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Original Research—CME

Older Age as a Prognostic Factor of Attenuated Pain Recovery After Shoulder Arthroscopy

Corey B. Simon, DPT, PhD, Joseph L. Riley III, PhD, Rogelio A. Coronado, PT, PhD, Carolina Valencia, PT, PhD, Thomas W. Wright, MD, Michael W. Moser, MD, Kevin W. Farmer, MD, Steven Z. George, PT, PhD

Abstract

Background: Shoulder pain and surgery are common among older adults. However, the extent to which older age affects recovery after shoulder surgery is not well understood.
Objective: To assess influence of older age on postoperative recovery factors 3 and 6 months after shoulder arthroscopy.
Design: Prospective cohort study.
Setting: University-affiliated outpatient orthopedic surgical center.
Patients: A convenience sample of 139 persons between 20 and 79 years of age who experienced shoulder pain, had musculoskeletal dysfunction based on imaging and physician assessment, and were scheduled for an arthroscopic shoulder procedure.
Main Outcome Measures: Postoperative outcomes were compared among younger, middle-aged, and older adults before surgery and at 3 and 6 months after surgery using analysis of variance modeling. Movement-evoked pain and an experimental laboratory correlate of pain processing were assessed at each time point. The influence of older age on 3- and 6-month pain outcomes were determined via multivariate regression analyses after accounting for preoperative, intraoperative, and postoperative prognostic factors.
Results: Older adults had higher movement-evoked pain intensity ($F_{2,108} = 5.18$, $P = .007$) and experimental pain response ($F_{2,111} = 7.24$, $P = .001$) at 3 months compared with young and middle-aged adults. After controlling for key prognostic factors, older age remained a positive predictor of 3-month movement-evoked pain ($R^2 = 0.05$; standardized [St.] $\beta = 0.263$, $P = .031$) and experimental pain response ($R^2 = 0.07$; St. $\beta = 0.295$, $P = .014$). Further, older age remained a positive predictor of movement-evoked pain at 6 months ($R^2 = 0.04$; St. $\beta = 0.231$, $P = .004$), despite no age group differences in outcome. Older age was found to be the strongest predictor of 3- and 6-month movement-evoked pain.
Conclusion: Older adults may experience more pain related to movement, as well as endogenous pain excitation, in the first few months after shoulder arthroscopy. Future age-related research should consider use of movement-evoked pain intensity and experimental pain response as pain outcomes, as well as the utility of such measures in clinical care.

Introduction

More than half of older adults experience some form of musculoskeletal pain [1-3]. Shoulder pain is particularly concerning because it affects up to 30% of community-dwelling adults older than 50 years [4,5]. Because pain is a major indicator for shoulder surgery [6,7], it is not surprising that shoulder surgical procedures among this population are also high [8]. Specifically, arthroscopic rotator cuff repair is reportedly more than 9 times higher in older adults compared with younger adults, and 10-year trends indicate a nearly 400% increase in shoulder surgery for seniors [9]. Moreover, the severity of rotator cuff disease and prevalence for affecting bilateral shoulders increases with age [10]. Despite these trends, age differences and age-related influence on postoperative shoulder pain recovery are poorly understood.

Older age is considered a prognostic factor of poor recovery for various postoperative recovery measures, including tendon healing [11,12] and functional recovery time [13]. In contrast, older age has not been associated with postoperative pain recovery [14]. However, few studies have been performed in this area, and limitations

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exist with regard to assessing pain postoperatively. First, the assessment time frame for pain recovery postoperatively is often greater than 1 year [14,15], despite the onset of chronic postoperative pain occurring between 2 and 6 months after surgery [16-18]. Few patients, if any, would consider 1 year as reasonable for experiencing pain relief. Second, such studies often use Likert-type subscales to categorize pain over time or in situations of rest, activity, and sleep. People report difficulty distinguishing pain intensity from decreased function with such scales [19], and research has identified less than optimum interscale correlation [20]. Visual analog scales (VAS) are also used; however, many older adults struggle with the VAS and/or the results do not correlate with other pain scales [21-23].

