

An Analgesic Regimen for Opioid Reduction in Elective Plastic Surgery: A Randomized Prospective Study

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Background: Prescription opioid misuse has been recognized as a national epidemic. The implications of this problem are especially important to consider, as postoperative opioid abuse can give rise to true addiction for surgical patients. The concept of enhanced recovery after surgery is increasingly used across various specialties to decrease the overabundance of postoperative opioid use.

Methods: This study prospectively examined 143 patients undergoing cosmetic elective surgery. Patients were randomized into one of two groups based on postoperative pain management regimen: multimodal (enhanced recovery after surgery) analgesia or traditional opioid analgesia. Data regarding postoperative pain scores, amount of postoperative opioids consumed, and duration of postoperative pain pill use were analyzed.

Results: Multimodal (enhanced recovery after surgery) regimen patients experienced a 13.0 percent reduction in their pain scores after admission to the postanesthesia care unit and a 34.2 percent reduction in pain score at discharge, compared with traditional opioid patients ($p = 0.049$ and $p = 0.0036$, respectively). Enhanced recovery after surgery patients experienced a 35 percent reduction in the number of pills taken in the postoperative period and an 18.4 percent reduction in the duration of consumption ($p = 0.0007$ and $p = 0.0539$, respectively).

Conclusions: The results demonstrate that multimodal postoperative pain management is an important tool for decreasing the amount of opioids prescribed and needed in the postoperative period. The overprescribing of opioids after surgery is a precursor to abuse and the increase in the national opioid reservoir. (*Plast. Reconstr. Surg.* 147: 325e, 2021.)

CLINICAL QUESTION/LEVEL OF EVIDENCE: Therapeutic, II.

Prescription opioid misuse has been recognized as a national epidemic. The implications of this problem are especially important to consider, as postoperative opioid abuse can give rise to true addiction for surgical patients. Of the 33,000 deaths caused by opioid overdose in 2015, half were attributable to prescription opioids.¹ Use of opioid medication is often a necessary part of postoperative analgesia, but many physicians fall short when it comes to prescribing opioids judiciously and recognizing the potential for long-term addiction. The use of multimodal analgesic regimens is an effective strategy to decrease the amount of opioids prescribed to patients.²

In a study of 39,140 patients undergoing elective surgery, it was found that nearly half of the patients were discharged with an opioid prescription, showing that surgeons do not hesitate in using opioid analgesics beyond the immediate postoperative period (Fig. 1).³ In this same study, 3.1 percent of patients were still using opioids more than 90 days after surgery.⁴ When patients are on opioids for longer periods following surgery, they are more likely to build tolerance and become addicted to these medications.^{5,6} This is crucial to considering patient safety, as the number of opioid-related deaths has been a rising epidemic for several decades.^{6,7} It has been estimated that there

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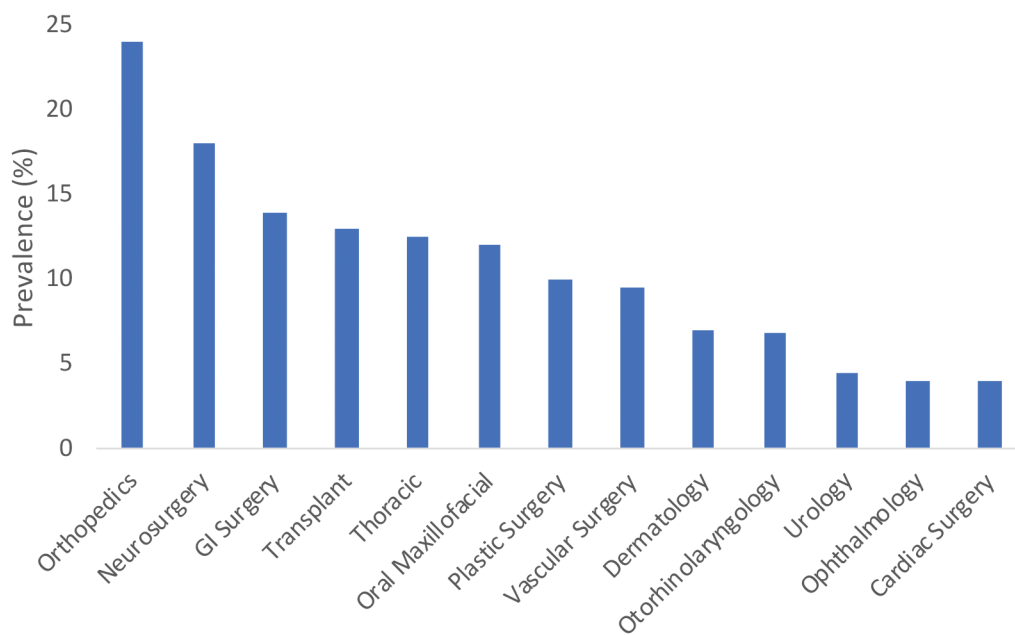


