Case Control Study

Baseline Kinesiophobia and Pain Catastrophizing Scores Predict Prolonged Postoperative Shoulder Pain

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Background: Chronic postsurgical pain remains a major hurdle in postoperative management, especially in patients undergoing shoulder surgery, for whom persistent pain rates are higher than for any other surgical site. Little is known about pain beliefs and attitudes as preoperative predictors of postoperative pain following nonarthroplasty shoulder surgery.

Objectives: We evaluated predictors of pain following nonarthroplasty shoulder surgery, hypothesizing that preoperative kinesiophobia, pain catastrophizing, and neuropathic pain scores are predictive of greater postoperative pain.

Study Design: Case control study.

Setting: Division of Sports Medicine at the University of Wisconsin School of Medicine and Public Health.

Methods: Consecutive patients aged 18 and older undergoing a nonarthroplasty shoulder operation were selected. At the preoperative appointment and 3 months postoperative, patients completed the Short-Form McGill Pain Questionnaire-2 to assess severity and quality of pain, the painDetect Questionnaire to screen for neuropathic pain, the Tampa Scale of Kinesiophobia to assess fear of movement and fear-avoidance beliefs, and the Pain Catastrophizing Scale to gauge rumination, magnification, and pessimism. A univariable negative binomial regression model was used to identify associations between preoperative predictors and postoperative scores, reporting risk ratios and 95% confidence intervals.

Results: Eighty-one patients completed the preoperative surveys and 43 patients completed at least one postoperative survey. The median pain score decreased from 3 out of 10 (interquartile range [IQR] = 2-5) in the preoperative group to one (IQR = 0-2) in the postoperative group ($P < 0.001$). Mean kinesiophobia scores decreased from 40.44 (standard deviation [SD] = 5.94) preoperatively to 35.40 (SD = 6.44) postoperatively ($P < 0.001$). Median pain catastrophizing scores decreased from 7 (IQR = 2-17]) preoperatively to 2 (IQR = 0-11]) postoperatively ($P = 0.005$). No significant changes in neuropathic pain scores were observed. Higher baseline kinesiophobia scores were associated with greater postoperative pain (risk ratio = 1.09, 95% confidence interval [CI] = 1.01 to 1.18), $P = 0.03$), as were higher pain catastrophizing scores (risk ratio = 1.05, 95% CI = 1.01 to 1.08), $P = 0.01$). No association between baseline neuropathic pain and degree of postoperative pain was identified.

Limitations: Limitations of the study include a single institution with multiple surgeons and types of surgery. The study drop-out rate was relatively high.

Conclusion: This study suggests that greater baseline kinesiophobia and pain catastrophizing are predictive of greater postoperative pain following nonarthroplasty shoulder surgery in an adult population.

Key words: Chronic pain, kinesiophobia, catastrophizing, neuropathic pain, shoulder surgery

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Persistent postsurgical pain remains a major problem across an array of disciplines. Patients who undergo a surgical procedure at the shoulder or upper arm are more likely to experience persistent postsurgical pain (74.5%) than those receiving an operation at any other site (1). Several studies have examined preoperative predictors of pain following orthopedic surgery at the hip, knee, and spine (2), and others have considered prognostic factors affecting shoulder healing and outcomes (3-6). Factors including mental health diagnoses (7-15) and opioid use (16-19) have been intensely scrutinized as potential predictors of inferior outcomes following surgery of the shoulder. However, less is known about the effect of pain beliefs and attitudes on pain outcomes following nonarthroplasty shoulder surgery. An improved understanding of which patients are most likely to suffer from persistent postsurgical pain may allow optimization of treatment plans for those with shoulder disability and pain.

The role of psychosocial factors in musculoskeletal pain is well documented (20). Pain catastrophizing (a perception of exaggerated pain with excessive rumination, magnification, or pessimism) has been connected to chronic postsurgical pain, with a stronger relationship observed following orthopedic surgery than surgery in general (21). Pain catastrophizing and kinesiophobia (a fear of pain due to movement) have both been associated with greater pain and disability in the shoulder, specifically, though results evaluating this relationship are conflicting (22).

Neuropathic pain is increasingly recognized as a significant contributor to pain in patients with shoulder injuries; one study found the prevalence of neuropathic pain in patients with a rotator cuff tear to be nearly 16% (23). Other reviews have documented the association between sensory abnormalities and persistent postsurgical pain (1,24) as well as the role of neuropathic pain in osteoarthritis (25). However, to date, these psychological factors have not been utilized to preoperatively predict levels of postoperative pain following nonjoint replacement shoulder surgery.

