Received: 6 March 2022 | Accepted: 28 October 2022

DOI: 10.1002/wjo2.87

RESEARCH PAPER

World Journal of Otorhinolaryngology-Head and Neck Surgery

A retrospective analysis of pain and opioid usage in head and neck free flap reconstruction

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Funding information

None

Abstract

Objectives: Investigate opioid usage and postoperative pain in patients undergoing head and neck free flap surgery.

Methods: A retrospective review of 100 consecutive patients undergoing head and neck free flap reconstruction at two academic centers was performed. Data captured included demographics, postoperative inpatient pain, pain at postoperative visits, morphine equivalent doses (MEDs) administration, medication history, and comorbidities. Data were analyzed using regression models, χ^2 tests, and student's *t*-tests.

Results: Seventy-three percent of patients were discharged with opioid medication, with over half (53.4%) continuing to take opioids at their second postoperative visit, and over one-third (34.2%) continuing to take them around 4-month postoperatively. One out of every five (20.3%) opioid-naïve patients chronically took opioids postoperatively. There was a poor association between inpatient postoperative pain scores and daily MEDs administered ($R^2 = 0.13$, 0.17, and 0.22 in postoperative Days 3, 5, and 7, respectively). Neither preoperative radiotherapy nor postoperative complications were associated with an increase in opioid usage.

Conclusions: For patients undergoing head and neck free flap operations, opioid medications are commonly used for postoperative analgesia. This practice may increase the chance an opioid-naïve patient uses opioids chronically. We found a poor association between MEDs administered and patient-reported pain scores, which suggests that standardized protocols aimed at optimizing analgesia while reducing opioid administration may be warranted.

Level of Evidence: 3 (Retrospective cohort study).

KEYWORDS

free flap reconstruction, head and neck, multimodal analgesia, opioids, postoperative pain

INTRODUCTION

Pain is multifactorial and defined by several features such as personal experience, quality perception, location, intensity, and emotional impact.[1] Managing postoperative pain, thus, is a multifaceted issue that is dependent on the patient, provider, specific institution, and national guidelines.[2] Patients undergoing head and neck surgery requiring free flap reconstruction often suffer from postoperative pain. This pain can be poorly controlled and may limit early mobilization and ambulation, putting patients at increased risk for complications.[3] One of the main options for postoperative pain control in this group of patients is the use of opioid analgesics, which have a variety of undesirable side effects. In addition, these patients are often discharged with a liberal number of opioid analgesics, which contributes to the overall burden of available medication in the opioid epidemic.[4] According to the Centers for Disease Control and Prevention, nearly 247,000 individuals died from prescription opioids in the United States from 1999 to 2019,[5] and those at the highest risk of opioid overdose are as likely to receive opioid medication from their clinician as they are from a friend or family member.[6]

Multimodal analgesia (MMA) is a method of pain control that combines various classes of medication for pain relief. Due to their ability to reduce opioid use and associated risks, MMA protocols are gaining popularity; however, limited published guidance on their use compared to opioid medication has created variability in physician prescribing patterns.[7–9] Specifically, data on MMA for the management of postoperative pain in patients undergoing head and neck free flap surgery are limited. A recent systematic review comparing MMA versus standard opioid-based pain management protocols found that an MMA protocol had equal efficacy in treating postoperative pain without the risk of postoperative morbidity in the head and neck free flap surgery population, although the number of individual studies remains low.[2] In this study, we investigate postoperative pain and opioid usage in patients undergoing head and neck free flap reconstructive surgery.

METHODS

A retrospective chart review was performed on 100 consecutive patients who underwent head and neck free flap reconstruction at two academic centers from July 2018 to January 2021. All patients who underwent head and neck free flap reconstruction at these centers during this interval were included in this study. Patients whose clinical documentation lacked pain scores or analgesic data were excluded, which totaled to two patients. Free flap procedures were performed by head and neck reconstructive physicians and included radial forearm-free flaps, anterolateral thigh-free flaps, fibula-free flaps, and scapula-free flaps. Ninety-one patients had a preoperative diagnosis of head and neck squamous cell carcinoma (SCC) before head and neck reconstruction, with the remaining nine having either a structural deformity, non-SCC head and neck tumor, osteoradionecrosis, or osteomyelitis. Data collected include postoperative pain scores, morphine equivalent doses (MEDs) administration, demographics, smoking history, outpatient visit pain scores, daily MEDs provided at discharge, medical comorbidities, and postsurgical complications (Tables 1 and 2). The continuous use of opioids at postoperative outpatient visits was based on medication reconciliation performed at each visit. Data were analyzed using Student's *t*-tests, χ^2 tests, one-way analysis of variance, and regression models. Statistical analysis was performed via online software (https://www.socscistatistics.com/), and significance was set to values of $p < 0.05$. This study received relevant institutional board review approval.

