


# Opioid overprescription in adolescents and young adults undergoing hip arthroscopy

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## ABSTRACT

Few studies have examined factors related to the increased consumption of opioids after hip arthroscopy in adolescents and young adults. This study sought to determine prescription patterns following hip arthroscopy in this population, and to determine clinical or surgical factors associated with increased post-operative opioid use. Daily post-operative opioid intake was obtained from pain-control logbooks of adolescents and young adults who underwent hip arthroscopy between January 2017 and 2020. Study outcomes were defined as the median total number of opioid tablets consumed, total days opioids were consumed, mean daily opioid consumption and the ratio of opioids prescribed post-operatively to consumed. Clinical and surgical factors were analyzed to determine any association with opioid consumption. Fifty-eight (20%) patients returned completed logbooks. Most patients (73%) were prescribed 30 oxycodone tablets. The median number of tablets consumed was 7 (range 0–41) over a median duration of 7 days (range 1–22). The median ratio of tablets consumed to prescribed was 20%. Increasing patient age at surgery was associated with increased total number of tablets consumed ( $r = 0.28$ ,  $P = 0.04$ ) and to the ratio of tablets consumed to prescribed ( $r = 0.30$ ,  $P = 0.03$ ). Patients who were prescribed more than 30 tablets consumed on average 7.8 more tablets than patients prescribed fewer ( $P = 0.003$ ). Patients who underwent regional anesthesia consumed tablets for longer compared with those who did not (median, 10 versus 4 days;  $P = 0.03$ ). After undergoing hip arthroscopy, adolescents and young adult patients are commonly overprescribed opioids, consuming on average only one-fifth of the tablets prescribed.

## INTRODUCTION

Multiple studies have demonstrated a discrepancy between the amount of opioid tablets prescribed and the amount ultimately consumed by the patient [1–4]. The overprescription of opioids is multifactorial and can depend on patient specific risk factors, physician prescribing habits and a poor correlation between 24 h pre-discharge opioid use and the amount used post-discharge [5, 6]. In a survey study, Sabatino *et al.* found that amongst adult patients undergoing the most common orthopedic procedures, over 60% of patients had unused tablets and only 40% of those patients properly disposed of them [7]. In the current

opioid epidemic, such findings raise concerns about opioid diversion and the non-medical use of prescribed narcotics in adults as well as in adolescents [8, 9]. This is a serious issue within the greater scope of the opioid epidemic and proper tracking of opioid use with subsequent adjustment of prescription amounts could help stem the opioid epidemic.

Children and adolescents are also affected by the opioid epidemic as opioid-related pediatric admissions have increased from 2004 to 2015 [10–13]. The non-medical use of narcotics and even the legitimate use in adolescents may lead to substance use disorders in adulthood [14].

George *et al.* demonstrated that over 50% of opioid prescriptions upon pediatric discharge were provided by orthopedic surgeons [15]. To that end, there is a need for effective procedure-specific protocols to prescribe the optimal amount of opioids upon discharge. Indeed, Tepolt *et al.* demonstrated that pediatric patients are overprescribed opioids upon discharge after knee arthroscopy [16]. While studies on opioid use after hip arthroscopic procedures exist in adult patients, there is a paucity of literature in adolescent as well as young adult patients [17–19].

The purpose of the study was to compare the number of opioids prescribed with the amount of opioids consumed post-operatively after hip arthroscopic procedures in adolescent and young adult patients. The secondary purpose was to determine which patient specific or surgical factors were associated with increased opioid intake. We hypothesized that patients would require fewer opioid tablets than were prescribed, and that patients who underwent perioperative peripheral nerve blocks would consume significantly less opioids than those who did not undergo peripheral nerve blocks.