This prospective study was designed to determine predictors of persistent pain following nonarthroplasty shoulder surgery. Among other variables, we considered preoperative neuropathic pain, pain catastrophizing, kinesiophobia, fear of re-injury, and analgesic medication use. We hypothesized that higher preoperative scores on kinesiophobia, pain catastrophizing, and neuropathic pain scales would be predictive of persistent postoperative pain following nonarthroplasty shoulder surgery.

Methods

Study Enrollment

From December 2017 through November 2018, we recruited patients who were planning to undergo a nonarthroplasty shoulder operation from a surgeon in the Division of Sports Medicine at the University of Wisconsin School of Medicine and Public Health. All surgeons in the Sports Medicine Division were enlisted to recruit all patients 18 years of age or older who agreed to participate. The only exclusion criterion was a lack of internet access, due to our reliance on email to deliver postoperative surveys. The study was reviewed by our institution's Institutional Review Board and found to be exempt from oversight since patients' personal data were redacted and not exposed to any additional risk or liabilities due to participation in the study.

Questionnaires

Eligible patients completed a series of questionnaires and provided information at their 1-2 week preoperative appointment and again at approximately 3 months postoperative. Basic demographics, comorbidities, pain severity and duration, tobacco use, work status, whether the injury was work-related, litigation status, opioid use, and history of previous shoulder surgery were also assessed at the preoperative visit. In our analysis of pre- and post-operative pain, we used "current pain" (rather than an average or worst pain) to enhance temporal consistency.

The Short-Form McGill Pain Questionnaire-2 (SF-MPQ-2) was used to assess severity and descriptors of pain. This revised edition of the MPQ, which in its original form has been widely used for more than 40 years to assess pain (26), consists of 22 items, including 7 added symptoms relevant to neuropathic pain, all of which are rated on an 11-point scale (27). The SF-MPQ-2 includes 4 subscales: continuous pain, intermittent pain, neuropathic pain, and affective descriptors. The SF-MPQ-2 has been demonstrated to be valid and reliable for both neuropathic and nonneuropathic pain (28).

The painDetect Questionnaire (PDQ) was used to screen for neuropathic pain. Though it was initially developed and validated for back pain (29,30), it has since been used for the shoulder (31). Scores range from -1 to +35; a score $\leq$ 12 indicates that a neuropathic pain

component is unlikely, a score ≥ 19 indicates a neuropathic pain component is likely, and a score of 13 to 18 is considered indeterminate.

The Tampa Scale of Kinesiophobia (TSK) was used to assess fear of movement and fear-avoidance beliefs. It too was initially developed and validated for back pain (32) but has since been employed in shoulder studies (22). Scores range from 17 to 68, with higher scores indicating a greater fear of pain, movement, and injury with a cutoff score of 37 indicating presence or absence of kinesiophobia (32).

The Pain Catastrophizing Scale (PCS) is used to gauge rumination, magnification, and pessimism. The PCS has been shown to be reliable and valid for pain and psychometric studies (33). Each item in the PCS is scored from 0 (not at all) to 4 (all the time), yielding a total score ranging from 0 to 52, with higher scores indicating greater levels of pain catastrophizing (33). Representing the 75th percentile in a distribution of PCS scores, a score of 30 indicates clinically relevant catastrophizing and is associated with poor treatment outcomes (33).

All 4 questionnaires—SF-MPQ-2, PDQ, TSK, and PCS—were completed at the preoperative appointment and again postoperatively. Patients were sent links via email to complete the 4 questionnaires 3 months after their operation. Patients received weekly reminders via email until the questionnaires were completed, in an effort to minimize bias due to loss to follow-up. The web application REDCap (projectredcap.org) was used to manage surveys and the database for this project.

Statistical Analysis

SAS software v9.4 (SAS Institutes, Cary, NC) was used for all analyses. Standard descriptive statistics were used to describe the study sample at baseline. Paired student t-tests were used to compare pre- and postoperative scores within a given questionnaire or metric. A univariable negative binomial regression model was used to identify associations between preoperative predictors and postoperative scores (e.g., association between baseline kinesiophobia scores and postoperative pain scores). Risk ratios and 95% confidence intervals are reported for these models. A Spearman's rank correlation coefficient was used to examine potential associations between: preoperative pain and postoperative pain; duration of shoulder pain and postoperative pain; preoperative pain and change in pain from the pre- to postoperative period.

Results

Eighty-one consecutive patients who agreed to participate in the study were enrolled. Of the 81 patients enrolled, 80 completed baseline preoperative surveys (Table 1). Seventy-two percent of participants were men. There was roughly equal representation in operation laterality. Forty-two (53%) patients had been suffering from shoulder pain for over a year with 24 (30%) having pain greater than 3 months. Shoulder pain was a result of a work injury in 16 (20%) patients. Forty-seven (59%) patients were working at the time of study enrollment and 15 (19%) were not working due to their shoulder pain. Only 11 (14%) patients were involved in litigation regarding shoulder injury. Thirteen (16%) patients had previously undergone shoulder surgery and 11 patients (14%) were taking opioid pain medication. Fourteen patients used tobacco (18%) and 7 patients carried a diagnosis of diabetes mellitus (9%).

