Opioid Consumption After Rotator Cuff Repair

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Purpose: Rising perioperative opioid use in the United States is of increasing concern. The purposes of this study were (1) to define opioid consumption after rotator cuff repair (RCR) in the United States and (2) to evaluate patient factors that may be associated with prolonged opioid use after arthroscopic RCR. **Methods:** All arthroscopic RCRs performed between 2007 and 2014 were identified by use of Current Procedural Terminology code (29,827). Patients who filled opioid prescriptions preoperatively were divided into those who filled prescriptions at 1 to 3 months preceding RCR and those who filled opioid prescriptions only in the 1 month preceding RCR. Risk ratios (RRs) were calculated by dividing the cumulative incidence of opioid prescriptions in patients with each patient factor by the cumulative incidence in those without each patient factor. **Results:** During the study period, 35,155 arthroscopic RCRs were performed. Of the patients, approximately 43% had filled an opioid prescription in the 3 months before RCR. At 3 months after RCR, patients who filled opioid prescriptions at 1 to 3 months before RCR were 7.45 (95% confidence interval [CI], 6.95-7.98) times more likely to be filling opioid medication prescriptions than those who had not been prescribed opioid medications before surgery; patients who filled opioid prescriptions in the month before RCR were 3.04 (95% CI, 2.8-3.29) times more likely to be filling opioid prescriptions at 3 months after RCR. Patients with psychiatric diagnoses (RR, 1.94; 95% CI, 1.85-2.04), myalgia (RR, 1.67; 95% CI, 1.6-1.75), and low-back pain (RR, 2.09; 95% CI, 2-2.2) were also found to be at risk of filling opioid prescriptions at 3 months postoperatively. **Conclusions:** We found approximately 43% of patients undergoing RCR received opioid medications before RCR. Patients who are prescribed narcotics before RCR are at increased risk of postoperative opioid demand. Patients with psychiatric diagnoses, myalgia, and low-back pain may be at increased risk of prolonged opioid use after surgery. **Level of Evidence:** Level III, retrospective case-control study.

Opioid pain medication use is of growing concern for surgeons and health care systems in the United States, recently reaching epidemic levels.[1,2] Opioid use has been exploding over the past 2 decades since the "under-treatment of pain"[2,3] was promoted. The World Health Organization estimates the United States is responsible for consumption of most of the world's prescribed opioids and 99% of the world's oxycodone.[4,5]

The opioid-prescribing guidelines of the Centers for Disease Control and Prevention[2] recommend a plan to taper off narcotics; however, no natural history study showing baseline normative values of opioid use after rotator cuff repair (RCR) has been performed. The detrimental impact of preoperative opiate use has been shown after spine surgery and knee arthroplasty[6-8]; however, no such study has evaluated its impact after RCR. Knowledge of risk factors for postoperative opioid use would aid surgeons and health care systems in identifying patients who are at risk of increased use and subsequently developing preoperative and postoperative pain and counseling regimens that may aid in decreased use.[9] Because all physicians and health care systems have been called to be responsible for the current opioid epidemic, patient risk factors for prolonged opioid use after various surgical interventions would be of great interest. The purposes of this study were (1) to define opioid consumption after RCR in the United States and (2) to evaluate patient factors that may be associated with prolonged opioid use after arthroscopic RCR. We hypothesized that filling of preoperative opioid prescriptions would lead to increased opioid demand in the first year after RCR.

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Methods

The Humana administrative claims database was the source of patient data and was accessed by use of the PearlDiver Technologies Research Program (PearlDiver, Fort Wayne, IN) in April 2015. Patient data are deidentified and Health Insurance Portability and Accountability Act compliant. This study was deemed institutional review board exempt by our institution. The Humana administrative claims database represents 16 million covered persons and includes both privately or commercially insured individuals and Medicare or Medicaid Advantage beneficiaries.

