



Pediatric Emergency Department Visits for Uncontrolled Pain in Postoperative Adenotonsillectomy Patients

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Objective: Identify demographic variables related to emergency department (ED) returns, and analgesic administration in the ED for postoperative pain after adenotonsillectomy (T&A).

Study Design: Pediatric Health Information System (PHIS) database analysis.

Methods: Forty-seven children's hospitals included in the PHIS database were queried for all ED visits within 30 days of surgery with a diagnosis of acute postoperative pain (n = 2459) from 2014 to 2015. The subset of postoperative T&A patients (n = 861) was further analyzed for variables associated with return, and for pain management strategies, specifically opioids, employed by the ED.

Results: Of the 2459 pediatric patients returning to the ED for acute postoperative pain, the largest subset included T&A patients (n = 861, 35%). Patients were seen an average of 4 days (SD 2.4) after their surgery. ED administration of opioids was not associated with gender, race, surgical diagnosis, or ethnicity. The rate of opioid administration by the ED increased with advancing age of the children analyzed (P = .01). The incidence was also higher for those with commercial versus Medicaid insurance carriers. A total of 204 (23.7%) patients received opioids while in the ED, 439 (51%) received both opioids and non-opioids, and only 51 (5.9%) received no pain medication.

Conclusion: T&A patients make up the largest subset of patients returning to the ED for postoperative pain. A total of 74.7% of patients receive opioids, either alone or in combination with non-opioids, on return to the ED. ED opioid administration was associated with older age of the child and payer, but not with gender, race, surgical diagnosis, or ethnicity.

Key Words: Pediatric adenotonsillectomy, adenotonsillectomy pain, adenotonsillectomy complications, PHIS database.

Level of Evidence: 4

INTRODUCTION

Tonsillectomy, often in conjunction with adenoidectomy, is the most common major surgical procedure performed in children.¹ It is estimated that around 500,000 children undergo adenotonsillectomy (T&A) annually in the United States.^{1,2} Managing throat pain after T&A is challenging, and pain management strategies after T&A vary widely across institutions and amongst physicians. In

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particular, after the boxed warning issued by the Food and Drug Administration (FDA) against routine use of codeine for post-operative T&A pain management in children, thoughts on optimal pain management strategies have evolved.^{1,3} Managing postoperative pain without reliance on opioids, and with greater reliance on ibuprofen, often alternating with acetaminophen, has become more commonplace.^{4,5} Other opioids, including hydrocodone, oxycodone, and morphine, are used postoperatively by some physicians, and other physicians only recommend opioids based on the age of the child, ie, >7 years of age.^{6,7}

Poor postoperative analgesia after T&A was common and contributed to an increased incidence of emergency department (ED) visits for assessment and treatment of pain and dehydration in a number of studies.^{2,8–10} The purpose of this study was to analyze return to ED visits within 30 days of T&A, and to identify demographic variables associated with return to ED and analgesic administration in the ED using data collected from a United States pediatric administrative database. Our objective was to acquire a better understanding of patient/population characteristics for those at risk for return to ED visits. This might provide opportunities for better education and modified pain management strategies in postoperative T&A patients.

METHODS

Data for this study were obtained from the Pediatric Health Information System (PHIS), an administrative

database that contains inpatient, emergency department, ambulatory surgery, and observation encounter-level data from 48 nonprofit, tertiary care pediatric hospitals in the United States. Hospitals are affiliated with the Children's Hospital Association (Lenexa, KS). Data quality and reliability are assured through a joint effort between the Children's Hospital Association and participating hospitals. Portions of the data submission and data quality processes for the PHIS database are managed by Truven Health Analytics (Ann Arbor, MI). For the purposes of external benchmarking, participating hospitals provide discharge/encounter data including demographics, diagnoses, and procedures. Nearly all of these hospitals submit resource utilization data (eg, pharmaceuticals, imaging, and laboratory) into PHIS. Data are de-identified at the time of data submission, and data are subjected to a number of reliability and validity checks before being included in the database. For this study, data were acquired from 47 participating children's hospitals (no data available from one hospital for study period). Although de-identified, records contain an encrypted medical record number that allows tracking of individual patients across multiple inpatient and outpatient encounters.

