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No Opioids after Septorhinoplasty: A Multimodal Analgesic Protocol

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Background: From a public health perspective, nasal surgery accounts for many unused opioids. Patients undergoing septorhinoplasty require few opioids, and efforts to eliminate this need may benefit both patients and the public.
Methods: A multimodal analgesic protocol consisting of 15 components encompassing all phases of care was implemented for 42 patients.
Results: Median age and BMI were 34 years and 23, respectively. Most were women (79%), White (79%), primary surgeries (62%), and self-pay (52%). Comorbid conditions were present in 74% of the patients, with anxiety (33%) and depression (21%) being the most common. Septoplasties (67%) and osteotomies (45%) were common. The median operative time was 70 minutes. No patients required opioids in recovery, and median time in recovery was 63 minutes. Ten (24%) patients required an opioid prescription after discharge. In those patients, median time to requirement was 27 hours (range 3–81), and median total requirement was 20 mg morphine equivalents (range 7.5–85). Protocol compliance inversely correlated to opioid use ($P = 0.007$). Compliance with local and regional anesthetic (20% versus 63%, $P = 0.030$) as well as ketorolac (70% versus 100%, $P = 0.011$) was lower in patients who required opioids. Patients who required opioids were less likely to be administered a beta blocker (0% versus 34%, $P = 0.041$). Pain scores were higher in opioid users on postoperative days 1–5 ($P < 0.05$). No complications occurred in those requiring opioids, and satisfaction rates were equivalent between groups.
Conclusion: This protocol allowed us to safely omit opioid prescriptions in 76% of patients following septorhinoplasty, without adverse effects on outcomes or patient satisfaction. *(Plast Reconstr Surg Glob Open 2020;8:e3305; doi: 10.1097/GOX.0000000000003305; Published online 21 December 2020.)*

INTRODUCTION

Of the 67,637 deaths related to drug overdose in 2018, 22% were attributable to prescription opioids.[1] There are many reasons for this; however, inappropriate opioid prescription certainly contributed.[2] This is particularly relevant for patients undergoing surgical procedures. Others have demonstrated that surgical patients are overprescribed opioids.[3–5] This may be due to a provider's desire to minimize discomfort, increase satisfaction, and avoid prescription refills.[3,6] Additionally, the Center for Disease Control provides no guidelines for postoperative opioid prescription. New and persistent opioid use occurs after 6% of general surgery procedures,[7,8] and patients undergoing aesthetic and reconstructive procedures are likely at a similar risk.

In 2018, more than 213,000 rhinoplasties were performed by plastic surgeons in the United States.[9] Most patients receive an opioid prescription for up to 30 tablets,[10–15] but fewer than 10–15 are typically needed.[10,12–16] Prior studies report that 91% of patients fill these prescriptions, but fewer than 70% dispose of unused tablets.[10,17] This equates to approximately 3 million unused opioid

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tablets every year. Multimodal analgesic protocols have been instituted in a variety of settings to reduce postoperative opioid requirements.[18–20] In plastic surgery, these protocols are most common in breast reconstruction.[21–24] Several interventions have been studied in septorhinoplasty,[25–30] but, to the best of our knowledge, no protocol has been published that describes routine omission of postoperative opioid prescriptions.

We sought to develop a multimodal analgesic protocol to enable providers to omit routine opioid prescriptions after septorhinoplasty. Herein, we describe our protocol and report our results.

METHODS

Approval from the University of Nebraska Medical Center Institutional Review Board was obtained before creating a prospective septorhinoplasty registry (IRB Protocol #301-19-EP) and conducting a retrospective analysis (IRB Protocol #230-19-EP).

Context

All surgeries were performed by the same surgeon at the Village Pointe Aesthetic Surgery Center in Omaha, Nebr. This university-affiliated center contains 2 operating rooms, a preoperative and postoperative holding area, and clinic. All perioperative and clinic staff received education before implementation of the protocol. Five certified registered nurse anesthetists, 5 surgical residents, and 1 advanced practice provider participated in patient care.

Study Design

Before beginning this study, we performed sample size calculations using NCSS Trial and PASS 2005 software with a power of 0.80 and an α of 0.05. For this analysis, we estimated expected opioid requirements and pain scores using data published by Patel et al. and Sari et al., respectively and concluded that a sample of at least 40 patients would be required to demonstrate significant differences in opioid utilization. (**See table, Supplemental Digital Content 1**, which displays sample size calculation changes in opioids pills. http://links.lww.com/PRSGO/B525; **See table, Supplemental Digital Content 2**, which displays sample size calculation for difference in pain scores. http://links.lww.com/PRSGO/B526.)[14,31] In consultation with our anesthesia colleagues, we then formulated a multimodal analgesic protocol (Fig. 1 and Table 1). At the time of initial consultation, patients were asked to complete an intake form to determine eligibility (Fig. 2). Patients were excluded if they had (1) taken opioids in the last 60 days; (2) had significant hepatic or renal dysfunction; (3) had a history of chronic pain; (4) were therapeutically anticoagulated or had a known bleeding disorder; (5) used illicit drugs; (6) were pregnant or breastfeeding; (7) or were allergic to any protocol medication. Patients without exclusion criteria were invited to participate. There were no incentives for participation or form completion.

