JSES International 9 (2025) 98–108

Contents lists available at ScienceDirect

JSES International

journal homepage: www.jsesinternational.org

Preoperative antidepressant use in patients with depression is associated with increased complications and additional shoulder procedures following rotator cuff repair

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ARTICLE INFO

Keywords:
Antidepressants
Arthroscopy
Postoperative complications
Risk factors
Rotator cuff
Depression
Mental health

Level of evidence: Level III; Retrospective Cohort Comparison Using Large Database; Prognosis Study

Background: Preoperative depression has been associated with inferior functional outcomes and increased complications following arthroscopic rotator cuff repair (RCR). This study evaluated the association of antidepressant use with postoperative complications following arthroscopic RCR.

Methods: The TriNetX database was used to evaluate postoperative outcomes of patients who underwent arthroscopic RCR from February 24, 2004 to February 24, 2024. Patients diagnosed preoperatively with depression and documented antidepressant use within 1 year preceding surgery were compared to patients with preoperative depression but no history of preoperative antidepressant use. The cohorts were propensity-matched for demographic factors including age, type 2 diabetes, nicotine dependence, alcohol-related and opioid-related disorders, and indicators of depression severity (eg, suicide attempt, history of self-harm, sleep disorders). Outcomes were evaluated within 90 days and 3 years postoperative.

Results: A total of 9151 patients with documented antidepressant medication use were matched with 5894 patients with no antidepressant use. Patients using antidepressants demonstrated significantly higher odds of acute postoperative pain ($P < .0001$), shoulder stiffness ($P = .0011$), and emergency department visit ($P < .0001$) within 90 days postoperative and significantly increased odds of shoulder pain ($P < .0001$); RCR revision surgery ($P < .0001$); shoulder arthrocentesis, aspiration, and/or injection ($P < .0001$); and shoulder arthroplasty ($P < .0001$) within 3 years postoperative.

Conclusion: Preoperative antidepressant use was associated with significantly increased odds of acute postoperative pain, emergency department visits, opioid abuse, and additional shoulder procedures following arthroscopic RCR and did not mitigate the deleterious impact of depression on arthroscopic RCR outcomes.

Rotator cuff tear is one of the most common musculoskeletal disorders in the adult population.[49] Rotator cuff tendinopathy occurs because of traumatic injury or degenerative changes and presents at an increasing incidence across the human lifespan.[15,40] This condition is a notable source of morbidity in the adult population and is associated with chronic pain, weakness, and upper extremity dysfunction.[30,32,33] Nonoperative and operative treatment options are available for rotator cuff disease, with arthroscopic rotator cuff repair (RCR) being the gold standard for surgical management of symptomatic rotator cuff tears.[8]

Mental health disorders have been shown to increase postoperative morbidity and mortality for multiple orthopedic procedures.[2,20,25,44] For arthroscopic RCR, psychosocial factors including mental health status, emotional distress, and patient expectations can significantly influence postoperative outcomes, including levels of pain and disability.[17,18,36] The functional limitations resulting from rotator cuff tendinopathy and concomitant pain and insomnia contribute to depressive symptoms among patients with rotator cuff disease.[31] Depressive symptoms and preoperative diagnoses of depression, reported in more than 26% of patients undergoing arthroscopic RCR,[5] are associated with poorer surgical outcomes, including inferior function and increased opioid

Institutional Review Board approval was not required as this study used deidentified patient records and did not involve the collection, use, or transmittal of individually identifiable data.

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https://doi.org/10.1016/j.jseint.2024.08.198

use.[6,9,23,27,29] With the established association between preoperative depression and inferior postoperative outcomes of arthroscopic RCR, there is great interest in potential interventions to mitigate the deleterious effects of preoperative depressive symptoms on postoperative outcomes for this procedure.[3]

Antidepressant medications are the cornerstone of medical management of depression, with the goal of treatment being the reduction of depressive symptoms. Although depressive symptoms are known to negatively impact postoperative outcomes, there is a paucity of literature describing the influence of antidepressant medication use, and the presumed improvement in depressive symptoms imparted by pharmacotherapy, on arthroscopic RCR outcomes among patients with depression. The aim of this study is to demonstrate the association between preoperative diagnoses of depression on postoperative outcomes following arthroscopic RCR and describe the influence of antidepressant medication use on arthroscopic RCR outcomes among patients with depression. We hypothesize that antidepressant use among patients with a preoperative diagnosis of depression will be associated with superior postoperative outcomes and fewer complications compared to patients with diagnosed depression and no history of antidepressant use.

Methods

In this retrospective observational cohort study, the global health database, TriNetX (TriNetX, LLC, Cambridge, MA, USA), was used to access deidentified electronic medical records. Institutional review board approval was not required as this study did not involve the collection, use, or transmittal of individually identifiable data. We queried more than 60 healthcare organizations and 100 million patients contained within the US Collaborative Network. The data collection period was from February 24, 2004 to February 24, 2024. STrengthening the Reporting of OBservational studies in Epidemiology (STROBE) guidelines were implemented.[11]

Cohorts were identified for analysis using diagnostic, procedural, event, and medication codes (Supplementary Table S1). Cohort 1 was defined as patients who underwent arthroscopic RCR (Current Procedural Terminology [CPT] code: 29827) and with a documented diagnosis of depression within 1 year preceding the date of surgery. Cohort 2 was defined as patients without a preoperative diagnosis of depression who underwent arthroscopic RCR. Cohort 3 was defined as patients with a diagnosis of depression and use of antidepressant medication within 1 year preceding the date of surgery. Cohort 4 was defined as patients with a diagnosis of depression and without documented use of antidepressant medication within 1 year preceding the date of surgery.

Additional cohorts were identified to investigate associations between individual antidepressant medication classes and postoperative outcomes. This was accomplished by defining each medication cohort as patients with a documented diagnosis of depression and use of a specific class of antidepressant medication with exclusion of other antidepressant medication classes within 1 year preceding the date of surgery. Antidepressant classes analyzed in this study included selective serotonin reuptake inhibitors (SSRIs) (ATC:N06AB), tricyclic antidepressants (TCAs) (VA:CN601), and atypical antidepressants (bupropion, RXNORM:42347 and mirtazapine, RXNORM:15996). Cohorts 1 and 2 were 1:1 propensity score–matched for demographic factors including age at surgery, ethnicity, race, sex, and nondemographic factors including type 2 diabetes mellitus (International Classification of Diseases, 10th Revision [ICD-10] code: E11), nicotine dependence (ICD-10: F17), alcohol-related disorders (ICD-10: F10), and opioid-related disorders (ICD-10: F11). To achieve comparable depression severity among patients in the remaining cohorts, propensity score matching (PSM) was performed using the same demographic and nondemographic factors as cohorts 1 and 2, with the addition of suicide attempts (ICD-10: T14.91), history of self-harm (ICD-10: Z91.5), and sleep disorders (ICD-10: G47).