Postoperative questionnaires (median time to follow-up 109 days, range 76 to 273 days) garnered variable participation: 43 patients completed some portion of follow-up surveys with 42 completing the SF-MPQ-2, 37 completing basic pain scales, 35 completing the TSK, 31 completing the PCS, and 20 completing the PDQ (Tables 2,3). Reasons for not participating are not clear but potentially relate to reliance on email for postoperative survey completion. The only difference identified between those who completed follow-up surveys versus those who did not was in regards to smoking status; 27% of patients who did not complete follow-up were smokers compared to 10% of those who did complete follow-up ($P = 0.04$).

Based on the PDQ, a large majority of patients had pain clearly attributable to nociception, both pre- and post-operatively (78% and 87%, respectively). A small minority of patients had a clear neuropathic component to their pain pre- and post-operatively (5% and 2%, respectively), and a minority of patients had an unclear contribution of neuropathic pain pre- and post-operatively (17% and 12%, respectively). Although the SF-MPQ-2 is not designed to identify neuropathic pain, the word count for neuropathic terms on this questionnaire suggest that the majority of patients exhibited at least some neuropathic pain preoperatively, while nearly half of patients exhibited some neuropathic pain postoperatively. Of all patients who provided preoperative responses, 77% selected at least one neuropathic pain term, with the most commonly noted words being numbness (54%), pins/needles (53%), allodynia (44%), and hot-burning pain (42%). In the

Table 1. *Demographics of patients at baseline.*

	Total cohort (n = 80)	Cohort with follow-up (n = 43)
Gender		
Men	58 (72%)	32 (74%)
Women	22 (28%)	11 (26%)
Side		
Left shoulder	42 (53%)	23 (53%)
Right shoulder	38 (47%)	20 (47%)
Duration of pain		
Less than 3 months	14 (17%)	9 (21%)
3-12 months	24 (30%)	12 (28%)
12 months	42 (53%)	22 (51%)
Shoulder pain result of work injury		
Yes	16 (20%)	9 (21%)
No	64 (80%)	34 (79%)
Work status		
Currently working	47 (59%)	24 (56%)
Not working due to shoulder pain	15 (19%)	8 (19%)
Not working due to other reasons	18 (23%)	11 (26%)
Litigation		
Yes	11 (14%)	3 (7%)
No	69 (86%)	40 (93%)
Diabetes		
Yes	7 (9%)	6 (14%)
No	74 (91%)	37 (86%)
Previous shoulder surgery		
Yes	13 (16%)	6 (14%)
No	67 (84%)	37 (86%)
Opioid use		
Yes	11 (14%)	6 (14%)
No	69 (86%)	37 (86%)
Smoker		
Yes	14 (18%)	4 (9%)
No	66 (82%)	39 (91%)
Ongoing pain		
Yes	38 (48%)	21 (49%)
No	42 (52%)	22 (51%)
Pain (VAS)		
Mean (standard deviation)	39.9 (26.6)	35.6 (26.6)
Median (interquartile range)	40 [18, 56.5]	32 [15,51]

(VAS= Visual Analog Scale)

Table 2. *Neuropathic pain prevalence at baseline and follow-up.*

Neuropathic Pain Prevalence	Full cohort	Cohort with follow-up	
	Pre-op (n = 81)	Pre-op (n = 43)	Post-op (n = 43)
PDQ Assessment:			
Nociceptive (1-12)	63 (78%)	35 (87%)	37 (86%)
Unclear (13-18)	14 (17%)	6 (14%)	5 (12%)
Likely (19-35)	4 (5%)	2 (4%)	1 (2%)
SF-MPQ-2 Assessment:			
Selection of > 1 neuropathic pain term	62 (77%)	33 (76%)	21 (49%)
Cold-Freezing	10 (12%)	4 (9%)	7 (16%)
Hot-Burning pain	34 (42%)	19 (44%)	12 (28%)
Pain caused by light touch	36 (44%)	21 (49%)	8 (19%)
Itching	13 (30%)	7 (16%)	8 (19%)
Tingling or Pins/Needles	43 (53%)	23 (53%)	12 (28%)
Numbness	44 (54%)	22 (51%)	11 (26%)

PDQ: PainDetect Questionnaire; SF-MPQ-2: Short-form McGill Pain Questionnaire 2

postoperative group, 21 (49%) patients selected at least one neuropathic pain term. For patients who provided both pre- and post-operative surveys, there was an overall decrease from pre- to post-operative in the number of patients selecting at least one word (33 to 21, respectively). Postoperative numbness and pins/needles were selected nearly half as frequently as preoperatively (22 to 11 and 21 to 12, respectively). Eight patients selected more neuropathic pain terms postoperatively than were selected preoperatively.

