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Data Article

Opioid Use for Postoperative Pain Control in Pediatric Supracondylar Humerus Fractures: A Pain-Diary Based Prospective Study

Ryan J O'Leary¹, Leah Herzog¹, Sara Van Nortwick¹, Matthew A Dow¹, Robert F Murphy^{1*}

¹Medical University of South Carolina Department of Orthopaedics and Physical Medicine, USA

***Corresponding Author:** Robert F Murphy, MD, Medical University of South Carolina Department of Orthopaedics and Physical Medicine, 96 Jonathan Lucas St, CSB 708, MSC 622, Charleston SC 29425, USA;
Email: murphyr@musc.edu

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Abstract

Introduction: There is limited research on postoperative pain control in pediatric populations following operative fixation of a Supracondylar Humerus (SCH) fractures. The purpose of the current study is to characterize the effectiveness of opioids vs non-opioid medication for postoperative pain control in pediatric patients following Closed Reduction Percutaneous Pinning (CRPP) of a SCH fracture.

Methods: An IRB-approved prospective study was conducted from November 2019 to June 2020 and eight patients were enrolled in the study. They received CRPP for a SCH fracture at our institution. These patients were instructed to complete a postoperative pain diary recording their level of pain as well as medication usage. For pain control, the patients were counselled to alternate acetaminophen and ibuprofen and were also prescribed a short course of hydrocodone-acetaminophen for severe pain. T-tests were performed to compare pain ratings and medication usage between each group.

Results: Of the eight patients in the study, three of the patients used opioid medication for pain control (in addition to acetaminophen and ibuprofen) and five patients used exclusively non-opioid medication for pain control (only acetaminophen and ibuprofen); from here-in these patients will be referred to as the “opioid group” and the “non-opioid” group, respectively. The opioid group and the non-opioid group did not differ significantly in age, weight, Gartland

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fracture type, or percent female (Table 1). The average total pain scores were 6.2 in the opioid group and 3.3 in the non-opioid group ($p=0.03$). For both groups, average pain scores were highest on the day of surgery and were lowest on postoperative day 4. The opioid group had higher pain scores on postoperative day 4 when compared with the non-opioid group and these results were statistically significant ($p=0.04$). The difference in acetaminophen and ibuprofen use between the two study groups was not statistically significant.

Discussion: Our results demonstrate that 62% of our patient cohort managed their post-operative pain control with non-opioid pain medication. When compared with the opioid group, the non-opioid group had lower overall average pain scores. These results suggest that appropriate pain control can be achieved without opioids in the majority of patients.

Keywords

Patient; Pain Control; Fracture; Pediatric

Introduction

Supracondylar Humerus (SCH) fractures are the most common elbow injuries in children [1]. They are classified into the Gartland Classification system which helps guide management; type I fractures are generally treated non-surgically while most displaced injuries (types II, III, IV) require closed reduction and percutaneous pinning (CRPP) [1,2]. Postoperative pain management protocol varies considerably, ranging from over-the-counter acetaminophen and ibuprofen to short courses of opioid medications [3]. Given the potential side effects of opioids as well as concerns for opioid misuse, there has been increased focus on limiting the use of opioid analgesics for SCH fracture in the pediatric population.

There is limited research on postoperative pain control in pediatric populations following operative fixation of a SCH fracture. The purpose of the current study is to characterize the effectiveness of narcotics vs non-opioid medication for postoperative pain control in pediatric patients following CRPP for a SCH fracture.

Method

A prospective study was conducted to study the effect of medication use on pain control in pediatric patients following CRPP for a SCH fracture. IRB approval was obtained. From November 2019 to June 2020, eight patients were identified and completed the study. They received CRPP for a SCH fracture at our institution by one of three pediatric orthopedic surgeons. These patients were instructed to complete a postoperative pain diary. The diary

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included a column with “Day after Surgery” (Range: day of surgery- postoperative day four), Pain Score (range: 1-10), amount of acetaminophen (Tylenol), amount of ibuprofen (Motrin), and amount of hydrocodone-acetaminophen (Hycet). The diary also included an infographic demonstrating the Wong-Baker FACES Pain Rating Scale (commonly used for grading pain in pediatric populations) and the VSAS Numeric Rating Scale.

For post-operative pain control, the patients were counselled to alternate acetaminophen and ibuprofen. They were also prescribed a short course of hydrocodone-acetaminophen for severe pain. Pain scores and medication usage was calculated for each individual patient then averaged for each study group. T-tests were performed to compare pain ratings and medication usage between each group.

Results

Of the eight total patients, the average patient age was 5.2 years old (range 1.3-7). The cohort was 37.5% female. The average patient weight was 18.7 kg. Of the eight cases, one of the cases four cases were Gartland IIs, one case was a Gartland III, and three cases were Gartland IVs.

Of the eight patients in the study, three of the patients used opioid medication for pain control (in addition to acetaminophen and ibuprofen) and five patients used exclusively non-opioid medication for pain control (only acetaminophen and ibuprofen). From here-in, the three patients that required opioids will be referred to as the “opioid group” and those that did not require opioids will be referred to as the “non-opioid group”. The opioid group and the non-opioid group did not differ significantly in age, weight, Gartland fracture type, or percent female (Table 1). The average total pain scores were 6.2 in the opioid group and 3.3 in the non-opioid group ($p=0.03$). For both groups, average pain scores were highest on the day of surgery and were lowest on postoperative day 4. The opioid group also had higher average pain scores on the day of surgery, postoperative day 1, postoperative day 2 and postoperative day 3 when compared to the non-opioid group however, these findings were not statistically significant (Table 1). The opioid group had higher pain scores on postoperative day 4 when compared with the non-opioid group and these results were statistically significant ($p=0.04$).