After receiving IRB approval from the Ann & Robert H. Lurie Children's Hospital of Chicago, the PHIS database was queried for ED visits for children with a primary diagnosis code of pain (n = 9855) for the time period January 1, 2014 through December 31, 2015. During this 2-year period, 2459 (25%) visits were for acute postoperative pain, defined as acute postop pain NEC (ICD-9 338.18) or acute post-procedural pain NEC (ICD-10 G89818). ED visits were matched by PHIS identifier to associate corresponding surgery encounters directly preceding ED visits. ED visits that occurred >30 days after surgery (n = 98) were excluded. Linked surgical procedures were then listed in order of frequency, and then categorized by similar or like procedures for a final list of most common procedures related to an ED visit for acute postoperative pain (Table I)

Of this total group of patients, 963 (39.2%) had undergone a tonsillectomy and/or adenoidectomy procedure. Those patients who had undergone adenoidectomy alone, lingual tonsillectomy, or drainage of a peritonsillar abscess were excluded from further analysis (n = 102, 10.6%). The final analysis was performed on postoperative tonsillectomy/adenotonsillectomy (T&A) patients (n = 861, 80.4%) (Table II). Additional data related to the type and frequency of opioid or non-opioid administration by the ED were extracted from the PHIS database. These data were further analyzed relative to the gender, race, ethnicity, patient age, surgical diagnosis, and insurance carrier.

Statistical Analysis

Descriptive statistics, categorical and regression analysis were conducted with SAS software (SAS Institute, Inc., Cary, NC; version 7.1, 2016). Descriptive statistics of categorical data were reported in frequencies and percentages. Bivariate comparisons were performed using Chi-square. Data were entered into a multiple logistic regression analysis model, and significance was determined at $P < .05$.

TABLE I.
Most Common Previous Surgical Procedures Noted in Emergency Department Patients Presenting With Acute Postoperative Pain Within 30 Days of Their Surgery.

Code and Procedure (n = 2459)	n	%
283 adenotonsillectomy, tonsillectomy, or adenoidectomy*	963	38.8
4702 laparoscopic appendectomy	48	2.0
2001 myringotomy with intubation	47	1.9
640 circumcision	24	1.0
8145 cruciate ligament repair NEC	17	0.7
5123 laparoscopic cholecystectomy	16	0.7
5845 hypospadias/epispadias repair	14	0.6
8147 repair of knee NEC	13	0.5
7911 closed reduction, internal fixation humerus	13	0.5
Procedures representing <1%†	518	22.4
No procedure associated with visit	786	31.9

*Inclusions, exclusions, and additional diagnosis codes in this category shown in Table II.

†Over 1000 codes represented in this category.

NEC = not elsewhere classified.

RESULTS

A total of 861 patients who presented to the ED for postoperative pain after tonsillectomy or T&A were identified by the PHIS database. Patients were seen an average of 4 days (SD 2.4, range 1–15 days) after their surgical procedure. Those patients who received opioids in the ED were seen earlier in their postoperative course (average 3.8 days, range 1–13 days), when compared to those who did not receive opioids (average 4.4 days, range 1–15 days, $P = .004$). There was no relationship between gender, race, ethnicity, insurance carrier, and opioid administration by the ED for postoperative pain. The

TABLE II.
Diagnoses Included and Excluded for Those Patients Presenting to the Emergency Department for Pain After Tonsillectomy Alone, T&A, or Related Procedures.

Code and Diagnosis n = 963	n (%)	Included
283 T&A	745 (77.4)	+
282 tonsillectomy	47 (4.9)	+
OCTPX22 resection tonsils, ext.	61 (6.3)	+
OC5PXZZ destruction tonsils, ext.	5 (0.5)	+
OCBPXZZ excision tonsils, ext.	3 (0.3)	+
OCBQXZZ resection adenoids, ext.	11 (1.1)	-
OC5QXZZ destruction adenoids, ext.	20 (2.1)	-
OC5QOZZ destruction adenoids, open	1 (0.1)	-
OCBQXZZ excision adenoids, ext.	2 (0.2)	-
286 adenoidectomy	57 (5.9)	-
285 excision lingual tonsils	3 (0.3)	-
280 tonsil/peritonsillar I&D	4 (0.4)	-
544 excision/destr peritonsillar tissue	4 (0.4)	-
Totals n (%)	963 (100)	861 (89.4)

Ext = external; destr = destruction; I&D = incision and drainage; T&A = adenotonsillectomy

primary diagnosis associated with T&A surgery were divided into three groups (tonsillar hypertrophy, sleep disturbance, and tonsillitis group) for analysis. The diagnoses were not associated with opioid administration by the ED (Table III).