Data Collection and Definitions

Patient characteristics (including age, gender, BMI, American Society of Anesthesia score, race, preferred language, and payer) were recorded. Surgical indications were categorized as aesthetic, functional, or both. Patient comorbidities, tobacco use history, and history of prior nasal surgery were also recorded. Our protocol consisted of 15 separate components, as listed in Table 1. These included (1) acetaminophen; (2) carbohydrate-rich drink; (3) scopolamine; (4) ondansetron; (5) gabapentin; (6) ketamine; (7) propofol; (8) local and regional anesthetic; (9) dexamethasone; (10) ketorolac; (11) omission of inhaled anesthetics; (12) restricted intravenous fluids; (13) omission of intraoperative opioids; (14) patient education, and (15) scheduled non-opioid analgesics from postoperative day (POD) 0–3. Protocol violations were defined as medication doses or volumes other than those specified in the protocol, any use of intraoperative opioids, use of anesthetic agents at the time of induction or at any point during the case, failure to provide patient education before discharge, and missing or unknown data. Protocol compliance was calculated for each patient and defined as the percent of protocol components without violation. Perioperative variables

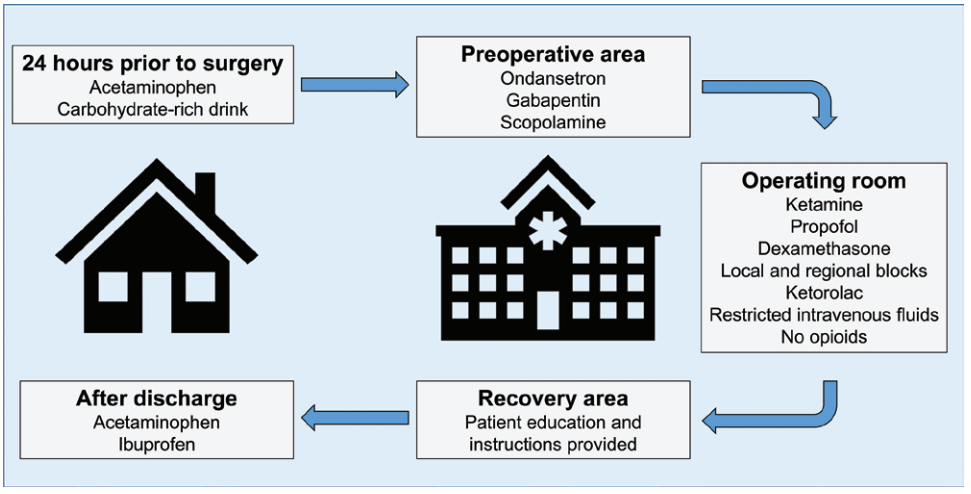

Fig. 1. Visual diagram depicting the phases of care and interventions used in the protocol.

Table 1. Multimodal Analgesic Protocol Definitions and Compliance by Component

Definition of Protocol Components	Opioids Needed after Surgery		*P*
	No	Yes	
No. patients	32	10	N/A
24 h before surgery			
1000 mg PO acetaminophen q8h for 3 doses	100.0%	100.0%	—
Carbohydrate-rich drink	93.8%	80.0%	0.236
Preoperative			
4 mg IV ondansetron	100.0%	100.0%	—
300 mg PO gabapentin	100.0%	100.0%	—
1 mg scopolamine transdermal patch	100.0%	100.0%	—
Intraoperative			
0.5 mg/kg IV ketamine bolus with additional 0.25 mg/kg/h	100.0%	100.0%	—
Continuous propofol infusion	78.1%	70.0%	0.678
Omission of any inhaled anesthetics	31.3%	10.0%	0.245
10 mg IV dexamethasone	96.9%	90.0%	0.424
Local and regional block with ≥9 mL given ≥7 min before incision*	62.5%	20.0%	0.030
≥30 mg IV ketorolac	100.0%	70.0%	0.011
Restricted intravenous fluids (<1000 mL)	87.5%	80.0%	0.616
Omission of intraoperative opioids and fentanyl analogues	90.6%	100.0%	1.000
Recovery			
Patient education provided in recovery before discharge	90.6%	80.0%	0.577
After discharge			
>70% of ibuprofen and acetaminophen tabs taken from POD 0–3	21.9%	20.0%	1.000

Values indicate percentage of patients compliant with each protocol component for each group.
*Local anesthetic was composed of 0.25% bupivacaine with 1:100,000 epinephrine. Local blocks were performed for the nose and septum. Regional blocks consisted of bilateral infraorbital blocks.

were recorded and included the dose or volume of all medications administered. Operative data included performance of an osteotomy, septoplasty, turbinate reduction or fracture, placement of spreader grafts and nasal splints, use of a bone rasp, operative time, and anesthetic time. Data pertinent to the recovery phase included time to discharge, pain scores, and administration of opioids. Using a validated Numeric Pain Rating Scale, pain scores were defined as none (0), mild (1–3), moderate (4–6), and severe (7–10), as described by McCaffery and colleagues.[32,33]

Preoperative Protocol

In the 24 hours before surgery, patients were instructed to take 1000 mg PO acetaminophen every 8 hours for 3 doses and to ingest a carbohydrate-rich drink (ie, Gatorade or Powerade) 2 hours before surgery. After arrival in the preoperative holding area, a peripheral IV was placed, a 1 mg transdermal scopolamine patch was applied, and the patient was administered 4 mg IV ondansetron and 300 mg PO gabapentin. Midazolam was administered only if clinically indicated.

Intraoperative Protocol

After transportation to the operating room, prophylactic antibiotics (2000 mg IV cefazolin or 900 mg IV clindamycin) were administered. Patients were then induced with propofol and 0.5 mg/kg IV ketamine (maximum 50 mg). After induction, but before incision, patients were administered 10 mg IV dexamethasone, and a propofol infusion was initiated. After successful intubation, 9 mL of 0.25% bupivacaine with 1:100,000 epinephrine was used to perform both a local block of the nose and septum as well as bilateral infraorbital nerve blocks. Surgical incision was delayed for 7 minutes after infiltration of local anesthetic. A total intravenous anesthesia technique was employed. Intravenous esmolol or labetalol was administered in lieu of fentanyl analogues to blunt any sympathetic response. Additional IV ketamine (0.25 mg/kg, maximum 20 mg/hour) was administered every hour for the duration of the case. Intravenous fluids were restricted to 1000 mL, and 30 mg IV ketorolac was administered before completing the case.

