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Factors Associated With Opioid Use After Endoscopic Sinus Surgery

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Objectives/Hypothesis: Responsible prescribing of postoperative pain medications is necessary in combatting the current opioid epidemic in the United States. The goal of this study was to determine which clinical factors affect opioid usage following functional endoscopic sinus surgery (FESS).

Study Design: Retrospective medical records study.

Methods: This is a single-institution retrospective study of subjects undergoing FESS by the senior author between September 2016 and December 2017. Opioid usage was assessed for each patient at the first postoperative visit. Univariate and multivariable analyses were performed to investigate factors associated with pain medication usage. Patients using opioids prior to surgery were excluded.

Results: A total of 136 patients were stratified into three groups based on number of opioid tablets taken during the first week after surgery: 31 patients (23%) took no opioids, 61 patients (45%) took one to five tablets, and 44 patients (32%) took more than five tablets. Gender, extent of surgery, revision surgery, polyp status, and cystic fibrosis did not significantly vary between the three groups. Multinomial logistic regression analysis with backward stepwise variable selection method revealed that those who had septoplasty (odds ratio [OR]: 4.84, 95% confidence interval [CI]: 1.68-13.98; P = .01) or were of younger age (OR 0.96, 95% CI: 0.93-0.99; P = .01) had significantly higher odds of taking more than five tablets.

Conclusions: The majority of patients undergoing FESS did not take more than five opioid tablets after surgery. Concurrent septoplasty and younger age were associated with increased opioid usage. Knowledge of such factors can help surgeons to assess opioid prescribing patterns and to counsel their patients on postoperative pain.

Key Words: Cystic fibrosis, functional endoscopic sinus surgery, postoperative opioid use, septoplasty.

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INTRODUCTION

The opioid overdose epidemic has garnered public attention recently in the United States. Starting in the 1990s, the first wave of opioid abuse was attributed to overreliance on opioid analgesics for the treatment of chronic pain.1 In response, multiple agencies on the federal and state levels have imposed sanctions and introduced legislation to curb the misuse of prescription opioids. These initiatives include but are not limited to the Secure and Responsible Drug Disposal Act of 2010, Prescription Drug Monitoring Programs, increased US Food and Drug Administration engagement of pharmaceutical companies, Centers for Disease Control and Prevention (CDC) guidelines for managing chronic pain, and state-specific policies limiting days of opioids prescribed for acute pain.2 Despite increased awareness and understanding of the abuse potential of opioid medications, the number of annual opioid deaths remains high. The latest Annual Surveillance Report of Drug-Related Risks and Outcome by the CDC estimates that 42,249 persons in the United States died from opioid-related drug overdose in 2016. Of these deaths, 17,087 were directly attributed to opioid prescriptions provided by medical practitioners. In 2017, over 190,000,000 opioid prescriptions were dispensed by pharmacies in the United States.1 In light of these findings, it is not surprising that physicians have been under scrutiny for pain management practices, catalyzing multiple specialty-specific studies in an attempt to mitigate misuse of opioid prescriptions.

Functional endoscopic sinus surgery (FESS) is one of the most common otolaryngologic procedures, establishing itself as the gold standard for the surgical treatment of chronic rhinosinusitis (CRS). Recent studies have advocated for restraint in opioid prescription practices following sinus surgery. For example, Jafari et al. found no differences in opioid requirements in patients who underwent extended sinus procedures compared to those who did not.3 A study surveying the postoperative course following FESS in 46 patients found that 63% of these patients completely ceased narcotic medication usage by postoperative day 7. Of note, 7% of patients in this study admitted to regularly using opioids prior to the procedure.4 Svider and colleagues performed a systematic review of nonopioid treatment options following FESS using the Cochrane bias tool and Grading of Recommendations Assessment, Development and Evaluation criteria, and found that acetaminophen, nonsteroidal anti-inflammatory drugs (NSAIDs), and gabapentin were effective opioid alternatives.5


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Despite these findings, the number of narcotics prescribed remains relatively high and inconsistent between providers. A recent survey querying members of the American Rhinology Society revealed that nearly 94% of otolaryngologists prescribed an opioid prescription following FESS. In a study by Ariapour et al. using the Centers for Medicare and Medicaid Services database, researchers found that rhinologists on average prescribed 5.4 days of opioids after FESS, with variations depending on surgeon age, experience, and demographics. Schwartz et al. surveyed members of the American Academy of Otolaryngology–Head and Neck Surgery, and found that the number of narcotics prescribed ranged from zero to 60; 13% of respondents prescribed no narcotic medication, and 50% prescribed 21 tablets or greater.

