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Innovative patient education and pain management protocols to achieve opioid-free shoulder arthroplasty

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Background: The creation of pain as the fifth vital sign led to skyrocketing opioid prescriptions and a crisis with addiction and abuse among Americans. The purpose of this study was to evaluate the effectiveness of a patient engagement model including education and innovative opioid-free multimodal pain management to achieve an opioid-free recovery after shoulder arthroplasty (SA).

Methods: Fifty patients undergoing SA were divided into 2 groups. In the opioid-free group (OFG), patients received additional preoperative education in combination with an innovative non-opioid multimodal pain management protocol and non-opioid alternatives. Patients were compared regarding pain levels and opioid consumption at 48 hours and at 2 weeks, as well as patient-reported outcome measures, using Student *t* tests.

Results: No significant differences were found in age (average, 69.76 years) ($P = .14$), American Society of Anesthesiologists grade (average, 2.25) ($P = .24$), sex, body mass index (average, 29.5) ($P = .34$), or comorbidity burden. In the OFG, 24% of patients reported use of rescue opioids (<2 pills) within the first 48 hours after surgery with complete cessation by 2 weeks postoperatively. Comparatively, in the control group, 100% of patients reported using opioids in the first 48 hours after surgery and 80% reported still taking opioids at 2 weeks postoperatively. Patients in both groups showed significant improvements in outcome scores ($P \leq .05$), with the OFG reporting significantly higher American Shoulder and Elbow Surgeons pain ($P = .036$) and Constant ($P = .005$) scores.

Conclusions: Our findings support complete elimination of opioid use by 2 weeks after SA using a patient engagement model with non–opioid-based alternative pain management. The elimination of opioid pain management did not diminish outcomes or patient satisfaction after SA.

Since the institution of pain as the fifth vital sign in the 1990s, physicians have been pressured to aggressively treat pain, which has led to an increase in opioid prescriptions and abuse in the United States. Prior research has shown that nearly 50% of patients are discharged with a prescription for opioids after surgery.[6] Because of these high prescribing rates, the United States today is in an opioid crisis, consuming 80% of the world's opioids while making up only 4.6% of the world's population.[10] In 2016 alone, over 236 million opioid prescriptions were written, enough for each American adult to have his or her own bottle of pills.[22] Because of this skyrocketing use, at present over 130 Americans are dying each day from opioid-related overdoses; it is notable that fewer persons were dying daily during the height of the Vietnam War.[8]

Orthopedic surgeons are among the top prescribers of opioids mainly because of their effectiveness and convenience in controlling postoperative pain, which has been considered the current standard of care.[20] After just 1 month, however, consumption of opioids can alter the nervous system, and once opioid use is prolonged in postoperative patients, this has been shown to lead to increased rates and risks of opioid dependence in these orthopedic surgery patients.[1,4–6,12,15,21,24] This concern for dependence provides a challenge for adequate pain control after orthopedic procedures, especially in patients who are taking opioids prior to surgery. In particular, it has been shown that total and reverse shoulder arthroplasty patients with prior use of opioids for pain control had higher pain levels, increased opioid consumption, and increased complication rates.[4,5,11,12,21] In addition, up to 30% of patients report misusing opioids.[6,19] With these high rates of

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misuse and dependence, orthopedic surgeons must recognize the risk of opioid use by patients postoperatively.

In light of the crisis, several studies have been performed to assess potential tools to decrease demand for opioids while still providing adequate pain control after surgery. One common strategy has been multimodal pain management typically integrating non-opioid medications and regional anesthesia. Recent total joint arthroplasty studies have proved multimodal treatment to be effective in controlling pain with decreased use of opioids.[2,3] Another successful method reported previously is preoperative education using videos to provide patients with more realistic expectations of postoperative pain, which significantly reduced opioid consumption.[14,16,18] In terms of complete elimination of opioids, one feasibility study reported opioid-free postoperative care after shoulder arthroplasty.[9] Low pain scores were found within the first 2 weeks using alternative non-opioid pain medications. The purpose of our study was to evaluate whether patient education combined with multimodal pain management would be more successful than traditional postoperative pain management in achieving an opioid-free postoperative recovery after shoulder arthroplasty.

