Pediatric Opiate Use After Hernia Repair

Hope Wilkinson MD[1], Kimberly Somers PA-C[1,2], Melissa Lingongo[1,2], and Casey Calkins MD[1,2]

1. Medical College of Wisconsin, Milwaukee, WI, Department of Surgery, 8900 W. Doyne Avenue, Milwaukee, WI 53226.
2. Children's Hospital of Wisconsin, Milwaukee, WI, 999 92nd Street, Suite CCC320, Milwaukee, WI 53226.

Corresponding author: Hope Wilkinson MD, 999 92nd Street, Suite CCC320, Milwaukee, WI 53226. Tel: (414) 266-6550 E-mail: khopewilkins@mcw.edu

Author Disclosure Statement
None of the four authors have any financial or personal relationships with organizations or people which could bias this work and conclusions.

Key Words: day surgery, pediatrics, narcotics, opioids, hernia repair

Abstract

Background: The ideal postoperative pain management regimen after outpatient pediatric surgical procedures is not known. We hypothesized that the use of non-opioid medications alone would provide adequate postoperative analgesia compared to those patients receiving opioids after pediatric herniorrhaphy.

Methods: A retrospective chart review of patients undergoing umbilical, inguinal and epigastric hernia repair at a US children's hospital during 2017 was conducted. Individual physician practice dictated whether opioids were prescribed. Data extracted included age, sex, procedure, pain medications prescribed and follow-up visits within 30 days of surgery. The Wisconsin Electronic Prescription Drug Monitoring Program was queried to determine whether opioid prescriptions had been filled. Calls were conducted 24 to 72 hours after surgery to assess for pain control, nausea/emesis, and wound issues.

Results: Of the 564 children included, 383 (68%) of children received prescriptions for opioids, of which 233 (61%) were filled. The average opioid prescription was for 6.4[1-29] doses. Among the 59% of patients who answered follow up calls, 97% reported pain as controlled and 7% reported nausea/emesis. Patients who received an opioid prescription exhibited the same rate of pain control (97%) as those who did not receive or fill an opioid prescription.

Conclusion: Non-opioid medications are effective in controlling postoperative pain after pediatric herniorrhaphy. Routine opioid administration does not change parent reported uncontrolled pain following ambulatory inguinal, umbilical or epigastric hernia repair compared to non-opioid pain management. A guideline promoting the use of non-opioid analgesia following pediatric herniorrhaphy is likely to decrease opioid use while offering adequate post-operative analgesia.

Introduction

Pain is an expected consequence of surgery, but the ideal postoperative pain management regimen after uncomplicated outpatient pediatric surgical procedures has not been well established in the

literature. Additionally, the rise in outpatient day surgery procedures means that parents are now responsible for management of post-operative pain control. Two recently published studies which involved surveying parents and guardians regarding post-operative outpatient pain management found that analgesics were dosed correctly only 44 – 55% of the time.[1,2] Additionally, Rony et al. reported that 73% of parents and guardians use of medications was influenced by worries about adverse effects from post-operative pain medications. This is consistent with findings that parents and guardians have a low rate of delivery of post-operative analgesia (opioid and non-opioid) to children following day surgery, with between 24 – 32% of children receiving 1 dose or fewer.[1-3] A retrospective cohort study of healthy pediatric patients in Tennessee enrolled in Medicaid without major chronic disease or prolonged hospitalization found an opioid prescription prevalence of 15% for all children, most commonly after outpatient procedures (56%).[4] They also found a cumulative incidence of opioid-related ED visits, hospitalizations or death of 38 per 100,000 prescriptions.[4] In randomized control trials comparing post-operative opioid analgesia to ibuprofen in pediatric patients, the use of opioids was associated with more nausea, vomiting, drowsiness and dizziness[5]; and more night time oxygen desaturations.6 Given the perilous nature of opioid over-dose, as well as the continued opioid epidemic, it is imperative to thoughtfully examine whether post-operative opioid analgesia is necessary and beneficial in children undergoing outpatient surgery.

The aim of this study was to examine the effects of postoperative oral opioids on short term outcomes of pediatric patients undergoing outpatient hernia repair. A retrospective review of all outpatient hernia repairs performed at a large free-standing academic children's hospital in 2017. We hypothesized that the use of non-opioid medications alone would provide adequate postoperative analgesia compared to opioid administration after uncomplicated pediatric herniorrhaphy.