With the great deal of variation in opioid prescribing practices after FESS, there is a need for a better understanding of patient opioid usage and the clinical and demographic factors that can influence opioid intake. For example, it is unclear if patients undergoing more extensive sinus surgery or concurrent septoplasty require more postoperative opioids. The objective of this study was to elucidate the impact of clinical and demographic factors on patient opioid usage following functional endoscopic sinus surgery.

MATERIALS AND METHODS

Data Collection

This study was approved by the Duke University Institutional Review Board. A retrospective medical record review was conducted on adult patients who underwent FESS for CRS between September 2016 and December 2017 with the senior author. All surgeries were performed in the operating room under general anesthesia. Information related to patient demographics, sinususes opened, extent of FESS (unilateral vs. bilateral, number of sinususes, extended sinusotomy), comorbidities, revision status, presence of polyops, pain medication use in the postanesthesia care unit (PACU), and concomitant procedures was recorded. Extended sinusotomy included extended maxillary antrostomy or Draf IIb/III procedures. Exclusion criteria included those patients with documented substance abuse/dependency, chronic medical conditions managed by opioid analgesics, and patients who had stand-alone balloon procedures.

The number of opioid tablets taken during the initial postoperative period was documented as reported by the patient at the first postoperative visit, 1 to 2 weeks following surgery. Patients were stratified into three cohorts based on number of opioid tablets taken: 1) none, 2) one to five, and 3) more than five. Aforementioned variables collected from electronic medical records were compared between groups.

Study data were collected and managed using REDCap electronic data capture tools hosted at Duke University. REDCap (Research Electronic Data Capture) is a secure, Web-based application designed to support data capture for research studies, providing 1) an intuitive interface for validated data entry, 2) audit trials for tracking data manipulation and export procedures, 3) automated export procedures for seamless data downloads to common statistical packages, and 4) procedures for importing data from external sources.

Statistical Analysis

Patient demographics, comorbidities, and surgery-related characteristics were summarized using median (25th, 75th percentiles) and frequency (percentage) by the comparison groups. Univariate analysis was conducted with Kruskal-Wallis tests for continuous variables and Fisher exact tests for categorical variables. Those factors that were found to have significant differences between groups in the univariate analysis were then used as independent variables in the multinomial logistic regression model with a backward elimination variable selection procedure, with no opioid tablets taken as the reference level. Statistical analyses were performed in SAS 9.4 (SAS Institute Inc., Cary, NC).

Perioperative Protocol

All surgeries were performed by the senior author (0.W.A.J.) at our academic institution. Perioperative intravenous dexamethasone was administered barring any clinical contraindications. Pledgets soaked in oxymetazoline or 1:1,000 epinephrine were used at the beginning of and during the surgery for hemostasis. A total intravenous anesthetic technique using fentanyl and propofol was utilized for anesthesia. Local anesthetic (1% lidocaine with 1:100,000 epinephrine) was not used for FESS, but was injected for concomitant septoplasty, rhinoplasty, and turbinate reduction only. Turbinate reduction was performed via submucosal resection using the 2-mm microdebrider (Medtronic Xomed, Jacksonville, FL). When deemed appropriate by the surgeon, mometasone-eluting stents (Intersect ENT, Palo Alto, CA) and absorbable packing material (Nasopore Polyganics, Groningen, the Netherlands or PosiSep [Hemostasis, St. Paul, MN]) was placed. Nonabsorbable packing or septal splints were not used.

All patients received postoperative antibiotics and oral steroids for 7 to 14 days. If a patient was noted to have severe polyv burden on radiographic imaging or endoscopic clinical examination, a steroid taper was started 1 week before surgery. Postoperatively, patients were prescribed 20 tablets of acetaminophen with codeine (300 mg, 30 mg), with instructions to take one to two tablets every 6 hours as needed for pain. For patients with adverse reactions to acetaminophen or codeine, either hydrocodone, oxycodone, or tramadol were prescribed. All patients were instructed to initially try acetaminophen 650 mg every 4 hours with or without ibuprofen 200 mg every 8 hours as needed for pain, and to fill the narcotic prescription only if pain was not under control. Pain medication use in the PACU was at the discretion of the anesthesiology team. Patients were seen for their first postoperative visit approximately 1 week after surgery.