When stratifying patients by age incrementally, patients >11 years of age were more likely to receive opioids during their ED admission than those in the 0 to 5 and 5 to 10 year age ranges ($P = .03$) (Table III). The relationship between older age of the patient and opioid

administration was confirmed by logistic regression analysis ($P = .01$) (Table IV). Older children were more likely to receive opioids than the younger patients. Overall, 442 (51.3%) patients received both opioids and non-opioid medications during their ED admission for postoperative pain. A total of 204 (23.7%) received opioids alone, and only 51 (5.9%) patients received no pain medication (Fig. 1). The most common non-opioids given by the ED included ibuprofen ($n = 138$, 16%), acetaminophen ($n = 121$, 14.1%), and ketorolac ($n = 54$, 6.3%). The most common opioids given included opioid/non-opioid combination products ($n = 298$, 34.6%), morphine sulfate ($n = 217$, 25.2%), and oxycodone ($n = 164$, 19%). Patients with commercial insurance products were more likely to receive opioids in the ED than those with Medicaid ($P = .03$) (Table IV).

TABLE III.

Analysis of Variables Associated With Administration of Opioids for Post-Tonsillectomy Pain in Children Presenting to the Emergency Department Within 30 Days After Their Surgery.

Variable	Opioids	Given in ED	Total	P-value
	No n (%)	Yes n (%)	n = 861	
Gender				
Female	93 (24)	294 (76)	387	.22
Male	114 (28.1)	292 (71.9)	406	
Total	204	589	793*	
Race				
African American	44 (25.2)	131 (75.3)	174	.85
Caucasian	112 (24)	353 (76)	465	
Other	27 (27)	73 (73)	100	
Total	183	556	739*	
Ethnicity				
Not Hispanic/Latino	137 (24)	434 (76)	571	.52
Hispanic/Latino	68 (28)	175 (72)	243	
Unknown	12 (25.5)	35 (74.5)	47	
Total	215	646	861	
Age Group				
0–5 Years	123 (29)	301 (71)	424	.03
6–10 years	58 (22.8)	196 (77.2)	254	
>11 years	35 (19.1)	148 (80.9)	183	
Total	215	646	861	
Insurance				
Commercial	38 (19.8)	154 (80.2)	192	.06
Medicaid	144 (28)	370 (72)	514	
Other	19 (21.8)	68 (78.2)	87	
Total	204	589	793*	
Tonsillar Hypertrophy				
No	52 (23.9)	166 (76.1)	218	.72
Yes	162 (25.4)	475 (74.6)	637	
Total	214	641	855*	
Sleep Disturbance				
No	109 (27.4)	289 (72.6)	398	.16
Yes	105 (23)	352 (77)	457	
Total	214	641	855*	
Tonsillitis				
No	176 (25)	537 (75)	703	1
Yes	38 (25)	114 (75)	152	
Total	214	641	855*	

*Missing data points for these variables (68, 122, 68, 6, 6, and 6, respectively).

Significant p -values shown in bold.

DISCUSSION

Managing postoperative pain in children can pose challenges across all surgical sub-specialties. When the PHIS data base was queried, 2459 patients from 47 children's hospitals were identified seeking ED treatment for postoperative pain during a 2-year period. As described, the greatest proportion were seen after either T&A or tonsillectomy alone. This points to the challenges faced in managing postoperative pain after T&A, despite variations in pain regimens including acetaminophen, ibuprofen, and often opioids. Although the database was not able to show the discharge pain regimens suggested after T&A, the analysis was able to show the type, opioid or non-opioid, and frequency of analgesics being utilized by EDs caring for children presenting with postoperative pain. Overall, the high incidence of children presenting to the ED with postoperative pain after T&A, and the common administration of opioids by the ED, suggest possible gaps in discharge education about assessing children for pain and appropriate usage/administration of analgesics after surgery. Whether the trend toward decreased use of opioids for home analgesia after T&A impacted ED returns rates was unclear, but these data can be tracked using the PHIS database over time.