Recovery Protocol

After arrival to the recovery area, the peripheral IV was locked. Patients were administered PO ibuprofen or PO acetaminophen for mild to moderate pain, and IV hydromorphone for severe pain. Before discharge, patients and individuals accompanying them were educated regarding expected pain, swelling, and bruising. Medication logs (Fig. 3), contact information, and all necessary non-opioid medications were provided before discharge from recovery. Medication logs prompted patients to document when acetaminophen, ibuprofen, ondansetron, and cefalexin were self-administered in addition to pain scores. Additionally, a portion of the medication log was reserved for opioid medications where patients documented the time, dose, and pain score associated with each opioid dose. Patients were instructed to report any moderate pain (4–6), for which an opioid prescription would be made available regardless of time of day, if desired. Patients who requested an opioid prescription were then instructed only to use it for severe pain (7–10).

Postoperative Patient Instructions

Patients were instructed to take 4 mg ondansetron ODT q8h for 3 days then as needed, 800 mg ibuprofen q8h for 3 days then as needed, 1000 mg PO acetaminophen q8h for 3 days then as needed, 500 mg PO cefalexin q6h for 7 days, and to remove the scopolamine patch after 3 days. On POD 1–3, patients were called to assess their symptoms, determine the need for an opioid pain medication, and address any questions or concerns. Pain scores and

Patient intake form

Name: _____

Age: _____ years

In the last 60 days, have you taken any of the following medications?

Codeine	Yes	No	Fentanyl	Yes	No
Hydrocodone	Yes	No	Meperidine	Yes	No
Oxycodone	Yes	No	Gabapentin	Yes	No
Methadone	Yes	No	Tramadol	Yes	No
Hydromorphone	Yes	No	Oxymorphone	Yes	No
Morphine	Yes	No			

Other Questions regarding your health:

Do you have a history of Liver disease?	Yes	No	If yes, what:
Do you have a history of Kidney disease?	Yes	No	If yes, what:
Do you have a history of chronic pain?	Yes	No	If yes, what:
Do you have a bleeding disorder?	Yes	No	If yes, what:
Do you take blood thinners?	Yes	No	If yes, what:
Do you use illicit drugs?	Yes	No	If yes, what:
Are you pregnant or breastfeeding?	Yes	No	

Are you allergic to any of the following medications?

Acetaminophen (Tylenol)	Yes	No	Fentanyl (Sublimaze)	Yes	No
Ondansetron (Zofran)	Yes	No	Esmolol (Brevibloc)	Yes	No
Gabapentin (Neurontin)	Yes	No	Toradol (Ketorolac)	Yes	No
Scopolamine (Hyoscine)	Yes	No	Dexamethasone (Decadron)	Yes	No
Midazolam (Versed)	Yes	No	Bupivicaine (Marcaine)	Yes	No
Cefazolin (Ancef)	Yes	No	Oxycodone (Roxicodone)	Yes	No
Clindamycin (Cleocin)	Yes	No	Morphine (Duramorph)	Yes	No
Diprivan (Propofol)	Yes	No	Hydromorphone (Dilaudid)	Yes	No
Cephalexin (Keflex)	Yes	No			

Fig. 2. Patient intake form. Patients were asked to complete this form to determine their eligibility for participation in the study.

medication logs were completed by patients and returned at the first postoperative visit. Patients were seen in clinic for postoperative follow-up by an advanced practice provider and surgeon at 1 week and 1 month, respectively. Attempts were made to contact patients after their second follow-up appointment to complete a short telephone survey. This consisted of 2 questions: (1) Were you satisfied with your pain control? and 2) How well was your pain controlled after surgery (both being measured using 1–10 Likert scales, with 1 indicating "failed to meet my expectations" and 10 indicating "exceeded my expectations")?

Outcomes of Interest

The primary outcome of this study was the need for any opioid medications after surgery. Secondary outcomes included (1) protocol compliance; (2) postoperative pain scores; and (3) postoperative outcomes.

Statistical Analysis

Data were reported between groups (patients who required postoperative opioids versus patients who did not require postoperative opioids). Chi square and Fisher's exact tests were used to analyze categorical data, whereas nonparametric Mann-Whitney tests were used to analyze continuous variables, each with $\alpha = 0.05$. For postoperative pain scores, averages were taken for every day for all patients, and the analyses were done via Mann-Whitney, with medians and quartiles presented. Protocol compliance was categorized into 80% or less or 81%–100% compliance, and analyzed using Fisher's exact tests. Data were reported as either median with interquartile range (IQR) frequencies and percentages. Statistical analyses were performed using SAS, v9.4.

RESULTS

Patient Characteristics

Forty-two patients were recruited for this study, and a complete description of characteristics can be found in Table 2. Data were reported based on the need for postoperative opioid. No differences existed between groups. For all patients, median age and BMI were 34 years and

Post-operative day _____ **Date** _____

Scheduled medications					**For severe pain**
Time	Pain score	Tylenol (1000 mg)	Motrin (800 mg)	Zofran (4 mg)	Oxycodone (5 mg)
		[ ]		[ ]	Time:
			[ ]		Dose: Pain score before dose:
		[ ]		[ ]	Time:
			[ ]		Dose: Pain score before dose:
		[ ]		[ ]	Time:
			[ ]		Dose: Pain score before dose:
*Keflex to be taken 4 times per day *Keep scopolamine patch on this day					

Pain scores and descriptions										
0	1	2	3	4	5	6	7	8	9	10
None	Mild pain			Moderate pain			Severe pain			

Fig. 3. A representative page of a patient's postoperative pain medication log. Patients were instructed to mark which medications they took and to write down the corresponding times and associated pain scores. An example of the visual pain scale was provided on each page to assist with documenting pain scores. A section specific for opioid medications was also included on each page but was only filled out by patients who required opioids. Patients were provided with a sheet for each postoperative day.

