical	39.1	37.0, 41.3	34.6	32.4, 36.7	**.002**	48.1	45.7, 50.5	43.8	45.7, 50.5	**.014**
VR12 mental	58.4	56.4, 60.3	53.3	50.1, 56.4	**.002**	59.7	57.8, 61.7	56.7	57.8, 61.7	**.026**
VR12 physical	41.4	39.2, 43.6	36.5	34.0, 38.9	**.002**	50.0	47.8, 52.3	45.7	47.8, 52.3	**.012**
VR6D	0.70	0.67, 0.72	0.63	0.60, 0.66	**.001**	0.78	0.75, 0.81	0.72	0.69, 0.76	**.004**

Abbreviations: IKDC, International Knee Documentation Committee; KOOS, Knee Osteoarthritis Outcomes Score; SF12, 12-Item Short Form Health; VR6D, Veterans RAND 6 Dimensions; VR12, Veterans RAND 12-Item Survey.
Bold indicates statistical significance (P < .05).

The impact of gender on functional outcomes

Women have a higher prevalence of MDD and anxiety as compared with men.[20] Previous studies examining gender differences in orthopedic outcomes have shown mixed results. Some studies indicate that women report higher pain intensity[21,26] and lower functional scores before surgery,[22,27] while others demonstrate that these differences diminish over time. For instance, in total knee arthroplasty, while women initially report worse outcomes preoperatively, they achieve similar or better outcomes compared with men by 3 to 12 months postsurgery.[28] In ACL reconstruction, females have been shown to have lower return-to-sport rates and worse biomechanical metrics following surgery compared with males.[27]

Our analysis found that women generally reported lower function and higher pain on all outcomes before and after surgery. The MDD-positive cohort in our study was disproportionately female, and this difference in composition was statistically significant.

Taking these facts into consideration, it is plausible that the lower reported outcomes among MDD-positive patients could be influenced by gender. We found that when controlling for gender, MDD-positive males had poorer outcomes than MDD-negative males. We found similar results when restricting the analysis to women, although fewer of the differences between outcomes reached statistical significance.

This provides evidence that gender is not a confounder. However, the smaller sample size in this subanalysis makes definitive conclusions challenging. MDD-positive individuals had worse outcomes, regardless of gender, but it is difficult to assess for certain whether the strength of this association varies with gender.

Table 9
Gender-stratified analysis of outcomes in MDD-positive and MDD-negative cohorts. Top—male patients only (n = 50). Bottom—female patients only (n = 70).

Variable	Mean	Mean	*P*	Variable	Mean	Mean	*P*
Preoperative	MDD-	MDD +		Postoperative	MDD-	MDD +	
IKDC	46.4	21.5	**.003**	IKDC	74.3	33.9	**.001**
KOOS—daily living	67.8	35.9	**.005**	KOOS—daily living	87.3	54.4	**.001**
Pain	58.4	39.8	**.015**	Pain	83.9	41.7	< **.001**
Quality of life	32.1	0.0	**.013**	Quality of life	69.8	12.5	< **.001**
Sports	35.9	5.0	**.021**	Sports	69.9	13.3	< **.001**
Symptoms	57.9	38.1	**.023**	Symptoms	80.1	47.6	**.001**
SF12 mental	56.3	39.1	< **.001**	SF12 mental	56.6	36.0	< **.001**
SF12 physical	39.5	32.2	.091	SF12 physical	48.7	34.8	**.009**
VR12 mental	59.0	43.9	**.001**	VR12 mental	60.8	36.7	< **.001**
VR12 physical	41.9	30.4	**.017**	VR12 physical	50.7	34.4	**.001**
VR6D	0.70	0.52	**.001**	VR6D	0.80	0.51	< **.001**
Variable	Mean	Mean	*P*	Variable	Mean	Mean	*P*
Preoperative	MDD -	MDD +		Postoperative	MDD -	MDD +	
IKDC	41.6	29.0	**.007**	IKDC	65.7	55.6	.107
KOOS—daily living	58.7	51.5	.116	KOOS—daily living	82.5	74.3	.107
Pain	51.8	44.2	.072	Pain	77.0	70.6	.158
Quality of life	27.7	10.6	**.001**	Quality of life	58.6	42.5	**.047**
Sports	36.1	13.5	**.001**	Sports	54.1	44.5	.182
Symptoms	52.3	47.9	.237	Symptoms	74.9	69.6	.197
SF12 mental	55.3	37.1	< **.001**	SF12 mental	55.5	44.6	< **.001**
SF12 physical	34.6	34.3	.450	SF12 physical	44.5	40.8	.172
VR12 mental	56.9	39.1	< **.001**	VR12 mental	58.9	47.9	< **.001**
VR12 physical	37.0	34.3	.186	VR12 physical	46.6	42.1	.122
VR6D	0.66	0.52	< **.001**	VR6D	0.74	0.65	**.007**

Abbreviations: IKDC, International Knee Documentation Committee; KOOS, Knee Osteoarthritis Outcomes Score; MDD, major depressive disorder; SF12, 12-Item Short Form Health; VR6D, Veterans RAND 6 Dimensions; VR12, Veterans RAND 12-Item Survey.
Bold indicates statistical significance (P < .05).