Demographics

The TriNetX database query yielded 115,350 patients who underwent arthroscopic RCR during the study period. Of these, 15,045 patients had a preoperative diagnosis of depression documented within 1 year preceding arthroscopic RCR, while 100,305 patients did not have a preoperative diagnosis of depression at any time point preceding surgery.

Prior to PSM, the average age of the cohort with depression was 58.0 ± 9.7 years, while the average age of the nondepressed cohort was 58.1 ± 10.7 years ($P = .218$). Compared to the nondepressed cohort, a significantly greater percentage of the patients with depression were female ($P < .001$), White ($P < .001$), not Hispanic or Latino ($P < .001$), had type 2 diabetes ($P < .001$), nicotine dependence ($P < .001$), alcohol-related disorders ($P < .001$), and opioid-related disorders ($P < .001$).

The cohort without depression had a comparatively larger percentage of males ($P < .001$), African Americans ($P = .070$), Asians ($P < .001$), Pacific Islanders ($P < .001$), other races ($P < .001$), unknown race ($P < .001$), Hispanic or Latino ($P < .001$), and unknown ethnicity ($P < .001$). All discrepancies between the 2 cohorts were nonsignificant following PSM ($P > .05$), apart from a higher percentage of patients of other races in the depression cohort ($P = .030$) (Table I).

Of the 15,045 patients with a preoperative diagnosis of depression, 9151 patients had documented use of antidepressant medication within 1 year preceding surgery and 5894 patients with depression did not use antidepressants within the year preceding arthroscopic RCR. Prior to PSM, the average age of the antidepressant cohort was 58.1 ± 9.6 years, and the average age of the non-antidepressant cohort was 57.9 ± 9.9 years ($P = .395$). Before PSM, the antidepressant cohort consisted of a significantly greater percentage of females ($P < .001$), African Americans ($P = .018$), not Hispanic or Latino ($P < .001$), patients with type 2 diabetes ($P < .001$), nicotine dependence ($P < .001$), alcohol-related disorders ($P < .001$), and opioid-related disorders ($P < .001$). The cohort of depressed patients without preoperative antidepressant use consisted of a significantly higher percentage of males ($P < .001$), Asians ($P < .001$), and unknown ethnicity ($P < .001$). All discrepancies between the 2 cohorts were nonsignificant following PSM ($P > .05$) as shown in Table II.

Statistical analyses

Arthroscopic RCR outcomes were analyzed from 1 to 90 days postoperative and 1 day to 3 years postoperative to investigate short-term and long-term outcomes, respectively. Outcomes analyzed at 90 days postoperative included postoperative infection (ICD-10 Clinical Modification [CM]: T81.4), acute postoperative pain (ICD-10-CM: G89.18), shoulder stiffness (ICD-10-CM: M25.61), physical therapy (PT) evaluation (CPT: 1029677), orthopedic aftercare (ICD-10-CM: Z47), deep vein thrombosis (DVT) (ICD-10-CM: I82.4), pulmonary embolism (PE) (ICD-10-CM: I26), upper limb mononeuropathy (ICD-10-CM: G56), hospital admission, and emergency department visit (Supplementary Table S1). Outcomes analyzed at 3 years postoperative included opioid abuse (ICD-10-CM: F11.1), shoulder pain (ICD-10-CM: M25.51), RCR revision surgery (CPT: 29827), shoulder arthrocentesis/aspiration/injection (CPT: 20610), and shoulder arthroplasty (CPT: 23472). Data gathered from TriNetX were reported in odds ratio (OR) and 95%

Table I
Demographics of patients with preoperative depression (cohort 1) vs. patients without depression (cohort 2) before and after 1:1 propensity matching.

Cohort	Demographic	Before PSM				
		Mean ± SD	Patients, n	% of cohort	*P*	Std diff
1	Age at index	58.0 ± 9.7	15,028	100%	.218	0.011
2		58.1 ± 10.7	100,053	100%		
1	Male		5278	35.1%	<.001	0.466
2			57,781	57.8%		
1	Female		8904	59.2%	<.001	0.479
2			36,008	36.0%		
1	White		11,261	74.9%	<.001	0.093
2			70,824	70.8%		
1	African American		1519	10.1%	.070	0.016
2			9644	9.6%		
1	Asian		154	1.0%	<.001	0.096
2			2238	2.2%		
1	American Indian		78	0.5%	.029	0.018
2			397	0.4%		
1	Pacific Islander		24	0.2%	<.001	0.042
2			375	0.4%		
1	Other race		349	2.3%	<.001	0.053
2			3184	3.2%		
1	Unknown race		1643	10.9%	<.001	0.075
2			13,391	13.4%		
1	Not Hispanic or Latino		11,215	74.6%	<.001	0.155
2			67,657	67.6%		
1	Hispanic or Latino		797	5.3%	<.001	0.035
2			6112	6.1%		
1	Unknown ethnicity		3016	20.1%	<.001	0.147
2			26,284	26.3%		
1	Type 2 diabetes		4011	26.7%	<.001	0.358
2			12,697	12.7%		
1	Nicotine dependence		3476	23.1%	<.001	0.406
2			8597	8.6%		
1	Alcohol-related disorders		1300	8.7%	<.001	0.297
2			2045	2.0%		
1	Opioid-related disorders		677	4.5%	<.001	0.251
2			588	0.6%		
Cohort	Demographic	After PSM				
		Mean ± SD	Patients, n	% of cohort	*P*	Std diff
1	Age at index	58.0 ± 9.7	14,682	100%	.461	0.009
2		58.1 ± 9.8	14,682	100%		
1	Male		5222	35.6%	.219	0.014
2			5323	36.3%		
1	Female		8623	58.7%	.162	0.016
2			8505	57.9%		
1	White		10,996	74.9%	.403	0.010
2			11,058	75.3%		
1	African American		1473	10.0%	.240	0.014
2			1534	10.4%		
1	Asian		154	1.0%	.191	0.015
2			132	0.9%		
1	American Indian		71	0.5%	.489	0.008
2			63	0.4%		
1	Pacific Islander		23	0.2%	.884	0.002
2			24	0.2%		
1	Other race		343	2.3%	.030	0.025
2			289	2.0%		
1	Unknown race		1622	11.0%	.454	0.009
2			1582	10.8%		
1	Not Hispanic or Latino		10,914	74.3%	.217	0.014
2			11,006	75.0%		
1	Hispanic or Latino		785	5.3%	.332	0.011
2			748	5.1%		
1	Unknown ethnicity		2983	20.3%	.423	0.009
2			2928	19.9%		
1	Type 2 diabetes		3830	26.1%	.266	0.013
2			3914	26.7%		
1	Nicotine dependence		3179	21.7%	.236	0.014
2			3263	22.2%		
1	Alcohol-related disorders		1098	7.5%	.894	0.002
2			1104	7.5%		
1	Opioid-related disorders		460	3.1%	.053	0.023
2			404	2.8%		