Patients had significantly lower pain scores, pain catastrophizing scores, and kinesiophobia scores postoperatively compared to preoperatively. Median pain scores decreased from 3 (interquartile range [IQR] = 2 to 5) to 1 (IQR = 0 to 2) ($P < 0.001$). Mean kinesiophobia scores per the TSK decreased from 40.44 (standard deviation [SD] = 5.94) to 35.40 (SD = 6.44) ($P < 0.001$). The median pain catastrophizing score per the PCS decreased from 7 to 2 ($P = 0.005$).

Greater preoperative pain was associated with greater postoperative pain (Spearman's $\rho = 0.34$, $P = 0.04$, n = 37). The higher the preoperative pain score, the greater the change (improvement) in postoperative pain (Spearman's $\rho = 0.62$, $P < 0.001$, n = 37). We did not find a significant relationship between the preoperative duration of shoulder pain and the level of postoperative pain (Spearman's $\rho = -0.005$, $P = 0.98$, n = 37).

Table 3. *Pre- to post-operative changes.*

	n	Preoperative	Postoperative	*P*-value
Pain, median [IQR]	37	3 [2,5]	1 [0,2]	< 0.001
painDetect, mean (SD)	20	8.00 (5.38)	8.62 (5.61)	0.42
TSK, mean (SD)	35	40.44 (5.94)	35.40 (6.44)	< 0.001
Catastrophizing, median [IQR]	31	7 [2,17]	2 [0,11]	0.005

(TSK= Tampa Scale of Kinesiophobia)

Neither tobacco use nor opioid use were found to be significantly associated with worse postoperative pain, but the number of opioid and tobacco users in this study was low. Median postoperative pain for those using opioids preoperatively was 2 (n = 5; IQR = 1 to 2), compared to 0 (n = 32; IQR = 0 to 1.5) for those who were not using opioids preoperatively (*P* = 0.77). Median postoperative pain for tobacco users was 2 (n = 3; IQR = 0 to 4), compared to 0.5 (IQR = 0 to 2) for nontobacco users (n = 34; *P* = 0.56).

Finally, higher preoperative scores in pain catastrophizing and kinesiophobia were both predictive of higher postoperative pain, though scores did not meet the threshold for the respective clinical diagnosis of catastrophizing or kinesiophobia. Higher pain catastrophizing scores at baseline were associated with increased postoperative pain (risk ratio[RR] = 1.05; 95% confidence interval [CI]: 1.01 to 1.08; *P* = 0.01). Likewise, higher kinesiophobia scores at baseline were associated with increased postoperative pain (RR = 1.09; 95%CI: 1.01 to 1.18; *P* = 0.03). No association was identified between baseline neuropathic pain scores and postoperative pain (*P* = 0.74) though it should be noted that baseline scores were below the threshold for neuropathic pain.

Discussion

We evaluated preoperative predictors of postoperative shoulder pain in adult patients undergoing nonarthroplasty shoulder surgery. Both pain catastrophizing and kinesiophobia were associated with higher levels of shoulder pain at approximately 3 months postoperative. In contrast, neuropathic pain was not associated with greater postoperative pain, though the prevalence of neuropathic pain was low. Not unexpectedly, higher preoperative pain was associated with higher postoperative pain. Reassuringly, a higher degree of preoperative pain was associated with greater improvement in pain from pre- to post-operative.

Previous studies have shown a relationship between pain catastrophizing and adverse postoperative results, including worse pain outcomes (53) and lower satisfaction (59) following hand/upper extremity surgery and carpal tunnel release as well as increased postoperative pain at the hip and knee (2). At the shoulder, studies have demonstrated an association between shoulder pain, in general, and attitudes toward pain, including catastrophizing and kinesiophobia (22). Anxiety and catastrophizing have been repeatedly associated with chronic postsurgical pain when considering all types of operations (21). Finally, the interaction of high pain catastrophizing scores and a genotype implicated in pain sensitivity has been shown to be predictive of higher postoperative pain ratings following arthroscopic shoulder surgery (60).

Our results suggest that pain catastrophizing and kinesiophobia are both valid predictors of prolonged pain following nonarthroplsty shoulder surgery. However, while catastrophizing scores significantly decreased from pre- to post-operative in our study population, scores were overall low with few patients exhibiting catastrophizing. In contrast, preoperative kinesiophobia scores were high and decreased postoperatively, though many patients still exhibited aspects of kinesiophobia with borderline scores at postoperative assessment.