Psychiatric comorbidities and outcome scores

Orthopedic literature has found that psychiatric diagnoses affect outcomes after arthroplasty,[4,5] hand surgery,[6] and sports medicine.[8] In polytrauma patients, comorbid psychiatric diagnoses were found to be an independent risk factor for increased complications.[7] Looking specifically at functional outcome scores, a 2010 study by Riediger et al looked at 79 patients who underwent total hip arthroplasty and found that individuals with high somatization and depression scores preoperatively reported higher pain levels and worse outcomes both preoperatively and at 6 weeks.[29] Studies have shown that depression is associated with increased postoperative complications and longer hospital stays after total joint arthroplasty.[30] Research has demonstrated that patients with psychiatric disorders have higher rates of emergency department visits and are more likely to be discharged to skilled nursing facilities.[31] Additionally, studies have found that patients with depression report higher pain levels and worse outcomes both preoperatively and postoperatively.[32]

Within sports medicine, Okafor et al found that preoperative psychological distress prior to rotator cuff repair, including fear avoidance and anxiety, had a stronger association with shoulder pain and function than tear severity.[33] Longo et al demonstrated that reductions in mental health symptoms were linked to better postoperative recovery in rotator cuff repair.[34] A systematic review by Phyomaung et al found that depression plays a significant role in knee pain, and that management is critical for ensuring optimal outcomes.[35] Broadly, these studies conclude that treating preoperative depression should be a priority for surgeons to maximize the clinical benefit of intervention. However, these studies generally looked only at postoperative outcome scores; they did not adequately control for the fact that preoperative outcomes may have been lower in patients with psychiatric conditions.

Our analysis suggests management of psychiatric conditions may not have an impact on improvement in clinical and functional outcomes. Preoperative and postoperative outcomes differed in patients with psychiatric comorbidities, but the improvement in scores did not differ. This finding suggests that widely used questionnaires such as IKDC, KOOS, SF12, VR12, and VR6D are independently influenced by variables such as depression, anxiety, and gender. Patients with depression and anxiety may view themselves as less physically capable, regardless of actual physical ability.

Since these scores are used as key metrics in evaluating the success of a variety of orthopedic procedures such as meniscectomies, comorbid depression or anxiety in a patient may paint an inaccurate picture. As such, identifying psychiatric comorbidities present before surgery should be a priority for any orthopedist tracking long-term patient functional outcomes. Additionally, expanding or combining instruments such as the IKDC and KOOS with tools that also look at psychiatric comorbidities (and other psychosocial factors such as gender) may be warranted to provide a more precise assessment of postoperative functional outcomes.

Limitations

To our knowledge, this is the only study looking at psychiatric comorbidities in meniscectomy. We are also the only study to look at the relationship between manic symptoms and functional outcomes. However, this study was limited to only functional outcomes, we did not analyze intra- and postoperative complications. We did not have any specific exclusion criteria relating to radiographic findings or meniscal extrusion. Additionally, while we analyzed the severity of anxious and manic symptoms, we only looked at MDD as a binary outcome, either present or absent. Our MDD-positive sample was, therefore, relatively small.

In addition, a larger sample size may have been able to more adequately determine whether gender was a confounder. We also did not formally test each sample for normality before conducting the statistical analysis. We did not include an a priori power analysis, as would have been ideal, but a post hoc power analysis revealed that we were adequately powered.

Conclusion

In this prospective study, comorbid anxiety and major depression were associated with both lower preoperative and postoperative functional outcomes after meniscectomy. Mania had no influence on outcomes. Despite worse absolute outcomes, patients with and without psychiatric comorbidities showed similar levels of improvement postoperatively. This suggests that effective screening, not treatment, should be the priority, as commonly used PROs may be unduly influenced by psychiatric conditions.

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Ethics approval

Complete written informed consent was obtained from the patient for the publication of this study and accompanying images. This study was approved by the Institutional Review Board at Rush University Medical Center. Approval was obtained on 7/25/2016, Approval-ORA #: 16050407-IRB01.

Declaration of Competing Interest

The authors declare the following financial interests/personal relationships that may be considered as potential competing interests: Corresponding author - Aesculap/B. Braun: research support (BJC), Medipost Inc: Research Support (BJC) American Journal of Sports Medicine: Editorial or governing board (BJC), Arthrex Inc: IP royalties, paid consultant, and research support (BJC), Bandgrip Inc: stock or stock options (BJC), Elsevier Publishing: IP royalties, publishing royalties, financial, or material support (BJC), Journal of the American Academy of Orthopedic Surgeons: Editorial or governing board (BJC), JRF Ortho: other financial or material support (BJC), National Institutes of Health (NIAMS & NICHD): research support (BJC), Ossio: stock or stock options (BJC). If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. R.G. Adaptive Testing Technologies: company founder.

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