Non-Opioid Multimodal Analgesia for Total Shoulder Arthroplasty Demonstrates Significant Reductions in Opioid Prescriptions without Increased Complications: A Retrospective Comparative Study

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INTRODUCTION: The purpose of this study was to compare the pain level and the amount of opioid consumed in postoperative total shoulder arthroplasty (TSA) patients who were treated with a standard opioid-including regimen versus a non-opioid multimodal analgesia regimen.

METHODS: We retrospectively reviewed two consecutive cohorts who underwent TSA either anatomic or reverse TSA by a single surgeon. The opioid cohort included patients from early 2016 to late 2020 who were prescribed Oxycodone/Acetaminophen 5 mg/325 mg only. The non-opioid cohort included patients from late 2020 to 2022 and consisted of preoperative oral analgesics (Celecoxib, Pregabalin, and Tramadol); intraoperative IV Dexamethasone and Acetaminophen, and local infiltration of Ropivacaine, Epinephrine, and Ketorolac; and postoperative oral Dexamethasone and oral analgesics (Pregabalin, Tizanidine, Magnesium, Ibuprofen, and Acetaminophen). The non-opioid cohort had the option to ask their surgeon for an opioid prescription postoperatively if needed. Patient-reported outcomes collected included Visual Analog Scale (VAS) scores for pain and Patient-Reported Outcome Information System (PROMIS) up to one year after surgery. Opioid consumption (preoperative, and 10-days, 6-weeks, and 3-months postoperative) using Morphine Milligram Equivalents (MME) were compared and analyzed using the nonparametric Wilcoxon rank-sum test for both cohorts. Total MME was calculated as max consumption. Univariate logistic regression analysis was used to identify potential predictors of receiving an opioid prescription and a multivariate model was created to control for covariates to identify independent predictors of opioid prescriptions > 1 month after surgery.

RESULTS: There were 232 patients in the opioid cohort and 112 in the non-opioid cohort. Patients in the non-opioid cohort had a higher median BMI (31.0 IQR [27.6 – 35.2] vs. 29.6 [25.9 – 34.2]; *P* = 0.03) and were less likely to have a diagnosis of chronic kidney disease (3.6% vs. 12.1%; *P* < 0.01) compared to the opioid cohort. No other between-group differences were found in demographic factors including age, sex, comorbidities such as diabetes mellitus, hypertension, smoking, or any psychiatric disorders (depression, anxiety, bipolar). The non-opioid cohort had lower mean VAS scores at preoperative (6.4 vs. 7.4; *P* < 0.05), 10-day (3.5 vs. 4.2; *P* < 0.05), and 6-week postoperative timepoints (2.1 vs. 2.8; *P* < 0.05) but no differences between the groups at 3-months postoperatively. No differences in PROMIS-Upper Extremity (UE), Pain Interference (PI), or Depression (D) were found preoperatively and up to 1 year after surgery. Opioid consumption was lower in the non-opioid multimodal cohort at all time periods (*P* < 0.01). Patients in the non-opioid cohort had significantly lower MMEs at discharge, and 10-day, 6-week, and 90-day time periods (*P* < 0.01) when compared to the opioid cohort. When analyzing risk factors for continued opioid prescriptions for the whole cohort, the univariate logistic regression model revealed that opioid usage 90 days prior to surgery (relative risk [RR] 4.69 [95% confidence interval (CI) 3.18 – 6.91; *P* < 0.01) and current tobacco use (RR 2.61 [95% CI 1.50 – 4.54]; *P* < 0.01) were associated with patients obtaining at least one opiate prescription > 30 days after surgery. Multivariate logistic regression modeling revealed that patients who used opiates 90 days prior to surgery and were current tobacco users were 8.52 and 4.92 times more likely to receive an opioid prescription filled > 30 days after surgery, respectively. Complications such as 90-day hospital readmissions and revision surgery at one-year were not significantly different between the groups.

DISCUSSION AND CONCLUSION:

A non-opioid multimodal postoperative regimen for patients undergoing anatomic or reverse TSA significantly reduces opioid prescriptions with similar patient-reported outcomes, subjective pain scores, and without increased complication rates compared to an opioid only regimen.