## METHODS

### Data collection

This retrospective case series was performed at a tertiary referral children's hospital, as part of a quality-improvement project deemed exempt from approval by the institutional review board. All adolescent patients (ages 10–19 years) and young adult patients (ages 20–35 years) who underwent hip arthroscopy at our institution by two surgeons from January 2017 to January 2020, and who returned a completed post-operative pain medication use logbook were included. Patients with a diagnosed pain syndrome or history of chronic pain, as determined by the patient taking opioid medications prior to surgery, were excluded. On the day of surgery, all patients were prescribed opioids (oxycodone 5 mg) and diazepam by the surgical assistant (fellow, resident or physician assistant) for pain control following discharge. The number of opioid medications was standardized across all prescribing surgical assistants. Over the course of the study, the number of tablets decreased from 60 tablets to 30 tablets, as a protocol change by the sports medicine division within our department to decrease the amount of opioid medications being prescribed. A few patients had 15 tablets prescribed as this was specifically requested by the patient (half of the intended prescription amount—30 tablets). All patients were provided with instruction for as-needed use of over-the-counter pain medications, such as acetaminophen and NSAIDs (non-steroidal anti-inflammatory medications), including recommended amount, and

frequency of use. Eligible patients were provided with pain-control logbooks in the preoperative area. The pain control log-books were specific to patients undergoing hip arthroscopy included in this study. They were also provided with instructions for logging any daily pain medication intake for a period of 21 days after surgery.

The following variables were obtained from the medical records: demographic characteristics (age, sex, weight, history of diagnosed psychiatric condition, prior opioid prescriptions); surgical information (type of procedure, total operative time, whether a nerve block was used and if so, what type, whether local anesthesia was used and, if so, what type, intravenous (i.v.) pain medications used in the perioperative period, whether the patient stayed overnight in the hospital, and whether there were any complications within 21 days post-operatively); and prescription information (type and amount of oral medications prescribed for post-operative pain control, whether refills were provided, and history of opioid prescriptions). Type of procedure was listed as hip arthroscopy with any or all of the following interventions (1. labral repair, 2. femoral osteoplasty, 3. acetabular osteoplasty, 4. loose body removal, 5. capsular closure, 6. other hip arthroscopic surgery not included in Categories 1–5). This methodology closely followed a previous study by Tepolt *et al.* [16] evaluating opioid consumption in patients undergoing knee arthroscopy.

### Statistical analysis

Patient opioid usage was summarized by the number of opioid tablets prescribed, the number of tablets consumed, the ratio of the number of tablets consumed to the number of tablets prescribed, the number of days opioids were consumed, and the number of tablets consumed per day. Opioid data were summarized by median and interquartile range (IQR, 25–75th percentile), as well as range. The 95th percentile of opioid tablets consumed was also calculated to ascertain a safe maximum prescription number. Bivariate comparison in opioid use outcomes was conducted using the Mann–Whitney *U*-test across binary covariates including the use of regional or local anesthesia, the use of preoperative pain control and overnight hospital admission. Bivariate comparison in opioid use outcomes was conducted using Spearman's rank correlation across continuous covariates including patient age, patient weight and duration of surgery. Spearman's rank correlation coefficient along with a 95% confidence interval (CI) was calculated for each association. Multivariate general linear modeling was used to determine associations between patient sex, weight, age, surgical time, the use of regional or local anesthesia, the use of perioperative i.v. pain control, and overnight stay with each opioid use outcome. All tests were

two-sided and  $P$ -values  $<0.05$  were considered statistically significant.

## RESULTS

Of the total number of patients between the ages of 10 and 35 years who underwent hip arthroscopy during the study period by the two surgeons,  $\sim 95\%$  met the inclusion criteria. Of those,  $\sim 20\%$  or 58 patients returned completed log-books and were analyzed in the study. The mean age of patients was 21.3 years old (range 14.9–34.3 years old) at time of surgery and the cohort was 72% female (Table I). The median tablets consumed were 7 (range 0–41 tablets) over a median duration of 7 days (range 1–22 days). Seventy-three percent of patients were prescribed 30 tablets of oxycodone (Table I). Fifteen percent of patients were prescribed 60 tablets, 10% were prescribed 50 tablets and 2% were prescribed 15 tablets. The median ratio of

tablets consumed to prescribed was 20% (range, 0–100%) and patients consumed a median of 1 tablet per day (range 0–4.3 tablets). The 95th percentile of opioids consumed was 28 tablets.