23, respectively. Most patients were White and women (both 79%), and 3 (7%) required an interpreter. Sixty-two percent underwent primary nasal surgery, 52% were self-pay, and 83% had aesthetic indications. Anxiety (33%) and depression (21%) were the most common comorbidities, and 74% had at least 1 comorbid condition. Twelve percent were actively using tobacco, and 93% had an American Society of Anesthesia score of 1–2.

Perioperative Variables

Complete information regarding perioperative medications and operative details is displayed in Table 3. Beta blockers were more often administered to patients who did not require opioids (34% versus 0%, $P = 0.041$); however, no other differences in perioperative care were observed. All patients received prophylactic antibiotics. Median volume of intravenous fluids was 698 mL (IQR 775 mL), and preoperative midazolam was administered to 40%. Inhalational anesthesia of any amount was used in 74%. Septoplasties (67%) and osteotomies (45%) were common. Spreader grafts were fashioned in 64%, and 62% required turbinate reduction or fracturing. Auricular cartilage was harvested in 1 patient, while another patient had graft material obtained from a rib. A bone rasp was used in 60% of cases. Nearly all (93%) had nasal splints placed. Median operative and anesthesia times were 70 minutes (IQR 25 minutes) and 113 minutes (IQR 34 minutes), respectively. Nine patients (21%) reported any pain scores > 0 before discharge. Of those, median pain scores did not differ between opioids users (median 4.5, N = 2) and non-users (median 4.0, N = 7) ($P = 0.437$). Ibuprofen or acetaminophen was administered to 12% in recovery, and none required hydromorphone. Only 1 patient had nausea in recovery. No patients experienced significant ketamine-related side effects (delirium, hallucinations, etc.). Median time in recovery was 63 minutes (IQR 15 minutes; range 41–124 minutes).

Protocol Compliance

Associations between protocol compliance and opioid requirement are displayed in Figures 4 and 5, and a complete listing of compliance related data can be found in

Table 2. Patient Characteristics

Characteristic	Opioids Needed after Surgery		*P*
	No	Yes	
No. patients	32	10	N/A
Age (y)	35 (18.5)	28.5 (36)	0.976
BMI (missing = 1)	23.6 (6.4)	22.4 (4.6)	0.439
Women	78.1%	80.0%	1.000
Men	75.0%	90.0%	0.416
Non-English speaking	9.4%	0.0%	1.000
Self-pay	53.1%	50.0%	1.000
Surgical indication			0.701
Aesthetic	34.4%	20.0%	
Functional	15.6%	20.0%	
Both	50.0%	60.0%	
Primary nasal surgery	62.5%	60.0%	1.000
Comorbidities			
At least 1 comorbidity	71.9%	80.0%	1.000
Anxiety	31.3%	40.0%	0.707
Diabetes mellitus	3.1%	10.0%	0.424
Depression	21.9%	20.0%	1.000
Obstructive sleep apnea	9.4%	10.0%	1.000
Gastroesophageal reflux disease	15.6%	10.0%	1.000
Hypertension	9.4%	10.0%	1.000
Postoperative nausea and vomiting	21.9%	10.0%	0.655
Other comorbidity	15.6%	20.0%	1.000
Tobacco use			0.577
Not actively using	90.6%	80.0%	
Actively using	9.4%	20.0%	
American Society of Anesthesia score			1.000
1	37.5%	30.0%	
2	56.3%	60.0%	
3	6.3%	10.0%	
4+	0.0%	0.0%	

Values are reported as either median (IQR) or percent of total for each group.

Table 1. An inverse relationship existed between overall protocol compliance and opioid requirement ($P = 0.007$) (Fig. 4). Patients who did not require opioids had higher compliance rates for local and regional blocks (63% versus 20%, $P = 0.030$) and ketorolac use (100% versus 70%, $P = 0.011$). The most frequent protocol violation was compliance with ibuprofen and acetaminophen after discharge (N = 28). This was largely due to patients not returning their data sheet. Of the 14 (33%) who returned these data, those requiring opioids tended to take <70% of their ibuprofen and acetaminophen after surgery (67% versus 13%, $P = 0.091$). The second most common protocol deviance was omission of inhaled anesthetics. Only 26% of cases were performed without any inhaled anesthetics; however, brief use was seen in 4 patients. The third most common deviance was the use of local and regional anesthetic. Seventy-six percent of patients received at least 9 mL, with only 3 receiving up to 10.2 mL. Time from local to incision was not recorded for 9 (21%) patients. All patients received a nasal and septal block as well as bilateral infraorbital blocks.

Postoperative Opioid Requirements and Pain Scores

Thirty-one percent of patients returned their pain score log. Of these, 6 required opioids. Median opioid requirement was 20 mg morphine equivalents (MME) (range 7.5–85 MME). Auricular cartilage was harvested in 1 patient, and rib cartilage was harvested in a separate

Table 3. Perioperative Medications and Details

Variable	Opioids Needed after Surgery		*P*
	No	Yes	
No. patients	32	10	N/A
Medication details			
Carbohydrate drink (missing = 4)	96.7%	100.0%	1.000
Midazolam (missing = 2)	46.9%	12.5%	0.114
Prophylactic antibiotics	100.0%	100.0%	—
Oxymetazoline (0.05% solution)	96.9%	100.0%	1.000
Beta blocker	34.4%	0.0%	0.041
Neuromuscular blocking agent	81.3%	100.0%	0.308
Neuromuscular blocking reversal agent	78.1%	70.0%	0.678
Total ketamine (mg)	40.0 (20.0)	40.0 (25.0)	0.660
Propofol induction bolus (mg)	200.0 (80.0)	180.0 (50.0)	0.555
Propofol infusion (mg)	762.2 (908.5)	505.5 (1415.0)	0.494
Total propofol (mg)	917.7 (989.5)	635.5 (1427.0)	0.400
Dexamethasone	10.0 (0.0)	10.0 (0.0)	0.424
Local/regional anesthetic (mL)	9.0 (0.0)	9.0 (2.2)	0.330
Time from local to incision (min)	10.0 (3.5)	18 (10.0)	0.181
Intravenous fluids (mL)	698.0 (727.0)	517.0 (832.0)	0.988
Operative details			
Septoplasty	65.6%	70.0%	1.000
Osteotomy	50.0%	30.0%	0.305
Spreader grafts	59.4%	80.0%	0.286
Bone rasp	62.5%	50.0%	0.714
Turbinate reduction or fracturing	62.5%	60.0%	1.000
Nasal splint			0.592
Internal	40.6%	60.0%	
External	9.4%	0.0%	
Both	43.8%	30.0%	
None	6.3%	10.0%	
Anesthesia time (min)	110.0 (35.0)	114.5 (37.0)	0.712
Operative time (min)	68.0 (16.0)	72.0 (29.0)	0.745
Recovery phase			
Ibuprofen or acetaminophen in recovery (missing = 7)	10.3%	33.0%	0.195
Time in recovery area (min)	61.0 (15.5)	65.5 (17.0)	0.615
Any pain score > 0 before discharge	21.9%	20.0%	1.000
Opioids administered	0.0%	0.0%	NT