All patients undergoing an arthroscopic RCR between January 2007 and December 2014 were identified by use of Current Procedural Terminology code 29,827. The inclusion criterion was any patient with this code. Patients who filled preoperative opioid prescriptions were divided into 2 groups. Patients who had filled at least 1 opioid prescription at 1 to 3 months preceding surgery were considered the 1- to 3-month group. Patients in this group may have also filled a prescription in the 0- to 1-month period before RCR. Patients were included in the 0- to 1-month group if they filled opioid prescriptions only in the 1 month preceding RCR. Patients in this group did not fill any preoperative prescriptions outside of the 1-month preoperative period. Non-opioid users were defined as having no history of opioid prescriptions filled before their procedures. Monthly prescription refill rates were then tracked postoperatively on a monthly basis for 1 year. Months from surgery were defined as follows: day 0 to 1 month was defined as 1 month, 1 month to 2 months was defined as 2 months, and so on. All common opioids were included (oral and transdermal). Tramadol prescriptions were excluded. Opioid prescription refills were then tracked on a monthly basis for 1 year postoperatively for all patients who underwent RCR.

Further subgroup analysis was performed to identify patient comorbidities (determined by *International Classification of Diseases, Ninth Revision* [ICD-9] codes) that may be risk factors for increased opioid use. These risk factors were chosen based on the clinical experience of the senior author (B.R.W.). Patients were then grouped based on the presence or absence of the following comorbidities, and opioid prescription refills were trended postoperatively in the same manner for all groups: Patients who carried a psychiatric diagnosis of anxiety or depression were identified by ICD-9 codes 266.2x, 296.3x, and 300.02. Patients who carried a myalgia diagnosis were identified by ICD-9 code 729.1. Patients with low-back pain were identified by ICD-9 codes 724.5 and 724.2.

The cumulative incidence of patients receiving opioid prescriptions was analyzed each month after surgery. A risk ratio (RR) was calculated by dividing the cumulative incidence of opioid prescriptions in patients with each patient factor by the cumulative incidence in those without each patient factor, and 95% confidence intervals (CIs) were determined. A CI including 1 indicates no statistically significant difference between groups, whereas a CI not including 1 indicates statistical significance and $P < .05$. Descriptive statistics were performed by use of Microsoft Excel (Microsoft, Redmond, WA). Advanced data analyses were performed with SAS software (version 9.4; SAS Institute, Cary, NC).

Results

Among 35,155 arthroscopic RCRs performed, 47% of patients were female patients and 58.5% of patients were aged between 60 and 74 years. No patients were excluded. Of the patients, approximately 43% (15,230 of 35,155) had filled an opioid prescription in the 3 months before RCR. Of these, 58.9% had been prescribed opioids at 1 to 3 months before RCR and 41.1% had been prescribed preoperative opioids only in the 1 month before RCR. In addition, 11.86% of patients (4,170 of 35,155) had a psychiatric diagnosis, 52.57% (18,480 of 35,155) had a diagnosis of low-back pain, and 22.43% (7,884 of 35,155) had a diagnosis of myalgia or fibromyalgia. Overall, opioid pain medication use fell precipitously in the year after RCR, with fewer than 10% of patients receiving prescriptions 11 to 12 months after surgery (Fig 1).

Patient Factors Associated With Prolonged Use

Preoperative Opiate Use. Patients filling preoperative opioid prescriptions at any time point were more likely to be taking these medications for prolonged periods after surgery than those who did not fill any opioid prescriptions preoperatively (Fig 2). At 3 months after RCR, patients in the 1- to 3-month opioid group were 7.45 (95% CI, 6.95-7.98) times more likely to fill opioid prescriptions than those who did not fill narcotic prescriptions preoperatively (Table 1). At 3 months after RCR, patients in the 0- to 1-month opioid group were 3.04 (95% CI, 2.8-3.29) times more likely to be filling opioid prescriptions (Table 1). At 9 months after surgery, patients in the 1- to 3-month opioid group were 12.47 (95% CI, 11.14-13.97) times as likely to fill opioid prescriptions than those not filling opioid prescriptions preoperatively (Table 1).