Our results suggest that pain attitudes and beliefs are not fixed but may change over time with intervention. As such, high degrees of pain catastrophizing or kinesiophobia should not be considered contraindications to shoulder surgery. However, one might consider preoperative screening for catastrophizing and kinesiophobia to identify patients at risk for prolonged postoperative pain. The information presented here may aid in counseling patients regarding realistic expectations and highlight cohorts of patients who may benefit from interventions to optimize mental health prior to surgery. Additionally, providers may consider physical or psychological therapy, patient education, or pharmacological treatments aimed to decrease catastrophizing or kinesiophobia prior to undergoing surgical intervention. Additional research is needed to determine how attitudes and beliefs about pain are shaped and whether interventions may diminish the incidence of prolonged postoperative pain.

The prevalence of neuropathic pain was also low in our study cohort, with most patients exhibiting predominantly nociceptive pain. Only 5% of patients clearly exhibited preoperative neuropathic pain, and an additional 17% demonstrated an unclear component of neuropathic pain via PDQ. Although the SF-MPQ-2 is not designed to identify neuropathic pain, responses to this survey suggest an underlying component of neuropathic pain in a large portion of our cohort, with 77% of patients selecting at least one neuropathic pain term. Other studies concerned with neuropathic pain and rotator cuff tears found a higher prevalence of neuropathic pain than in our cohort (23,31). Our results suggest generally low levels of neuropathic pain in this population and improvement in neuropathic pain from pre- to postoperative. More studies are needed to determine the true prevalence of neuropathic pain in shoulder surgery candidates and whether the presence of neuropathic pain predicts greater postoperative pain.

Unsurprisingly, preoperative opioid use has been associated with a greater likelihood of postoperative opioid use following total shoulder arthroplasty (16,19) and arthroscopic shoulder surgery in general (18). Previous associations have been made between opioid use and both postoperative pain (16) and symptom burden (18). Higher preoperative pain and preoperative opioid use have both been associated with worse pain postoperatively (11). Nicholson et al (61) developed a risk calculator for prolonged postoperative opioid use after any shoulder surgery; significant factors included preoperative opioid use, body mass index, tobacco use, and psychiatric disorders. Our study did not demonstrate a significant relationship between opioid use and postoperative pain but, again, the number of patients in the opioid group was very small.

Tobacco use has been associated with a longer duration of postoperative opioid use after rotator cuff repair (37) and increased pain and greater opioid use after total shoulder arthroplasty (47). We did not find tobacco use to be significantly associated with postoperative pain but the number of patients in the tobacco group was very small. We also noted a paucity of workers' compensation cases, ongoing litigation, and absence from work due to shoulder pain which have been noted previously to be causes of chronic pain following surgery.

Mental health conditions and psychological distress have been associated with worse pain and shoulder outcomes pre- (9,13) and post-operatively (11,14,37,45,46,57,58) in patients undergoing shoulder surgery. Poor mental health has also been associated with a longer time to return to work postoperatively (7). In contrast, other authors have failed to find any significant association between preoperative stress or mood disorders and postoperative pain, complications, length-of-stay, shoulder outcome scores or improvement in pain (10,15,12). Regardless, multiple studies showing inferior outcomes for those with a preoperative psychological distress or mental health diagnosis nonetheless demonstrate meaningful improvement in pain and/or outcomes following shoulder surgery (8,11,14). Though we did not include measures of mental health in our study, our results add to the body of evidence that attitudes and beliefs interplay with perceived pain in surgical patients, based upon outcomes associated with catastrophizing and kinesiophobia.

Limitations

Our study has a number of limitations. This study was completed at a single institution; results are not necessarily generalizable. We included patients undergoing multiple types of shoulder operations performed by multiple surgeons, adding heterogeneity to our study, though we excluded patients undergoing total shoulder arthroplasty in an effort to homogenize results. Follow-up results were subpar: of those who completed preoperative surveys, only 25% to 46% completed postoperative questionnaires, depending on the specific survey; this may have introduced selection bias. We solely concerned ourselves with pain and did not attempt to otherwise quantify outcomes with shoulder-specific outcome scores, thus we cannot associate postoperative pain with functional outcomes. Finally, our sample size was relatively small which may have limited our capacity to determine statistical significance for predictors of relatively low prevalence, e.g., neuropathic pain, tobacco use, and opioid use.

Conclusion

In this prospective cohort study, we found that greater baseline kinesiophobia and baseline pain catastrophizing are predictive of greater postoperative pain following nonarthroplasty shoulder surgery in an adult population. We did not find a significant relationship between neuropathic pain and degree of postoperative pain. Pain, catastrophizing, and kinesiophobia scores all significantly decreased from pre- to post-operative in our study population. The results presented here may be used to provide tailored counsel to shoulder surgery candidates.