TABLE 1 Patent demographics

Characteristic	Value
No. of patients	100
Sex	
Male	64
Female	36
Age (years)	
Mean ± SD	61.8 ± 13.3
Range	2–87
Race	
White	58
Black	33
Asian/Asian American	2
Other	7
Comorbidities	
DM	19
COPD	9
CHF	3
CAD/MI	8
HTN	50
Asthma	11
Dementia/delirium	4
Depression/anxiety	17
Alcohol use disorder	16
Substance user disorder	6
Previous/current smokers	68
History of previous head and neck radiotherapy	39
History of previous head and neck surgery	47
Prior opioid use preoperatively	31

Abbreviations: CAD/MI, coronary artery disease/myocardial infarction; CHF, congestive heart failure; COPD, chronic obstructive pulmonary disease; DM, diabetes mellitus; HTN, hypertension; SD, standard deviation.

TABLE 2 Surgical details

Characteristic	Value
Preoperative comorbid risk (MFI-5 Score)	
0	40
1	38
2	21
3	1
Primary tumor/defect location	
Oral cavity	48
Oropharynx	12
Larynx	7
Hypopharynx	5
Parotid	3
Sinonasal	3
Maxilla	8
Scalp/facial skin	13
Free flap type	
Radial forearm	27
Anterolateral thigh	37
Fibular	29
Scapular	7
Postoperative hospital length of stay (days)	11.7 ± 6.5
Postoperative surgical complications	
Hematoma/seroma	5
Wound dehiscence	9
Wound infection	18
Fistula formation	2
Free flap failure	3
Return to OR within 30 days	16
Clavien-Dindo	
I	79
II	12
III	4
IV	4
V	1
Postoperative medical complications	
VTE	8
MI	1
Pneumonia	5
CVA	3
Sepsis	2
UTI	3
Readmission within 30 days of discharge	14
Usage of skin graft	44
Operative time (min)	671 ± 152

Abbreviations: CVA, cerebrovascular accident; MFI-5, modified 5-item frailty index; MI, myocardial infarction; OR, operating room; UTI, urinary tract infection; VTE, venous thromboembolism.

RESULTS

Of the 100 total patients, 73 were discharged with opioid analgesics. Of these patients, 72.6% ($n = 53$) had continued to take opioids by the time of their first postoperative visit, 53.4% ($n = 39$) had continued by the time of their second postoperative visit, and 34.2% ($n = 25$) had continued by the time of their third postoperative visit, which on average occurred 22.2, 43.9, and 115.2 days postoperatively, respectively.

Preoperatively, 69 patients were opioid-naïve, of whom 49 (71%) were discharged with opioid medication. Among the preoperatively opioid-naïve patients, 43.5% ($n = 30$), 33.3% ($n = 23$), and 20.3% ($n = 14$) were taking opioid medication at their first, second, and third postoperative visits, respectively. Of the 31 patients taking opioids preoperatively, 77.4% ($n = 24$) were discharged with opioid medication. Of these 31 patients who had been taking opioids preoperatively, 74.2% ($n = 23$), 51.6% ($n = 16$), and 35.5% ($n = 11$) were taking opioid medication at their first, second, and third postoperative visits, respectively.

There was no significant difference in postoperative opioid usage at the time of discharge between patients who were or were not taking opioids preoperatively ($p = 0.505$). Patients who took opioids preoperatively were taking opioids at their first postoperative visit at a significantly higher rate than those who were opioid-naïve ($p = 0.004$); however, opioid usage at the second postoperative visit was not significantly different between groups ($p = 0.083$). By the third postoperative visit, there was no significant difference in opioid usage between opioid-naïve and chronic opioid users ($p = 0.105$).