PSM, propensity score matching; *SD*, standard deviation; *Std diff*, Standard difference.

Table II
Demographics of patients with preoperative depression and antidepressant use (cohort 3) vs. patients with preoperative depression and no antidepressant use (cohort 4) before and after 1:1 propensity matching.

Cohort	Demographic	Before PSM				
		Mean ± SD	Patients, n	% of cohort	*P*	Std diff
3	Age at index	58.1 ± 9.6	9148	100%	.395	0.014
4		57.9 ± 9.9	5881	100%		
3	Male		3083	33.7%	<.001	0.076
4			2195	37.3%		
3	Female		5609	61.3%	<.001	0.107
4			3296	56.0%		
3	White		6834	74.7%	.430	0.013
4			4427	75.3%		
3	African American		968	10.6%	.018	0.040
4			552	9.4%		
3	Asian		71	0.8%	<.001	0.061
4			83	1.4%		
3	American Indian		55	0.6%	.080	0.030
4			23	0.4%		
3	Pacific Islander		10	0.1%	.054	0.031
4			14	0.2%		
3	Other race		225	2.5%	.163	0.024
4			124	2.1%		
3	Unknown race		985	10.8%	.419	0.013
4			658	11.2%		
3	Not Hispanic or Latino		7005	76.6%	<.001	0.114
4			4211	71.6%		
3	Hispanic or Latino		481	5.3%	.758	0.005
4			316	5.4%		
3	Unknown ethnicity		1662	18.2%	<.001	0.120
4			1354	23.0%		
3	Type 2 diabetes		2712	29.6%	<.001	0.169
4			1310	22.3%		
3	Nicotine dependence		2320	25.4%	<.001	0.134
4			1162	19.8%		
3	Alcohol-related disorders		926	10.1%	<.001	0.134
4			378	6.4%		
3	Opioid-related disorders		492	5.4%	<.001	0.110
4			186	3.2%		
3	Suicide attempt		32	0.3%	.226	0.021
4			14	0.2%		
3	History of self-harm		79	0.9%	<.001	0.062
4			22	0.4%		
3	Sleep disorders		4787	52.3%	<.001	0.385
4			1978	33.6%		
Cohort	Demographic	After PSM				
		Mean ± SD	Patients, n	% of cohort	*P*	Std diff
3	Age at index	58.1 ± 9.7	5552	100%	.521	0.012
4		58.0 ± 9.9	5552	100%		
3	Male		2027	36.5%	.875	0.003
4			2019	36.4%		
3	Female		3193	57.5%	.604	0.010
4			3220	58.0%		
3	White		4230	76.2%	.807	0.005
4			4219	76.0%		
3	African American		518	9.3%	.604	0.010
4			534	9.6%		
3	Asian		60	1.1%	.477	0.013
4			68	1.2%		
3	American Indian		19	0.3%	.536	0.012
4			23	0.4%		
3	Pacific Islander		10	0.2%	1	<0.001
4			10	0.2%		
3	Other race		123	2.2%	.948	0.001
4			122	2.2%		
3	Unknown race		595	10.7%	.666	0.008
4			581	10.5%		
3	Not Hispanic or Latino		4094	73.7%	.697	0.007
4			4112	74.1%		
3	Hispanic or Latino		320	5.8%	.262	0.021
4			293	5.3%		
3	Unknown ethnicity		1138	20.5%	.833	0.004
4			1147	20.7%		
3	Type 2 diabetes		1309	23.6%	.840	0.004

(*continued on next page*)

Table II (*continued*)

Cohort	Demographic	After PSM				
		Mean ± SD	Patients, n	% of cohort	*P*	Std diff
4			1300	23.4%		
3	Nicotine dependence		1144	20.6%	.888	0.003
4			1150	20.7%		
3	Alcohol-related disorders		385	6.9%	.793	0.005
4			378	6.8%		
3	Opioid-related disorders		166	3.0%	.384	0.017
4			182	3.3%		
3	Suicide attempt		12	0.2%	.695	0.007
4			14	0.3%		
3	History of self-harm		21	0.4%	.879	0.003
4			22	0.4%		
3	Sleep disorders		1993	35.9%	.766	0.006
4			1978	35.6%		

PSM, propensity score matching; *SD*, standard deviation; *Std diff*, Standard difference.

confidence intervals (CIs). PSM was performed through 1:1 logistic regression. Statistical analyses were performed within the TriNetX platform. Statistical significance was defined as $P < .05$ for all analyses. The Bonferroni correction was used to control for multiple comparisons.

Results

Outcomes of patients with depression vs. patients without depression

Table III shows arthroscopic RCR outcomes following PSM between patients with and without a preoperative diagnosis of depression. Preoperative depression was associated with significantly increased odds of postoperative infection (OR, 1.85; 95% CI, 1.25-2.74; $P = .0020$), acute postoperative pain (OR, 1.67; 95% CI, 1.49-1.86; $P < .0001$), shoulder stiffness (OR, 1.26; 95% CI, 1.16-1.37; $P < .0001$), DVT (OR, 1.85; 95% CI, 1.36-2.53; $P = .0007$), PE (OR, 2.10; 95% CI, 1.53-2.89; $P < .0001$), upper limb mononeuropathy (OR, 1.83; 95% CI, 1.55-2.17; $P < .0001$), emergency department visit (OR, 1.88; 95% CI, 1.73-2.04; $P < .0001$), PT evaluation (OR, 1.34; 95% CI, 1.28-1.42; $P < .0001$), and orthopedic aftercare (OR, 1.39; 95% CI, 1.31-1.47; $P < .0001$) up to 90 days postoperative. Within 3 years postoperative, preoperative depression was associated with significantly higher odds of opioid abuse (OR, 2.43; 95% CI, 1.77-3.35; $P < .0001$); shoulder pain (OR, 1.58; 95% CI, 1.51-1.65; $P < .0001$); arthrocentesis, aspiration, and/or injection (OR, 1.45; 95% CI, 1.37-1.54; $P < .0001$); and shoulder arthroplasty (OR, 2.45; 95% CI, 2.02-2.99; $P < .0001$) (Fig. 1). The overall rate of RCR revision surgery in this cohort, regardless of diagnosis of depression, was 8.5% (2491/29,364). Odds of hospital admission and RCR revision surgery were not significantly associated with depression.