References

1. Johansen A, Romundstad L, Nielsen CS, Schirmer H, Eggen AE, Stubhaug A. Epidemiology of persistent postoperative pain: Association of persistent pain and sensory abnormalities. *Scand J Pain* 2010; 1:172-173.
2. Hernández C, Díaz-Heredia J, Berraquero ML, Crespo P, Loza E, Ruiz Ibán MÁ. Preoperative predictive factors of postoperative pain in patients with hip or knee arthroplasty: A systematic review. *Reumatol Clínica (English Ed)* 2015; 11:361-380.
3. Park JS, Park HJ, Kim SH, Oh JH. Prognostic factors affecting rotator cuff healing after arthroscopic repair in small to medium-sized tears. *Am J Sports Med* 2015; 43:2386-2392.
4. Shon MS, Koh KH, Lim TK, Kim WJ, Kim KC, Yoo JC. Arthroscopic partial repair of irreparable rotator cuff tears: Preoperative factors associated with outcome deterioration over 2 years. *Am J Sports Med* 2015; 43:1965-1975.
5. Jain NB, Ayers GD, Fan R, et al. Predictors of pain and functional outcomes after operative treatment for rotator cuff tears. *J Shoulder Elb Surg* 2018; 27:1393-1400.
6. Wylie JD, Baran S, Granger EK, Tashjian RZ. A comprehensive evaluation of factors affecting healing, range of motion, strength, and patient-reported outcomes after arthroscopic rotator cuff repair. *Orthop J Sport Med* 2018; 16:2325967117750104
7. Gowd AK, Cvetanovich GL, Liu JN, et al. Preoperative mental health scores and achieving patient acceptable symptom state are predictive of return to work after arthroscopic rotator cuff repair. *Orthop J Sports Med* 2019; 7:2325967119878415
8. Kennedy P, Joshi R, Dhawan A. The effect of psychosocial factors on outcomes in patients with rotator cuff tears: A systematic review. *Arthroscopy* 2019; 35:2698-2706.
9. Sahoo S, Ricchetti ET, Zajichek A, et al. Associations of preoperative patient mental health and sociodemographic and clinical characteristics with baseline pain, function, and satisfaction in patients undergoing rotator cuff repairs. *Am J Sports Med* 2020; 48:432-443.
10. Lonergan TM, Villarreal AD, Smith RA, Brolin TJ, Azar FM, Throckmorton TW. Mood disorders do not predict a more difficult course after primary anatomic total shoulder arthroplasty. *Curr Orthop Pract* 2019; 30:254-256.
11. Ravindra A, Barlow JD, Jones GL, Bishop JY. A prospective evaluation of predictors of pain after arthroscopic rotator cuff repair: Psychosocial factors have a stronger association than structural factors. *J Shoulder Elbow Surg* 2018; 27:1824-1829.
12. Potter MQ, Wylie JD, Granger EK, Greis PE, Burks RT, Tashjian RZ. One-year patient-reported outcomes after arthroscopic rotator cuff repair do not correlate with mild to moderate psychological distress. *Clin Orthop Relat Res* 2015; 473:3501-3510.
13. Cho CH, Seo HJ, Bae KC, Lee KJ, Hwang I, Warner JJP. The impact of depression and anxiety on self-assessed pain, disability, and quality of life in patients scheduled for rotator cuff repair. *J Shoulder Elbow Surg* 2013; 22:1160-1166.
14. Werner BC, Wong AC, Chang B, et al. Depression and patient-reported outcomes following total shoulder arthroplasty. *J Bone Joint Surg Am* 2017; 99:688-695.