Movement-evoked pain and experimental pain response are 2 measures with potential for determining age-related influence on postoperative shoulder pain recovery. Movement-evoked pain is rated after the corresponding anatomic joint has been put in motion, which is important for orthopedic conditions given the relationship between movement and pain behavior. Moreover, movement-evoked pain is potentially more precise than pain recall measures because measurement is assessed in real-time. Movement-evoked pain is reportedly more intense than pain at rest and has different postoperative analgesic mechanisms, independent of age comparisons [24]. During experimental pain response testing, a standardized pain stimulus (eg, thermal and mechanical) is applied to the skin of a person to measure evoked pain intensity. The benefit of experimental pain response testing is that it is related to central pain processing [25,26], and previous research has found experimental pain response to be related to postoperative pain [27].

Therefore, the overall purpose of our study was to determine whether older age was a prognostic factor of pain recovery 3 and 6 months after shoulder arthroscopy. We first assessed how postoperative movement-evoked pain and experimental pain response differed among older adults compared with middle-aged and young adults. Although previous research in non-musculoskeletal conditions suggests that movement-evoked pain is similar across age groups [21], we anticipated that older adults would have higher movement-evoked pain given the relation of movement to an orthopedic condition like shoulder pain. Additionally, we anticipated that the experimental pain response would be higher in older adults compared with young adults based on previous laboratory findings [28]. Our second aim was to determine the extent to which older age uniquely predicted 3- and 6-month movement-evoked pain and experimental pain response after accounting for key prognostic factors. Because age adversely influences other aspects of postoperative recovery, we anticipated similar findings using the enhanced pain measures previously described.

Methods

Study Cohort

Data originated from a sample of persons with shoulder pain scheduled for shoulder arthroscopy at a university-affiliated outpatient orthopedic surgical center from February 2009 to May 2012. Inclusion criteria were age between 20 and 79 years; pain limited to the anterior, lateral, or posterior shoulder; a diagnosis of musculoskeletal dysfunction based on imaging and physician assessment; and having been scheduled for an arthroscopic shoulder procedure. Exclusion criteria included pain greater than 3 months in another anatomic region; prior shoulder surgery within the past year; shoulder-related fracture, tumor, or infection; current or previous chronic pain disorder diagnosis; current psychiatric management; and gastrointestinal or renal illness. This study was approved by the University of Florida Institutional Review Board.

Participants reported shoulder pain duration and intensity, shoulder disability level, and current medications. Physical testing assessed movement-evoked pain and experimental pain response. Participants then underwent shoulder arthroscopy and returned 3 and 6 months postoperatively to re-collect information provided preoperatively, as well as to reassess pain outcome measures.

Pain Outcome Measures

Movement-Evoked Pain Intensity

Patients were instructed to elevate their arm in the frontal plane (ie, shoulder abduction) as high as possible and to rate pain intensity at their highest point. A 101-point numeric pain rating scale (NPRS) was used for this task ("No pain" = 0 and "Worst pain intensity imaginable" = 100). The 101-point NPRS has been determined to be a valid and sensitive rating scale for assessing musculoskeletal pain [29], and the NPRS is reportedly the preferred postoperative rating scale across age groups [30]. Although (to our knowledge) movement-evoked pain has not been examined specifically for age group differences in a cohort undergoing shoulder surgery, similar measures have been assessed across age groups for other surgical conditions [21]. Moreover, movement-evoked pain has been used to examine recovery from knee total arthroplasty, which is an age-related surgical condition [24]. Shoulder abduction was used because it is a predominant motion of pain and/or risk factor of shoulder pain [31,32].