Methods

Patient cohort and demographic data

This prospective case-control study included 50 patients undergoing consecutive shoulder arthroplasty performed by a fellowship-trained surgeon from 2017-2018 at a single institution. Patients were included in the study if older than 18 years and undergoing primary shoulder arthroplasty. The exclusion criteria included a history of opioid, alcohol, or drug dependence; a history of medical conditions that were contraindications to the protocol; revision arthroplasty surgery; pregnancy; and any cognitive or psychiatric condition inhibiting the ability to provide informed consent. Demographic data collected included age, sex, body mass index (BMI), American Society of Anesthesiologists (ASA) class, anatomic or reverse arthroplasty, medical and psychiatric comorbidity burden, smoking status, and prior opioid use. All patients' reported opioid use was recorded and verified with state prescription drug–monitoring websites. Preoperative opioid dependence was defined by 3 or more continuous opioid prescriptions in the 3-month period leading up to surgery.[7]

Intervention

Patients enrolled in the study were divided into 1 of 2 groups: the opioid-free group (OFG) and the group undergoing the standard postoperative protocol (control group [CG]). Of the patients, 25 were included in the intervention group (ie, OFG) and 25 were included in the CG. Patients in the intervention group were provided with educational materials on alternative pain management protocols, as well as discharge instructions detailing the opioid crisis, postoperative alternative nonopioid medications, and pain management plan. Patients were counseled by a member of the research team on pain expectations after surgery, non-opioid alternatives to control pain, and over-the-counter analgesics for pain relief. The CG underwent standard preoperative assessments and multimodal pain management postoperatively with standard postoperative opioid prescriptions.

All surgical procedures were performed by a single fellowship-trained shoulder surgeon at the same facility. Standardized surgical implants and techniques were used for all patients enrolled in the study, and patients underwent either an anatomic or reverse arthroplasty, as indicated. All patients received a multimodal pain management protocol consisting of gabapentin, acetaminophen, and an ultrasound-guided interscalene block with 0.5% ropivacaine preoperatively, followed by intraoperative Decadron (Merck & Co., Inc. Whitehouse Station, NJ, USA), ketorolac, and local infiltration of liposomal bupivacaine if no contraindications were noted. Intervention patients were instructed on discharge to take oral ketorolac and scheduled acetaminophen for 48 hours and to subsequently take scheduled oral acetaminophen and ibuprofen as needed for pain. All patients were also given a prescription for oxycodone with Tylenol (McNeil Consumer Healthcare, Fort Washington, PA, USA) (Percocet; Endo Pharmaceuticals Inc., Dublin, Ireland) for breakthrough pain.

Opioid use and outcomes

Patient demographic information was collected for the entire cohort, including age, sex, BMI, ASA class, smoking status, and comorbidity burden. Patient-reported opioid consumption including dose, type of opioid, and quantity of pills and visual analog scale (VAS) pain scores were recorded at 24 hours, 48 hours, and 2 weeks postoperatively. All patient-reported opioid consumption was converted into total oral morphine equivalents using standard conversion factors as characterized by the Consortium to Study Opioid Risks and Trends. Outcome variables were collected via phone follow-up at 48 hours and at routine follow-up office visits at 2 weeks, 6 weeks, and 3 months postoperatively. Patient-reported outcome measures were collected at all follow-up visits, including the Penn Shoulder Score (PENN), American Shoulder and Elbow Surgeons (ASES) shoulder score, and Subjective Shoulder Value.