15. Wong SE, Colley AK, Pitcher AA, Zhang AL, Ma CB, Feeley BT. Mental health, preoperative disability, and postoperative outcomes in patients undergoing shoulder arthroplasty. *J Shoulder Elbow Surg* 2018; 27:1580-1587.
16. Curtis W, Rounds AD, Stone M, et al. Effect of preoperative opioid usage on pain after total shoulder arthroplasty. *J Am Acad Orthop Surg* 2019; 27:E734-E742.
17. Hah JM, Cramer E, Hilmoe H, et al. Factors associated with acute pain estimation, postoperative pain resolution, opioid cessation, and recovery: Secondary analysis of a randomized clinical trial. *JAMA Netw Open* 2019; 2:e190168.
18. Lu Y, Beletsky A, Cohn MR, et al. Perioperative opioid use predicts postoperative opioid use and inferior outcomes after shoulder arthroscopy. *Arthroscopy* 2020; 36:2645-2654.
19. Berglund DD, Rosas S, Kurowicki J, Horn B, Mijic D, Levy JC. Preoperative opioid use among patients undergoing shoulder arthroplasty predicts prolonged postoperative opioid use. *J Am Acad Orthop Surg* 2019; 27:E691-E695.
20. Vranceanu AM, Barsky A, Ring D. Psychosocial aspects of disabling musculoskeletal pain. *J Bone Joint Surg Am* 2009; 91:2014-2018.
21. Theunissen M, Peters ML, Bruce J, Gramke HF, Marcus MA. Preoperative anxiety and catastrophizing: A systematic review and meta-analysis of the association with chronic postsurgical pain. *Clin J Pain* 2012; 28:819-841.
22. Martinez-Calderon J, Struyf F, Meeus M, Luque-Suarez A. The association between pain beliefs and pain intensity and/or disability in people with shoulder pain: A systematic review. *Musculoskelet Sci Pract* 2018; 37:29-57.
23. Ko S, Choi C, Kim S, Chae S, Choi W, Kwon J. Prevalence and risk factors of neuropathic pain in patients with a rotator cuff tear. *Pain Physician* 2018; 21:E173-E180.
24. Johansen A, Romundstad L, Nielsen CS, Schirmer H, Stubhaug A. Persistent postsurgical pain in a general population: Prevalence and predictors in the Tromsø study. *Pain* 2012; 153:1390-1396.
25. Dimitroulas T, Duarte RV, Behura A, Kitas GD, Raphael JH. Neuropathic pain in osteoarthritis: A review of pathophysiological mechanisms and implications for treatment. *Semin Arthritis Rheum* 2014; 44:145-154.
26. Melzack R. The McGill pain questionnaire: From description to measurement. *Anesthesiology* 2005; 103:199-202.
27. Dworkin RH, Turk DC, Revicki DA, et al. Development and initial validation of an expanded and revised version of the Short-form McGill Pain Questionnaire (SF-MPQ-2). *Pain* 2009; 144:35-42.
28. Lovejoy TI, Turk DC, Morasco BJ. Evaluation of the psychometric properties of the revised short-form McGill pain questionnaire. *J Pain* 2012; 13:1250-1257.
29. Freynhagen R, Baron R, Gockel U, Tölle TR. painDETECT: A new screening questionnaire to identify neuropathic components in patients with back pain. *Curr Med Res Opin* 2006; 22:1911-1920.
30. Freynhagen R, Baron R. The evaluation of neuropathic components in low back pain. *Curr Pain Headache Rep* 2009; 13:185-190.
31. Karasugi T, Ide J, Kitamura T, Okamoto N, Tokunaga T, Mizuta H. Neuropathic pain in patients with rotator cuff tears. *BMC Musculoskelet Disord* 2016; 17:451.
32. Goubert L, Crombez G, Van Damme