Experimental Pain Response

Experimental pain response was assessed using a temporal summation of second pain protocol. A train of 5 heat pulses of the same temperature (50°C) were applied to the thenar eminence of the hand on the involved extremity for 0.5 seconds (a 2.5-second interpulse interval) using a 2.5 cm^2 surface area thermode connected to a PATHWAY Model Advanced Thermal Stimulator (Medoc Advanced Medical Systems, Ramat Yishai, Israel). Using the NPRS, participants rated intensity of the second pain experienced after initial heat at each pulse, which is the pain experienced after the initial onset of heat. Pain rating after the first pulse was then subtracted from pain rating after the fifth pulse to determine pain intensity change over the 5-pulse train. Increased pain intensity change is considered a temporal summation of second pain, which has been associated with central pain processing [25,26,33]. Notably, median nerve involvement for carpal-tunnel syndrome was not assessed in our participants. However, this test is more specific to pain facilitation originating from c-nociceptive fibers, which have not been found to correlate with diagnostic carpal-tunnel syndrome symptomatology [34].

Covariates

Demographics

Patients provided information pertaining to age, gender, and pain duration preoperatively. Participants were *a priori* categorized to young (20-39 years), middle-aged (40-59 years), or older (60-79 years) age groups for purposes of the planned data analyses. We included a middle-aged group based on previous epidemiologic findings of peak pain intensity during middle age [35] and identified differences in endogenous pain sensitivity and modulation found among middle-aged adults [36,37]. Pain duration was measured in the amount of symptom weeks from onset until the preoperative session.

Pain Catastrophizing

Pain catastrophizing is an exaggerated negative response to a painful experience [38]. Preoperative pain catastrophizing has been found be a consistent factor influencing postoperative pain and/or disability [39-42]. In this study, we used the Pain Catastrophizing Scale, which consists of 13 items and a total score ranging from 0 to 52 (higher scores indicate higher pain catastrophizing).

Intraoperative and Postoperative Factors

We accounted for the potential influence of arthroscopic procedures as determined by intraoperative report. Participants were dichotomously coded (yes, no) regarding whether they underwent acromion, biceps, bursa, capsular, chondral, labral, or rotator cuff tear (RCT) procedures. Further, although RCT severity has not been found to predict postoperative pain [14,43,44], RCT procedures are reported to be the most painful of shoulder surgeries [45]. Therefore, we also assessed the invasiveness of the procedure (eg, debridement and repair) as a covariate.

The potential for analgesic medication to influence postoperative pain was also accounted for. For the purpose of this study, analgesic medication was any drug deemed a peripheral analgesic, nonsteroidal anti-inflammatory drug, or opioid agent. At 3 and 6 months, patients provided a medication list that was then categorized by a single rater.

Statistical Analysis

Analyses were completed using IBM SPSS Statistics software, version 21 (IBM Corp, Armonk, NY). The α level was set at 0.05 for all statistical tests. Univariate analysis of variance modeling was used to examine preoperative group differences in continuous predictors (pain duration and pain catastrophizing) and outcome measures preoperatively and 3 and 6 months postoperatively (movement-evoked pain and experimental pain response). Further, repeated measures analysis of variance assessed changes in movement-evoked pain preoperatively to postoperatively and whether an age group by time interaction existed. To account for unequal sample size and potential variance heterogeneity across groups, differences were confirmed using the Brown-Forsythe test. Further, Bonferroni correction was used to assess simple effects because it is considered a more conservative post-hoc measure. χ^2 analyses were used to assess preoperative group differences in categorical predictors (eg, gender, arthroscopic procedure, and analgesic medication use).

Influence of age group on movement-evoked pain and experimental pain response were examined using separate simple ordinary least squares regression models at each time point. First, crude estimates were derived using simple regression. A similar analysis was also performed to assess the influence of arthroscopic procedure on postoperative movement-evoked or experimental pain. Factors demonstrating an association at $P < .10$ were then adjusted for age. Any factor maintaining association with postoperative outcomes after age adjustment was then entered in all final hierarchical multiple regression models at each corresponding time point.