There was a low correlation between average daily inpatient pain scores and average daily MEDs administered in the first three, five, and seven postoperative days ($R^2 = 0.13$, 0.17, and 0.22, respectively). Average daily inpatient pain scores were significantly higher in those who were prescribed opioid analgesics at discharge versus those who were not prescribed them ($p = 0.0006$). The average daily inpatient pain scores were also significantly higher in patients who had continued to take opioid analgesia at their first and second postoperative visits than those who were not prescribed opioid analgesics at discharge ($p = 0.0002$; $p = 0.0001$, respectively). At the time of the first and second postoperative outpatient visits, patients who continued to take opioid analgesics had significantly higher

TABLE 3 Association of inpatient and outpatient pain scores with opioid use at discharge and postoperatively

Cohort	Average inpatient pain score	*p*
Patients prescribed opioids at discharge	3.65 ± 1.72	0.0006
Patients not prescribed opioid at discharge	2.37 ± 1.27	
Patients continuing opioid intake at POV1	3.86 ± 1.81	0.0002
Patients not taking opioids at POV1	2.37 ± 1.27	
Patients continuing opioid intake at POV2	4.01 ± 1.75	0.0001
Patients not taking opioids at POV2	2.37 ± 1.27	
Cohort	**Outpatient visit pain score**	***p***
Patients continuing opioid intake at POV1	3.32 ± 3.20	0.0048
Patients not taking opioids at POV1	1.37 ± 2.29	
Patients continuing opioid intake at POV2	2.89 ± 3.43	0.0019
Patients not taking opioids at POV2	1.19 ± 2.15	

Abbreviation: POV, postoperative visit.

outpatient pain scores than patients who were not taking opioid analgesics (Table 3; $p = 0.0048$; $p = 0.0019$, respectively).

Patients who suffered postoperative surgical complications ($n = 31$) were no more likely to be discharged with opioid analgesia than those without postoperative surgical complications ($p = 0.094$). Patients who suffered postoperative surgical complications were no more likely to be taking opioid medications at their first ($p = 0.496$), second ($p = 0.397$), and third ($p = 0.532$) postoperative visits compared to those without postoperative surgical complications.

Patients with a history of preoperative head and neck radiotherapy (Table 1; $n = 39$) were also no more likely to be discharged with opioid analgesia than those without a history of preoperative head and neck radiotherapy ($p = 0.499$). Additionally, there was no significant difference in MEDs per day prescribed at discharge between patients with a history of preoperative radiotherapy and those without (64.6 vs. 43.9; $p = 0.17$). Patients with preoperative radiotherapy were no more likely to be taking opioid medications at their first ($p = 0.89$), second ($p = 0.93$), and third ($p = 0.19$) postoperative visits compared to patients without preoperative radiotherapy.

Daily pain scores ($p = 0.318$) and daily inpatient MEDs administered ($p = 0.708$) were not significantly different between patients receiving skin grafts or not. The location of the primary tumor/pathology and the operative site had no influence on average inpatient pain scores (f-ratio = 0.940; $p = 0.446$). Tumors located in the hypopharynx, however, were associated with higher average daily inpatient MEDs administered compared to tumors/pathologies found in the oropharynx (54.70 vs. 18.59; $p = 0.023$) and maxilla (54.70 vs. 8.84; $p = 0.002$); no other significant associations were found between other operative locations. Free flap donor site was also not associated with average inpatient pain scores (f-ratio = 1.087; $p = 0.358$) nor average daily inpatient MEDs administered (f-ratio = 1.899; $p = 0.135$) (Supporting Information: Table 1).

DISCUSSION

Physician prescriptions for opioid analgesics greatly contribute to the opioid epidemic by creating a household supply of these medications that may eventually be misused. Postoperative pain from head and neck free flap reconstructive surgery is often managed by opioids that are continued for weeks postoperatively. Importantly, while studies have shown promise in the use of MMA for postoperative pain control in patients undergoing head and neck free flap surgery, reporting outcomes are variable, making standardized guidelines difficult to create.[2] Our study demonstrates that most patients undergoing head and neck reconstruction surgery are discharged with opioid analgesia, of whom a significant portion continues to take opioid medications chronically, as defined by opioid use over 45 days during a 90-day period.[10] In our cohort, over half continue to take opioids 6-week postoperatively, and over one-third continue to take them almost four months postoperatively. Overall, regardless of preoperative opioid consumption status, one out of every four patients undergoing head and neck free flap reconstruction continues to take opioid medication 4 months postoperatively. Among opioid-naïve patients, one out of every five continues to take opioid medications 4 months postoperatively. While chronic opioid usage postoperatively may not be surprising in chronic opioid users, this data may demonstrate that postoperative opioid administration may contribute to chronic opioid usage in opioid-naïve patients. We found that higher inpatient postoperative pain is associated with ongoing opioid usage after discharge. However, inpatient pain scores and inpatient MEDs administered were poorly correlated, which calls into question opioid prescribing patterns based on perceived pain severity. This finding indicates that improving inpatient pain control, possibly through nonopioid analgesics, may be one way to reduce ongoing opioid use in outpatients. The WHO Analgesic Ladder promotes that moderate pain (which is defined as pain between 4 and 7 out of 10) be controlled with weak opioid usage[11]; however, because the overall average daily pain in both groups was relatively low (<4 out of 10),

greater emphasis on controlling patient pain while minimizing opioid use may be warranted.