Statistical analysis

Power analyses based on previous studies using the area under the curve for a VAS were performed.[17] Predicting detection of a 30% difference with a power greater than 80% and a significance level of .05, a minimum of 25 patients would be needed in each comparison group. All analyses were performed using comparisons between the OFG and CG. Continuous variables were summarized using descriptive statistics, whereas categorical parameters were summarized using the number and percentage of subjects. Student t tests and χ^2 analyses were used to analyze demographic differences and to compare opioid consumption rates, as well as outcome scores, between groups. All statistic analyses were performed using SPSS software (IBM SPSS Statistics for Mac, version 23.0; IBM, Armonk, NY, USA).

Results

Of the 50 patients enrolled, 24 were women and 26 were men; the average age was 69.8 years, with no significant differences between groups ($P = .14$). The average ASA class was 2.25 and average BMI was 29.5, with no differences found between groups ($P = .24$ and $P = .34$, respectively) (Table I). No differences in rates of diabetes, hypertension, morbid obesity, smoking status, or psychiatric comorbidities were noted between groups ($P > .05$) (Table I). No patients in either group were preoperatively dependent on opioid medications.

At baseline, no significant differences in reported pain scores were found between groups; the OFG had an average VAS score of 5.48 compared with 6.17 in the CG ($P = .52$). There were also no differences in patient-reported outcome scores at baseline for the ASES score or PENN. The average preoperative ASES function score was 17.1 in the OFG and 10.7 in the CG ($P = .456$). For the PENN, the average preoperative score was 22.9 in the OFG compared with 12.2 in the CG ($P = .202$) (Table II).

Table I
Demographic characteristics of each group

Characteristic	Opioid-free group	Control group	*P* value
Sex, n			
Male	16	10	.116
Female	9	15	
Age, yr	72.4	67.9	.307
ASA class	2.43	2.15	.241
BMI	28.64	30.45	.343
Type of surgery, n			
Anatomic	7	10	.550
Reverse	18	15	
Diabetes, %	12	12	.827
Morbid obesity, %	8	8	.794
Hypertension, %	32	48	.303
Psychiatric comorbidity, %	4	4	.718
Current smoker, %	4	12	.068

ASA, American Society of Anesthesiologists; *BMI*, body mass index.

Postoperatively, the OFG had lower pain scores at both recorded time points. At 24 hours, the OFG reported a lower average pain score of 5 compared with 7.3 in the CG ($P = .036$). At 48 hours, the OFG also reported a lower pain score (3.0 vs. 4.2 in CG, $P = .005$). In the OFG, 24% of patients reported taking 1 dose of rescue opioids in the first 48 hours and 0% reported opioid use at 2 weeks postoperatively. Of the patients in the CG, 100% reported taking opioids in the 48 hours after surgery and 80% reported continued opioid use at 2 weeks postoperatively (Fig. 1).

At last follow-up, patients in both groups showed significant improvements in patient-reported outcome scores (Table II). The average 3-month postoperative ASES pain score was higher in the OFG (47.8) than in the CG (42.6, $P = .036$). At final follow-up (average, 90 days postoperatively; range, 45-180 days), the average ASES scores were similar, with 75.48 in the OFG and 70.30 in the CG ($P = .991$). In terms of functional outcomes postoperatively, the OFG had a higher Constant score, with an average of 30.1 compared with 23.6 in the CG ($P = .005$). Otherwise, no significant differences in the ASES score or PENN were found between groups postoperatively.

Discussion

With the growing awareness of the opioid epidemic, a few interventions have focused on the impact of minimizing these addictive medications and optimizing outcomes. As orthopedic surgeons remain among the highest prescribers of opioids, it is our duty to identify interventions and methodologies that successfully minimize these medications while still engaging patients in the process. This study aimed to develop a program to minimize opioid use in patients undergoing shoulder procedures through integration of multimodal non–opioid-based pain management protocols coupled with patient education tools on alternative pain management options. Our results suggest education and a standardized program can be successful in significantly reducing, if not altogether eliminating, opioid use after shoulder arthroplasty.