Final predictive models assessed age group influence after accounting for prognostic factors preoperatively (eg, preoperative movement-evoked pain, pain duration, and pain catastrophizing), intraoperatively (eg, arthroscopic procedure), and postoperatively (eg, analgesic medication use). For each model, preoperative, intraoperative, and postoperative prognostic factors were entered in the first block, whereas dummy-coded age groups were entered in the second block. To prevent multicollinearity within the models [46], *a priori* cut-off rules were established for factor intercorrelation ($r = 0.70$), tolerance (0.20), and variance inflation (4).

Results

One hundred thirty-nine persons with shoulder pain underwent shoulder arthroscopy. A description of preoperative characteristics of older adults (n = 30) and comparison with young (n = 57) and middle-aged (n = 52) adults are presented in Table 1. Age groups did not differ on pain duration or pain catastrophizing. Preoperatively, movement-evoked pain and experimental pain response did not differ between older and middle-aged adults or older and young adults ($P > .05$; Figures 1 and 2). However, preoperative movement-evoked pain was higher among middle-aged adults compared with younger adults ($F_{2,137} = 4.48$, $P = .013$).

Frequency of acromion ($\chi^2_{(2,\ N\ =\ 109)} = 22.22$, $P < .001$), biceps ($\chi^2_{(2,\ N\ =\ 109)} = 10.45$, $P = .001$), bursa ($\chi^2_{(2,\ N\ =\ 109)} = 32.03$, $P < .001$), labral ($\chi^2_{(1,\ N\ =\ 109)} = 18.32$, $P < .001$), and RCT ($\chi^2_{(1,\ N\ =\ 109)} = 27.78$, $P < .001$) procedures differed for younger adults compared with middle-aged adults. Acromion ($\chi^2_{(1,\ N\ =\ 87)} = 32.20$, $P < .001$), biceps ($\chi^2_{(1,\ N\ =87)} = 36.11$, $P < .001$), bursa ($\chi^2_{(1,\ N\ =\ 87)} = 22.90$, $P < .001$), labral ($\chi^2_{(1,\ N\ =\ 87)} = 18.05$, $P < .001$), and RCT ($\chi^2_{(1,\ N\ =\ 87)} = 29.18$, $P < .001$) procedures also differed between younger and older adults. Between middle-aged and older adults, a difference existed in the frequency of biceps procedures ($\chi^2_{(1,\ N\ =\ 82)} = 10.67$, $P = .002$).

At 3 months, frequency of analgesic medication differed between younger and middle-aged adults, ($\chi^2_{(2,\ N\ =86)} = 10.15$, $P = .003$) and younger and older adults ($\chi^2_{(2,\ N\ =\ 75)} = 5.63$, $P = .025$). At 6 months, frequency of analgesic medication differed between younger and older adults ($\chi^2_{(2,\ N\ =\ 70)} = 7.88$, $P = .007$) and middle-aged and older adults ($\chi^2_{(1,\ N\ =\ 64)} = 5.69$, $P = .029$). Frequency distribution for arthroscopic procedure and analgesic medication are provided in Table 1.

Arthroscopic Procedure Influence on Postoperative Outcomes

Unadjusted influence of arthroscopic procedures are presented in Table 2. At 3 months, only RCT invasiveness influenced movement-evoked pain after adjusting for age (RCT debridement, $R^2 = 0.05$, $P = .016$). Arthroscopic procedures did not influence 3-month experimental pain after adjusting for age ($P > .05$). At 6 months, and after adjusting for age, only capsular procedure influenced movement-evoked pain-intensity ($R^2 = 0.04$, $P = .043$), whereas no arthroscopic factor influenced experimental pain ($P > .05$).