### Total opioid tablets consumed

Bivariate analysis found a moderately positive correlation between patient age at surgery and the total number of tablets consumed ( $r = 0.28$ ; 95% CI = 0.02–0.50;  $P = 0.04$ ). In addition, patients who were prescribed more than 30 tablets at surgery consumed more tablets overall (median, 13 tablets;  $P = 0.02$ ) compared with those who were prescribed 30 or fewer tablets (median, 5 tablets) (Table II). Multivariate analysis determined that subjects who were prescribed more than 30 tablets at surgery consumed, on average, 7.8 more tablets overall compared with those who were prescribed 30 or fewer tablets at surgery ( $P = 0.003$ ).

**Table I. Cohort summary (N = 58)**

<i>Characteristic</i>	<i>Freq.</i>	<i>(%)</i>	<i>(Range)</i>
Age at surgery (years; mean $\pm$ SD)	21.3	$\pm$ 4.97	(14.9–34.3)
Sex (% male)	17	(28%)	
Side (% right)	30	(50%)	
Weight at surgery (kg; mean $\pm$ SD)	68.8	$\pm$ 14.1	(43–108)
Surgical time (min)	96	(85–116)	(65–223)
Regional anesthesia	10	(16%)	
Local anesthesia	57	(93%)	
Preoperative i.v.	61	(100%)	
Overnight admission	13	(21%)	
Oxycodone 5 mg prescribed	59	(97%)	
15 tablets	1	(2%)	
30 tablets	43	(73%)	
50 tablets	6	(10%)	
60 tablets	9	(15%)	
<i>Opioid usage</i>	<i>Median</i>	<i>(IQR)</i>	<i>(range)</i>
Total tablets consumed	7	(3–13)	(0–41)
Ratio consumed/prescribed	0.2	(0.07–0.33)	(0–1)
Days tablets consumed	7	(4–12)	(1–22)
Ratio tablets consumed/days consumed	1.1	(0.35–1.84)	(0–4.33)

SD, standard deviation; IQR, interquartile range.

**Table II. Bivariate associations with total tablets consumed**

Characteristic	r	(95% CI)			P
Age at surgery	0.28	(0.02 to 0.5)			0.04
Weight at surgery	-0.02	(-0.28 to 0.24)			0.86
Duration of surgery	-0.02	(-0.28 to 0.24)			0.87
Characteristic	Median	(IQR)	Median	(IQR)	P
Sex (females; males)	7	(4 to 12)	5	(2 – 16)	0.59
Local anesthesia (yes; no)	4	(3 to 5)	7	(3 – 14)	0.21
Regional anesthesia (yes; no)	8	(4 to 12)	4	(2 – 17)	0.58
Overnight admission (yes; no)	8	(4 to 13)	4	(1 – 12)	0.35
Prescribed more than 30 tablets (yes; no)	13	(7 to 20)	5	(2 – 10)	0.02

r, Spearman's rank correlation coefficient; CI, confidence interval; IQR, interquartile range.