The Clinical Practice Guideline (CPG) related to tonsillectomy in children included an action statement recommending that clinicians advocate for pain management after T&A and educate caregivers about the importance of managing and reassessing pain.¹ No specific pain management regimens were recommended, rather a focus on the education component for the caregiver and reassessment of the child as needed was emphasized. Mahant et al.¹¹ utilized the PHIS database to analyze the association of these CPGs to perioperative care processes and outcomes in children undergoing T&A. Post-guidelines, revisits for bleeding remained stable, but total revisits to the hospital for T&A complications increased (8.2% to 9%, $P < .001$), primarily because of an increase in revisits for pain. Another large national database study, reported an overall ED revisit rate of 7.6% (2740/36,221 patients) after T&A.⁹ Many of the revisits related to pain and vomiting/nausea/dehydration (18.4% and 28.2%, respectively), and an increased emphasis on symptom control was suggested as a means of preventing a large portion of the revisits.

TABLE IV.

Analysis of the Association of Age and Insurance Product on the Incidence of Opioid Administration by the Emergency Department for Post-Tonsillectomy Pain.

Variables Compared	P-value	Odds Ratio	95% Confidence Interval
Overall age	0.01	1.06	1.02–1.1
>11 years vs. 0–5 years	0.01	1.8	1.2–2.8
6–10 years vs. 0–5 years	0.13	1.3	0.92–1.9
Other vs. Medicaid	0.3	1.36	0.79–2.35
Commercial vs. Medicaid	0.03	1.58	1.05–2.35

Significant P-values shown in bold.

Overall, the impact of non-hemorrhage related complications on the immediate quality of life and global costs after T&A, has highlighted the need to improve postoperative pain management.^{2,8}

In a review on control of pain after tonsillectomy, regular assessment of a child's pain, potentially done with behavioral pain scales, was mentioned as a means of quantifying the pain level.¹² Even if pain is recognized though, parents may not give prescribed analgesics at the recommended dosages. In their feasibility study evaluating scheduled dosing of acetaminophen plus hydrocodone after T&A in 47 children ages 3 to 5 years, Sutters et al.¹³ noted that the number of missed doses was significantly higher on the third postoperative day when compared to the first day after surgery. The authors suggested that adherence to the scheduled analgesic dosing was negatively impacted by a number of factors including difficulty getting the child to take the pain medication, side effects, and the amount/frequency/timing of medication administration, especially the nighttime dosing.¹³ In our analysis, patient revisits to the ED occurred an average of 4 days (range 1–15 days) after their T&A. This timeframe is similar to that noted in the previous study relative to parental reduction in analgesic dosing, and points to the importance of regular pain assessment and dosing of analgesics even after the third postoperative day. Additional instructions on managing opioid side effects like nausea, vomiting, and constipation or adjustments to non-opioids analgesic medications could be

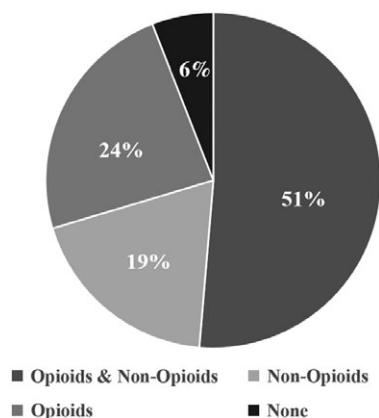


Fig. 1. Frequency and type of pain medication administration by the ED for postoperative tonsillectomy patients. ED = emergency department

tools to help mitigate the ED revisit rates. Non-opioid analgesics were often utilized by the ED (ibuprofen and acetaminophen given in 263 patients, 30.5%) for pain management in the patients analyzed, suggesting that some of the patients could have been managed in the home setting.