RESULTS

Table I summarizes demographic and clinical information, as well as results of the univariate analysis. Of the total 136 patients who met inclusion criteria for this study, 31 patients (23%) reported taking no opioid medications, 61 (45%) reported taking one to five tablets, and 44 (32%) reported taking more than five tablets. One hundred six (77.9%) patients were prescribed acetaminophen with codeine, two (1.5%) took acetaminophen with oxycodone, 12 (8.8%) took acetaminophen with hydrocodone, 13 (9.6%) took oxycodone alone, and three (2.2%) took tramadol alone. The median age between these groups did vary significantly ($P = .01$), with a higher proportion of older patients (median age of 60 years; $Q_1 = 41, Q_3 = 70$) in the group that reported no opioid use compared to the median age of 49 years ($Q_1 = 36, Q_3 = 66$) and 42.5 years ($Q_1 = 33, Q_3 = 57$) in the groups reportedly taking one to five and more than five tablets, respectively. There was a slight preponderance of males in our study (55.9%), but no statistically significant gender differences between groups in the univariate analysis.
difference between opioid intake groups ($P = .75$). Fifteen patients (11%) had a diagnosis of cystic fibrosis, and 85 patients (62.5%) had nasal polyps. Neither were associated with differences in opioid use ($P = .23$ and $P = .74$, respectively).

Of the specific sinuses that were involved, the number of sinuses opened (median = 9.5; Q1 = 4.5, Q3 = 10), and the presence of extended frontal and maxillary sinusotomies were not associated with increased opioid use (Table I). However, patients who underwent bilateral FESS were significantly more prevalent in the more than five opioid tablets group than patients who underwent unilateral FESS ($P = .01$). Patients with concurrent septoplasty were disproportionately higher in the more than five tablets group, compared to the one to five or no tablets group (59.1%, 41.0%, 22.6%, respectively; $P < .01$). Concurrent rhinoplasty, turbinate reduction, and revision surgery were not associated with increased opioid use ($P = .82$, .30, .16, respectively), although only four patients underwent concurrent rhinoplasty. The majority of patients received opioids in the PACU. However, this did not appear to significantly influence postoperative opioid use at home.

Multinomial logistic regression with backward stepwise variable selection method included the variables septoplasty and age in the model. The results revealed that for a patient undergoing a septoplasty, the odds of taking more than five tablets were approximately five times greater than those taking none, after controlling for age (odds ratio [OR]: 4.84, 95% confidence interval [CI]: 1.68-13.98; $P < .01$) (Table II).

Although the odds were also increased in the one to five tablets group compared to the nil group, this finding did not reach statistical significance (OR: 2.38, 95% CI: 0.88-6.40; $P = .09$). Additionally, for every unit increase in age, the odds of a patient taking more than five tablets were significantly lower compared to those taking no pain tablets after controlling for whether septoplasty was performed (OR: 0.96, 95% CI: 0.93-0.99; $P = .01$).

**DISCUSSION**

The purpose of this study was to investigate opioid usage after FESS for CRS. Specifically, we sought to determine if clinical factors such as demographics and extent of surgery influenced these requirements. On multivariate analysis, we found that concurrent septoplasty conferred significantly increased odds of requiring more than five tablets compared to no opioid use after controlling for age. This does not come as a surprise considering septoplasty often requires

**TABLE I. Univariate Analysis of Demographic and Procedural Variation Stratified by Number of Reported Opioid Tablets Required.**