Values are reported as either median (IQR) or percent of total for each group.
NT, not testable.

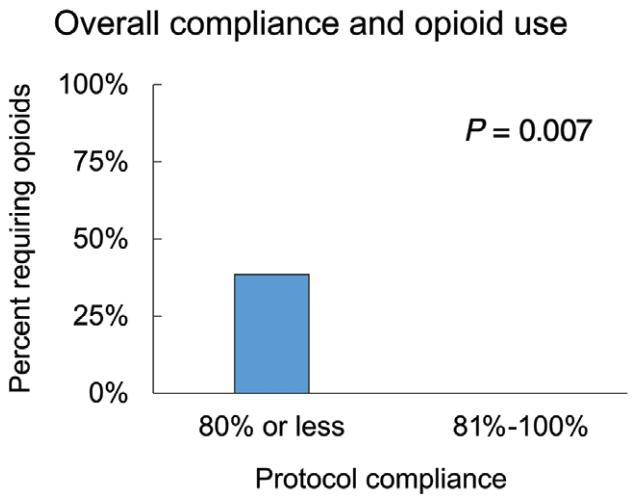

Fig. 4. Bar graph demonstrating an inverse correlation between overall protocol compliance and the need for opioid pain medications. Patients who exceeded 80% compliance did not require opioids, whereas 38% of patients with 80% or less compliance did (P = 0.007).

patient. Both patients required opioids, with MMEs of 85 and 20, respectively. Median time to opioid requirement was 27 hours (IQR 28 hours, range 3–81 hours). Pain score trends are displayed in Figure 6. Pain scores were higher in patients requiring opioids on PODs 1–5 (all $P < 0.01$). For opioid users, median pain scores peaked at 6.7 (IQR 2.8) on POD 2. For those who did not require opioids, median pain scores peaked at 2.8 (IQR 4.0) on POD 1.

Postoperative Outcomes and Patient Satisfaction

We safely omitted opioid prescriptions in 76% of patients without sacrificing patient satisfaction. We were able to contact 16 (38%) patients for the follow-up telephone survey, 3 of which required opioids. Patients from both groups rated their overall pain control as a median of 9 of 10 (P = 0.880), and no patient reported dissatisfaction with their pain control. No episodes of bleeding or septal hematoma occurred. Two patients presented to the emergency department, neither of whom required opioids after surgery. The first developed significant nausea and vomiting the night after surgery, and the second was a diabetic who presented with hyperglycemia 2 days after surgery. No patients presented to an emergency department for uncontrolled pain. One patient developed a small 5 mm posteriorly positioned clinically insignificant septal perforation. Three were prescribed antibiotics for sinus (N = 2) and superficial surgical site infections (N = 1), and 1 patient was prescribed an antifungal for presumed yeast infection (N = 1). Nearly all presented to their 1-week (N = 41) and 1-month (N = 38) follow-up appointments.