Age Group Differences and Influence on Postoperative Movement-Evoked Pain

No age × time interaction existed for movement-evoked pain preoperatively to 3 months postoperatively ($P > .05$). However, at 3 months, older adults had higher movement-evoked pain compared with young and middle-aged adults ($F_{2,108} = 5.18$, $P = .007$; Figure 1). The final predictive model accounted for 20.7% of the variance in 3-month movement-evoked pain. After controlling for preoperative, intraoperative, and postoperative prognostic factors, older age accounted for approximately 5% of additional variance and was the strongest predictor (standardized [St.] $\beta = 0.263$, $P = .031$) of 3-month movement-evoked pain (Table 3).

No age × time interaction existed for movement-evoked pain preoperatively to 6 months postoperatively ($P > .05$), and 6-month movement-evoked pain did not differ across age groups (Figure 1). The final predictive model accounted for 17.5% of the variance in 6-month movement-evoked pain. After controlling for preoperative, intraoperative, and postoperative

Table 1
Demographic and prognostic factors by age group

	Young (n = 57)	Middle (n = 52)	Older (n = 30)	*P* Value
Mean age, y (SD)	27.60 (5.90)	49.52 (5.39)	67.27 (5.36)	
Pain duration, wk (SD)	47.30 (54.85)	88.44 (129.43)	71.29 (93.89)	.071
Pain catastrophizing (SD)	11.12 (9.06)	12.17 (9.29)	8.06 (6.83)	.127
Female (%)	28	40	37	.397
Procedure (%)				
Acromion	18	62	80	**<.001**
Biceps	2	21	57	**<.001**
Bursa	16	69	67	**<.001**
Capsular	7	12	13	.588
Chondral	18	6	20	.106
Labral	88	50	45	**<.001**
Rotator cuff	18	67	77	**<.001**
Analgesic medication (%)				
3 mo	10	39	32	**.005**
6 mo	18	21	50	**.009**

Values for mean age, pain duration, and pain catastrophizing represent mean differences by age group preoperatively. Pain duration = shoulder pain in weeks; pain catastrophizing = total score on Pain Catastrophizing Scale; procedure = yes/no per intraoperative report; analgesic medication = peripheral analgesic, nonsteroidal anti-inflammatory drug, or opioid agent taken at time of follow-up (3, 6 mo). Significant predictors are in bold type.

SD = standard deviation.

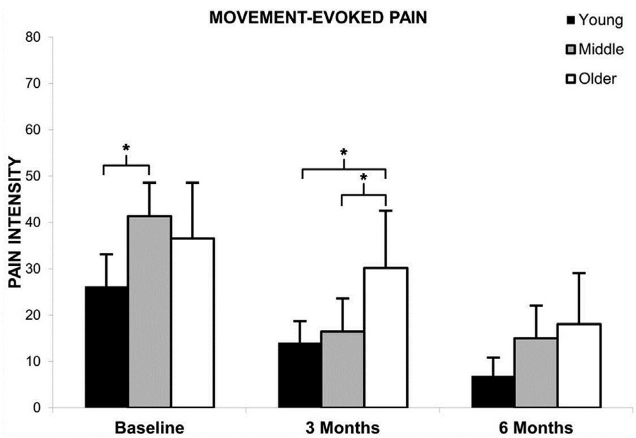

Figure 1. Age group differences in movement-evoked pain. Baseline = preoperative measures; 3 months = 3-month postoperative measures; 6 months = 6-month postoperative measures. Brackets with asterisks signify group differences ($P < .05$); error bars represent 95% confidence intervals; pain intensity = pain at end-range shoulder abduction on a 0-100 numeric pain rating scale.

prognostic factors, older age accounted for approximately 4% of additional variance and was the strongest predictor (St. $\beta = 0.231$, $P = .040$) of 6-month movement-evoked pain (Table 4).