Impact of antidepressant use among patients with depression

Table IV shows arthroscopic RCR outcomes following PSM among depressed patients with and without preoperative antidepressant use. Within 90 days postoperative, patients with antidepressant use demonstrated significantly higher odds of acute postoperative pain (OR, 1.40; 95% CI, 1.19-1.65; $P < .0001$), shoulder stiffness (OR, 1.25; 95% CI, 1.10-1.43; $P = .0011$), emergency department visit (OR, 1.36; 95% CI, 1.20-1.53; $P < .0001$), and PT evaluation (OR, 1.31; 95% CI, 1.21-1.43; $P < .0001$). Within 3 years postoperative, antidepressant use was associated with significantly increased odds of shoulder pain (OR, 1.40; 95% CI, 1.29-1.51; $P < .0001$); RCR revision surgery (OR, 1.71; 95% CI, 1.48-1.98; $P < .0001$); shoulder arthrocentesis, aspiration, and/or injection (OR, 1.27; 95% CI, 1.17-1.39; $P < .0001$); and shoulder arthroplasty (OR, 1.76; 95% CI, 1.35-2.28; $P < .0001$) (Fig. 2). The overall rate of RCR revision surgery in this cohort, regardless of antidepressant use, was 7.4% (824/11,104). Postoperative infection, orthopedic aftercare, DVT, PE, upper limb mononeuropathy, and hospital admission were not significantly associated with preoperative antidepressant use (Fig. 3).

Impact of antidepressant use by drug class

Preoperative SSRI use among depressed patients was associated with significantly higher odds of acute postoperative pain (OR, 1.30; 95% CI, 1.06-1.58; $P = .0111$), shoulder stiffness (OR, 1.28; 95% CI, 1.10-1.50; $P = .0019$), PE (OR, 1.75; 95% CI, 1.04-2.92; $P = .0315$), emergency department visit (OR, 1.34; 95% CI, 1.16-1.55; $P < .0001$), and PT evaluation (OR, 1.22; 95% CI, 1.10-1.35; $P = .0001$) within 90 days postoperative (Table V). Within 3 years postoperative, preoperative SSRI use was significantly associated with opioid abuse (OR, 2.01; 95% CI, 1.17-3.45; $P = .0095$); shoulder pain (OR, 1.26; 95% CI, 1.14-1.38; $P < .0001$); RCR revision surgery (OR, 1.32; 95% CI, 1.10-1.59; $P = .0024$); shoulder arthrocentesis, aspiration, and/or injection (OR, 1.18; 95% CI, 1.06-1.31; $P = .0021$); and shoulder arthroplasty (OR, 1.51; 95% CI, 1.11-2.07; $P = .0094$).

Within 90 days postoperative, preoperative TCA use was significantly associated with increased odds of emergency department visits (OR, 1.66; 95% CI, 1.17-2.35; $P = .0040$). Up to 3 years postoperative, patients with preoperative TCA demonstrated higher odds of RCR revision surgery (OR, 1.95; 95% CI, 1.21-3.15; $P = .0052$) and shoulder arthrocentesis, aspiration, and/or injection (OR, 1.65; 95% CI, 1.25-2.17; $P = .0004$) (Table V).

Preoperative use of atypical antidepressants (ie, bupropion or mirtazapine) was associated with increased odds of shoulder stiffness, PT evaluation, and orthopedic aftercare within 90 days postoperative. Up to 3 years postoperative, preoperative atypical antidepressant use was significantly associated with shoulder pain (OR, 1.24; 95% CI, 1.06-1.44; $P = .0074$) and RCR revision surgery (OR, 1.63; 95% CI, 1.21-2.20; $P = .0011$) (Table V).

Discussion

This study found preoperative antidepressant use among patients with depression to be significantly associated with increased short-term and long-term postoperative complications and additional shoulder procedures following arthroscopic RCR. Additionally, this study further demonstrated the association between preoperative depression and increased postoperative complications following arthroscopic RCR. The present study is, to our

Table III
Outcomes following arthroscopic rotator cuff repair after 1:1 propensity matching of patients with preoperative depression vs. patients without depression.

Outcome	Depression (N = 14,682)	Control (N = 14,682)	Odds ratio (95% CI)	*P*
90-day outcomes				
Infection	70 (0.5)	38 (0.3)	1.85 (1.25-2.74)	**.0020***
Acute postoperative pain	838 (5.7)	515 (3.5)	1.67 (1.49-1.86)	**<.0001****
Shoulder stiffness	1358 (9.2)	1099 (7.5)	1.26 (1.16-1.37)	**<.0001****
PT evaluation	4112 (28.0)	3295 (22.4)	1.34 (1.28-1.42)	**<.0001****
Orthopedic aftercare	3274 (22.3)	2515 (17.1)	1.39 (1.31-1.47)	**<.0001****
DVT	116 (0.8)	63 (0.4)	1.85 (1.36-2.53)	**.0007***
PE	117 (0.8)	56 (0.4)	2.10 (1.53-2.89)	**<.0001****
Upper limb mononeuropathy	384 (2.6)	212 (1.4)	1.83 (1.55-2.17)	**<.0001****
Hospital admission	53 (0.4)	37 (0.3)	1.43 (0.94-2.17)	.0912
Emergency department visit	1713 (11.7)	964 (6.6)	1.88 (1.73-2.04)	**<.0001****
3-year outcomes				
Opioid abuse	127 (0.9)	53 (0.4)	2.43 (1.77-3.35)	**<.0001****
Shoulder pain	9118 (62.1)	7483 (51.0)	1.58 (1.51-1.65)	**<.0001****
RCR revision	1227 (8.4)	1264 (8.6)	0.97 (0.89-1.05)	.4384
Arthrocentesis, aspiration, and/or injection	3715 (25.3)	2776 (18.9)	1.45 (1.37-1.54)	**<.0001****
Shoulder arthroplasty	341 (2.3)	141 (1.0)	2.45 (2.02-2.99)	**<.0001****

CI, confidence interval; *PT*, physical therapy; *DVT*, deep vein thrombosis; *PE*, pulmonary embolism; *RCR*, rotator cuff repair.
Categorical data presented as n (% of cohort), $^{**}P < .0001$, $^{*}P < .05$.
Bonferroni correction $P < .0033$; Bold: significant after Bonferroni correction.

