Use of Opioids in the Early Postoperative Period After Arthroscopic Rotator Cuff Repair

A Systematic Review

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Background: Postoperative treatment plans after orthopaedic procedures frequently include opioids for pain relief.

Purpose: To evaluate opioid use in the early postoperative phase after arthroscopic rotator cuff repair (ARCR) to develop a procedure-specific understanding of the current role of opioids in pain management for this procedure.

Study Design: Systematic review; Level of evidence, 4.

Methods: A PubMed search was used to identify eligible studies. Data on patient demographics, visual analog scale pain scores, and opioid use patterns (in morphine milligram equivalents [MMEs]) were collected and assessed. Cumulative MMEs were reported on postoperative day (POD) zero, and mean MMEs were reported on subsequent PODs (days 1, 2, 3, 5, 7, and 14). Metaregression, I^2 indices, and Cochran *Q* tests were used to evaluate study variation, heterogeneity, and variance.

Results: A total of 1487 patients in 22 studies were included in the analysis. An estimated 51% (95% CI, 31%-70%) of patients with nerve blocks (NBs) were opioid-free through POD-0 versus 40% (95% CI, 1.2%-97%) of patients without NBs, which increased to 65% (95% CI, 55%-74%) versus 25% (95% CI, 1.7%-86%) by POD-1. Opioid requirements were highest in the first 72 hours after ARCR. NB use reduced opioid requirement on POD-0 compared with no NB use (15.8 vs 45.0 MMEs, respectively; $P < .001$) but did not reduce requirements after that. In addition, NB use led to a statistically significant increase in opioid requirements on POD-7 (28.6 vs 9.5 MMEs, respectively; $P < .001$). Using a model that assumes stable opioid requirements between our time points, weighted mean cumulative opioid consumption was 163 MMEs in the first week and 273 MMEs in the first 2 weeks (150 and 287 MMEs in patients with NB; 180 and 261 MMEs in patients without NB, respectively).

Conclusion: Opioid use is relatively common in the early postoperative period after ARCR. Pain scores and opioid requirements may spike on POD-1; however, patients should be educated and reassured that they will gradually decrease usage over the initial 2-week postoperative period.

Keywords: opioid; orthopaedics; pain; rotator cuff; surgery

The US opioid epidemic is a national public health crisis.[10,11] From 1999 to 2019, nearly half a million opioid overdose deaths have been attributed to both prescription and illicit opioids, with a mean of 38 deaths per day from prescription opioids in 2019 alone.[10,11] Outside of mortality, prescription opioid abuse has significant morbidity; health care costs related to hospitalizations and treatment of opioid use disorders totaled $35 billion in 2017.[16] In addition, prescription opioid use is an important predictor of future illicit opioid use with notable links to heroin addiction.[12,14,16]

Actively combating the opioid crisis is especially important in the field of orthopaedics given that orthopaedic surgeons are the third highest opioid prescribers in the United States.[31] Of orthopaedic patients with opioid dependence, an estimated 8.8% of those who were opioid naïve before surgery developed chronic opioid use disorder after their procedure.[39] Increased awareness of the opioid epidemic breeds opportunities to decrease its societal impact. For orthopaedic surgeons, tailoring postoperative opioid prescription to specific procedures offers an opportunity to optimize opioid prescribing practices to prevent unnecessary opioid exposure.

Arthroscopic rotator cuff repair (ARCR) is expected to cause more acute postoperative pain relative to other orthopaedic procedures.[3,9,34] ARCR has become an increasingly popular surgical modality in repairing rotator cuff tears (RCTs) in recent years due to advances in less invasive arthroscopic techniques; however, pain management after

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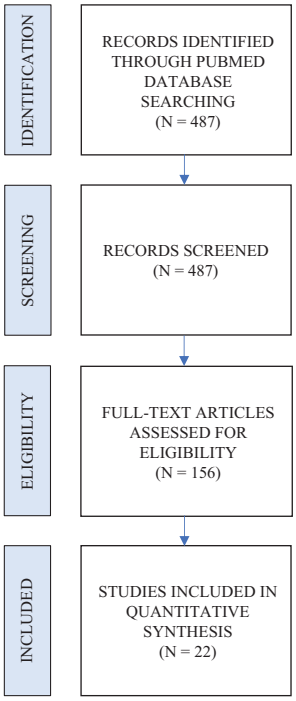

Figure 1. PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flow diagram.