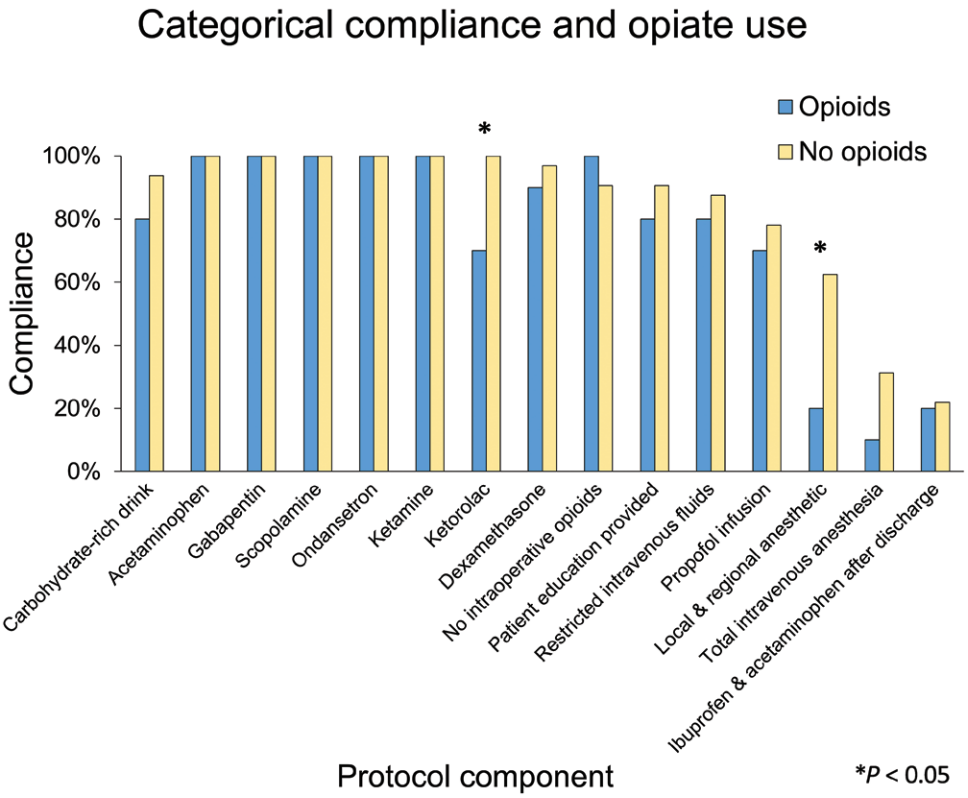

Fig. 5. Figure depicting the differences in patient compliance for all components of the protocol. Patients who required opioids (blue) had lower compliance rates for local and regional blocks (20% versus 63%, P = 0.030) and for ketorolac administration (70% versus 100%, P = 0.011). Relatively low compliance was seen with the use of inhaled anesthetics and ibuprofen/acetaminophen after discharge.

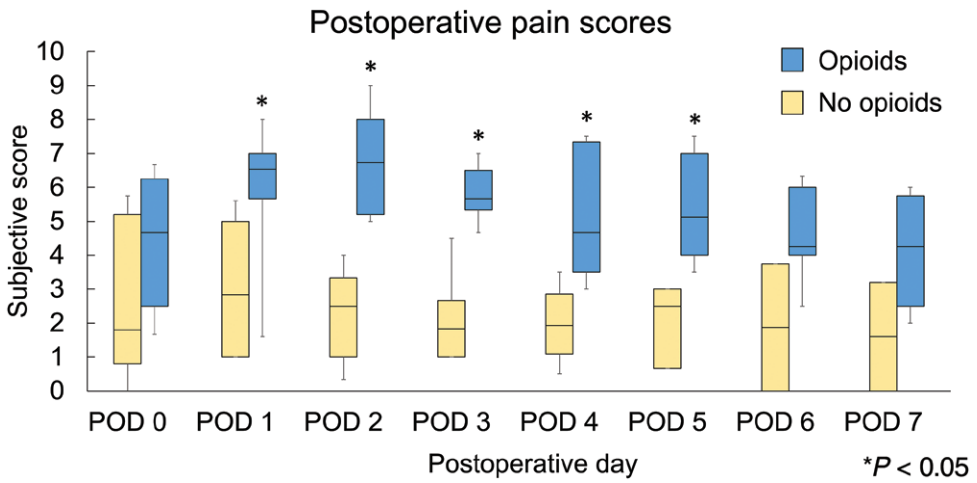

Fig. 6. Box plot displaying the trends in postoperative pain scores for PODs 0–7. For opioid users, pain scores peaked on POD 2, with median pain score of 6.7 (IQR 2.8). For non-users, pain scores peaked on POD 1 at 2.8 (IQR 4.0). Pain scores differed between groups on PODs 1–5 (all $P < 0.05$).

DISCUSSION

This is one of the first studies proposing a multimodal analgesic regimen for surgeons performing septorhinoplasty. Our study shows that routine omission of opioids is safe and does not negatively impact patient satisfaction. In addition, patients who adhered to the protocol were less likely to require opioids. We conclude that with the use of this protocol, opioids do not need to be routinely prescribed after septorhinoplasty in settings where opioids can be made available, if needed.

This study has limitations. All surgeries were performed by one surgeon at a single location, and our patient population was largely composed of young healthy White women. Therefore, the results of this study may not be generalizable to other patient populations or institutions. However, many required osteotomies and septoplasties, supporting the use of this protocol for more invasive procedures. Although patient satisfaction was equivalent between groups, our sample size was relatively small, and specific aspects of patient satisfaction were not addressed. We had a 38% telephone survey response rate, with representation from both groups. Of the 16 responders, 5 were patients who required opioids. To better determine patient-reported outcomes associated with use of this protocol, we will be surveying future patients using the rhinoplasty outcomes evaluation survey.[34] It should be noted that this was not a comparative study. Anecdotally, our patients were always prescribed and required opioids after surgery. However, these data were not recorded in prior years, and we were unable to provide a historical comparison. It should be noted that the goal of this study was to determine the feasibility of omitting an opioid prescription after surgery, which does not require a comparative group.

With regard to protocol violations, we noted several in the use of total intravenous anesthesia. We later discovered that this was due to anesthetist concern about prolonged stays in recovery due to potential drowsiness. As a result, several of the anesthetists chose to administer inhaled anesthetics at half the rate they would typically use in combination with the propofol infusion. Patient compliance with non-opioid pain medications after discharge was also low. This was largely due to patients not providing us with these data, as opposed to true non-compliance. A trend toward lower compliance was observed in patients who required opioids (67% versus 13%, $P = 0.091$). We suspect this is due to the relatively small sample size. Similarly, the number of patients who required opioids was small; therefore, we were unable to perform a multivariable analysis to identify factors independently associated with needing opioids after surgery. However, of the 2 patients who required additional cartilage grafts (ribs and auricular cartilage), both required opioids. Such patients may be at a higher risk for opioid use after surgery. Practical barriers to implementing this protocol also exist. This protocol requires a 7-minute delay between injection of local anesthetic and incision. However, injection of local before prepping a draping may enhance operating room efficiency and reduce any potential delay. In addition, this protocol is dependent on the provider making an opioid prescription available, if needed. In situations where this is not possible, patients should be discharged with an opioid prescription.