Psychiatric Diagnoses. Patients with psychiatric diagnoses of anxiety and depression had a strong association with postoperative filling of opioid prescriptions after RCR (Fig 3). They were found to be 1.94 (95% CI, 1.85-2.04) times as likely to be filling narcotic

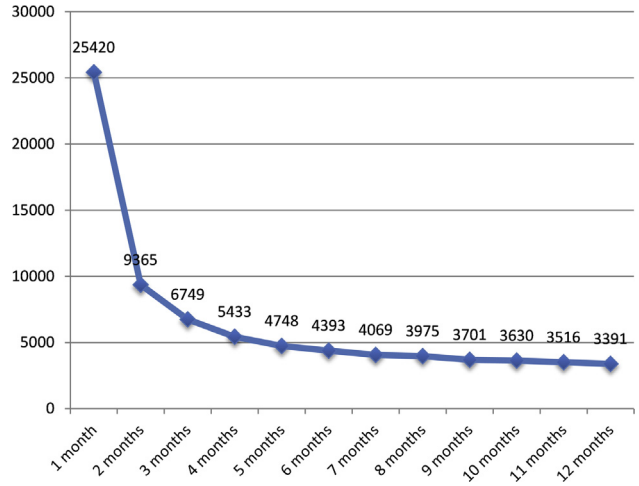

Fig 1. Number of patients filling narcotic prescriptions at a given time postoperatively.

prescriptions at 3 months postoperatively. At 6 months postoperatively, those with a psychiatric diagnosis were 2.43 (95% CI, 2.28-2.58) times as likely to be filling narcotic prescriptions, with this trend continuing through 12 months postoperatively (Table 1).

Myalgia and Low-Back Pain. Similar results were found with fibromyalgia (RR, 1.67; 95% CI, 1.6-1.75; Fig 4) and low-back pain (RR, 2.09; 95% CI, 2-2.2; Fig 5) diagnoses for opioid use at the 3-month postoperative time point (Table 1).

Discussion

We found that preoperative opiate use was rampant, at a rate of 43%, with high rates of patients filling opiate prescriptions before surgery. Filling of preoperative opioid prescriptions was the strongest predictor of postoperative opioid use, and patients with psychiatric diagnoses, fibromyalgia, and low-back pain were also filling significantly more narcotic prescriptions after surgery.

Previous authors have considered how preoperative opioid use may influence postoperative opioid demand and clinical outcome. Armaghani et al.[10] evaluated 583 patients undergoing spine surgery and found that 55% reported preoperative opioid use compared with 43% in our study. They determined that preoperative use was associated with a significantly decreased rate of opioid independence at 12 months postoperatively (41% opioid independent) compared with preoperatively opioid-naive patients (74% opioid independent). Zywiel et al.[7] studied 49 patients who underwent primary knee arthroplasty who had also used opioid pain medications more than 1 month before surgical intervention. They compared this group with a matched group of opioid-naive patients. They found the patients who took preoperative opioids had a longer hospital stay (4.3 days vs 3.4 days), required reoperation for knee stiffness more often (11 patients vs 0 patients), and had lower patient-reported outcomes (Knee Society score of 79 points vs 92 points). Lee et al.[8] evaluated 583 patients undergoing lumbar thoracolumbar or cervical spine surgery. They found that patients who self-reported using preoperative narcotics had inferior outcomes measured by 12-item Short Form Health Survey scores, Euro-Quality of Life scores, and Oswestry Disability and Neck disability index scores at 3 and 12 months after spine surgery. Preoperative opioid use had the strongest association with prolonged prescription opioid demand after surgery in our study; patients should be counseled about the risk of increased postoperative opioid demand when taking narcotic medications before surgery. We found no guidelines in the literature that recommend use of opioids for rotator cuff pathology. Thus, we recommend encouraging patients to discontinue long-term opioid pain medication use before RCR. Prior authors have found nonsteroidal anti-inflammatories to provide pain relief for patients with painful rotator cuff pathology who have not undergone RCR,[11] and we encourage consideration of nonsteroidal anti-inflammatory drugs or other non-narcotic medications if needed in the perioperative setting if not otherwise contraindicated. Although we are unable to comment on clinical outcomes after RCR in patients who are being prescribed narcotic medications preoperatively, we hypothesize this finding is not unique to knee arthroplasty and spine surgery and may be seen in postoperative rotator cuff populations as well.