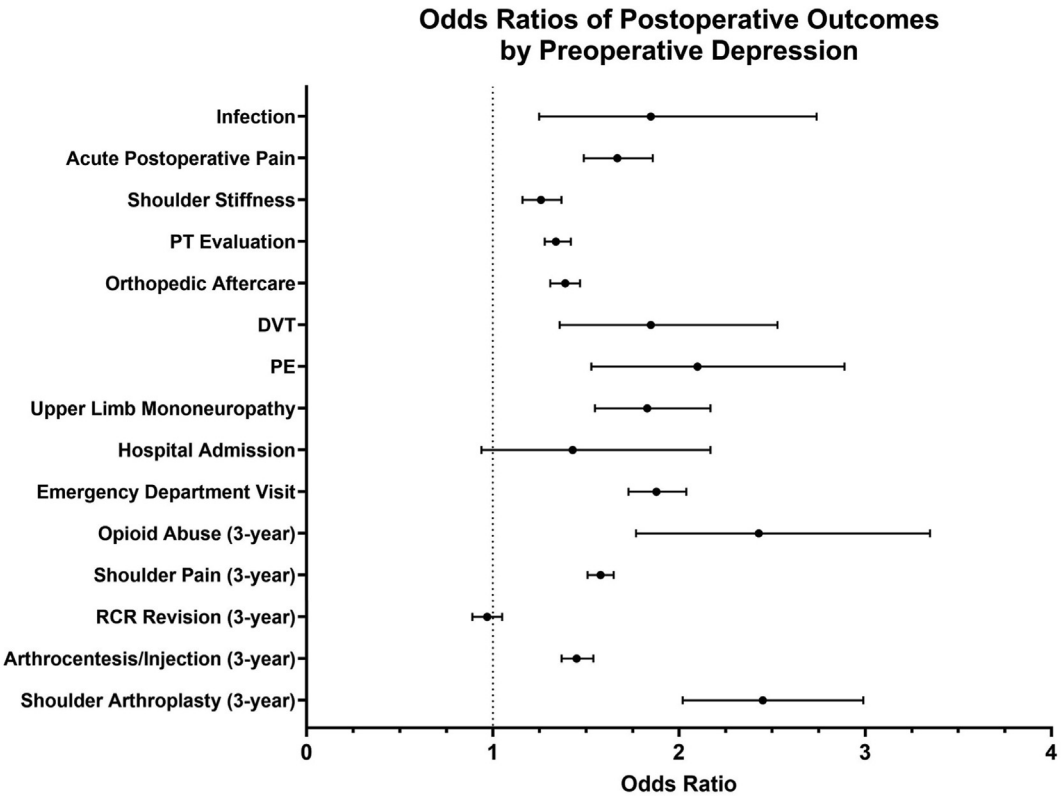

Figure 1 Odds ratios of postoperative outcomes by preoperative depression. *PT*, physical therapy; *DVT*, deep vein thrombosis; *PE*, pulmonary embolism; *RCR*, rotator cuff repair.

knowledge, the first to investigate the implications of preoperative depression treatment on arthroscopic RCR outcomes in patients with depression.

Contrary to the hypothesis, antidepressant use among patients with a preoperative diagnosis of depression was associated with inferior postoperative outcomes and increased complications following arthroscopic RCR when compared to patients with depression and no history of antidepressant use. Because preoperative psychological dysfunction has repeatedly been shown to be associated with poorer postoperative outcomes following arthroscopic RCR,[9,14,35] we anticipated preoperative depression pharmacotherapy would mitigate the deleterious effects of psychological dysfunction on postoperative outcomes. The findings of the present study indicate the interplay between depressive symptoms and arthroscopic RCR outcomes may be more complex than previously thought, as treatment of depression was associated with worse short-term and long-term postoperative outcomes.

In addition to depressive symptoms, several other aspects of mental status have been shown to influence postoperative outcomes following arthroscopic RCR. Higher preoperative resilience is

Table IV
Outcomes following arthroscopic rotator cuff repair after 1:1 propensity matching of preoperatively depressed patients with and without preoperative antidepressant use.

Outcome	Antidepressant (N = 5552)	Control (N = 5552)	Odds ratio (95% CI)	*P*
90-day outcomes				
Infection	22 (0.4)	27 (0.5)	0.81 (0.46-1.41)	.4741
Acute postoperative pain	347 (6.3)	252 (4.5)	1.40 (1.19-1.65)	**<.0001****
Shoulder stiffness	517 (9.3)	421 (7.6)	1.25 (1.10-1.43)	**.0011***
PT evaluation	1658 (29.9)	1360 (24.5)	1.31 (1.21-1.43)	**<.0001****
Orthopedic aftercare	1209 (21.8)	1273 (22.9)	0.94 (0.86-1.02)	.1449
DVT	45 (0.8)	38 (0.7)	1.19 (0.76-1.83)	.4406
PE	49 (0.9)	32 (0.6)	1.54 (0.98-2.40)	.0580
Upper limb mononeuropathy	150 (2.7)	123 (2.2)	1.23 (0.96-1.56)	.0980
Hospital admission	23 (0.4)	17 (0.3)	1.35 (0.74-2.50)	.3419
Emergency department visit	682 (12.3)	519 (9.3)	1.36 (1.20-1.53)	**<.0001****
3-year outcomes				
Opioid abuse	56 (1.0)	29 (0.5)	1.94 (1.24-3.09)	.0033*
Shoulder pain	3580 (64.5)	3138 (56.5)	1.40 (1.29-1.51)	**<.0001****
RCR revision	512 (9.2)	312 (5.6)	1.71 (1.48-1.98)	**<.0001****
Arthrocentesis, aspiration, and/or injection	1447 (26.1)	1205 (21.7)	1.27 (1.17-1.39)	**<.0001****
Shoulder arthroplasty	156 (2.8)	90 (1.6)	1.76 (1.35-2.28)	**<.0001****

CI, confidence interval; *PT*, physical therapy; *DVT*, deep vein thrombosis; *PE*, pulmonary embolism; *RCR*, rotator cuff repair.
Categorical data presented as n (% of cohort). $^{**}P < .0001$, $^{*}P < .05$.
Bonferroni correction $P < .0033$; Bold: significant after Bonferroni correction.