**Table III. Bivariate associations with ratio of tablets consumed to prescribed**

Characteristic	r	(95% CI)			P
Age at surgery	0.30	(0.04 to 0.52)			0.03
Weight at surgery	0.04	(-0.23 to 0.29)			0.79
Duration of surgery	-0.01	(-0.27 to 0.25)			0.93
Characteristic	Median	(IQR)	Median	(IQR)	P
Sex (females; males)	0.22	(0.11 to 0.33)	0.17	(0.07 – 0.43)	0.65
Local anesthesia (yes; no)	0.10	(0.05 to 0.18)	0.20	(0.08 – 0.35)	0.19
Regional anesthesia (yes; no)	0.20	(0.09 to 0.33)	0.14	(0.04 – 0.35)	0.55
Overnight admission (yes; no)	0.23	(0.10 to 0.33)	0.14	(0.03 – 0.37)	0.36
Prescribed more than 30 tablets (yes; no)	0.22	(0.12 to 0.34)	0.17	(0.07 – 0.33)	0.61

r, Spearman's rank correlation coefficient; CI, confidence interval; IQR, interquartile range.

#### Ratio opioid tablets consumed to prescribed

Bivariate analysis found a moderately positive correlation between patient age at surgery and the ratio of tablets consumed to prescribed ( $r=0.30$ ; 95% CI=0.04 – 0.52;  $P=0.03$ ) (Table III). Multivariate analysis found that for each additional year of age, the ratio of tablets consumed to prescribed increased by 1% ( $P=0.02$ ).

#### Opioid tablets consumed per day

Bivariate analysis found no significant associations between patient or surgical characteristics and the number of tablets

consumed per day (Table IV and Fig. 1). Multivariate analysis, however, determined that patients who were prescribed more than 30 tablets at surgery consumed 0.7 more tablets per day compared with those who were prescribed 30 or fewer tablets at surgery ( $P=0.03$ ).