S, Vlaeyen JWS, Bijttebier P, Roelofs J. Confirmatory factor analysis of the Tampa Scale for Kinesiophobia: Invariant two-factor model across low back pain patients and fibromyalgia patients. *Clin J Pain* 2004; 20:103-110.

33. Sullivan MJL, Bishop SR, Pivik J. The Pain Catastrophizing Scale: Development and validation. *Psychol Assess* 1995; 7:524-532.
34. Ho JC, Kane L, Stone MA, Romeo AA, Abboud JA, Namdari S. Arthroscopic débridement of irreparable rotator cuff tears: Predictors of failure and success. *J Shoulder Elbow Surg* 2020; 29:e118-e123.
35. Van Linthoudt D, Deforge J, Malterre L, Huber H. Rotator cuff repair. Long-term results. *Joint Bone Spine* 2003; 70:271-275.
36. Woollard JD, Bost JE, Piva SR, Kelley Fitzgerald G, Rodosky MW, Irrgang JJ. The ability of preoperative factors to predict patient-reported disability following surgery for rotator cuff pathology. *Disabil Rehabil* 2017; 39:2087-2096.
37. Roberson TA, Azar FM, Miller RH, Throckmorton TW. Predictors of postoperative pain and narcotic use after primary arthroscopic rotator cuff repair. *Tech Shoulder Elb Surg* 2017; 18:20-24.
38. Karanjkar Y, Prabhu A, Vishal K. Correlation of handgrip strength to postoperative outcomes in rotator cuff repair: A preliminary report. *Muscles Ligaments Tendons J* 2019; 9:145-149.
39. Kim YS, Kang KH, Lee HJ. Factors related to pain in patients with retorn rotator cuffs: Early postoperative pain predicts pain at 12 months postoperatively. *Orthop J Sport Med* 2020; 8:2325967120947414.
40. Haviv B, Rutenberg TF, Yaari L, Khatib M, Rath E, Yassin M. Which patients are less likely to improve after arthroscopic rotator cuff repair? *Acta Orthop Traumatol Turc* 2019; 53:356-359.
41. Alsubheen SA, MacDermid JC, Overend TJ, Faber KJ. Predictors of clinical benefits and one-year functional outcomes following shoulder arthroplasty. *Iowa Orthop J* 2019; 39:69-75.
42. Chen RE, Papuga MO, Nicandri GT, Miller RJ, Voloshin I. Preoperative Patient-Reported Outcomes Measurement Information System (PROMIS) scores predict postoperative outcome in total shoulder arthroplasty patients. *J Shoulder Elbow Surg* 2019; 28:547-554.
43. Franovic S, Kuhlmann N, Schlosser C, Pietroski A, Buchta AG, Muh SJ. Role of preoperative PROMIS scores in predicting postoperative outcomes and likelihood of achieving MCID following reverse shoulder arthroplasty. *Semin Arthroplasty* 2020; 30:154-161.
44. Lung BE, Kanjiya S, Bisogno M, Komatsu DE, Wang ED. Preoperative indications for total shoulder arthroplasty predict adverse postoperative complications. *JSES Open Access* 2019; 3:99-107.
45. Menendez ME, Lawler SM, Ring D, Jawa A. High pain intensity after total shoulder arthroplasty. *J Shoulder Elbow Surg* 2018; 27:2113-2119.
46. Solberg MJ, Alqueza AB, Hunt TJ, Higgins LD. Predicting 1-Year postoperative visual analog scale pain scores and American Shoulder and Elbow Surgeons Function Scores in total and reverse total shoulder arthroplasty. *Am J Orthop (Belle Mead NJ).* 2017; 46:E358-E365.
47. Wells DB, Holt AM, Smith RA, Brolin TJ, Azar FM, Throckmorton TW. Tobacco use predicts a more difficult episode of care after anatomic total shoulder arthroplasty. *J Shoulder Elbow Surg* 2018; 27:23-28.
48. Parsons M, Routman HD, Roche CP, Friedman RJ. Preoperative external rotation deficit does not predict poor outcomes or lack of improvement after reverse total shoulder arthroplasty: External rotation and reverse shoulder outcomes. *J Orthop* 2020; 21:379-383.
49. Levy JC, Ashukem MT, Formaini NT. Factors predicting postoperative range of motion for anatomic total shoulder arthroplasty. *J Shoulder Elbow Surg* 2016; 25:55-60.
50. Collin P, Matsukawa T, Denard PJ, Gain S, Lädermann A. Preoperative factors influence the recovery of range of motion following reverse shoulder arthroplasty. *Int Orthop* 2017; 41:2135-2142.
51. Baettig SJ, Wieser K, Gerber C. Determinants of patient satisfaction following reconstructive shoulder surgery. *BMC Musculoskelet Disord* 2017; 18:458.
52. Rauck RC, Ruzbarsky JJ, Swarup I, et al. Predictors of patient satisfaction after reverse shoulder arthroplasty. *J Shoulder Elbow Surg* 2020; 29:e67-e74.
53. Alokozai A, Eppler SL, Lu LY, Sheikholeslami N, Kamal RN. Can patients forecast their postoperative disability and pain? *Clin Orthop Relat Res* 2019; 477:635-643.
54. Swarup I, Henn CM, Nguyen JT, et al. Effect of preoperative expectations on the outcomes following total shoulder arthroplasty. *Bone Joint J* 2017; 99B:1190-1196.
55. Desai VN, Cheung E V. Postoperative pain associated with orthopedic shoulder and elbow surgery: A prospective study. *J Shoulder Elbow Surg* 2012; 21:441-450.
56. Styron JF, Higuera CA, Strnad G, Iannotti JP. Greater patient confidence yields greater functional outcomes after primary total shoulder arthroplasty. *J Shoulder Elbow Surg.* 2015; 24:1263-1267.
57. Dambreville A, Blay M, Carles M, Hovorka I, Boileau P. Can the postoperative pain level be predicted preoperatively? *Rev Chir Orthop Reparatrice Appar Mot* 2007; 93:541-545.
58. Wong SE, Zhang AL, Berliner JL, Ma CB, Feeley BT. Preoperative patient-reported scores can predict postoperative outcomes after shoulder arthroplasty. *J Shoulder Elbow Surg* 2016; 25:913-919.
59. Mosegaard SB, Stilling M, Hansen TB. Pain Catastrophizing Scale as a predictor of low postoperative satisfaction after hand surgery. *J Orthop* 2020; 21:245-248.
60. George SZ, Wallace MR, Wright TW, et al. Evidence for a biopsychosocial influence on shoulder pain: Pain catastrophizing and catechol-O-methyltransferase (COMT) diplotype predict clinical pain ratings. *Pain* 2008; 136:53-61.
61. Nicholson AD, Kassam HF, Steele JL, Passarelli NR, Blaine TA, Kovacevic D. Development of a clinical risk calculator for prolonged opioid use after shoulder surgery. *J Shoulder Elbow Surg* 2019; 28:2225-2231.