We also found that patients who were not previously filling narcotic prescriptions who received an opioid prescription in the 1 month leading up to RCR were at

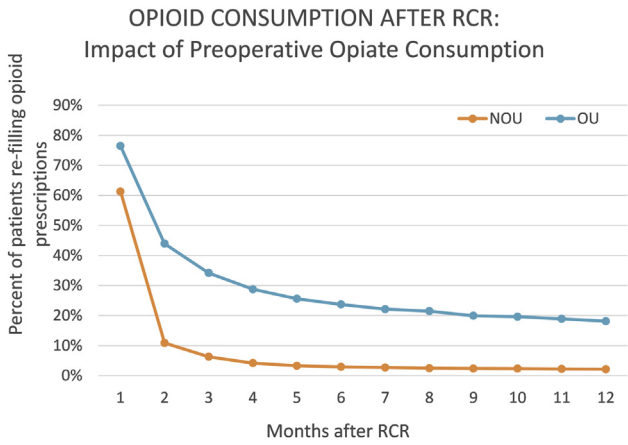

Fig 2. Percentage of patients filling narcotic prescriptions at a given time postoperatively in patients prescribed preoperative opioid medications (OU) leading up to surgery compared with those not filling preoperative narcotic prescriptions (NOU). (RCR, rotator cuff repair.)

Table 1. Relative Risk and 95% CIs for Receiving Postoperative Narcotic Prescriptions at Given Time Points After RCR

Time After RCR	Long-Term Opioid Consumption		Short-Term Opioid Consumption		Psychiatric Diagnoses		Fibromyalgia Diagnosis		Low-Back Pain Diagnosis	
	RR	95% CI	RR	95% CI	RR	95% CI	RR	95% CI	RR	95% CI
1 mo	1.44	1.42-1.46	0.99	0.97-1.01	1.11	1.09-1.12	1.04	1.02-1.06	1.06	1.04-1.07
2 mo	5.21	4.94-5.48	2.64	2.48-2.8	1.71	1.64-1.78	1.45	1.4-1.51	1.64	1.58-1.71
3 mo	7.45	6.95-7.98	3.04	2.8-3.29	1.94	1.85-2.04	1.67	1.6-1.75	2.09	2-2.2
4 mo	9.92	9.11-10.8	3.3	2.98-3.65	2.13	2.01-2.25	1.84	1.75-1.93	2.55	2.41-2.7
5 mo	11.53	10.48-12.69	3.5	3.12-3.92	2.29	2.16-2.42	2.01	1.9-2.12	2.89	2.71-3.08
6 mo	12.10	10.93-13.4	3.54	3.14-4	2.43	2.28-2.58	2.03	1.92-2.14	3.14	2.94-3.36
7 mo	12.15	10.93-13.51	3.29	2.90-3.73	2.44	2.29-2.60	2.15	2.03-2.28	3.41	3.17-3.66
8 mo	12.59	11.28-14.06	3.64	3.2-4.15	2.49	2.34-2.66	2.13	2-2.25	3.51	3.26-3.78
9 mo	12.47	11.14-13.97	3.53	3.08-4.03	2.53	2.37-2.70	2.21	2.08-2.35	3.88	3.58-4.2
10 mo	12.53	11.18-14.05	3.28	2.86-3.77	2.52	2.35-2.69	2.20	2.07-2.34	3.88	3.58-4.2
11 mo	12.40	11.04-13.94	3.46	3.02-3.98	2.56	2.39-2.74	2.18	2.05-2.33	4.16	3.82-4.52
12 mo	12.46	11.07-14.04	3.66	3.18-4.21	2.57	2.39-2.75	2.16	2.03-2.31	4.10	3.76-4.46

CI, confidence interval; RCR, rotator cuff repair; RR, risk ratio.