Age Group Differences and Influence on Postoperative Experimental Pain

Older adults had higher experimental pain response compared with young and middle-aged adults ($F_{2,111} = 7.24$, $P = .001$) at 3 months (Figure 2). The final predictive model accounted for 20.2% of the variance in 3-month experimental pain response. After controlling for preoperative, intraoperative, and postoperative

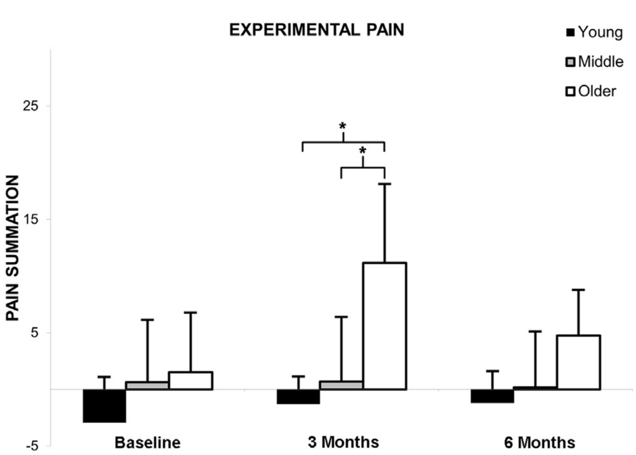

Figure 2. Age group differences in experimental pain. Baseline = preoperative measures; 3 months = 3-month postoperative measures; 6 months = 6-month postoperative measures. Brackets with asterisks signify group differences ($P < .05$); error bars represent 95% confidence intervals; pain summation = pain intensity change (0-100 numeric pain rating scale) between first heat pulse and fifth heat pulse over a 5-pulse train. A positive score is considered temporal summation of second pain or enhanced central pain excitation.

Table 2
Arthroscopic procedural influence on postoperative outcomes

Outcome	3 Months R^2	6 Months R^2
Movement pain		
Procedure (Y/N)		
Acromion	<0.001	0.004
Biceps	0.008	0.042**
Bursa	<0.001	0.033*
Capsular	0.001	0.049**
Chondral	<0.001	<0.001
Labral	<0.001	0.050**
Rotator cuff	<0.001	0.002
Surgical invasiveness		
Rotator cuff debridement	0.027*	0.002
Rotator cuff repair	0.027*	0.007
Experimental pain		
Procedure (Y/N)		
Acromion	0.033*	0.006
Biceps	0.044**	0.053**
Bursa	0.023	0.014
Capsular	0.001	<0.001
Chondral	0.004	0.001
Labral	<0.001	0.002
Rotator cuff	0.027*	0.053**
Surgical invasiveness		
Rotator cuff debridement	0.001	<0.001
Rotator cuff repair	0.026	0.070***

R^2 = unadjusted estimates.
* $P < .10$; ** $P < .05$; *** $P < .01$.

prognostic factors, older age remained a significant predictor and accounted for approximately 7% of additional variance in 3-month experimental pain response (St. $\beta = 0.295$, $P = .014$) (Table 3).

At 6 months, experimental pain response did not differ across age groups (Figure 2). The final predictive model accounted for 17.3% of the variance in 6-month experimental pain response; however, older age was not a predictor after accounting for preoperative experimental pain response, demographics, and covariates (Table 4).

Discussion

Older adults have increased prevalence of shoulder pain and surgery, yet the impact of older age on postoperative pain outcomes is poorly understood. This study assessed age group differences and influence using measures and a time frame better suited for assessing postoperative pain recovery. First, older adults reported higher pain ratings 3 months after surgery. Further, older age adversely influenced pain recovery at 3 and/or 6 months. Despite variance explained by older age being small (~4%-7%), prediction was above and beyond pre-established prognostic factors such as preoperative pain, demographics, and covariates including psychological distress (pain catastrophizing), surgery type, and postoperative analgesic medication use. More importantly, older age was in