Figure 1. Percentage of patients receiving opioids up to 90 days stratified by pain regimen.

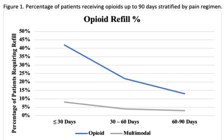

Table 1. Demographics

	Opioid Group (n= 232)	Multimodal Group (n = 112)	*P* - value
Opioid Usage 90 days prior to surgery	52 (22.4)	7 (6.3)	< 0.01*
Age (years)	69.9 ± 8.5	70.6 ± 8.1	0.43
BMI (kg/m²)	29.6 [25.9 – 34.2]	31.0 [27.6 – 35.2]	0.03*
Sex			0.70
Female	115 (49.6)	58 (51.8)	
Male	117 (50.4)	54 (48.2)	
Hypertension	156 (67.2)	82 (73.2)	0.26
CKD	28 (12.1)	4 (3.6)	0.01*
Diabetes	53 (22.8)	24 (21.4)	0.77
Psychiatric Disorders	51 (22.0)	23 (20.5)	0.76
Current Tobacco Use	15 (6.5)	2 (1.8)	0.07
ASA Score	2.63 ± 0.49	2.65 ± 0.60	0.74
3-month Postop Complication	6 (2.59)	0 (0.0)	0.18

Abbreviations: SD = standard deviation; IQR = interquartile range; CKD = chronic kidney disease; ASA = American Society of Anesthesiologists score; Postop = postoperative.
Data presented as n (%), median [IQR], or mean ± SD as appropriate.
* indicates a *P* – value < 0.05.

Table 2. Opioid Prescriptions > 1 month with Univariate and Multivariate Analyses

	Prescriptions > 1 month	No Prescriptions	Univariate Relative Risk (95% CI)	Univariate P-Value	Multivariate Relative Risk (95% CI)	Multivariate *P* - Value
n = 344	67	277				
Opioid Group vs Multimodal Group						
Opioid Group	62 (26.7)	170 (73.3)	5.99 (2.48 – 14.5)	< 0.0001*	5.34 (2.01 – 14.2)	< 0.0001*
Multimodal Group	5 (4.5)	107 (95.5)				
Opioid Usage 90 days prior to surgery	33 (49.3)	26 (9.4)	4.69 (3.18 – 6.91)	< 0.0001*	8.52 (4.38 – 16.6)	< 0.0001*
Age (years)	68.8 ± 7.8	70.5 ± 8.5	0.98 (0.95 – 1.01)	0.15		
BMI (kg/m²)	31.0 [26.9 – 34.4]	30.0 [26.1 – 34.7]	1.01 (0.97 – 1.05)	0.76		
Sex						
Female	37 (55.2)	136 (49.1)	1.22 (0.79 – 1.87)	0.37		
Male	30 (44.8)	141 (50.9)				
Hypertension	49 (73.1)	189 (68.2)	1.21 (0.74 – 1.98)	0.43		
CKD	9 (13.4)	23 (8.3)	1.51 (0.83 – 2.76)	0.43		
Diabetes	17 (25.4)	60 (21.7)	1.18 (0.72 – 1.92)	0.52		
Psychiatric Disorders	19 (28.4)	55 (19.9)	1.44 (0.91 – 2.30)	0.13		
Current Tobacco Use	8 (11.9)	9 (3.3)	2.61 (1.50 – 4.54)	0.008*	4.92 (1.66 – 14.7)	0.006*
ASA Score	2.71 ± 0.60	2.62 ± 0.56	1.36 (0.83 – 2.20)	0.21		
3-month Postop Complication	3 (4.48)	3 (1.08)	4.28 (0.84 – 21.7)	0.09		

Abbreviations: SD = standard deviation; IQR = interquartile range; CKD = chronic kidney disease; ASA = American Society of Anesthesiologists score; Postop = postoperative.
Data presented as n (%), median [IQR], or mean ± SD as appropriate.
* indicates a *P* – value < 0.05.