Our data showed that 75% of patients received opioids alone or in combination with non-opioid analgesics when they returned to the ED for postoperative pain. Data from the 2001 to 2010 National Hospital Ambulatory Medical Care Survey showed that the use of opioid analgesics in pediatric pain-related ED visits increased significantly from 11.2% to 14.5%. This change was most dramatic in the adolescent population.¹⁴ Investigations showed that the increased use of opioids to treat pain was associated with the rising rates of prescription opioid abuse and related morbidity and mortality, particularly in adolescents and young adults.^{14,15} On the other hand, the incidence of opioid addiction in children receiving opioids was exceedingly rare, per Tobias et al.,¹⁶ and should not limit delivery of effective analgesia. The trend toward improving pain management in pediatric ED patients has led to increases in opioid analgesia prescriptions.¹⁴ Adequate analgesia must be balanced with appropriate dosing, disposal, education about possible side-effects of opioids if being administered.

There was a significant increase in opioid administration relative to the older age of the child noted in our analysis. In their survey of pediatric pain assessment and management strategies by Illinois Hospital EDs, Probst et al.,¹⁷ noted that opioid administration was associated with older patient age, geographic location of the hospital (more commonly given in urban locations), and ED volume. Only 50% of patients in moderate to severe pain were offered an analgesic during their ED visit based on their analysis. The authors noted that 80% of the responding hospitals had access to pain assessment scales, but that when evaluating infants and non-verbal children these scales were only used in 37% of rural hospitals and 42% of non-rural locations.¹⁷ A younger child's discomfort level can be underappreciated, and therefore undertreated, given their lack of ability to communicate their pain.^{16,18,19} Postoperative pain control in this age range was associated with maladaptive behavior and possible long-term cognitive and emotional sequelae.^{19,20}

Our data showed that 6% of patients evaluated by the ED for postoperative pain received no pain medication. This points to the need for improving pain assessments in children, and again educating healthcare providers and families on pain management strategies.

Increased opioid administration by the ED in patients who were female and white has been demonstrated.¹⁴ Our data did not show a gender or race/ethnicity difference in opioid prescribing by the ED. Similar to the other study, our analysis showed a higher rate of opioid administration in those with commercial insurance carriers when compared to those with Medicaid. Greater access to care and parent/patient's expectations have been suggested as reasons for this difference.¹⁴ In addition, categories of diagnoses, including tonsillar hypertrophy, tonsillitis, and sleep disturbance, were not associated with an increased rate of opioid administration in the ED, suggestive of no specific link between indication for surgery and postoperative pain levels.

The largest number of patients being seen by the ED in our analysis were for children age 0 to 5 years. Per previous analyses, the perceived increased risk of using opioid analgesics in these younger patients may have prevented providers and parents from aggressively managing pain after surgery.^{21,22} In addition, 183 children >11 years of age were seen for ED revisits, and it might be expected that more children in this age range were prescribed opioid analgesics to manage their postoperative pain. Despite this, children in this age range were more likely to receive opioids during their ED revisit than the younger children. Although the PHIS data base was not able to elucidate the prescribed discharge pain medication regimens recommended to patients eventually seen for ED visits after T&A, the data point to continued gaps in educating parents about pain assessments and continued dosing of medications even after the first few postoperative days.

General limitations to administrative databases, like PHIS, have been described and included lack of clinical granularity, disease severity, and etiologic information. This was felt to arise from the lack of clinical details in billing, and the poor specificity of coding and coding practices.²³ Regardless of potential inaccuracies in coding by hospital administrative staff, there also remain significant variability in clinical practices for common diagnoses across the country even in the era of CPGs related to these diagnoses.²⁴ Despite this, database analyses can provide useful aggregate data analyses about practice trends across the country.

CONCLUSION

Pediatric ED revisits for postoperative pain after T&A were more common than any other ambulatory surgical procedure. Opioids alone or in combination with non-opioids were administered to 75% of the patients being evaluated by ED providers. Opioids were more commonly prescribed to the older children and adolescents being evaluated in the ED. There was no association between gender, race, ethnicity, or surgical diagnosis and increased administration of opioids. Those with commercial insurance were more likely to receive opioids than those with Medicaid.

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