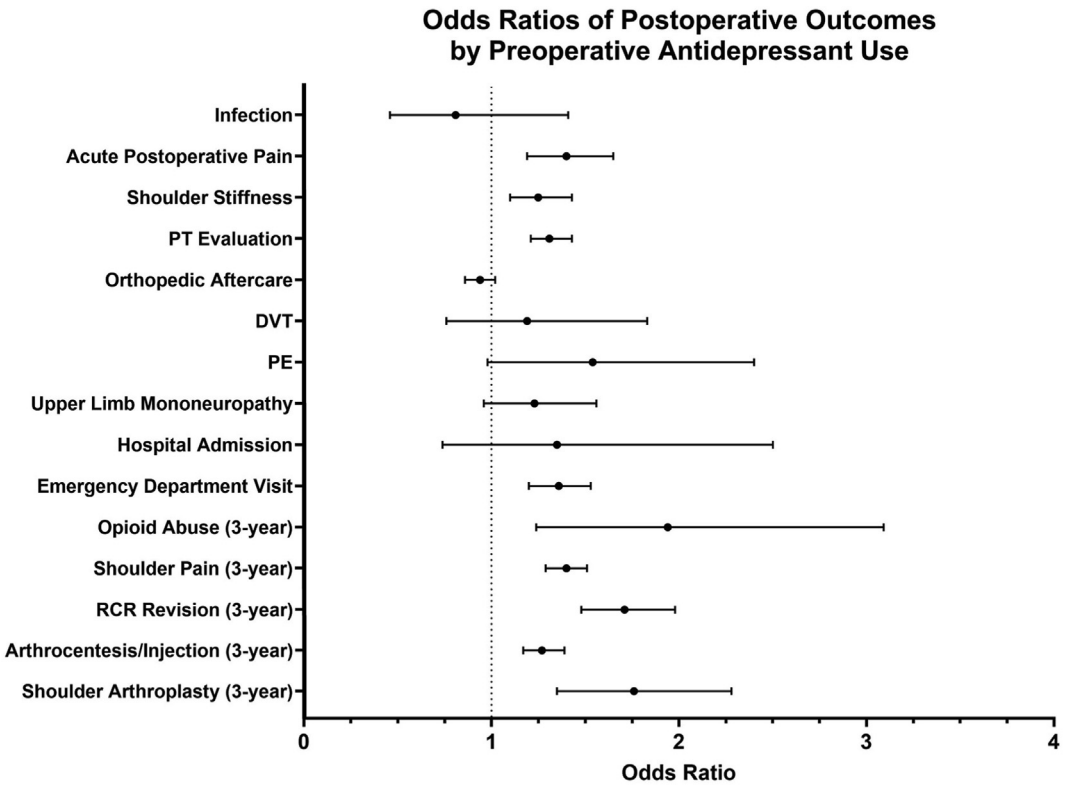

Figure 2 Odds ratios of postoperative outcomes by preoperative antidepressant use. *PT*, physical therapy; *DVT*, deep vein thrombosis; *PE*, pulmonary embolism; *RCR*, rotator cuff repair.

associated with greater postoperative functional outcomes and earlier recovery following arthroscopic RCR.[42,45] Furthermore, preoperative confidence in surgical outcome,[41] optimism,[38] and higher preoperative expectations[7,17,43] are significantly associated with improvement in functional outcomes and increased patient satisfaction following arthroscopic RCR. Current literature suggests that patient outlook may influence postoperative outcomes to a similar, and perhaps greater, degree than the medical treatment of depressive symptoms alone. Additional studies that assess preoperative improvement in depressive symptoms with a validated instrument, such as the Patient Health Questionnaire-9 (PHQ-9), are necessary to further characterize the association between management of depression and arthroscopic RCR outcomes.

Preoperative antidepressant use has varied associations with postoperative outcomes for other orthopedic procedures. Similar to the findings of the present study, preoperative antidepressant use has been associated with poorer outcomes for pain and function following hip arthroscopy[50] and femoroacetabular impingement surgery,[12] as well as prolonged postoperative opioid use following lumbar spine surgery.[21] Notably, these studies compared outcomes among patients with preoperative antidepressant use to patients without antidepressant use or a documented diagnosis of