TABLE 1
Opioid Conversion Factors[a]

Opioid	MME Conversion Factor
Meperidine hydrochloride (mg)	0.1
Tramadol (mg)	0.1
Fentanyl, buccal (μg)	0.13
Codeine (mg)	0.15
Dihydrocodeine (mg)	0.25
Pentazocine (mg)	0.37
Tapentadol (mg)	0.4
Morphine (mg)	1
Hydrocodone (mg)	1
Opium (mg)	1
Oxycodone (mg)	1.5
Methadone (mg)	3
Oxymorphone (mg)	3
Hydromorphone (mg)	4
Butorphanol (mg)	7
Levorphanol tartrate (mg)	11

[a]Conversion factors from US Department of Health and Human Services.[47] MME, morphine milligram equivalent.

ARCR continues to be a major challenge.[3,9,34] Current American Academy of Orthopaedic Surgery guidelines for postoperative pain management of rotator cuff injuries recommend a multimodal analgesic approach to better manage pain and reduce opioid exposure, but a clear consensus on appropriateness, timing, dosage, and duration of opioid usage has not been established.[1]

The purpose of this systematic review is to evaluate opioid use in the early postoperative period after ARCR to better clarify a procedure-specific understanding of opioid use specific to ARCR. Our hypotheses are 2-fold: First, that not all patients will require opioids after ARCR and second, that opioid use will gradually decrease over the early postoperative period.

METHODS

Literature Search

A systematic review of postoperative opioid use after ARCR was conducted according to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. A search of articles published before August 30, 2021, in Medline (PubMed) was performed using the keywords "postoperative," "shoulder," and "opioid." A single investigator (A.B.S.) screened abstracts manually for inclusion. Articles eligible for inclusion described patients' cumulative or mean opioid consumption at specific time points within the first 14 days after ARCR or the number of patients not requiring opioids in the first 48 hours postoperatively in an original patient population. Reviews, editorials, and studies that did not specify data specific to ARCR were excluded. In total, 487 abstracts from initial data search were screened and after removal of duplicates, 156 full-text publications were reviewed, and 22 were included in final quantitative analysis (Figure 1).[¶] Data on study type, study level of evidence, patient demographics, pain-related interventions, visual analog scale (VAS) pain scores, and opioid use patterns were collected and pooled for analysis. Opioid use amounts were converted to morphine milligram equivalents (MMEs) for standardization before analysis (Table 1).

[¶]References 3, 5–8, 13, 15, 19, 20, 22, 24, 28, 30, 32, 36, 40, 41, 44–46, 49, 51.

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TABLE 2
Studies Included in Analysis[a]

Lead Author	Year	Patients (N)	Type of Study	LOE
Borgeat[5]	2010	80	RCT	NR
Bryan[6]	2007	56	Retrospective observational	4
Cabaton[7]	2019	103	RCT	NR
Caldwell[8]	2020	87	Prospective observational	4
Coghlan[13]	2009	70	RCT	1
Desroches[15]	2016	53	RCT	1
Ikemoto[19]	2015	45	RCT	NR
Ilfeld[20]	2019	11	Crossover	NR
Khashan[22]	2016	45	RCT	NR
Klein[24]	2019	114	Prospective cohort	4
Mahure[28]	2017	37	RCT	2
Mandava[30]	2021	100	RCT	2
Moutzouros[32]	2020	27	Prospective observational	4
Patel[36]	2021	41	Prospective observational	4
Bang[3]	2010	46	RCT	1
Sethi[40]	2019	50	RCT	2
Singh[41]	2021	57	RCT	2
Syed[44]	2018	134	RCT	1
Tangtiphaiboontana[45]	2021	101	RCT	1
Thackeray[46]	2013	30	RCT	1
Verdecchia[49]	2021	54	RCT	1
Weekes[51]	2021	146	RCT	2

[a]LOE, level of evidence; NR, not reported; RCT, randomized controlled trial.

Data Analysis

All included studies specified whether patients received a nerve block (NB), defined as preoperative, intraoperative, or postoperative incorporation of an NB for analgesia. Data were stratified into patients who received a form of NB and patients who did not receive a form of NB but received other forms of analgesia such as transcutaneous electrical nerve stimulation, percutaneous peripheral nerve stimulation, or other oral, non-NB medications (combined as "other" group).