Table 3. Patient Reported Outcomes Up to One Year

	Opioid Group (n= 232)	Multimodal Group (n = 112)	*P* - value
Preoperative			
PROMIS-UE	28.7 ± 6.1	29.0 [25.0 – 32.0]	0.65
PROMIS-PI	63.0 [59.5 – 66.9]	63.0 [60.0 – 67.0]	0.58
PROMIS-D	49.9 [42.3 – 55.4]	48.0 [42.0 – 53.0]	0.13
ASES Score	39.4 ± 17.0	29.9 [15.0 – 44.1]	**< 0.01***
VAS Pain Score	8.0 [6.0 – 10.0]	7.0 [4.3 – 8.0]	**< 0.01***
10 Days Postoperative			
PROMIS-UE	23.8 [18.9 – 28.8]	25.5 ± 7.3	0.74
PROMIS-PI	65.4 [60.7 – 70.7]	65.0 [61.7 – 67.5]	0.89
PROMIS-D	52.4 [43.1 – 56.1]	44.0 [34.0 – 50.0]	**< 0.01***
VAS Pain Score	4.0 [2.0 – 6.0]	3.0 [1.0 – 5.3]	**0.01***
6 Weeks Postoperative			
PROMIS-UE	33.1 ± 6.1	30.8 ± 6.1	0.98
PROMIS-PI	57.3 [52.6 – 61.5]	58.0 [55.8 – 63.0]	0.14
PROMIS-D	45.5 [38.9 – 51.0]	46.0 [36.6 – 51.0]	0.64
VAS Pain Score	2.0 (0.0 – 4.0)	2.0 [0.0 – 3.0]	0.13
3 Months Postoperative			
PROMIS-UE	37.1 ± 6.7	36.3 ± 6.4	0.75
PROMIS-PI	53.4 [49.7 – 59.3]	55.5 [51.8 – 59.0]	0.23
PROMIS-D	45.5 [39.3 – 51.7]	46.0 [34.0 – 52.0]	0.38
VAS Pain Score	0.0 [0.0 – 3.0]	0.0 [0.0 – 2.0]	0.08
6 Months Postoperative			
PROMIS-UE	39.3 ± 7.0	38.0 ± 8.3	0.78
PROMIS-PI	52.9 ± 8.9	54.0 ± 8.7	0.27
PROMIS-D	46.0 [38.8 – 48.6]	46.0 [36.0 – 51.8]	0.69
ASES Score	82.7 [73.7 – 90.1]	68.8 ± 24.5	0.27
VAS Pain Score	0.0 [0.0 – 2.0]	0.0 [0.0 – 2.0]	0.47
1 Year Postoperative			
PROMIS-UE	41.4 ± 9.2	41.0 [36.0 – 44.0]	0.32
PROMIS-PI	51.1 [38.9 – 60.2]	53.5 [44.8 – 58.5]	0.22
PROMIS-D	43.0 [34.2 – 51.7]	39.5 [34.0 – 47.0]	0.07
ASES Score	85.5 [75.7 – 94.1]	91.4 [69.5 – 95.0]	0.75
VAS Pain Score	0.0 [0.0 – 2.0]	0.0 [0.0 – 1.0]	0.09

Abbreviations: PROMIS = Patient – Reported Outcomes Measurement Information System; UE = upper extremity; PI = pain interference; D = depression; VAS = visual analog scale; ASES = American Shoulder and Elbow Surgeons.
Data presented as median [IQR] or mean ± SD as appropriate.
* Indicates a *P* – value < 0.05.

Table 4. Relative Risk of Obtaining an Opioid by Cohort Up to 90 Days Postoperatively

Postoperative Date	RR of Multimodal vs Opioid Group using Postoperative Opioids	*P* - Value
At Discharge	0.18 (0.12 – 0.28)	**< 0.01***
At 30 Days	0.19 (0.10 – 0.36)	**< 0.01***
30-60 Days	0.17 (0.06 – 0.45)	**< 0.01***
60-90 Days	0.21 (0.06 – 0.66)	**< 0.01***
Total from Surgery - 90 days postop	0.16 (0.09 – 0.32)	**< 0.01***

Data is depicted as Relative Risk (95% Confidence Interval)
* indicated *P* < 0.05