2 to 3 times increased risk of postoperative opioid use in the 12 months after RCR compared with those who did not fill narcotic prescriptions preoperatively. This may represent a population of short-term opiate users; although they are not as likely as long-term users to have prolonged opiate use after surgery, they still use opioids at alarming rates after surgery compared with those who do not fill preoperative narcotic prescriptions. Some institutions, as current practice dictates, are providing opioid prescriptions to patients during this time frame for patients to have available for use after surgery. This is done for the sake of convenience to surgical teams, patients, and families on the day of surgery. Although our dataset is unable to distinguish reasons for filling of preoperative opioid medication prescriptions, we believe our findings at least suggest that providing preoperative narcotic medication to previously opioid-naive patients may lead to increased postoperative demand in the setting of RCR. We recommend patient counseling on this association and believe that opioid education programs are important to avoid preoperative opiate use. We recommend further prospective work in this area and reconsideration of preoperative opioid medication prescribing habits.

We have identified a rapid drop in filling of prescription opioid medications after RCR, with fewer than 10% of patients still requiring narcotic medication refills 12 months after surgery (Fig 1). Surgeons should counsel patients that use of opioid medication for more than 2 months after RCR is not common. Medication refills after 2 months should be carefully considered, and reasons for ongoing narcotic medication requirements should be examined. Health care systems might use these data when setting quality measures and monitoring prescribing habits after RCR. We also encourage surgeons to consider alternative postoperative pain control regimens after RCR. Previous authors have considered various non-opioid

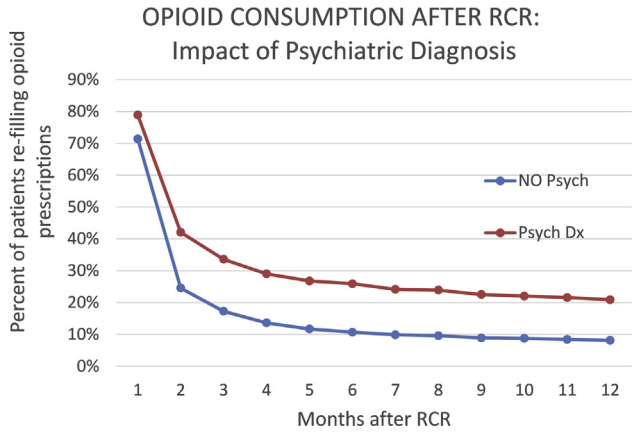

Fig 3. Percentage of patients filling narcotic prescriptions at a given time postoperatively in patients with a psychiatric diagnosis (Psych Dx) compared with those with no psychiatric diagnoses (NO Psych). (RCR, rotator cuff repair.)

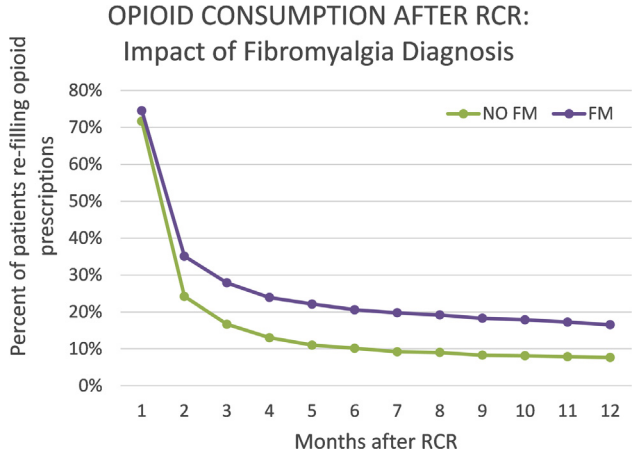

Fig 4. Percentage of patients filling narcotic prescriptions at a given time postoperatively in patients with a diagnosis of fibromyalgia (FM) compared with those without fibromyalgia (NO FM). (RCR, rotator cuff repair.)