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>None, N = 31</th>
<th>1–5, N = 61</th>
<th>&gt;5, N = 44</th>
<th>Total, N = 136</th>
<th>$P$ Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age at surgery, yr, median (Q1, Q3)</td>
<td>60.0 (41.0, 70.0)</td>
<td>49.0 (36.0, 66.0)</td>
<td>42.5 (33.0, 57.0)</td>
<td>50.0 (35.0, 65.0)</td>
<td>.01$^+$</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.75$^+$</td>
</tr>
<tr>
<td>Male</td>
<td>18 (58.1%)</td>
<td>32 (52.5%)</td>
<td>26 (59.1%)</td>
<td>76 (55.9%)</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>13 (41.9%)</td>
<td>29 (47.5%)</td>
<td>18 (40.9%)</td>
<td>60 (44.1%)</td>
<td></td>
</tr>
<tr>
<td>FESS laterality</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.01$^{†‡}$</td>
</tr>
<tr>
<td>Unilateral</td>
<td>6 (19.4%)</td>
<td>12 (19.7%)</td>
<td>1 (2.3%)</td>
<td>19 (14.0%)</td>
<td></td>
</tr>
<tr>
<td>Bilateral</td>
<td>25 (80.6%)</td>
<td>49 (80.3%)</td>
<td>43 (97.7%)</td>
<td>117 (86.0%)</td>
<td></td>
</tr>
<tr>
<td>Maxillary</td>
<td>29 (93.5%)</td>
<td>60 (98.4%)</td>
<td>43 (97.7%)</td>
<td>132 (97.1%)</td>
<td></td>
</tr>
<tr>
<td>Anterior ethmoid</td>
<td>29 (93.5%)</td>
<td>56 (91.8%)</td>
<td>42 (95.5%)</td>
<td>127 (93.4%)</td>
<td></td>
</tr>
<tr>
<td>Posterior ethmoid</td>
<td>23 (74.2%)</td>
<td>46 (75.4%)</td>
<td>27 (61.4%)</td>
<td>96 (70.6%)</td>
<td>.28$^+$</td>
</tr>
<tr>
<td>Frontal</td>
<td>24 (77.4%)</td>
<td>46 (75.4%)</td>
<td>33 (75.0%)</td>
<td>103 (75.7%)</td>
<td>1.00$^+$</td>
</tr>
<tr>
<td>Sphenoid</td>
<td>19 (61.3%)</td>
<td>40 (65.6%)</td>
<td>27 (61.4%)</td>
<td>86 (63.2%)</td>
<td>.90$^+$</td>
</tr>
<tr>
<td>Extended maxillary antrostomy</td>
<td>4 (13.8%)</td>
<td>5 (8.2%)</td>
<td>1 (2.3%)</td>
<td>10 (7.5%)</td>
<td>.17$^+$</td>
</tr>
<tr>
<td>Extended frontal sinusotomy</td>
<td>1 (3.4%)</td>
<td>5 (8.2%)</td>
<td>1 (2.3%)</td>
<td>7 (5.2%)</td>
<td>.53$^+$</td>
</tr>
<tr>
<td>Septoplasty</td>
<td>7 (22.6%)</td>
<td>25 (41.0%)</td>
<td>26 (59.1%)</td>
<td>58 (42.6%)</td>
<td>&lt;.01$^{†‡}$</td>
</tr>
<tr>
<td>Turbinate reduction</td>
<td>21 (67.7%)</td>
<td>43 (70.5%)</td>
<td>36 (81.8%)</td>
<td>100 (73.5%)</td>
<td>.28$^+$</td>
</tr>
<tr>
<td>Rhinoplasty</td>
<td>1 (3.2%)</td>
<td>1 (1.6%)</td>
<td>2 (4.5%)</td>
<td>4 (2.9%)</td>
<td>.82$^+$</td>
</tr>
<tr>
<td>Polyps</td>
<td>21 (67.7%)</td>
<td>38 (62.3%)</td>
<td>26 (59.1%)</td>
<td>85 (62.5%)</td>
<td>.74$^+$</td>
</tr>
<tr>
<td>Revision</td>
<td>14 (45.2%)</td>
<td>23 (37.7%)</td>
<td>11 (25.0%)</td>
<td>48 (35.3%)</td>
<td>.16$^+$</td>
</tr>
<tr>
<td>PACU medications</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oxycodone</td>
<td>19 (61.3%)</td>
<td>34 (55.7%)</td>
<td>26 (59.1%)</td>
<td>79 (58.1%)</td>
<td>.90$^+$</td>
</tr>
<tr>
<td>Hydrocodone</td>
<td>24 (77.4%)</td>
<td>43 (70.5%)</td>
<td>34 (77.3%)</td>
<td>101 (74.3%)</td>
<td>.72$^+$</td>
</tr>
<tr>
<td>Cystic fibrosis</td>
<td>4 (12.9%)</td>
<td>9 (14.8%)</td>
<td>2 (4.7%)</td>
<td>15 (11.1%)</td>
<td>.23$^+$</td>
</tr>
<tr>
<td>No. of sinuses, median (Q1, Q3)</td>
<td>9.0 (4.0, 10.0)</td>
<td>10.0 (5.0, 10.0)</td>
<td>9.0 (5.0, 10.0)</td>
<td>9.5 (4.5, 10.0)</td>
<td>.95$^*$</td>
</tr>
<tr>
<td>Range</td>
<td>1.0–10.0</td>
<td>1.0–10.0</td>
<td>2.0–10.0</td>
<td>1.0–10.0</td>
<td></td>
</tr>
</tbody>
</table>