Previous studies show that the medications and techniques in our protocol are efficacious when used alone.[25–30,35–39] Carbohydrate-rich drinks before surgery have been shown to reduce discomfort and anxiety.[35] Gabapentin reduced pain scores and opioid requirements in several studies, including a review of 15 randomized trials in head and neck surgery.[28,36,37] Two additional trials support gabapentin use in septorhinoplasty.[26,29] Intraoperative corticosteroids are often used for their anti-inflammatory effects but also have notable effects on postoperative pain.[26] The sympatholytic properties of esmolol may also contribute to lower pain scores and opioid requirements after rhinoplasty.[30] Intravenous non-steroidal anti-inflammatory medications are a key component for many enhanced recovery pathways, and randomized studies support their

use in septorhinoplasty.[27,39] In other trials, subtherapeutic ketamine and total intravenous anesthetic techniques have reduced the rate of emergence agitation, decreased pain scores, and increased patient satisfaction scores.[40–44] Local and regional nerve blocks have proved successful as well.[25,31] In contrast to these studies, we sought to develop an anesthetic regimen encompassing all phases of care that incorporated several agents with known efficacy when used alone.

Similar protocols have been implemented for patients undergoing postmastectomy alloplastic or microvascular breast reconstruction. In this setting, enhanced recovery protocols have reduced the length of stay, reduced pain, and increased quality of recovery metrics.[21–23] The adoption of similar protocols could significantly improve the quality of care for other aesthetic and reconstructive surgery patients.

Future avenues for research may include identifying patients who are at a high risk for opioid use, so as to facilitate selective prescribing practices. A recent study by Marshall et al reported results for 35 patients undergoing rhinoplasty, and found that operative technique was not associated with opioid use.[45] This study was similar to ours in that it was likely underpowered to identify individual factors associated with opioid use. We are continuing to enroll patients in our registry and hope to accrue enough patients to identify risk factors for opioid use. Additionally, we aim to better quantify patient-reported outcomes associated with this protocol. The utility of this protocol in other outpatient surgical settings remains unknown and may serve as an additional area for investigation. The implications of this study have direct benefits for patients and indirect societal benefits. Any intervention to reduce the number of opioids needed by patients after surgery will reduce the risk of long-term use. In addition, a reduction in the number of unused opioids would benefit society, as 71% of current opioid abusers obtain their medications from friends or family.[46]

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REFERENCES

1. *National Institute on Drug Abuse. Overdose Death Rates.* Bethesda, MD: National Institute of Health. Available at https://www.drugabuse.gov/related-topics/trends-statistics/overdose-death-rates. Accessed March 15, 2020.
2. Kolodny A, Courtwright DT, Hwang CS, et al. The prescription opioid and heroin crisis: a public health approach to an epidemic of addiction. *Annu Rev Public Health.* 2015;36:559–574.
3. Hill MV, McMahon ML, Stucke RS, et al. Wide variation and excessive dosage of opioid prescriptions for common general surgical procedures. *Ann Surg.* 2017;265:709–714.
4. Rose KR, Christie BM, Block LM, et al. Opioid prescribing and consumption patterns following outpatient plastic surgery procedures. *Plast Reconstr Surg.* 2019;143:929–938.
5. Rock AN, Akakpo K, Cheresnick C, et al. Postoperative prescriptions and corresponding opioid consumption after septoplasty or rhinoplasty. *Ear Nose Throat J.* 2019.
6. Coughlin JM, Shallcross ML, Schäfer WLA, et al. Minimizing opioid prescribing in surgery (MOPiS) initiative: an analysis of implementation barriers. *J Surg Res.* 2019;239:309–319.
7. Brummett CM, Waljee JF, Goesling J, et al. New persistent opioid use after minor and major surgical procedures in US adults. *JAMA Surg.* 2017;152:e170504.
8. Hooten WM, St Sauver JL, McGree ME, et al. Incidence and risk factors for progression from short-term to episodic or long-term opioid prescribing: a population-based study. *Mayo Clin Proc.* 2015;90:850–856.
9. 2018 Plastic Surgery Statistics Report. Arlington Heights, IL: American Society of Plastic Surgeons. 2018. Available at https://www.plasticsurgery.org/documents/News/Statistics/2018/plastic-surgery-statistics-full-report-2018.pdf. Accessed March 15, 2020.
10. Sethi RKV, Miller AL, Bartholomew RA, et al. Opioid prescription patterns and use among patients undergoing endoscopic sinus surgery. *Laryngoscope.* 2019;129:1046–1052.
11. Aulet RM, Trieu V, Landrigan GP, et al. Changes in opioid prescribing habits for patients undergoing rhinoplasty and septoplasty. *JAMA Facial Plast Surg.* 2019;21:487–490.
12. Justicz N, Gadkaree SK, Yamasaki A, et al. Defining typical acetaminophen and narcotic usage in the postoperative rhinoplasty patient. *Laryngoscope.* 2020.
13. Gadkaree SK, Shaye DA, Occhiogrosso J, et al. Association between pain and patient satisfaction after rhinoplasty. *JAMA Facial Plast Surg.* 2019;21:475–479.
14. Patel S, Sturm A, Bobian M, et al. Opioid use by patients after rhinoplasty. *JAMA Facial Plast Surg.* 2018;20:24–30.
15. Locketz GD, Brant JD, Adappa ND, et al. Postoperative opioid use in sinonasal surgery. *Otolaryngol Head Neck Surg.* 2019;160:402–408.
16. Sclafani AP, Kim M, Kjaer K, et al. Postoperative pain and analgesic requirements after septoplasty and rhinoplasty. *Laryngoscope.* 2019;129:2020–2025.
17. Feinberg AE, Chesney TR, Srikandarajah S, et al; Best Practice in Surgery Group. Opioid use after discharge in postoperative patients: a systematic review. *Ann Surg.* 2018;267:1056–1062.
18. Helander EM, Billeaud CB, Kline RJ, et al. Multimodal approaches to analgesia in enhanced recovery after surgery pathways. *Int Anesthesiol Clin.* 2017;55:51–69.
19. Mathiesen O, Dahl B, Thomsen BA, et al. A comprehensive multimodal pain treatment reduces opioid consumption after multilevel spine surgery. *Eur Spine J.* 2013;22:2089–2096.
20. McLeod RS, Aarts MA, Chung F, et al. Development of an enhanced recovery after surgery guideline and implementation strategy based on the knowledge-to-action cycle. *Ann Surg.* 2015;262:1016–1025.
21. Batdorf NJ, Lemaine V, Lovely JK, et al. Enhanced recovery after surgery in microvascular breast reconstruction. *J Plast Reconstr Aesthet Surg.* 2015;68:395–402.
22. Dumestre DO, Redwood J, Webb CE, et al. Enhanced recovery after surgery (ERAS) protocol enables safe same-day discharge after alloplastic breast reconstruction. *Plast Surg (Oakv).* 2017;25:249–254.
23. Dumestre DO, Webb CE, Temple-Oberle C. Improved recovery experience achieved for women undergoing implant-based breast reconstruction using an enhanced recovery after surgery model. *Plast Reconstr Surg.* 2017;139:550–559.
24. Rojas KE, Manasseh DM, Flom PL, et al. A pilot study of a breast surgery enhanced recovery after surgery (ERAS) protocol to eliminate narcotic prescription at discharge. *Breast Cancer Res Treat.* 2018;171:621–626.