Table 3
Influence on 3-month postoperative outcomes

	Movement Pain*		Experimental Pain†	
Prognostic Factor	β	*P* Value	β	*P* Value
A				
Middle age (40-59 y)‡	0.052	.604	0.066	.501
Older age (60-79 y)‡	**0.314**	**.002**	**0.362**	**< .001**
B				
Preoperative movement pain	**0.256**	**.015**		
Preoperative experimental pain			**0.285**	**.003**
Gender¶	**−0.208**	**.032**	0.076	.421
Pain duration	0.062	.508	−0.009	.920
Pain catastrophizing	0.053	.577	−0.026	.787
RTC debridement	−0.154	.138	−0.004	.972
RTC repair	0.054	.640	0.001	.995
Analgesic medication	−0.064	.531	0.055	.575
Middle age (40-59 y)	0.023	.848	0.015	.901
Older age (60-79 y)	**0.263**	**.031**	**0.295**	**.014**

A = Crude estimate of age group influence on outcomes; B = age group influence after accounting for prognostic factors.
Significant predictors are in bold type.
* R^2 final model (*P* value) for A: **.088 (.007)** and for B: **.207 (.005)**.
† R^2 final model (*P* value) for A: **.117 (< .01)** and for B: **.202 (.007)**.
‡ Compared with young adults (20-39 y).
¶ Gender coded as 0 for male, 1 for female.

many cases the strongest predictor of postoperative pain.

Postoperative nonmusculoskeletal surgery studies have reported age to be a negative pain predictor, meaning that younger adults are actually at risk for experiencing a higher level of pain [47,48]. Further, the recent systematic review of prognostic factors of RTC repair recovery by Fermont et al [14] did not find age to influence pain outcomes. These previous findings would suggest that postoperative pain is less of an issue for older adults. However, prior examination in shoulder surgery studies may not have been conducive for assessing age influence on pain, given the longer study follow-up time. Second, prior psychometric assessment of pain in aging has highlighted difficulty in measuring pain among older adults, often because of the outcome measure itself [21,22]. In contrast, movement evoked-pain appears to be a better measure to assess age group differences and prognostic influence. Moreover, movement-evoked pain in conjunction with an NPRS may be more ideal for older adults, because previous research has found no age group differences in post-operative movement-evoked pain when alternative metrics (eg, VAS) were used [21].

Table 4
Influence on 6-month postoperative outcomes

	Movement Pain*		Experimental Pain†	
Prognostic Factor	β	*P* Value	β	*P* Value
A				
Middle age (40-59 y)‡	0.196	.070	0.057	.593
Older age (60-79 y)‡	**0.241**	**.026**	**0.217**	**.045**
B				
Preoperative movement pain	0.150	.160		
Preoperative experimental pain			0.281	.005
Gender¶	0.025	.801	0.177	.082
Pain duration	−0.026	.790	0.057	.561
Pain catastrophizing	**0.199**	**.044**	−0.191	.056
Capsular procedure	0.151	.150	−0.032	.760
Analgesic medication	−0.035	.728	−0.111	.295
Middle age (40-59 y)	0.162	.145	0.008	.944
Older age (60-79 y)	**0.231**	**.040**	0.162	.157

A = crude estimate of age group influence on outcomes; B = age group influence after accounting for prognostic factors.
Significant predictors are in bold type.
* R^2 final model (*P* value) for A: .056 (.054) and for B: **0.175 (.015)**.
† R^2 final model (*P* value) for A: .040 (.127) and for B: **0.173 (.021)**.
‡ Compared with young adults (20-39 y).
¶ Gender coded as 0 for male, 1 for female.