The number of patients with preoperative opioid or narcotic use was assessed in studies that did not exclude this demographic. Oral opioids in MMEs were reported as cumulative administration in the postanesthesia care unit (PACU) or recovery room (RR) and on postoperative day (POD) zero. Oral opioids in MMEs administered in the first 6 hours were considered PACU/RR administration given their proximity to the procedure. Mean oral MMEs of opioids per day were calculated for POD-1, -3, -5, -7, and -14 from either the cumulative or daily MMEs as reported by the study.

Statistical Analysis

Summary measures included estimate means with 95% CI. Metaregression using a random-effects model was used in statistical analysis to acknowledge between-study and within-study variation. I^2 indices were used to evaluate between-study heterogeneity, and Cochran Q tests were used to evaluate total variance. Statistical significance was set at $P < .05$.

RESULTS

A total of 22 publications and 1487 patients were eligible for inclusion (Table 2). Most patients were male (n = 847; 61%). The mean (±SD) patient age was 57 ± 4.6 years, weight was 75.2 ± 7.0 kg, and body mass index was 30.0 ± 1.5, and surgeries lasted a mean of 103.8 ± 25.7 minutes (Table 3). While 13 studies excluded patients with preoperative opioid use, the 4 studies that included and reported these patients described a distribution of 5.2% (n = 61) who received NBs and 1.6% (n = 5) who did not receive NBs.

NBs were used in 79% (n = 1176) of patients, with NB-specific details presented in Table 4. In total, 73% of studies (11 of 15) performed only single NB injections, with the vast majority involving interscalene brachial plexus blocks. The remaining 4 studies used a single NB with a continuous infusion. All NBs used long-acting amide anesthetics. Bupivacaine or its liposomal form were the anesthetics used most frequently for NBs.

VAS Pain Scores

VAS scores are recorded in Figure 2A and Table 5. The estimated preoperative VAS score was 5.4 (95% CI, 4.7-6.0); the score was only recorded in patients who received NBs. The VAS score decreased to 1.8 (95% CI, 1.2-2.5) in the PACU/RR in patients who received NBs versus 3.5 (95% CI, 0.8-6.2) in patients who did not ($P = .31$). Of patients with NBs, the mean VAS score at POD-0 was 2.6 (95% CI, 1.8-3.4) but this increased to 4.4 (95% CI, 3.3-5.5) by POD-1. Of patients without NBs, the mean VAS score for POD-0 was 6.1 (95% CI, 5.1-7.1) but increased to 6.4 (95%

TABLE 3
Characteristics of the Study Patients[a]

Characteristic	NB		Other		*P* Value for Comparison
	Summary Estimate (95% CI)	*P* Value (Cochran *Q*)	Summary Estimate (95% CI)	*P* Value (Cochran *Q*)	
Age, y	56.5 (54.6-58.4)	<.001	56.3 (54.0-58.5)	<.001	.87
Male, %	61.4 (57.8-64.8)	.060	59.7 (47.2-71.0)	<.001	.46
Current/former smoker, %	14.4 (7.7-25.5)	.042	14.9 (3.3-47.0)	<.001	.80
Weight, kg	78.6 (73.8-83.4)	.003	72.7 (68.0-77.5)	<.001	.13
BMI	29.6 (28.9-30.3)	.015	31.2 (29.6-32.8)	.359	.18
Surgery duration, minutes	94.7 (82.9-106.5)	<.001	113.8 (86.9-140.7)	<.001	.24

[a]BMI, body mass index; NB, nerve block.

