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Research article

Effect of single dose intraoperative IV acetaminophen in pediatric tonsillectomy or adenotonsillectomy

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ABSTRACT

Background: A number of different treatment regimens have been described for post-operative pain management for pediatric tonsillectomy following the widespread discontinuation of the use of codeine due to safety concerns. However, the literature is lacking with regard to the relative efficacy of the treatment regimens. This study is designed to determine the effectiveness of an intraoperative dose of intravenous acetaminophen for pediatric tonsillectomy pain management.

Methods: Records were reviewed for pediatric patients undergoing tonsillectomy with a single surgeon between 2012 and 2014. Pain scores, need for narcotic analgesics, and recovery times were reviewed for up to 24 postoperative hours. Patients were grouped based on whether they received an intraoperative dose of intravenous acetaminophen (Group 1) or did not receive it (Group 2). The primary outcome measure was pain score during the 24-h post-operative period. Secondary outcome measures include need for narcotic medications for breakthrough pain in the recovery room and time spent in the recovery room and hospital.

Results: 350 patients were included, of which 116 received an intraoperative dose of intravenous acetaminophen. Patients in Group 1 had lower pain scores during the second postoperative hour (1.27 vs. 2.06, $p = 0.008$). No significant differences were noted for pain scores during postoperative hours 1 or 3–24. Patients in Group 1 spent less time in the Recovery Room (59.08 min vs. 69.5 min, $p = 0.016$) but more time in the hospital (24.54 h vs. 19.66 h, $p = 0.030$). There was no difference between the groups based on whether the patients received narcotics for breakthrough pain in the recovery room (79.3% vs. 70.9%, $p = 0.094$).

Conclusion: Intraoperative intravenous acetaminophen may lead to improved pain scores in the early postoperative period and decreased time in the recovery room, but this group also had a longer hospital stay. This information should instigate randomized controlled trials of this intervention.

1. Introduction

Post-operative pain management for pediatric tonsillectomy operations has historically been achieved using codeine and acetaminophen. There has been a shift away from this strategy, however, due to reports of deaths caused by the administration of codeine following pediatric tonsillectomy. In 2012, Kelly et al., discussed several cases across North America in which administration of codeine to children who were rapid metabolizers of this medication via increased levels of cytochrome P4502D6 led to a greatly increased production of morphine, resulting in respiratory depression, and ultimately proving to be fatal [1]. Consequently, there is great interest in establishing a safe and efficacious alternative to this pain management strategy.

Nonsteroidal anti-inflammatory drugs (NSAIDs) are generally a valued component of any pain control regimen. While they had previously been demonstrated to be effective at controlling post-operative pain following pediatric operations, the use of NSAIDs for this purpose was largely limited by the fear that they may increase the risk of bleeding due to their action on the cyclooxyge-

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nase (COX) enzymes [2]. Recent studies have shown that nonsteroidal anti-inflammatory drugs (NSAIDs) do not cause an increased risk of bleeding following tonsillectomy operations [3]. A meta-analysis by Riggin et al. in 2013 concluded that the use of NSAIDs for analgesia following tonsillectomy in both adult and pediatric populations led to no increased risk of bleeding when compared to opiates or placebo [4]. Therefore, NSAIDs have become more widely accepted as an appropriate option for post-operative pain management.

One emerging strategy employed in the post-operative pain management for pediatric tonsillectomy procedures is to utilize both ibuprofen and acetaminophen. Using this approach, each medication is given according to a standing order, but the dosing schedule is staggered so the patient receives the medications in an alternating fashion. There is some evidence to suggest that a regimen of a combination of acetaminophen and ibuprofen can provide safe and effective pain relief following pediatric tonsillectomy [5].

Furthermore, there is evidence to suggest that the use of a single prophylactic perioperative dose of IV acetaminophen may be effective for pain management following pediatric tonsillectomy. In one study, the administration of a single intraoperative dose of IV acetaminophen improved pain relief and reduced narcotic requirement in the post-operative period when compared to placebo [6]. Another study compared the efficacy of an intraoperative dose of IV acetaminophen with that of an intraoperative dose of IV tramadol and found the two to be similar with regard to all outcome measures [7].