25. Boselli E, Bouvet L, Augris-Mathieu C, et al. Infraorbital and infratrochlear nerve blocks combined with general anaesthesia for outpatient rhinoseptoplasty: a prospective randomised, double-blind, placebo-controlled study. *Anaesth Crit Care Pain Med.* 2016;35:31–36.
26. Demirhan A, Tekelioglu UY, Akkaya A, et al. Effect of pregabalin and dexamethasone addition to multimodal analgesia on postoperative analgesia following rhinoplasty surgery. *Aesthetic Plast Surg.* 2013;37:1100–1106.
27. Gozeler MS, Sakat MS, Kilic K, et al. Does a single-dose preemptive intravenous ibuprofen have an effect on postoperative pain relief after septorhinoplasty? *Am J Otolaryngol.* 2018;39:726–730.
28. Kazak Z, Meltem Mortimer N, Sekerci S. Single dose of preoperative analgesia with gabapentin (600 mg) is safe and effective in monitored anesthesia care for nasal surgery. *Eur Arch Otorhinolaryngol.* 2010;267:731–736.
29. Pourfakhr P, Khajavi MR, Jalali A, et al. Low-dose preoperative pregabalin improves postoperative pain management in septorhinoplasty surgery: a double-blind randomized clinical trial. *Eur Arch Otorhinolaryngol.* 2019;276:2243–2249.
30. Vahabi S, Rafieian Y, Abbas Zadeh A. The effects of intraoperative esmolol infusion on the postoperative pain and hemodynamic stability after rhinoplasty. *J Invest Surg.* 2018;31:82–88.
31. Sari E, Simsek G. Comparison of the effects of total nasal block and central facial block on acute postoperative pain, edema, and ecchymosis after septorhinoplasty. *Aesthetic Plast Surg.* 2015;39:877–880.
32. McCaffery M, Beebe A, et al. *Pain: Clinical Manual for Nursing Practice.* St. Louis, MO: Mosby; 1989.
33. Williamson A, Hoggart B. Pain: a review of three commonly used pain rating scales. *J Clin Nurs.* 2005;14:798–804.
34. Alsarraf R. Outcomes research in facial plastic surgery: a review and new directions. *Aesthetic Plast Surg.* 2000;24:192–197.
35. Hausel J, Nygren J, Lagerkranser M, et al. A carbohydrate-rich drink reduces preoperative discomfort in elective surgery patients. *Anesth Analg.* 2001;93:1344–1350.
36. Sanders JG, Dawes PJ. Gabapentin for perioperative analgesia in otorhinolaryngology-head and neck surgery: systematic review. *Otolaryngol Head Neck Surg.* 2016;155:893–903.
37. Turan A, Memiş D, Karamanlioğlu B, et al. The analgesic effects of gabapentin in monitored anesthesia care for ear-nose-throat surgery. *Anesth Analg.* 2004;99:375–8, table of contents.
38. Honarmand A, Safavi M, Karaky H. Preincisional administration of intravenous or subcutaneous infiltration of low-dose ketamine suppresses postoperative pain after appendectomy. *J Pain Res.* 2012;5:1–6.
39. Nguyen BK, Yuhan BT, Folbe E, et al. Perioperative analgesia for patients undergoing septoplasty and rhinoplasty: an evidence-based review. *Laryngoscope.* 2019;129:E200–E212.
40. Demir CY, Yuzkat N. Prevention of emergence agitation with ketamine in rhinoplasty. *Aesthetic Plast Surg.* 2018;42:847–853.
41. Şanli M, Gülhaş N, Bilen BT, et al. The effect of addition of ketamine to lidocaine on postoperative pain in rhinoplasties. *Turk J Med Sci.* 2016;46:789–794.
42. Moscona RA, Ramon I, Ben-David B, et al. A comparison of sedation techniques for outpatient rhinoplasty: midazolam versus midazolam plus ketamine. *Plast Reconstr Surg.* 1995;96:1066–1074.
43. Kocaturk O, Keles S. Recovery characteristics of total intravenous anesthesia with propofol versus sevoflurane anesthesia: a prospective randomized clinical trial. *J Pain Res.* 2018;11:1289–1295.
44. Jo JY, Jung KW, Kim HJ, et al. Effect of total intravenous anesthesia vs volatile induction with maintenance anesthesia on emergence agitation after nasal surgery: a randomized clinical trial. *JAMA Otolaryngol Head Neck Surg.* 2019;145:117–123.
45. Marshall RV, Rivers NJ, Manickavel S, et al. Postoperative opioid use in rhinoplasty procedures: a standardized regimen. *Facial Plast Surg.* 2020.
46. Jones CM, Paulozzi LJ, Mack KA. Sources of prescription opioid pain relievers by frequency of past-year nonmedical use: United States, 2008–2011. *JAMA Intern Med.* 2014;174:802–803.