Postoperative acetaminophen and ibuprofen use for the two study groups is documented in Table 2. The non-opioid group used more acetaminophen in the postoperative period than the opioid group, although this result was not statistically significant ($p=0.80$). The opioid group used more ibuprofen in the postoperative period, although this result was not statistically significant ($p=0.24$) (Fig. 1).

Group Characteristics and Average Pain Scores			
	Opioid Group	Non-Opioid Group	p-value
Group Characteristics			
Number of Patients	3	5	-
Average Age	4.7	5.5	0.66
Average Weight	18.2	19	0.83
% Female	0%	60%	-
Gartland Classification			
Type I	0	0	-
Type II	0	4	-
Type III	1	0	-
Type IV	2	1	-
Average Pain Scores (Scale: 0-10)			
Overall Average	6.2	3.3	0.03
Day of Surgery	8	5.7	0.39
Postoperative Day 1	7.4	4.6	0.19
Postoperative Day 2	6.3	3.4	0.09
Postoperative Day 3	5	2.3	0.08
Postoperative Day 4	4.3	0.7	0.04

Table 1: Characteristics of the two study groups as well as average postoperative pain scores.

Medication Use			
	Opioid Group	Non-Opioid Group	p-value
Hydrocodone-Acetaminophen Use (mL)			
Total Average Use	8.3	0.0	0.02
Use by Day			
Day of Surgery	18.8	0.0	-
Postoperative Day 1	10.0	0.0	-
Postoperative Day 2	5.0	0.0	-
Postoperative Day 3	3.8	0.0	-
Postoperative Day 4	3.8	0.0	-
Acetaminophen Use (mL)			
Total Average Use	7.7	8.4	0.80
Use by Day			
Day of Surgery	2.7	3.4	-
Postoperative Day 1	14.7	16.7	-
Postoperative Day 2	5.3	10.4	-
Postoperative Day 3	8.0	8.6	-
Postoperative Day 4	8.0	2.8	-
Ibuprofen Use (mL)			
Total Average Use	8.2	5.1	0.24
Use by Day			
Day of Surgery	2.9	7.0	-
Postoperative Day 1	9.1	11.1	-
Postoperative Day 2	9.1	6.0	-
Postoperative Day 3	10.7	1.6	-
Postoperative Day 4	9.1	0.0	-

Table 2: Average postoperative medication use for the two groups.

Figure 1: Average postoperative medication use for the two groups.

Discussion

Our results demonstrate that 62% of our patient cohort managed their post-operative pain control with non-opioid pain medication. When compared with the opioid group, the non-opioid group had lower overall average pain scores. These results suggest that appropriate pain control can be achieved without narcotics in the majority of patients.

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Previous studies have studied appropriate postoperative pain control regimens following CRPP of a SCH fracture. A study by Swanson, et al., identified 217 patients who received CRPP for a SCH fracture [3]. 174 of these patients were treated with acetaminophen and 43 were treated with opioid medications. Results of the study showed non-statistically significant differences in mean pain scores for the two study groups. The authors concluded that acetaminophen is as effective as opioids for postoperative pain control in CRPP for SCH fractures. A study by Nelson, et al., studied opioid usage and pain control in eight-one patients that received CRPP for a SCH fracture and demonstrated that pain levels and opioid usage decreased to a “clinically unimportant” level by postoperative day three [4]. They also found that patients used less than 25% of their prescribed opioid medication and suggested that a prescription of seven opioid doses is an appropriate dose that balances opioid stewardship with proper analgesia. A study by Adams, et al., demonstrated that use of perioperative ketorolac decreases postoperative pain, opioid use, hospitalization cost, and length of stay in patients following CRPP for SCH [5]. Multiple studies have suggested the use of intra-articular injections as a method of pain control following CRPP for SCH. A study by Kim, et al., on twenty-one patients that received CRPP for SCH found that injection of intraoperative bupivacaine into the fracture site decreased use of narcotics [6]. IV paracetamol had a synergistic effect on this result when used in combination with intraoperative bupivacaine. A study by Georgopoulos, et al., on one hundred twenty-four patients status post CRPP for SCH demonstrated that intraarticular injection of bupivacaine significantly improved pain scores and decreased use of narcotics [7].

It is important that orthopedic surgeons balance opioid stewardship with analgesia when considering pain control regimens for patients that receive CRPP for a SCH fracture. The results of this study suggest that with appropriate counselling and tempering of expectations in regard to pain, appropriate pain control can be achieved with non-opioid medications such as acetaminophen and ibuprofen for the majority of patients following surgery for SCH fractures. Patients who report pain scores over 5 out of 10 or persistent opioid use beyond postoperative day four should warrant further clinical evaluation for complications such as compartment syndrome or ischemia.

One limitation of this prospective study is the small sample size. The statistical significance of some of our data, particularly postoperative pain scores, is limited by the sample size. Additionally, due to the small sample size, there could have been confounding variables that biased the data results. There is potential for self-selecting bias in this prospective study. The patients were not randomized into the opioid and non-opioid groups. All patients were prescribed a short course of opioids and each patient made the individual choice whether or not to use the opioid medication. The patients, therefore self-selected which study group they ended up in. Our results demonstrate that the opioid group had higher overall pain scores, however they might have required opioid medication due to more severe postoperative pain. Additionally, these patients may have naturally had lower pain tolerances when compared to their non-opioid using peers.

With appropriate counselling and tempering of expectations in regards to pain, appropriate pain control can be achieved with non-opioid medications such as acetaminophen and ibuprofen for the majority of patients following surgery for SCH fractures.

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