We found that patients with postoperative surgical complications were no more likely to be discharged with opioid medications compared to patients without postoperative surgical complications. Additionally, postoperative surgical complications were not associated with an increase in opioid analgesia use at postoperative visits. Previous studies have demonstrated an association between postoperative complications and pain after surgery,[12] which prompts physicians to provide adequate analgesia appropriately to suffering patients; however, our data shows that postoperative complications in the setting of head and neck free flap reconstruction do not impact postoperative opioid usage. There was also no association between preoperative head and neck radiotherapy in opioid prescription rates and postoperative outpatient opioid usage. Because the majority of patients in our cohort had a preoperative diagnosis of head and neck cancer, disease burden may have been hypothesized to impact pain in the postoperative setting. In fact, our cohort demonstrates that there is almost a 50% increase in discharge MEDs per day prescribed to patients with a history of preoperative radiotherapy compared to those without a history of preoperative radiotherapy. While the data are not statistically significant, it is understandable that the disease burden of head and neck cancer in the setting of free flap reconstruction has a potential impact on postoperative pain. Additionally, our data suggest that primary tumor location does not contribute to differences in daily inpatient pain scores, yet patients with primary tumors in the hypopharynx tend to receive more inpatient MEDs than patients with primary tumors in the maxillary and oropharyngeal regions. While the reasoning behind these findings is not entirely clear, it does further allude to the discordance seen in postoperative pain and MEDs administered. Finally, free flap donor sites do not seem to significantly alter postoperative pain and narcotic administration in the inpatient setting, which may help elucidate any potential fallacies regarding seemingly more painful free flap donor sites.

The invasiveness of head and neck reconstruction greatly impacts postoperative narcotic usage, and patient-reported outcomes have demonstrated that tumor resection within the oral cavity is one of the most painful procedures in otolaryngology.[13] MMA protocols have picked up traction in many surgical specialties particularly due to their demonstrated efficacy in controlling postoperative pain as well as decreasing opioid abuse.[14,15] In head and neck surgery, MMA protocols have also been shown to minimize postoperative pain and opioid usage; however, outcomes on postoperative pain have varied among studies.[16–25] Some studies have shown that the use of ketamine, acetaminophen, gabapentin, and/or celecoxib provides significant pain relief comparable to opioid usage postoperatively.[16–18] One specific study used an MMA protocol consisting of preoperative gabapentin and acetaminophen, intraoperative acetaminophen, and postoperative gabapentin, acetaminophen, celecoxib, and ketorolac.[19] At our center, we have adopted an MMA protocol (Table 4) for head and neck free flap

TABLE 4 Multimodal analgesia protocol

Characteristic	Gabapentin	Acetaminophen	Ketorolac	Celecoxib	Fentanyl/other opioid
Preoperative	900 mg[a] PO OR 300 mg[b] PO	1000 mg PO × 1			
Intraoperative		1000 mg IV × 1			
Postoperative	300 mg[c] PO/DHT TID OR 300 mg[d] PO/DHT QD	650 mg PO/DHT q6h	15 mg[e] IV q6h PRN (for 4–6 pain) for 72 h	200 mg[f] PO/DHT q12h	PRN[g] fentanyl 24–48 h postoperatively
Discharge	Day 1[h]: 750 mg Day 2: 600 mg Day 3: 450 mg Day 4: 300 mg Day 5: 150 mg OR Day 1[i]: 150 mg	650 mg q6h PO/PEG q6h PRN		5-day[j] supply	PRN

Abbreviations: DHT, ingestion through Dobhoff tube; GFR, glomerular filtration rate; PEG, ingestion through PEG tube; PO, oral; TID, three timeas a day.

[a]If GFR > 79 ml/min.

[b]If GFR < 79 ml/min.

[c]If GFR > 30 ml/min.

[d]If GFR < 30 ml/min.

[e]If GFR > 50 ml/min.

[f]If no history of liver, kidney, or heart failure.

[g]If history of chronic opioid use.