Methods

A retrospective chart review was conducted of all patients less than 19 years of age undergoing umbilical, inguinal and epigastric hernia repair at the Children's Hospital of Wisconsin, Milwaukee, a single US free-standing children's hospital, during one calendar year (2017). Patients were excluded if discharge did not occur within 24 hours of surgery or if patients had undergone other procedures, including tympanostomy tubes, tonsillectomy, pyloromyotomy, and laparoscopic appendectomy concurrently. The study was approved by the Children's Hospital of Wisconsin IRB (1216340-1, May 31, 2018).

Individual physician practice dictated whether opioids were prescribed. Data extracted included age, sex, procedure, pain medications prescribed and prescriber and follow-up visits within 30 days of surgery. At our institution, standardized follow-up calls are conducted between 24 and 72 hours following surgery to assess for pain control, nausea/vomiting, constipation and wound issues. Parents serve as the primary source of information in children unable to answer the questions reliably in the post-operative follow up calls, and responses are recorded in the electronic medical record.

The Wisconsin Electronic Prescription Drug Monitoring Program (ePDMP), a Wisconsin state website, is a central resource to see if opioid prescriptions have been filled. The ePDMP was queried

for those patients who received an opioid prescription to determine if the prescriptions had been filled.

The primary outcome was reported pain control on follow-up phone call. Secondary outcomes included reported nausea and vomiting on the follow-up phone call and ER visits related to uncontrolled pain, nausea, vomiting, constipation or other adverse effects of opioid medications. Number needed to harm was calculated based on secondary outcomes. When comparing cohorts of children exposed to outpatient opioids and those not exposed, children < 2 years of age were excluded from analysis given the low rates of prescribing in those age groups (25% of children < 2 years old received opioid prescriptions compared to 81% of >2-year-olds) and concern about skewing of the analysis. Descriptive statistics of categorical variables were calculated as totals and percentages and compared with a χ-squared test or Fischer's exact when appropriate. Aggregate rates were compared using one-way ANOVA. Statistical analysis was performed using IBM SPSS Statistics version 24 (Armonk, NY: IBM Corp). Statistical significance was defined as $p < 0.05$.

Results

Overall, 564 primary hernia repairs were performed by ten pediatric general surgeons at CHW during the study period. Slightly more than half, 55.5%, of patients were male. Each surgeon preformed between 26 and 100 cases. A majority of children, 67.7%, were given a prescription for opioids and 55% of children were given a prescription for a non-opioid pain medication (i.e. acetaminophen or ibuprofen). Of the opioid prescriptions given to parents and guardians, 62% were filled. The average opioid prescription was for 6.4[1-29] doses.

Children undergoing umbilical or epigastric hernia repair were more likely to receive an opioid prescription than those undergoing inguinal hernia repairs (77.7% v. 54%, $p < 0.0001$). However, procedure type did not affect the likelihood children received a non-opioid prescription or filled their opioid prescriptions (53.8% v. 55.4%, $p = 0.272$; 45.4% v. 37.2%, $p = 0.294$), (Table 1).

Older children were more likely to receive opioid prescriptions, as 95% of children over the age of 12 received opioid prescriptions compared to 76% of 1 to 3-year-olds ($p < 0.0001$), (Figure 1). The mean number of doses prescribed to children ages 6 months – 12 years was between 5.14 and 5.67 doses. However, for children > 12 years, the average number of doses of opioid prescribed was 9.2 ± 5.95. Older children were also more likely to have their prescription filled. In our study, children ages 6 months – 12 years, filled between 54% - 69% of prescriptions and children > 12 years old filled 83% of prescriptions.

Attending physicians were most likely to prescribe opioids (92% of the time) compared to residents (55%), fellows (66%) and advanced practice providers (i.e. Nurse practitioners and physician assistants) (APPs) (27%). Attending surgeons prescribed the lowest mean doses 5.5[2 – 20] and fellows the highest 7.2[3 – 29]. APPs were most likely to write for non-opioid adjuncts and prescribed them 91% of the time. Receiving a non-opioid prescription was not associated with a decreased likelihood of filling any opioid prescriptions (50.8% v. 49.2%, $p = 0.770$).