$^*$Kruskal-Wallis test.
$^†$Denotes statistical significance.
$^‡$Fisher exact test.

FESS = functional endoscopic sinus surgery; PACU = postanesthesia care unit.
Shen et al. recently published a similar post-FESS analysis and also found that the number of sinuses was not a factor in postoperative pain. Moreover, they found that patients with higher preoperative ear and facial dysfunction scores on the 22-item Sino-Nasal Outcome Test were found to require additional opioid prescriptions following surgery.\textsuperscript{14}

The inclination of a surgeon to prescribe opioids may stem from prior opioid prescribing habits and fear of patient dissatisfaction, the latter spurring a number of studies.\textsuperscript{6,15,16} Emerging patient satisfaction reimbursement models and unregulated online physician rating systems may further aggrandize this concern. What options do we have to ensure our patients are having adequate pain control following FESS? Certainly, identifying patient variables and procedures associated with increased discomfort would allow for selective opioid prescribing practices, as suggested by this study and others.\textsuperscript{3,4,6,7,14,17} The importance of preoperative counseling should also be emphasized, as it may provide concordance between patient expectation and realistic FESS postoperative course to help minimize opioid use.\textsuperscript{4} Furthermore, individual surgeons can assess opioid requirements in their patient population and modify their own prescribing patterns accordingly.

Adherence to up-to-date, empirically derived practices is also important, as 22% of surveyed rhinologists did not know current evidence-based practice guidelines for postoperative pain.\textsuperscript{6} In the aforementioned systematic review by Svider et al., the use of NSAIDS postoperatively had grade A evidence for appropriate pain control. Although there may be a generalized hesitancy associated with use of NSAIDS following FESS, bleeding risk for this population was cited to be 0.8%.\textsuperscript{5} Other alternatives for pain control have been proposed as well. In a randomized clinical trial by Moeller et al, no differences in postoperative epistaxis rates were found in patients who received intravenous ketorolac compared to intravenous fentanyl during FESS procedures.\textsuperscript{18} Kim et al. proposed an alternative technique utilizing topical anesthesia; this study demonstrated significantly lower reported pain and increased patient satisfaction following FESS and septoplasty procedures when patients were given topical fentanyl-soaked nasal packing compared to saline soaked packing.\textsuperscript{19}

Limitations of this study include the use of artificially stratified categories for opioid use. In addition, the group taking more than five opioid tablets varied greatly in terms of opioid intake. However, we stratified patients based on these categories to produce meaningful statistical results and to account for recall bias. The potential for recall bias is certainly a limitation, as the majority of our patients did not bring their medications to the initial postoperative appointment, and some were unable to count the exact number of tablets they consumed. Variations in surgical technique may impact the external validity to other institutions or otolaryngologists. Nonetheless, the findings of our study substantiate the potential for postoperative pain management reform in patients undergoing FESS.

**CONCLUSION**

Increased opioid tablet usage following FESS was associated with concomitant septoplasty and younger age. As
demonstrated by studies in various surgical subspecialties including otolaryngology, the extent of surgery did not portend greater postoperative analgesic needs. Familiarity with these findings, along with other contemporary studies, should facilitate the implementation of safe and effective opioid prescription guidelines and ultimately limit narcotic misuse.

BIBLIOGRAPHY