Fig. 1. Prevalence of opioid abuse in patients by specialty. (Reprinted with permission from Jiang X, Orton M, Feng R, et al. Chronic opioid usage in surgical patients in a large academic center. *Ann Surg.* 2017;265:722–727. DOI: 10.1097/SLA.0000000000001780.)

is a 44 percent increase in misuse for every opioid prescription refilled, which corresponds to a 20 percent increase in misuse for every week of prescription.^{5,8} Despite the rising numbers of deaths and increasing reports of misuse, surgeons have yet to find the right balance of opioid prescription. Between 3 and 10 percent of opioid-naïve patients become chronic users, and as many as 80 percent of prescribed pills go unused.^{9,10}

In a more recent study, it was found that new persistent opioid use after surgery is common and is associated with behavioral and pain disorders, suggesting that misuse is attributable not solely to surgical pain but to addressable patient-level predictors such as age, sex, race, education, family history, tobacco use, mood disorders, comorbidities, socioeconomic status, and presence of preoperative pain.¹¹ The concept of enhanced recovery after surgery was developed in 1997, and is increasingly used across various specialties.^{12,13} Enhanced recovery after surgery allows for multidisciplinary and multimodal approaches to perioperative care, including preoperative counseling, nutrition plans, anesthetic and analgesia regimens, and early mobilization.^{14–19} Implementation of multimodal analgesic regimens can decrease opioid consumption and the ensuing related complications. Enhanced recovery after surgery protocols have also been demonstrated to decrease health care expenditures and increase overall patient satisfaction.²⁰ In a recent review, it was found that

there was no increased risk of adverse events when using some medications (e.g., intravenous acetaminophen, ketamine, liposomal bupivacaine, and gabapentin) as opioid alternatives.²¹ This randomized prospective study was designed to determine the effectiveness of multimodal (enhanced recovery after surgery) pain management protocols in elective plastic surgery patients.

PATIENTS AND METHODS

This is a study on the feasibility and outcomes of an enhanced recovery after surgery protocol used in patients undergoing elective cosmetic surgery on an outpatient basis under general anesthesia. The study prospectively enrolled 143 patients between the ages of 18 and 67 years. This study design was presented and approved by the Institutional Review Board at Georgetown University, and the study practices used followed all the guidelines of the Department of Health and Human Services Regulations for the Protection of Human Subjects. All statistics were calculated using Microsoft Excel 2017 (Microsoft Corp., Redmond, Wash.) and MedCalc (MedCalc Software, Ostend, Belgium). All *p* values were calculated using a two-sample *t* test.