More than half of patients, 334 (59%), had a parent or guardian who responded to a follow up call. For those who responded, 97% reported pain as controlled: there was no difference among patients receiving an opioid prescription compared to those who did not (98% v. 94%, $p = 0.06$). Overall, 7% of parents or guardians reported nausea/emesis after discharge in their child. In those children

older than 2 years of age who filled an opioid prescription, 12% reported nausea/emesis versus 4.4% of patients who received but did not fill an opioid prescription (p = 0.04), (Table 2). Additionally, in those children older than 2 years of age who filled an opioid prescription 2.8% reported uncontrolled pain compared to 2.6% of patients who received but did not fill an opioid prescription (p = 0.92). Based on reported nausea and vomiting at the time of the follow-up phone calls, the number needed to harm in our study by an opioid prescription is 13.2 patients.

A significant number of children, (11%), had an unscheduled visit to the general surgery clinic, their pediatrician, urgent care or emergency department within the CHW electronic health record within 30 days of surgery; the majority of visits were not related to the procedure (viral infections, otitis media, etc.). Two children without an opioid prescription (1%) sought care for postoperative pain. Five children who filled an opioid prescription (1.3%) sought care in the emergency department or clinic for constipation, nausea or emesis compared to two children (1%) who did not receive an opioid prescription (p = 0.55). Additionally, there were eight phone calls within POD 0-7 regarding nausea, vomiting or constipation, from parents or guardians of children who had received and filled opioid prescriptions, compared to two phone calls from children who had either not received an opioid prescription or not filled their prescription (3.4% vs.0.6%. p = 0.01).

Discussion

For pediatric patients undergoing outpatient hernia repair non-opioid analgesia appears to be equivalent to opioids, with overall 97% reporting pain as controlled on follow-up phone calls. In children who received opioid prescriptions 62% were filled. Similar to what is described in the adult literature, the pain medication received by patients varied by the procedure performed with umbilical hernia patients being more likely to receive opioid prescriptions than inguinal hernia patients.[7-9] Both Overton et al. and the Michigan Surgical Quality Collaborate recommend more opioid doses following umbilical hernia repair than inguinal hernia repair in adults.[8-9] Clearly, adult guidelines cannot be uniformly applied to children. Review of national prescribing habits following pediatric umbilical hernia repair by Cartmill et al., found that 52% of children undergoing umbilical hernia repair filled an opioid prescription with half of children receiving a prescription for greater than 3 days, this compares similarly to our institution were 41% of opioid prescriptions were filled after outpatient pediatric hernia repair.[10]

Our review showed a mean number of prescribed doses of 6.4 doses with a range of 1 – 29. Only one patient, who had received 4 doses, called for a re-fill. At our institution, attending surgeons prescribed the lowest mean doses 5.5[2 – 20] and fellows the highest 7.2[3 – 29]. This is similar to what was seen in an adult retrospective review of general surgery discharges in which residents and APP prescribed higher doses than attending surgeons.[11] APPs were more likely to write prescriptions for acetaminophen and ibuprofen; however, any change in patient compliance with these medications after receiving a prescription is not known.

In our study there was no significant difference in the percentage of surveyed parents and guardians reporting their child's pain as well controlled at follow-up phone call between those that received and filled opioid prescriptions and those without opioids in the home (2.6% v. 2.8%, p = 0.92). This observation is supported by several double-blinded randomized controlled trials showing no significant difference in children's pain when receiving either an opioid or ibuprofen

following discharge after tonsillectomy, extremity fracture or outpatient orthopedic surgery.[5-6,12] Furthermore, data from a randomized controlled trial in adults also supports the equivalence of ibuprofen and acetaminophen compared to acetaminophen and an opioid for acute pain control when presenting to the ED with moderate to severe acute extremity pain.[13]

A retrospective cohort study between 1999 – 2014 which reviewed all children in Tennessee on Medicaid between 2 and 17 years old who did not have a major chronic disease or prolonged hospitalization found a cumulative incidence of opioid ED visits, admissions and deaths of 38 per 100,000 prescriptions with a number needed to harm of one adverse event for every 2611 opioid prescriptions.[4] Randomized control trial data comparing opioid analgesia to ibuprofen found more nausea, vomiting, drowsiness and dizziness and more night time oxygen desaturations.[5-6] In our study, patients who filled opioid prescriptions were more likely to have nausea and vomiting on follow-up phone calls (12% v. 4.4%, p = 0.04) and made more calls to the general surgery clinic with complaints of constipation (3.4% v. 0.6%, p = 0.01).