TABLE 4
NBs Used in the Included Studies[a]

Study	NB Anesthetic	Anesthetic Delivery Method	Block Type
Borgeat[5]	Ropivacaine	Single injection + 48-hour continuous infusion	IBPB
Bryan[6]	Bupivacaine	Single injection + 48-hour continuous infusion	IBPB
Cabaton[7]	Levobupivacaine	Single injection	IBPB or SCBPB
Caldwell[8]	Bupivacaine	Single injection	SSNB, ANB, and shoulder area
Coghlan[13]	Ropivacaine	Single injection + 36-hour continuous infusion	SAS
Desroches[15]	Ropivacaine	Single injection	SSNB or IBPB
Ikemoto[19]	Ropivacaine	Single injection or single block + infusion	IBPB or SSNB + infusion into SAS
Mahure[28]	Not disclosed	Single injection	IBPB
Mandava[30]	Bupivacaine or bupivacaine + LP bupivacaine	Single injection	IBPB
Sethi[40]	Bupivacaine or bupivacaine + LP bupivacaine	Single injection	IBPB or IBPB + SSNB
Singh[41]	Bupivacaine + LP bupivacaine	Single injection	IBPB
Syed[44]	Not disclosed	Single injection	IBPB
Tangtiphaiboontana[45]	Not disclosed	Single injection	IBPB
Thackeray[46]	Bupivacaine	Single injection	IBPB
Weekes[51]	Ropivacaine	Single injection	IBPB

ANB, axillary nerve block; IBPB, interscalene brachial plexus block; LP, liposomal; NB, nerve block; SAS, subacromial space; SCBPB, supraclavicular brachial plexus block; SSNB, suprascapular nerve block.

CI, 5.5-7.3) by POD-1, although VAS scores were only recorded in 1 study and comparative *P* values could not be obtained.

Opioid Requirements

Opioid requirements in MMEs are recorded in Figure 2B and Table 5. Fewer than half of patients (38%; n = 167) did not require opioids on POD-0 after leaving the PACU or RR, which decreased slightly to 35% (n = 80) who did not require opioids over POD-1. However, when divided into patients who received NBs versus those who did not, there were significant differences in the number of patients who either remained opioid-free after surgery or did not use opioids through POD-1 or POD-2 ($P < .001$ for both). An estimated 51% (95% CI, 31-70%) of patients with NBs were opioid-free at 24 hours versus 40% (95% CI, 1.2-97) of patients without NBs, which increased to 65% (95% CI, 55-74) versus 25% (95% CI, 1.7-86) at 48 hours. Estimated opioid requirements are presented in Figure 3. There were significant differences between MMEs at POD-0 and POD-7. At POD-0, MMEs were estimated to be 15.8 (95% CI, 11.1-20.6) among patients with NBs and 45.0 (95% CI, 39.1-51.0) among patients without NBs ($P < .001$) with a weighted mean of 20.5 MMEs for the 2 groups combined. At POD-7, MMEs are estimated to be 28.6 (95% CI, 24.2-32.9) among patients with NBs and 9.5 (95% CI, 6.5-12.5) among patients without NBs ($P < .001$) with a weighted mean of 16.2 MMEs for the 2 groups combined. Assuming stable opioid requirements (POD-2 = POD-3, POD-4 = POD-5, POD-6 = POD-7, and POD-8-13 = POD-14), weighted mean cumulative opioid use was 163 MMEs in the first week and