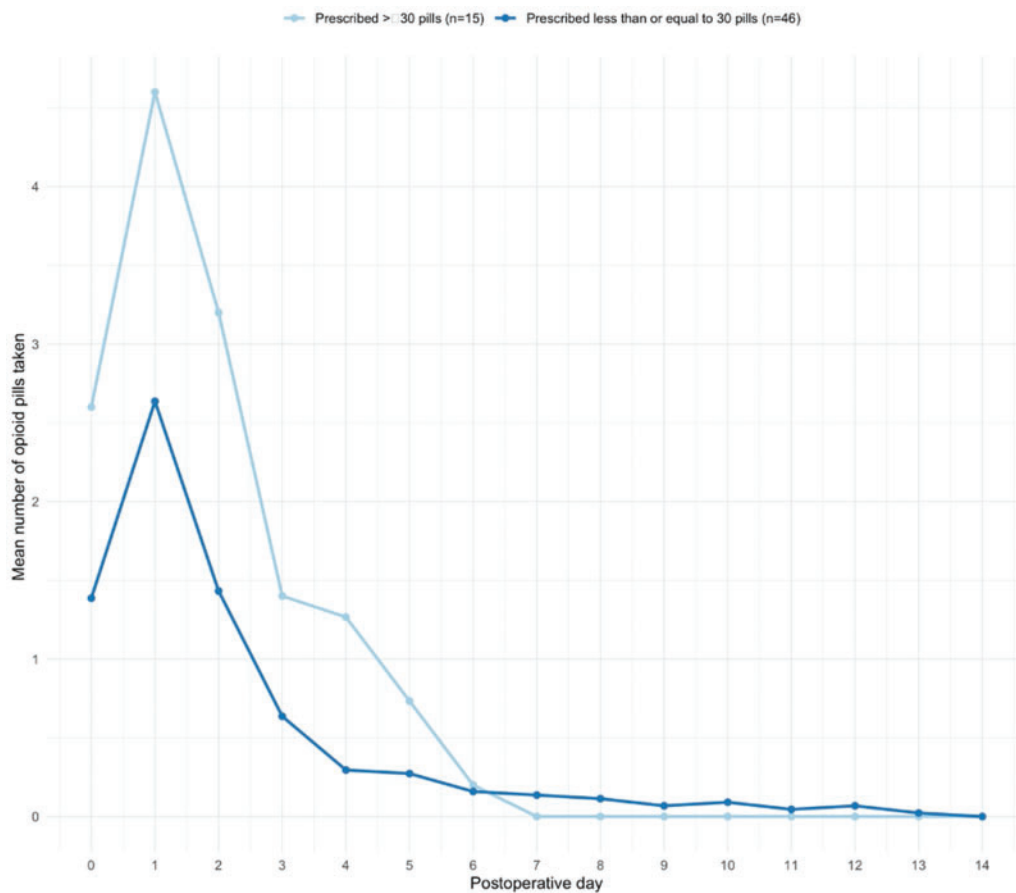
#### Number of days tablets consumed

Bivariate analysis found a moderately negative correlation between the duration of surgery and the number of days tablets were consumed ( $r = -0.31$ ; 95% CI = -0.52 to -0.07;  $P=0.01$ ) (Table V). In addition, patients who

**Table IV. Bivariate associations with tablets consumed per day**

Characteristic	r	(95% CI)			P
Age at surgery	0.14	(-0.13 to 0.38)			0.30
Weight at surgery	0.09	(-0.17 to 0.34)			0.50
Duration of surgery	0.18	(-0.09 to 0.41)			0.19
Characteristic	Mean	(IQR)	Mean	(IQR)	P
Sex (females; males)	1.25	(0.40 to 1.75)	0.67	(0.17 – 2.29)	0.86
Local anesthesia (yes; no)	0.87	(0.3 to 1.38)	1.10	(0.35 – 1.90)	0.48
Regional anesthesia (yes; no)	0.92	(0.37 to 1.76)	1.44	(0.41 – 1.98)	0.56
Overnight admission (yes; no)	0.97	(0.43 to 1.75)	1.29	(0.09 – 2.68)	0.78
Prescribed more than 30 tablets (yes; no)	1.37	(1.78 to 2.23)	0.87	(0.29 – 1.76)	0.05

r, Spearman's rank correlation coefficient; CI, confidence interval; IQR, interquartile range.



**Fig. 1.** Line chart illustrating the mean number of opioid pills consumed by post-operative day, grouped by number of pills prescribed

**Table V. Bivariate associations with days tablets were consumed**

Characteristic	r	(95% CI)			P
Age at surgery	0.24	(−0.01 to 0.47)			0.06
Weight at surgery	−0.13	(−0.37 to 0.13)			0.33
Duration of surgery	−0.31	(−0.52 to 0.07)			0.01
Characteristic	Median	(IQR)	Median	(IQR)	P
Sex (females; males)	8	(4 to 12)	7	(3 – 11)	0.14
Local anesthesia (yes; no)	4	(2 to 7)	8	(4 – 12)	0.14
Regional anesthesia (yes; no)	10	(4 to 12)	4	(2 – 8)	0.03
Overnight admission (yes; no)	10	(4 to 12)	4	(2 – 8)	0.05
Prescribed more than 30 tablets (yes; no)	11	(4 to 12)	7	(4 – 12)	0.58

r, Spearman's rank correlation coefficient; CI, confidence interval; IQR, interquartile range.

underwent regional anesthesia consumed tablets for longer (median, 10 days) compared with those who did not undergo regional anesthesia (median, 4 days;  $P = 0.03$ ) (Table V). Multivariate analysis, however, found that these effects were not significant when controlling for additional factors.

### DISCUSSION

Using patient-reported opioid consumption data, we found that adolescent and young adult patients consumed 20% of their prescribed opioids after hip arthroscopic surgery. There has been an increasing incidence of opioid overprescription and opioid-related hospitalizations in children and adolescents [10–13]. Opioid consumption in adult patients after hip arthroscopy is well-documented in the literature [17–19]. Our study adds to the literature by providing patient-reported consumption data in the adolescent and young adult populations and highlights the large difference between the numbers of opioids prescribed and consumed.

The discrepancy between the number of opioids prescribed and consumed, combined with the trend that increasing number of opioids prescribed correlated with increased number of opioids consumed, presents an opportunity for physicians to decrease the number of tablets initially prescribed. In our study, 95% of patients consumed 28 or less tablets, and 75% of patients consumed opioid tablets for 12 days or less.