Our study is limited in its nature as a retrospective review of a single institution. Our data reflects our practices, which includes advance practice providers typically doing discharge orders for children < 3 months old who only receive acetaminophen for post-operative pain control. Our follow-up calls data is limited by possible selection bias as parents occupied caring for their children in active pain may be less likely to answer the phone or may be more interested in talking to a healthcare provider. Our follow-up ER visit and clinic visits are limited to those that visited providers included in our electronic medical record network of providers. A major advantage of this study is the use of the ePMDP data to verify which patients filled their opioid prescriptions, however, given that patients with filled prescriptions may not take any doses the rates of adverse effects may be higher than reported.[14]

Our study suggest non-opioid medications are equally effective in controlling post-operative pain after pediatric herniorrhaphy compared to opioid medications. Routine opioid administration does not appear to positively affect postoperative pain management in this population and is associated with a higher rate of medication related side effects. Standard practice at our institution in weight based acetaminophen and ibuprofen alternating every three hours. We hope this data serves as evidence to counsel parents and providers that opioid medications are not necessary. In fact, our study suggests that opioid prescriptions are more likely to cause harm in the form of worsened nausea and vomiting than provide improved pain control.

References

1. Brown R, Fortier MA, Zolghadr S, Gulur P, Jenkins BN, Kain ZN. Postoperative Pain Management in Children of Hispanic Origin: A Descriptive Cohort Study. *Anesth Analg*. 2016;122(2):497-502.
2. Rony RY, Fortier MA, Chorney JM, Perret D, Kain ZN. Parental postoperative pain management: attitudes, assessment, and management. *Pediatrics.* 2010;125(6):e1372-8.
3. Hegarty M, Calder A, Davies K, et al. Does take-home analgesia improve postoperative pain after elective day case surgery? A comparison of hospital vs parent-supplied analgesia. P*aediatr Anaesth.* 2013;23(5):385-9.
4. Chung CP, Callahan ST, Cooper WO, et al. Outpatient Opioid Prescriptions for Children and Opioid-Related Adverse Events. *Pediatrics*. 2018;142(2).

5. Poonai N, Datoo N, Ali S, et al. Oral morphine versus ibuprofen administered at home for postoperative orthopedic pain in children: a randomized controlled trial. *CMAJ*. 2017;189(40):E1252-E1258.
6. Kelly LE, Sommer DD, Ramakrishna J, et al. Morphine or Ibuprofen for post-tonsillectomy analgesia: a randomized trial. *Pediatrics*. 2015;135(2):307-13.
7. Hill MV, Stucke RS, Billmeier SE, Kelly JL, Barth RJ. Guideline for Discharge Opioid Prescriptions after Inpatient General Surgical Procedures. *J Am Coll Surg.* 2018;226(6):996-1003.
8. Overton HN, Hanna MN, Bruhn WE, et al. Opioid-Prescribing Guidelines for Common Surgical Procedures: An Expert Panel Consensus. J *Am Coll Surg.* 2018;227(4):411-418.
9. "Postoperative Opioid Prescribing." Michigan Surgical Quality Collaborative, 27 Sept. 2018, msqc.org/transforming-surgical-care-michigan.
10. Cartmill RS, Yang DY, Fernandes-taylor S, Kohler JE. National variation in opioid prescribing after pediatric umbilical hernia repair. *Surgery*. 2018.
11. Blay E, Nooromid MJ, Bilimoria KY, et al. Variation in post-discharge opioid prescriptions among members of a surgical team. *Am J Surg*. 2018;216(1):25-30.
12. Poonai N, Bhullar G, Lin K, et al. Oral administration of morphine versus ibuprofen to manage postfracture pain in children: a randomized trial. *CMAJ*. 2014;186(18):1358-63.
13. Chang AK, Bijur PE, Esses D, Barnaby DP, Baer J. Effect of a Single Dose of Oral Opioid and Nonopioid Analgesics on Acute Extremity Pain in the Emergency Department: A Randomized Clinical Trial. *JAMA*. 2017;318(17):1661-1667.
14. Wisconsin Department of Safety and Professional Services. "Welcome - Wisconsin Prescription Drug Monitoring Program." Wisconsin Perscriptions Drug Monitoring Program, pdmp.wi.gov/.