Patients were randomized preoperatively to either a standard opioid postoperative pain regimen or a novel multimodal analgesic approach. As part of the experimental protocol, patients in

Table 1. Multimodal Enhanced Recovery after Surgery Protocol

Preoperative Medications	Intraoperative Medications	Postoperative Medications
1 g of acetaminophen by mouth	Standard anesthesia medications	650 mg of acetaminophen every 8 hr 300 mg of gabapentin every 8 hr
300 mg of gabapentin		5 mg of oxycodone every 4–6 hr for breakthrough pain only

the multimodal (enhanced recovery after surgery) group were given 1 g of oral acetaminophen and 300 mg of oral gabapentin at least 1 hour before the start of surgery, in the preoperative suite. In this group, each patient was prescribed 300 mg of gabapentin orally every 8 hours for a total of 3 days, 650 mg of acetaminophen orally every 8 hours, and 5 mg of oxycodone orally every 4 to 6 hours for breakthrough pain. Patients were instructed to alternate the gabapentin and acetaminophen so that they were taking a pain medication every 4 hours (Table 1). The standard opioid postoperative protocol consisted of Percocet 5 mg/325 mg every 4 to 6 hours, with no preoperative medication given (Table 2). The dosing of Percocet 5 mg/325 mg every 4 to 6 hours, 4 g/day, was chosen based on practice preexisting prescribing habits. At the preoperative nursing appointment, each patient was randomized to a study group by the study coordinator. Patients were counseled by nurse and given protocol sheets to ensure that patients understood protocols. At mid study, the groups were analyzed to make sure they were comparable in procedure type and number of subjects in the group.

All operations were performed in the same outpatient surgery center, by the same surgeon, who was blinded to study arm. All operations were performed under general anesthesia, and patients were given pain medications during surgery at the discretion of the anesthesiologist, who was blinded to the study arm, and presumably managed the anesthetic and analgesic plans similarly. All patients received local anesthetic, or regional blocks specific for the case, during surgery. No regional blocks with long-acting pain medication were used, to avoid confounding effects. Some operations did involve combinations of procedures in more than

Table 2. Traditional Opioid Protocol

Preoperative Medications	Intraoperative Medications	Postoperative Medications
None	Standard anesthesia medications	Percocet 5 mg/325 mg every 4–6 hr

Table 3. Demographics

Demographics	Standard	Multimodal	<i>p</i>
Mean age ± SD, yr	41.4 ± 13.9	39.2 ± 13.4	0.18
Mean BMI ± SD, kg/m ²	24.6 ± 4.5	23.9 ± 4.0	0.17
Mean length of surgery, min	158 ± 73.3	163 ± 73.5	0.35

BMI, body mass index.

one area (e.g., liposuction of the body with mastopexy), but no cases involved more than two areas in a single procedure. In the postanesthesia care unit, patients were given pain medications to include one or more of the following: Valium, Vicodin, oxycodone IR, fentanyl, Percocet, or Dilaudid. All medications in the postanesthesia care unit were given as needed, based on pain scores, at the discretion of the consistent postanesthesia care unit nurse, who was also blinded to study arm. Patients were asked to rate their pain on a 0- to 10-point Likert scale 30 minutes after arriving to the postanesthesia care unit and at discharge. The end-point for discharge was standard eating, drinking, and pulse oximetry over 96 percent on room air, and pain at or below a 4 on the Likert pain scale. Morphine equivalency tables were used to determine the amount of opioids given to each patient in the postanesthesia care unit.

During the postoperative phone call, 1 day after surgery, patients were counseled on their medication protocol once again and asked to record the day they stopped taking all opioid pain medications. Patients were also asked to bring in pill bottles to determine how many opioid pain pills were taken in the postoperative pain period. Excess pills were properly disposed of by nursing staff. Patients were finally asked to report whether or not they were satisfied with their postoperative pain management (yes or no).

RESULTS

The statistical level of significance was set at 5 percent (*p* < 0.05) for all analyses. All data were analyzed using an independent two-sample *t* test. There was no significant difference between the demographics (mean ages, body mass index, and surgery lengths) of each group (Table 3). In the

Table 4. Pain Scores*

Group	30-Min PACU Score	Discharge Score	Percentage Reduction in Pain Score from PACU Admission to Discharge
Multimodal analgesia	4.5 ± 2.1	2.3 ± 1.6	50.0
Standard analgesia	5.2 ± 2.5	3.1 ± 1.8	40.8

PACU, postanesthesia care unit.
*Scores are on a 0–10 Likert scale.