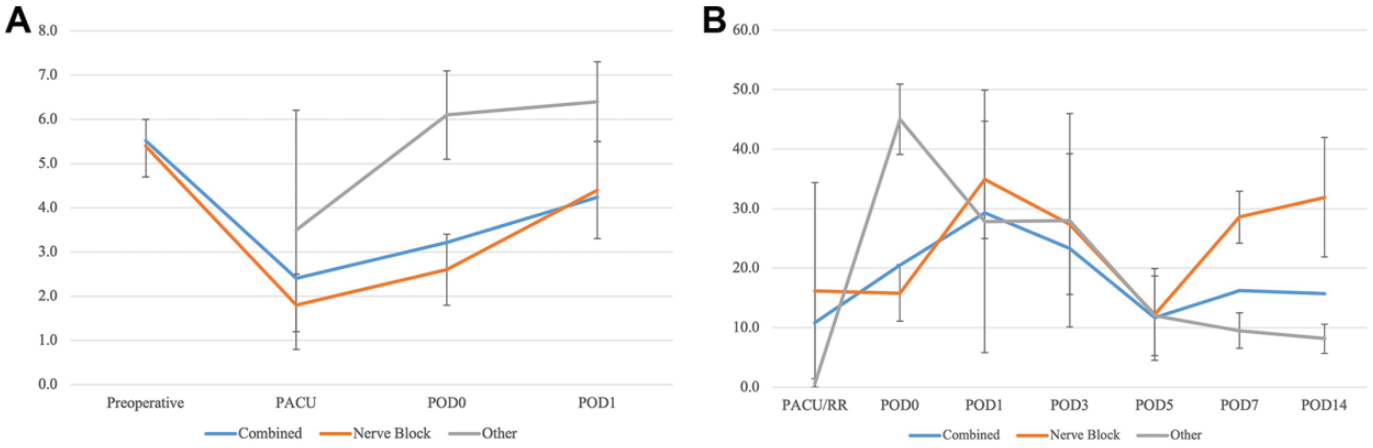

Figure 2. (A) Weighted mean VAS pain scores and (B) opioid consumption in MMEs. Error bars indicate SD. MME, morphine milliequivalent; PACU, postanesthesia care unit; POD, postoperative day; RR, recovery room; VAS, visual analog scale.

TABLE 5
VAS Scores and Opioid Consumption[a]

	NB			Other			
	Patients (n)	Summary Estimate (95% CI)	*P* Value (Cochran *Q*)	Patients (n)	Summary Estimate (95% CI)	*P* Value (Cochran *Q*)	*P* Value for Comparison
VAS score							
Preoperative	323	5.4 (4.7-6.0)	<.001	0	—	—	—
PACU/RR	350	1.8 (1.2-2.5)	<.001	72	3.5 (0.8-6.2)	<.001	.31
POD-0	536	2.6 (1.8-3.4)	<.001	27	6.1 (5.1-7.1)	—	—
POD-1	326	4.4 (3.3-5.5)	<.001	27	6.4 (5.5-7.3)	—	—
Opioid consumption, MME							
PACU/RR	97	16.2 (0 to 34.8)	<.001	27	0.6 (0-1.4)	—	—
POD-0	476	15.8 (11.1-20.6)	<.001	83	45.0 (39.1-50.9)	<.001	<.001
POD-1	443	34.9 (25.0-44.7)	<.001	38	27.8 (5.8-49.9)	<.001	.64
POD-3	223	27.4 (15.6-39.2)	<.001	38	28.0 (10.1-46.0)	.033	.96
POD-5	196	12.2 (4.5-19.9)	<.001	11	12.0 (5.3-18.7)	—	—
POD-7	138	28.6 (24.2-32.9)	.018	83	9.5 (6.5-12.5)	<.001	<.001
POD-14	134	31.9 (21.9-42.0)	.035	45	8.2 (5.7-10.6)	<.001	.12

[a]Dashes indicate inability to calculate based on number of studies or availability of data. MME, morphine milliequivalent; NB, nerve block; PACU/RR, postanesthesia care unit/recovery room; POD, postoperative day.

273 MMEs in the first 2 weeks. Among patients who received NBs, weighted mean cumulative opioid use was 150 MMEs from POD-0 to POD-7 and 287 MMEs from POD-0 to POD-14. In patients who did not receive NBs, weighted mean cumulative opioid use was 180 MMEs from POD-0 to POD-7 and 261 MMEs from POD-0 to POD-14.

DISCUSSION

The data evaluated from this systematic review enhances insight into ARCR-specific trends in opioid requirements. Our results indicate that opioid requirements were highest in the first 72 hours after ARCR, with a significant increase in the first 24 hours after surgery ($P < .001$). While NBs led to a statistically significant reduction in opioid use within the first 24 hours after ARCR, they did not appear to significantly reduce opioid use after that time period. By POD-5, opioid requirements were nearly half their initial levels (weighted mean opioid consumption: 20.5 MMEs on POD-0 to 11.7 MMEs on POD-5); however, opioid requirements increased by POD-7 and POD-14 in individuals who received NBs while continuing to decrease in those who did not. Despite the reputation of ARCR as being among the more painful orthopaedic procedures, a statistically significant number of patients, including those who did and did not have NBs, did not require opioids on POD-1 and POD-2.