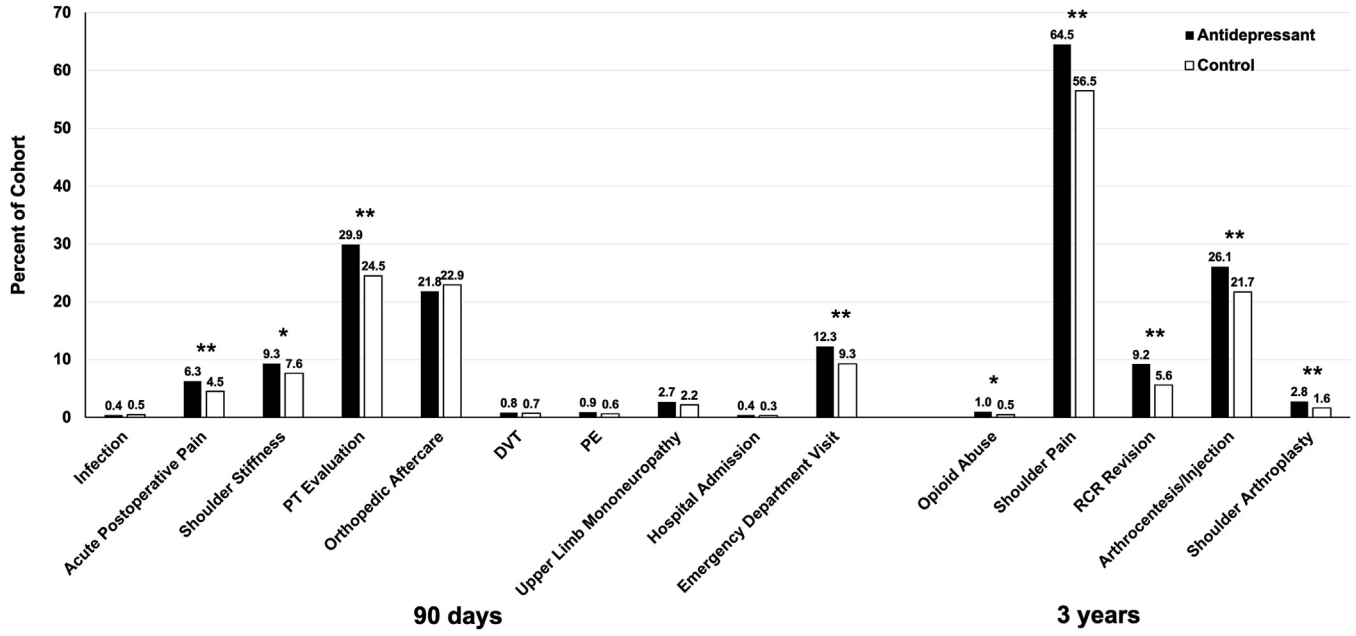

Figure 3 Outcomes following arthroscopic rotator cuff repair of patients with depression by antidepressant use. $^{**}P < .0001$; $^{*}P < .05$. *PT*, physical therapy; *DVT*, deep vein thrombosis; *PE*, pulmonary embolism; *RCR*, rotator cuff repair.

depression. Therefore, it is plausible that antidepressant use largely served as a proxy indicator of depression in the aforementioned studies. In contrast, a retrospective review of total hip arthroplasty and total knee arthroplasty outcomes by Yao et al[48] demonstrated significantly lower rates of arthroplasty revision among depressed patients with preoperative SSRI use compared to depressed patients without SSRI use. The current state of the literature provides limited insight into the influence of antidepressant use on postoperative outcomes for patients with depression undergoing orthopedic procedures. Additional studies investigating the impact of preoperative antidepressant use on postoperative outcomes among patients with depression are warranted.

Multiple findings that may impact clinical decision-making are readily derived from the present study. First, mental health disorders have previously been associated with the development of opioid misuse for multiple orthopedic procedures, including arthroscopic RCR.[9,10,39] Further demonstrating this phenomenon, this study also found preoperative antidepressant use was associated with significantly increased odds of postoperative pain and opioid abuse. Mental health plays an influential role in pain perception following RCR, as mental status is a stronger correlate of shoulder pain than morphology of rotator cuff tear following this procedure.[46] These findings suggest postoperative pain control and conservative opioid use are of particular importance in patients with preoperative depression and antidepressant use to decrease the odds of development of opioid-related disorders.

Second, both preoperative depression and preoperative antidepressant use were significantly associated with increased odds of progression to shoulder arthroplasty. Apfel et al[1] previously demonstrated a rate of progression to shoulder arthroplasty of 1.4% within 9 years postarthroscopic RCR without consideration of mental status. Similarly, Freshman et al[14] demonstrated a rate of progression to shoulder arthroplasty among patients with preoperative mental health disorders of 1.4% within 2 years postarthroscopic RCR, a 2.3-fold increase in the risk of postoperative progression to shoulder arthroplasty. In the present study, progression to shoulder arthroplasty was observed in 2.3% of patients with preoperative depression and 2.8% of patients with depression and preoperative antidepressant use, with both cohorts demonstrating significantly higher odds of shoulder arthroplasty than controls (1.0% and 1.6%, respectively). With significantly greater odds of progression to shoulder arthroplasty observed in these cohorts and previously described rates of failure of RCR as high as 94%,[13,16,24,51] the presence of preoperative depression and antidepressant use may warrant additional consideration of shoulder arthroplasty during shared decision-making for the surgical management of rotator cuff tears.

The findings of this study suggest preoperative antidepressant use, even if effective in the management of depression, is insufficient to mitigate the deleterious impacts of poor preoperative mental health on RCR outcomes. We speculate the increased rates of complications and additional procedures among patients with antidepressant use described in this study are likely attributable to greater severity of depression in the subset of depressed patients with antidepressant use as compared to depressed patients without antidepressant use preceding surgery. Plausibly, depressed patients in this cohort who sought treatment with antidepressant medications experienced more severe depression than depressed patients who did not require pharmacotherapy. Therefore, it is conceivable that inadequate depression treatment and subsequently poorer preoperative mental health allowed the previously described phenomenon of inferior RCR outcomes related to increasing psychological dysfunction to manifest.[9,14,35] The role of antidepressant use in the preoperative management of depression is further called into question by high levels of bias in the antidepressant literature[19] and findings challenging the serotonin hypothesis of depression.[34] These considerations indicate the need for further study on this topic, particularly after controlling for depression severity with a validated instrument, such as the PHQ-9.

This study has several strengths, the first of which is that this is the first investigation into the impact of depression treatment on outcomes of arthroscopic RCR among patients with depression. This study further elucidates the previously described association between psychological dysfunction and outcomes of RCR. Furthermore, the validity of this propensity-matched analysis is strengthened by the matching of biomedical characteristics

Table V
Outcomes following arthroscopic rotator cuff repair after 1:1 propensity matching of preoperatively depressed patients with and without preoperative antidepressant use by antidepressant medication class.