Table II
Preoperative and postoperative patient-reported outcome scores

Measure	Opioid-free group	Control group	*P* value
Preoperative			
ASES pain score	22.66	19.16	.528
ASES function score	17.10	10.11	.456
PENN for function	22.93	12.8	.202
Constant score	12.26	15.40	.210
SSV	28.30	24.60	.661
Postoperative			
ASES pain score	47.8	42.6	.036*
ASES function score	27.68	27.7	.991
PENN for function	36.33	32.41	.375
Constant score	30.01	23.6	.005*
SSV	73.8	69.1	.525

ASES, American Shoulder and Elbow Surgeons; *PENN*, Penn Shoulder Score; *SSV*, Subjective Shoulder Value.
* Statistically significant.

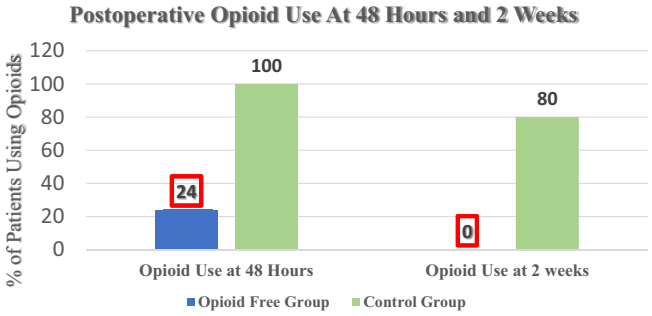

Figure 1 Opioid consumption compared between groups in immediate postoperative period.

Recent studies have found similar results decreasing the need for postoperative opioid use with patient education prior to rotator cuff repair. These studies found that patients who received preoperative education were less likely to be taking opioids at last follow-up, regardless of whether they were preoperatively opioid dependent.[13,14,16,18,23] Specifically, in our cohort, there was a 75% reduction in the number of patients who used opioids in the 48-hour period after surgery and 80% of our OFG patients were able to manage their pain without any opioid medications at all. By providing patients with education, engaging them in the decision-making process, and providing them with the right pain management tools, we can significantly reduce postoperative opioid consumption.

In addition to reducing opioid consumption, our results showed that after shoulder surgery, patients were able to achieve excellent pain control without opioids. The opioid-free cohort had lower pain scores than the CG at last follow-up, suggesting that taking these opioid medications may have long-term effects on pain nociception. This finding is also in concordance with recent literature that has established that patients with long-term opioid consumption prior to or following arthroplasty report higher pain scores and increased complications.[1,11,20,21,24] By engaging patients and setting pain expectations, as well as providing alternative pain management instructions, it seems that increased levels of pain can be avoided in these particular populations.

Even with successful reduction of opioid consumption, this apparently did not negatively impact patient satisfaction or outcomes of our patients as both cohorts reported similar improvements. Both groups were able to achieve similar increases in range of motion and patient-reported outcomes, suggesting there are not significant limitations to rehabilitation and recovery following surgery without opioid use. In addition, physician-assessed Constant scores were significantly higher for the OFG, which may highlight that these patients may be able to achieve better overall functional outcomes when expectations of postoperative pain are set preoperatively.

Although our study provides some important conclusions regarding interventions to achieve opioid-free surgery, it is not without limitations. One limitation is that our cohort was not randomized; instead, patients self-selected an opioid-free

postoperative course, and this may not be reflective of the general population. Second, none of the patients in our study had preoperative dependence, and these types of strategies and results cannot be extrapolated to—and would not be expected in—patients with preoperative dependence. Perhaps weaning programs for this population should be the focus of future studies to still achieve an opioid-minimized postoperative recovery after shoulder surgery, but further research in this area is needed.

Conclusion

Our findings support complete elimination of opioid use by 2 weeks after shoulder arthroplasty using a patient engagement model with non–opioid-based alternative pain management. The elimination of opioid pain management did not diminish outcomes or patient satisfaction after shoulder arthroplasty.

Disclaimer

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