The differential influence of older age on experimental pain response is particularly important because it is an indirect indication of central pain processing. Experimental pain stimuli are standardized such that changes in pain response can be assessed for the presence of abnormal pain excitation and/or pain inhibition. Previous research in this area has elucidated enhanced pain excitation [49,50] and decrement in pain inhibition [51-53] among older adults compared with young adults. Based on these findings, Lautenbacher [28] proposed an imbalance between endogenous excitatory and inhibitory processes, which creates an excitatory state and increased pain predisposition with age. In other words, the inhibitory capacity of older adults changes so that they are in constant state of pain excitation. Perhaps this imbalance is heightened postoperatively, predisposing older adults to an excitatory state in the months after shoulder surgery. Three-month postoperative convergence of higher movement-evoked pain and experimental pain response strengthens this argument and suggests that attenuated pain recovery is a legitimate concern when treating older adults. Although it is not currently used as an age-related postoperative recovery measure, experimental pain response may be considered for future studies.

Limitations should be considered when interpreting findings and when developing future trials. First, age group differences were only assessed at 2 postoperative time points. The most significant age differences in pain occurred at 3 months; however, assessing pain at multiple time points around 3-month follow-up may better elucidate the course of pain recovery as it pertains to age. We also accounted for potential influence of arthroscopic procedure but not the cumulative effects of these procedures. Ascertaining the extent to which concomitant procedures are additive in their influence on postoperative outcomes is a future priority. Similarly, this study accounted for RCT invasiveness and actually found the less invasive procedure (debridement) to influence postoperative movement-evoked pain after adjusting for age. However, we also note that a greater frequency of middle-aged and older adults underwent RCT procedures than did younger adults and that the study was not powered to test 3-way interactions. Future work will determine whether age moderates the influence of surgical procedure invasiveness on postoperative outcomes. Finally, information pertaining to minimal clinically important difference in postoperative movement-evoked pain is currently lacking and should be explored in future studies.

Conclusion

Movement-evoked pain intensity and experimental pain response were higher among older adults compared with young adults after shoulder arthroscopy. Older age uniquely contributed to pain outcomes even after accounting for other prognostic factors. Collectively, these findings highlight the importance of older age as a prognostic factor of postoperative pain recovery. Future age-related postoperative studies should consider movement-evoked pain intensity and experimental pain response for measuring pain, given the challenges in measuring pain among older adults.

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Disclosure

C.B.S. Department of Physical Therapy, College of Public Health and Health Professions, University of Florida, 2004 Mowry Rd, PO Box 100242, Gainesville, FL 32610; Pain Research & Intervention Center of Excellence, University of Florida, Gainesville, FL. Address correspondence to: C.B.S.; e-mail: coreysimon@phhp.ufl.edu
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J.L.R. Pain Research & Intervention Center of Excellence, University of Florida, Gainesville, FL
Disclosures outside this publication: grant/grants pending, NIH (money to institution)

R.A.C. Department of Orthopaedic Surgery and Rehabilitation, Vanderbilt University, Nashville, TN
Disclosure: nothing to disclose

C.V. Department of Applied Medicine and Rehabilitation, Indiana State University, Terre Haute, IN
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T.W.W. Department of Orthopaedics and Rehabilitation, University of Florida, Gainesville, FL
Disclosures related to this publication: grant, NIH (money to institution)

M.W.M. Department of Orthopaedics and Rehabilitation, University of Florida, Gainesville, FL
Disclosures outside this publication: consultancy, Arthrex, Inc (money to author)

K.W.F. Department of Orthopaedics and Rehabilitation, University of Florida, Gainesville, FL
Disclosures outside this publication: consultancy, Arthrex, Inc, Exactech, Inc (money to author)

S.Z.G. Department of Physical Therapy, College of Public Health and Health Professions, University of Florida, 2004 Mowry Rd, PO Box 100242, Gainesville, FL 32610; Pain Research & Intervention Center of Excellence, University of Florida, Gainesville, FL
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CME Question

This article explores pain after shoulder surgery, a common procedure in older adults. The study found that older age was a predictor of higher pain at 6 months post procedure depending on the:

a. Type of surgical procedure performed
b. Pain duration preoperatively
c. Experimental pain response
d. Movement-evoked pain intensity

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