Outcome	SSRI (N = 3737)	Control (N = 3737)	OR (95% CI)	*P*	TCA (N = 518)	Control (N = 518)	OR (95% CI)	*P*	Atypical (N = 1381)	Control (N = 1381)	OR (95% CI)	*P*
90-day outcomes												
Infection	12 (0.3)	16 (0.4)	0.75 (0.35-1.59)	.4488	10 (1.9)	10 (1.9)	1.00 (0.41-2.42)	1.0000	10 (0.7)	10 (0.7)	1.00 (0.42-2.41)	1.0000
Acute postoperative pain	230 (6.2)	180 (4.8)	1.30 (1.06-1.58)	.0111*	49 (9.5)	34 (6.6)	1.49 (0.94-2.35)	.0860	92 (6.7)	70 (5.1)	1.34 (0.97-1.84)	.0748
Shoulder stiffness	385 (10.3)	307 (8.2)	1.28 (1.10-1.50)	.0019*	63 (12.2)	51 (9.8)	1.27 (0.86-1.88)	.2335	157 (11.4)	116 (8.4)	1.40 (1.09-1.80)	.0089*
PT evaluation	1095 (29.3)	946 (25.3)	1.22 (1.10-1.35)	.0001*	154 (29.7)	140 (27)	1.14 (0.87-1.50)	.3347	455 (32.9)	366 (26.5)	1.36 (1.16-1.61)	.0002*
Orthopedic aftercare	831 (22.2)	898 (24)	0.90 (0.81-1.01)	.0661	134 (25.9)	129 (24.9)	1.05 (0.80-1.39)	.7211	288 (20.9)	356 (25.8)	0.76 (0.64-0.91)	.0022*
DVT	39 (1)	28 (0.7)	1.40 (0.86-2.28)	.1770	10 (1.9)	10 (1.9)	1.00 (0.41-2.42)	1.0000	10 (0.7)	14 (1)	0.71 (0.32-1.61)	.4122
PE	40 (1.1)	23 (0.6)	1.75 (1.04-2.92)	.0315*	10 (1.9)	10 (1.9)	1.00 (0.41-2.42)	1.0000	10 (0.7)	10 (0.7)	1.00 (0.42-2.41)	1.0000
Upper limb mono-neuropathy	94 (2.5)	87 (2.3)	1.08 (0.81-1.45)	.5984	10 (1.9)	14 (2.7)	0.71 (0.31-1.61)	.4087	40 (2.9)	31 (2.2)	1.30 (0.81-2.09)	.2792
Hospital admission	13 (0.3)	11 (0.3)	1.18 (0.53-2.64)	.6826	10 (1.9)	10 (1.9)	1.00 (0.41-2.42)	1.0000	10 (0.7)	10 (0.7)	1.00 (0.42-2.41)	1.0000
Emergency department visit	484 (13)	373 (10)	1.34 (1.16-1.55)	<.0001**	94 (18.1)	61 (11.8)	1.66 (1.17-2.35)	.0040*	163 (11.8)	133 (9.6)	1.26 (0.99-1.60)	.0650
3-year outcomes												
Opioid abuse	40 (1.1)	20 (0.5)	2.01 (1.17-3.45)	.0095*	10 (1.9)	10 (1.9)	1.00 (0.41-2.42)	1.0000	15 (1.1)	10 (0.7)	1.51 (0.67-3.36)	.3151
Shoulder pain	2363 (63.2)	2160 (57.8)	1.26 (1.14-1.38)	<.0001**	365 (70.5)	336 (64.9)	1.29 (1.00-1.68)	.0541	903 (65.4)	835 (60.5)	1.24 (1.06-1.44)	.0074*
Rotator cuff retear	2124 (56.8)	1894 (50.7)	1.28 (1.17-1.40)	<.0001**	316 (61)	292 (56.4)	1.21 (0.95-1.55)	.1299	795 (57.6)	730 (52.9)	1.21 (1.04-1.41)	.0129*
RCR revision	287 (7.7)	221 (5.9)	1.32 (1.10-1.59)	.0024*	52 (10)	28 (5.4)	1.95 (1.21-3.15)	.0052*	120 (8.7)	76 (5.5)	1.63 (1.21-2.20)	.0011*
Arthrocentesis, aspiration, and/or injection	961 (25.7)	847 (22.7)	1.18 (1.06-1.31)	.0021*	168 (32.4)	117 (22.6)	1.65 (1.25-2.17)	.0004*	345 (25)	327 (23.7)	1.07 (0.90-1.28)	.4247
Shoulder arthroplasty	99 (2.6)	66 (1.8)	1.51 (1.11-2.07)	.0094*	18 (3.5)	15 (2.9)	1.21 (0.60-2.42)	.5956	25 (1.8)	29 (2.1)	0.86 (0.50-1.48)	.5825

SSRI, selective serotonin reuptake inhibitor; *OR*, odds ratio; *CI*, confidence interval; *TCA*, tricyclic antidepressant; *PT*, physical therapy; *DVT*, deep vein thrombosis; *PE*, pulmonary embolism; *RCR*, rotator cuff repair.
Categorical data presented as n (% of cohort). $^{**}P < .0001$, $^{*}P < .05$.

between cohorts that are associated with increased postoperative complications following RCR (ie, type 2 diabetes and nicotine dependence).[4,22,37,47]

The limitations of this study include those that are inherent to retrospective reviews using large databases that are reliant on administrative coding, including potential misclassification and residual confounding. Additionally, specific data regarding rotator cuff tear characteristics that are known impactors of RCR healing rates (eg, size, thickness, retraction, fatty infiltration, and number of tendons involved) were not available for analysis.[26] Furthermore, this study is limited by the use of CPT codes for the identification of patients who underwent RCR as well as for procedural outcomes, as this did not allow for the determination of ipsilateral vs. contralateral outcomes. However, similar methodology has recently been described in the study of shoulder pathology.[28] Although PSM was performed, it is possible that matching insufficiently controlled for the baseline differences between the cohorts. Preoperative indicators of depression severity were matched, but this may have incompletely accounted for differences in depression severity between the cohorts. With this consideration, antidepressant medication use among patients in this study may have served as a marker of more severe depression, in which case, poorer outcomes would have been expected based on the previously discussed association between preoperative mental health dysfunction and poorer outcomes of arthroscopic RCR. Although the use of a preoperative diagnosis of depression allowed for the analysis of its impact on postoperative outcomes, psychological function assessed by a validated instrument is likely a superior predictor of postoperative outcomes as compared to merely the presence or absence of a diagnosis of depression. Future investigations should use a validated psychiatric instrument (eg, PHQ-9, Hospital Anxiety and Depression Scale) to quantify and control for depression severity before analyzing the impact of depression treatment on outcomes of arthroscopic RCR. Despite these limitations, this study is the first to investigate the impact of antidepressant use on outcomes of arthroscopic RCR among patients with a preoperative diagnosis of depression and showed a significant association between preoperative antidepressant use and increased postoperative complications following this procedure.

Conclusion

After propensity matching to control for demographic information and depression severity among patients with depression, preoperative antidepressant use was associated with poorer outcomes and increased complications following arthroscopic RCR. Future studies should seek to quantify and control for depression severity using a validated psychiatric instrument, as well as investigate the impact of other depression treatments on postoperative arthroscopic RCR outcomes.

Disclaimers:

Funding: This study received no funding.
Conflicts of interest: Dr. Jeremy S. Somerson reports educational support from Arthrex, Medinc of Texas, and DJO/Encore, outside the scope of this project. The authors, their immediate families, and any research foundation with which they are affiliated have not received any financial payments or other benefits from any commercial entity related to the subject of this article.

Supplementary Data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jseint.2024.08.198.

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