While our results reaffirm that patients experience high postoperative pain after ARCR, we propose that opioid

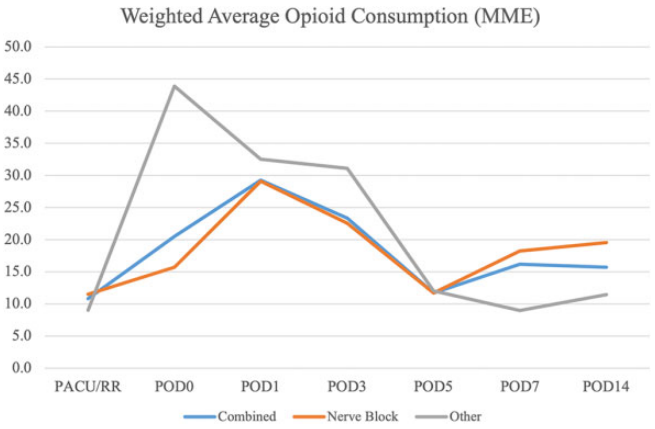

Figure 3. Weighted mean opioid consumption (MME). MME, morphine milliequivalent.

requirements may be lower than expected, especially in the setting of improved multimodal pain management. Despite relatively low VAS scores in the PACU/RR, opioids are still used in this setting; however, the rate of opioid use is substantially lower in the PACU/RR when compared with the first 48 hours postoperatively, after which both VAS scores and consequent opioid use increase. A survey of American Shoulder and Elbow Surgeons Society members found that shoulder surgeons routinely prescribe a mean of 462.5 MMEs of opioids to patients after ARCR.[52] Stepan et al[42] recommended 300 to 480 MMEs for postoperative pain after ARCR. Lovecchio et al[27] supported prescribing 210 MMEs of opioids for the first 7 days for treatment of postoperative pain after ARCR. Perhaps the most conservative estimate of opioid requirements was provided by Overton et al,[35] who recommend anywhere from 0 to 150 MMEs at discharge after ARCR. Our study found that over a 7-day period, postoperative opioid requirements after discharge after ARCR were approximately 152 MMEs among all included patients or 150 MMEs in patients with NBs versus 180 MMEs in patients without NBs. This represents a massive discrepancy when compared with the routine prescription of 462.5 MMEs and suggests that opioid requirements may be 2 to 4 times less than currently perceived.

Our study also indicates that a statistically significant number of patients do not require opioids in the first 48 hours postoperatively. While perceptions of opioid requirements may overestimate use, there is a growing body of literature to suggest that an opioid-free pathway is possible after ARCR and, among patients who do require opioids, many will cease use after POD-7. With use of a local-regional NB for ARCR, 39% of patients will not require opioids and 90% of those who do will discontinue opioids by POD-7.[8] Similarly, when provided with comprehensive multimodal analgesia, including NBs, nonsteroidal anti-inflammatory drugs, diazepam, and acetaminophen, Moutzouros et al[32] found that 30% of patients did not require postoperative opioids after ARCR. The opioid reluctance may not be limited exclusively to physicians: Kumar et al[25] found that, of 50 ARCR patients, only 6 refilled their initial opioid prescriptions, despite many still reporting pain at POD-7. Overton et al[35] noted that surgeons generally prescribe more opioids than patients want. These findings suggest that although many patients will report having pain up to and beyond POD-7 after ARCR, their pain can likely be managed either with minimal or no opioid medications.

Regional NBs, particularly interscalene brachial plexus blocks, have been well-documented methods to reduce postoperative pain and opioid requirements in patients undergoing ARCR.[17,23,26,29,38,50] The results of our systematic review confirm that placement of NBs significantly reduces opioid requirements in the first 24 hours after surgery. While there are pharmacokinetic and pharmacodynamic differences between the various long-acting anesthetics used in brachial plexus NBs, there is no clear evidence demonstrating superiority in terms of reducing postoperative VAS scores and opioid requirements.[2,18,33,37,48] Our results similarly demonstrate consistent benefits in reduced opioid use in the first 24 hours after ARCR despite what specific formulation of long-acting anesthetic was used. In addition, the use of nonopioid analgesics as part of multimodal pain management improves patient comfort and reduces opioid exposure.[1] Other protective strategies in mitigating opioid risk include preoperative education disclosing the health and addiction concerns associated with opioid use while encouraging patient empowerment. Incorporating a preoperative educational video and handout detailing the risks and benefits of opioids reduces mean opioid use by 19% at 2 weeks, 33% at 6 weeks, and 42% at 3 month follow-up after ARCR.[51] Research regarding the efficacy of relaxation exercises in reducing postoperative pain and opioid use after ARCR offers further insights into pain reduction, with evidence suggesting that relaxation exercises significantly reduce opioid consumption in the first 2 weeks postoperatively.[46]