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Table 5. Narcotics in the Postoperative Period*

Postoperative Period	Multimodal Analgesia	Standard Analgesia	Percentage Reduction	<i>p</i>
No. of pills taken	7.7 ± 5.3	11.9 ± 8.4	35.9	0.0007
No. of days pills needed	3.9 ± 2.2	4.7 ± 3.5	18.4	0.05

*These results do not include the amount of gabapentin taken in the multimodal group. All patients in the multimodal group took 300 mg of gabapentin every 8 hr for 3 days, according to study design.

multimodal analgesia group, 38.8 percent of operations included body procedures, 46.9 percent of operations included breast procedures, and 34.7 percent of operations included facial procedures. In the standard postoperative opioid group, 37.9 percent of operations included body procedures, 45.5 percent of operations included breast procedures, and 28.8 percent of operations included facial procedures. There was no significant difference in the types of procedures performed in each group.

In the multimodal analgesia group, dosing of 1 g of acetaminophen, in the preoperative area, was chosen, to avoid any overdose issues with excess acetaminophen (maximum daily, 4 g). Gabapentin was also given in the preoperative area to ensure dosing and that all patients took the medication within the same time frame.

In the postanesthesia care unit, the multimodal analgesia group had an average 30-minute postanesthesia care unit pain score of 4.5 ± 2.1 and an average discharge score of 2.3 ± 1.6 , a 50.4 percent reduction in pain throughout the postanesthesia care unit stay. The standard postoperative opioid group had an average 30-minute postanesthesia care unit pain score of 5.2 ± 2.5 and an average discharge pain score of 3.1 ± 1.8 , a 40.4 percent reduction in pain throughout the postanesthesia care unit stay (Table 4). The difference between postanesthesia care unit and discharge pain scores in the multimodal analgesia group versus the standard opioid group was found to be statistically significant for both the 30-minute postanesthesia care unit and discharge pain scores, at values of $p = 0.049$ and $p = 0.003$, respectively. The average morphine equivalents given in the postanesthesia care unit was 13.1 ± 5.8 for the multimodal analgesia group and 13.1 ± 6.6 for the standard opioid group. There was no significant difference in the amount of opioids given in the postanesthesia care unit to get patients to the appropriate pain threshold for discharge ($p = 0.500$).

In the postoperative period, there was a 91 percent response rate (9 percent of patients were removed from the study for protocol deviations). Patients using the multimodal pain regimen used an average of 7.7 ± 5.3 opioid pain pills for 3.9 ± 2.2 days in the postoperative period, whereas those using the

traditional opioid regimen used an average of 11.9 ± 8.4 opioid pain pills for 4.7 ± 3.5 days (Table 5). This represents a significant 35.0 percent reduction in the number of opioid pain pills needed in the postoperative period ($p = 0.0007$). Patients using the multimodal analgesia regimen demonstrated an 18.4 percent difference in the number of days to cessation of opioids; the difference was not statistically significant ($p = 0.05$).

All medication costs were considered as the average medication cost for a patient without insurance. The average cost of medications for a patient in the multimodal analgesia group was \$48.39, whereas the cost of the medications in the standard opioid group was \$39.81, a \$8.58 difference in cost (Table 6).^{20,22–25} The cost for the practice to stock acetaminophen and gabapentin for multimodal analgesia patients in the preoperative area was \$2.40 per patient (Table 7). Prices were obtained from pharmacy bills of the practice, which matched average national prices.^{20,22–25}

DISCUSSION

Multimodal analgesia approaches have been increasingly popular across many specialties. These approaches give the opportunity for

Table 6. Patient Cost Based on Postoperative Analgesia Protocol

	No. of Tables	Cost
Multimodal analgesia		
Oxycodone	30	\$17.50
Zofran	6	\$16.09
Gabapentin	9	\$6.27
Acetaminophen	30	\$8.53
Total		\$48.39
Difference in cost		\$8.58
Standard opioid analgesia		
Percocet	3	\$23.72
Zofran	6	\$16.09
Total		\$39.81

Table 7. Practice Cost per Patient of Multimodal Analgesia

Medication	No. of Tablets	Cost
Acetaminophen 500 mg	2	\$1.70
Gabapentin 300 mg	1	\$0.70
Total		\$2.40

physicians to decrease the amount of circulating opioids, while also improving many patient outcomes. Although the prescribing of opioids after elective cosmetic surgery may be common, with fewer circulating opioids, there is a lower probability of misuse and abuse.