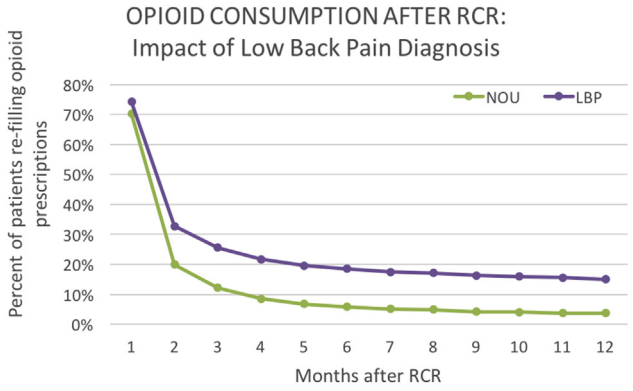

Fig 5. Percentage of patients filling narcotic prescriptions at a given time postoperatively in patients with a diagnosis of low-back pain (LBP) compared with those without low-back pain (NOU). (RCR, rotator cuff repair.)

pain control regimens,[11,12] cryotherapy,[13] and intralesional analgesia[14] in an effort to control postoperative pain with varying effects on postoperative narcotic demand. Further inquiry into the efficacy of non-opioid postoperative pain control regimens is necessary.

We also have identified other risk factors for increased postoperative opioid demand after RCR. Low-back pain is a common problem in the United States. Some medical societies and governing bodies have previously recommended narcotics for the treatment of low-back pain.[15,16] In their review of multiple prospective trials, Martell et al.[17] found no increased pain relief for chronic low-back pain patients taking opioids compared with placebo or non-opioid pain control. In their review of the literature, Goldenberg et al.[18] reported that fibromyalgia patients receiving opioids have poorer outcomes and that, in fact, fibromyalgia treatment guidelines recommend against opioids. They also reported risk factors for opioid use as female sex; geographic variation; psychological factors; a history of opioid use, misuse, or abuse; and patient or physician preference. We found that patients with psychiatric diagnoses, patients with fibromyalgia, and patients with low-back pain were more likely to be taking narcotic medication after RCR. Patients with these diagnoses should be counseled preoperatively that they are at risk of increased narcotic use after RCR. We propose that an informed discussion between the patient and the surgeon regarding the awareness of the issue may be sufficient. Furthermore, there may be treatments used to help limit postoperative opioid use; however, these techniques warrant further study.[19] We recommend that patients with these comorbidities be monitored closely in the postoperative period. Extra care should be taken to ensure these patients are not being prescribed narcotic pain medications by other providers for their low-back pain or fibromyalgia.

Limitations

This study has some limitations. First, other patient factors not evaluated may correlate with opiate use. Second, although we are able to report on number of prescriptions filled from a multicenter patient population, we are unable to provide the specific opioid used in each case, exact pill counts, or data on the number of tablets of opioid medication patients actually used as a limitation of the data source. Although we are able to report how often patients filled opioid prescriptions, which may be a marker for actual opioid use, we are unable to account for actual pills consumed. In this regard, it is possible we have presented the upper limit of what opioid consumption might be in the setting of RCR. Clearly, more granular data that report actual pill counts would be ideal. In addition, because we used an administrative claims database, these findings are largely dependent on proper documentation and coding. The diagnosis of entities such as myalgia can be complicated, and we acknowledge that exact diagnostic criteria for the comorbidities assessed may not be uniform across all health care entities in this study. We are also unable to report patient pain in this work, which to varying degrees may be associated with opioid demand after RCR. Furthermore, we are unable to comment on how opioid use prior to 3 months affects postoperative opioid demand. We are not able to look prior to 3 months, and patients who filled prescriptions at 3 months may very well have also filled prescriptions at 6 or 12 months. Unfortunately, we are unable to report on this. Given our reported findings on those who filled preoperative opioid prescriptions at 1 to 3 months before RCR, it is possible that those who filled opioid prescriptions prior to 3 months would also be at risk of increased filling of postoperative opioid prescriptions.

Conclusions

From a large multicenter database, we found approximately 43% of patients undergoing RCR received opioid medications before RCR. Patients who are prescribed narcotics before RCR are at increased risk of postoperative opioid demand. Patients with psychiatric diagnoses, myalgia, and low-back pain may be at increased risk of prolonged opioid use after surgery.

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