However, there is a gap in the literature regarding the efficacy of a single intraoperative dose of IV acetaminophen when used alongside the emerging combination regimen of acetaminophen and ibuprofen for post-operative pain management. Because there has been some evidence that a single intraoperative dose of IV acetaminophen can improve post-operative pain following pediatric tonsillectomy, as well as separate evidence that the post-operative regimen of alternating ibuprofen and acetaminophen can also be beneficial in this setting, many practitioners have begun to combine these options with the goal of improved pain management. However, while there is evidence supporting the benefit of either of these two pain management options, there is a lack of evidence regarding whether combining them results in any significant improvement in post-operative pain management when compared to using the post-operative strategy of alternating ibuprofen and acetaminophen alone. The goal of this retrospective study was to look for evidence that IV acetaminophen resulted in any outcome improvement, particularly in pain scores, in our population of pediatric tonsillectomy patients receiving the alternating ibuprofen and acetaminophen post-operative pain management regimen.

2. Methods

A retrospective cohort study was performed after receiving approval from the Penn State Milton S. Hershey Medical Center Institutional Review Board. Pediatric patients undergoing tonsillectomy or adenotonsillectomy with a single surgeon between March 2012 and December 2014 at a single academic medical center were included in the study. Chart reviews were performed on these patients to acquire information regarding patient characteristics and outcome variables. Patients were divided into cohorts based on whether they received a single intraoperative dose of IV acetaminophen (Group 1 received intraoperative IV acetaminophen, Group 2 did not receive intraoperative IV acetaminophen). Group 2 received no acetaminophen via any route of administration in the immediate preoperative or intraoperative period. The decision to administer IV acetaminophen was made by the anesthesiologist involved in the case based on their personal preference and practice patterns. Medications administered in the Recovery Room (RR) were also determined by the anesthesia team. Following discharge from the RR, both groups received an alternating regimen of ibuprofen and acetaminophen in the post-operative period which is standard at our institution. Both medications are given every six hours but the administration is staggered so that patients receive one medication every three hours.

The main outcome measure for this study was the level of pain reported for various post-operative time intervals (hours 1, 2, 3, 4, 5–8, 9–12, 13–16, 17–20, and 21–24). Pain scores were recorded using a combination of the Wong-Baker Faces Pain Rating Scale [8], a numeric rating scale (scores 0–10) [9], and the Face, Legs, Activity, Cry, Consolability (FLACC) scale [10]. Choice of scale depended on the age of the patient. Secondary outcome measures in this study included the time spent in the RR, time spent in the hospital, complications, and the need for narcotic pain medications for breakthrough pain in the RR.

A non-parametric test (Wilcoxon Rank-Sum Test) was used to test for differences for ordinal outcome variables such as number of doses of medications [11]. A Chi-square test was used to test for differences in nominal data such as gender, procedure, and indication for surgery. *T*-tests were used to compare groups for outcomes comprised of continuous data such as age, weight, pain scores and durations.

3. Results

Three hundred and sixty-three patients were included in this study. Thirteen patients were excluded because they had not received intra-operative fentanyl, leaving 350 study patients. Of these, 116 patients received a single intraoperative dose of IV acetaminophen (Group 1) and 234 patients did not receive IV acetaminophen (Group 2). Table 1 summarizes the patient characteristics between these two groups. There were no significant differences between Groups 1 and 2 in terms of gender, age, BMI, comorbidities or comorbid syndromes. Twenty patients are listed as "other" regarding presence of comorbidities. Of these twenty patients, six had a congenital heart anomaly (n = 3 Group 1, n = 3 Group 2), two had a coagulation disorder (n = 1 Group 1, n = 1 Group 2), three had a seizure disorder (n = 2 Group 1, n = 1 Group 2), seven patients had asthma alongside a congenital heart anomaly (n = 4 Group 1, n = 3 Group 2), one patient had asthma and a seizure disorder (n = 1 Group 1), and the final patient had a congenital heart anomaly, gastroesophageal reflux, and a coagulation disorder (n = 1 Group 1).

Table 2 summarizes characteristics of the operation(s) performed as well as the indications for the procedure. Seven patients are listed as "other" regarding the indication for the procedure. Of these seven patients, three underwent operation due to asymmetric tonsils (n = 3, Group 1), two patients underwent the procedure for failure to thrive (n = 1 Group 1, n = 1 Group 2), one patient underwent operation due to a combination of Obstructive Sleep Apnea (OSA) and Failure To Thrive (FTT) (n = 1 Group 2), and the final patient of these seven underwent the procedure for a combination of OSA, recurrent tonsillitis, and failure to thrive (n = 1 Group 1).

Table 3 lists intraoperative medications given. Patients in Group 1 received a statistically significantly larger dose of dexamethasone by weight (0.31 mg/kg vs. 0.28 mg/kg, $p = 0.009$). Mean dexamethasone dose per kilogram was 0.29 mg. The study population was divided into low dose (<0.29 mg/kg) and high dose (>0.29 mg/kg) dexamethasone groups, distribution of which was not significantly different between Groups 1 and 2 ($p = 0.112$). No

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