Identifying which perioperative characteristics are associated with increased opioid use is important as it can potentially allow prescribers to personalize the post-operative narcotic regimens to individual patients. In this study, we

investigated the relationship between patient demographic characteristics and surgical factors with opioid consumption. We found that increasing opioid prescription amounts were associated with increased opioid consumption in both daily amounts and total tablets consumed. This may suggest that decreasing the amount of opioids initially prescribed to patients undergoing hip arthroscopy may lead to lower numbers consumed. We also found that younger patients tended to consume a lower percentage of opioids prescribed as well as a lower number of tablets overall. Parents tend to be more involved in the post-operative care and medication management of our younger patients, and this may also play a role in a subsequent decreased use of opioids in younger patients. Perhaps a greater focus on preoperative counseling on expectations of pain management post-operatively may help lower opioid consumption in this patient population.

We also found that increased operative time was associated with a decreased amount of opioid tablets consumed and that the use of perioperative regional anesthesia was associated with an increased total number of days patients consumed opioids. However, these associations were not maintained in multivariate analysis. There has been literature to support that regional anesthesia in hip arthroscopy decreases opioid use in the early post-operative period [20–22]. In this study, we found no association between the use of local anesthesia and opioid consumption. We did find that there was an association between overnight admission and increased duration of opioid consumption that approached, but did not achieve, statistical significance. In this study, the criteria for overnight admission



varied subjectively based on physician practices, patient and parent preference, and on timing of surgery during the day. Further studies would be required to examine which patient and surgical factors are associated with same day surgery versus overnight observation.

While, to our knowledge, there is no study published previously in the literature on the adolescent population regarding opioid consumption following hip arthroscopy, several studies have been published in the adult literature. The overall findings on adjunct analgesia (nerve blocks, peri-articular and intra-articular injections, and oral medications) for patients undergoing hip arthroscopy are that these modalities did provide pain benefits post-operatively. A systematic reviewed demonstrated that adjunct analgesia after hip arthroscopy in adults may reduce post-operative opioid consumption when compared with placebo [20]. However, there were inconclusive findings in terms of length of hospital stay as the primary endpoint [20]. While some studies have found local infiltration anesthesia to have the greatest immediate reduction in post-operative pain and opioid use, this relationship was not seen in our study [20]. Interestingly, type of analgesia appears to have no effect on the length of stay in Post-Anesthesia Care Unit (PACU) [20]. Regarding peripheral nerve blocks, improvements in pain scores and opioid consumption has been found in the PACU and in the 48–72 h following surgery [20–23]. Despite these interventions and findings, there remains no consensus in the hip arthroscopy literature on the recommended amount or prescription patterns of narcotics to prescribe after hip arthroscopy [24]. Moreover, attempts have also been made to develop opiate free post-operative treatment modalities in hip arthroscopy, which may be the most desired course of action for patients, clinicians and society as a whole [25].

While using patient-reported data allowed us to appreciate opioid consumption patterns and their relationships with demographic and perioperative patterns, there are some limitations to this type of data collection. There is a possibility of patients underestimating their opioid use if they incorrectly logged this information. Moreover, as we only reported the consumption patterns of patients that returned the logbooks, this could present a selection bias.

### CONCLUSION

After undergoing hip arthroscopy, adolescents and young adult patients are commonly overprescribed opioids, consuming on average only one-fifth of the tablets prescribed. This finding mirrors findings in the pediatric knee arthroscopy literature and provides an opportunity to reassess current opioid prescribing behaviors in the adolescent and young adult populations. Moreover, it was not found that the use of regional anesthesia was not found to decrease overall opioid consumption.

### DATA AVAILABILITY

The data underlying this article will be shared on reasonable request to the corresponding author.

### CONFLICT OF INTEREST STATEMENT

None declared.

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