[h]If getting 300 mg TID while inpatient, proceed with 5-day taper.

[i]If getting 300 mg once daily while inpatient, proceed with 1-day taper.

[j]If receiving while inpatient.

patients, with preliminary data suggesting successful postoperative analgesia with a reduction in opioid usage. Our patient cohort in this study consists of the 100 most recent patients receiving head and neck free flap reconstruction before the implementation of our center's MMA protocol. We believe that all patients in our study cohort would have benefited from the usage of an MMA protocol, given that other recent studies have demonstrated efficacy in the head and neck free flap reconstruction patient population. At our center, we use a similar regimen as described by Eggerstedt et al.[19] with success. Gabapentin has been shown to be an effective means of postoperative pain control in the inpatient setting,[26] as well as decrease the incidence of opioid usage postoperatively.[27] Additionally, MMA has been shown to promote better pain control at outpatient follow-up and reduce hospital readmissions in patients undergoing surgery.[18,28] While Eggerstedt et al.[19] mentioned providing discharge instructions for tapering gabapentin to patients, specific guidelines on how to taper gabapentin postoperatively in the head and neck free flap patient population is yet to be described. Abrupt discontinuation of centrally acting medication such as gabapentin is discouraged; however, there are no specific recommendations for tapering off gabapentin. Factors such as how long the patient takes the drug, how large the dose is, and physiological factors such as age, gender, and body weight are all important to consider.[29] Some studies, however, state that for patients who are on gabapentin for a short period of time, tapering could be done in the span of 3–7 days.[30–32] At our center, we recommend gabapentin be tapered by 150 mg daily in the span of 5 days postdischarge (if patients were receiving gabapentin three times daily as inpatients) or be tapered in 1 day with a total dose of 150 mg (if patients were receiving gabapentin once daily as inpatients). Additionally, we discharge patients at our center with acetaminophen to be used as needed, as well as a 5-day supply of celecoxib (Table 4). Further investigation is required to determine the efficacy of this regimen in this patient population compared to patients receiving narcotics for pain control.

While opioids are effective analgesics for postoperative pain, opioid usage postoperatively continues to be significant in patients undergoing head and neck free flap surgery. Further investigation is needed into interventions that reduce continued postoperative opioid use while improving pain control.

Our study is not without limitations. Our primary outcome of postoperative pain is reliant on a patient's subjective experience with pain, which is multifaceted and difficult to standardize. The use of medication reconciliation for evaluation of continued outpatient opioid use without verifying with a pill count raises the possibility that outpatient use could have been over or underestimated. Additionally, the retrospective nature of this cohort study produces a bias in data availability and collection. Lastly, while we do make suggestions on an MMA protocol that may provide equal efficacy in postoperative pain control for patients receiving head and neck reconstruction, further comparative data is necessary to demonstrate its effectiveness.

CONCLUSION

Patients undergoing head and neck free flap surgery usually experience postoperative pain that tends to be managed with opioids, which are often overprescribed by their providers. Our results indicate that in this patient population, overprescribing opioids postoperatively contributes to extended postoperative opioid usage, especially in opioid-naïve patients. Furthermore, a poor association between the MEDs administered postoperatively and patients' reported pain indicates a possible role for nonopioid analgesics. Given that clinician prescriptions strongly contribute to the opioid epidemic by creating a household supply without necessarily improving postoperative pain control, it is imperative to further investigate the role of MMA in this patient population to eliminate unnecessary narcotic provision to patients at risk of opioid dependence.

AUTHOR CONTRIBUTIONS

All listed authors in this manuscript have made substantial contributions to the conception and design, or acquisition of data, or analysis and interpretation of data; they have been involved in drafting the manuscript or revising it critically for important intellectual content, and they have given final approval of the version to be published. Each author has participated sufficiently in the work to take public responsibility for appropriate portions of the content and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

ACKNOWLEDGMENT

We would like to thank all authors for their thoughtful contributions to this manuscript. No financial support was provided for this article.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

Data used for this study are not publicly available but accessible upon reasonable request.

ETHICS STATEMENT

This material is the authors' own original work, which has not been previously published elsewhere. The paper is not currently being considered for publication elsewhere. The paper reflects the authors' own research and analysis in a truthful and complete manner.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

How to cite this article: Towfighi P, Hill A, Crossley JR, et al. A retrospective analysis of pain and opioid usage in head and neck free flap reconstruction. *World J Otorhinolaryngol Head Neck Surg*. 2023;9:153-159. doi:10.1002/wjo2.87