There is increased interest in preoperatively screening patients to identify those at risk for high opioid use after surgery. Factors associated with increased postoperative opioid requirements include a history of psychiatric disorders, a history of opioid use, and a history of alcohol or antidepressant use.[21,32,36,43] Preoperative risk assessments such as the Distress and Risk Assessment Method, modified Zung score, and Pain Catastrophizing Scale have emerged as predictors of increased opioid requirements after ARCR.[32,36] Understanding which patients are at an increased risk for both high postoperative pain and high postoperative opioid use can guide surgeons in managing preoperative expectations and individualized postoperative analgesia to minimize opioid exposure and prevent opioid-associated risks.

Interestingly, we report 2 results that are notably different from existing literature specific to patients with NBs: the statistically significant higher opioid requirements on POD-7 and the increase in opioid requirements by POD-14 that was not statistically significant. Existing literature demonstrates that opioid requirements are expected to decrease by POD-7.[8,20,28] A possible explanation for these findings lies in the variable reporting methodologies between studies. While the methodology of

averaging cumulative opioid was used consistently in data collection, the 2 studies reporting opioid use at POD-7 in patients with NBs reported cumulative opioid use exclusively, which could potentially alter these data; however, the authors aimed to achieve consistency throughout data collection to make an isolated data inflation at this specific time point less likely. Psychological perceptions of pain may be another explanation, as patients with NBs who experience minimal pain in the early postoperative period may have higher expectations for pain management. While rebound pain after peripheral NBs is an established phenomenon, it typically occurs 12 to 24 hours postoperatively rather than at POD-7[4]; however, the cumulative opioid use requirements reported before POD-7 may capture this trend in our data. With regard to types of NB, there is evidence that continuous interscalene NBs are linked to lower pain scores when compared with no NB, while single-shot interscalene blocks are associated with higher pain scores 24 hours postoperatively.[23] Despite these inconsistencies, our data still strongly support the use of NBs after ARCR to provide a significant reduction in opioid use in the first 48 hours postoperatively, a period associated with the highest opioid requirements. If there is concern for increased opioid use later in the early postoperative period, surgeons can consider discussing this finding with patients preoperatively before NB placement to better manage pain expectations within the first week and encourage them to maintain low or no opioid use even as NBs wear off.

Limitations

Limitations to our systematic review include inevitable variability among the preoperative, perioperative, and postoperative protocols of the included studies, specifically with data regarding NBs, anesthetic protocols, nonopioid pharmacotherapy protocols, variable MME concentrations in different opioids preferentially prescribed, use of additional multimodal analgesia interventions such as transcutaneous electrical nerve stimulation and percutaneous peripheral nerve stimulation, and whether studies excluded or did not collect preoperative opioid/narcotic use. Given the wide variability in study protocols and reporting patterns, our ability to perform subanalyses was limited by data availability in existing studies. Studies also varied in how opioid requirements were monitored, with many relying on patients' self-reported data. In addition, variability in reporting introduced inconsistency within results: For studies that only reported cumulative opioid requirements over a specific period, mean daily opioid usage was used for analysis, thereby introducing the potential to overestimate or underestimate trends in opioid requirements over time. Finally, included studies were published in the time span from 2007 to 2021, and while this enables a comprehensive review of opioid use after ARCR, advances in technology and practice guidelines likely influenced prescribing and opioid use patterns over time.

CONCLUSION

Ultimately, patients undergoing ARCR broadly reported considerable postoperative pain, which was expected to increase over the first 2 days. While postoperative opioid use increased over the first 48 hours postoperatively, it decreased to half its initial levels and plateaued by POD-5. Efforts to decrease postoperative opioid use should focus on multimodal analgesia strategies given that NBs significantly increase incidence of opioid-free postoperative periods for 24 and 48 hours after surgery and decrease opioid requirements over POD-0. Our research highlights that opioid-free ARCR recovery is possible, and opioid requirements should be assessed carefully in the early postoperative period to optimize prescription patterns that conservatively meet patients' individualized needs. Future research will help determine an ideal opioid schedule specific to ARCR to best control pain while minimizing opioid exposure.

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