As the United States prescribes 90 percent of the world's opioid pain medication, and 80 percent of prescribed pills go unused, we are creating an enormous opioid reservoir.²² This was shown by the objective nature of this study and the results; patients kept their bottles of pain medication and postoperatively counted the pills at the 1-month follow-up appointment.

This study analyzed the effects of a multimodal analgesia approach on patients undergoing elective cosmetic surgery. Patients receiving multimodal analgesia were compared to patients receiving a standard opioid-based medication regimen. There was no significant difference in the demographics in each group, nor was there any significant difference in procedure frequency (breast, facial, and body procedures) or length. All procedures were performed by the same surgeon under similar conditions, including general anesthesia and the use of local anesthetic. In this study of 143 patients, it was demonstrated that the use of multimodal analgesia in the preoperative and postoperative periods translated to a decrease in pain scores in the postanesthesia care unit and discharge. The consistent, blinded postanesthesia care unit nurse gave equivalent doses of opioids to each group, which reflects a treating pattern. However, the patients still experienced a 21.2 percent greater reduction in pain. Outcomes in all pain score reductions were found to be statistically significant, with a 13.0 percent reduction in postanesthesia care unit pain assessment and a 34.2 percent reduction in pain scores at discharge. The amount of opioids required for patient discharge in the postanesthesia care unit was lower for the multimodal analgesia group (calculated as morphine equivalents), but no significant difference was found at a 95 percent confidence interval. It is useful to note that the number of opioid pills taken in the postoperative period was significantly less in the multimodal analgesic regimen group, representing a 35.0 percent reduction in the number of opioid pills taken. Each patient was given a prescription that included 30 opioid pain pills. Patients using the multimodal regimen used an average of 7.7 ± 5.3 opioid pain pills in the postoperative period, whereas traditional opioid patients used an average of 11.9 ± 8.4 . This demonstrates that we overprescribed opioids in the postoperative

period. Our new protocol is to prescribe no more than 24 opioid pain pills, which is two times the average taken during the postoperative period.

The cost to a patient on the multimodal analgesia regimen compared to the standard opioid regimen was \$8.58 more, out of pocket, and would likely be less for a patient who has medical insurance.²²⁻²⁶ The cost to the surgical facility is \$2.40 per patient and includes the price to stock both acetaminophen and gabapentin for use in the preoperative area.²³⁻²⁷ The cost to the patient and facility to use the multimodal analgesic approach discussed here is marginal considering that patients have less pain, take less opioids, and are more satisfied. Furthermore, the amount of prescribed opioids in circulation is decreased. The multimodal analgesic regimen discussed used the preloading of nonopioid pain medication in the preoperative area, which few studies have included. We chose oral acetaminophen versus the more expensive intravenous acetaminophen. In the future, we would consider using intravenous acetaminophen to assess further improvement in regimen adoption. It may also be considered that beginning gabapentin dosing the evening before surgery could prove to be more therapeutic.

The practice standard opioid prescription was typically 40 opioid pain pills for the postoperative period. The results of this study demonstrate that we are consistently overprescribing, which is contributing to the opioid reservoir. Practices must evaluate their prescribing policies to decrease the amount of opioids in circulation and thus decreasing the risk of abuse. In reality, this study shows that 15 tablets is adequate for the average patient, absent a multimodal enhanced recovery after surgery program. The American Society of Plastic Surgeons 2018 statistics report 1,811,740 cosmetic surgical procedures in 2018.¹⁸ If surgeons had prescribed 40 opioid pain pills for each of these operations, this would be 72,469,600 pills at a cost of \$42,273,933.31 in oxycodone alone, given the multimodal protocol discussed in this article. If we reduce the number of pain pills theoretically prescribed to 25, this would have been a total of 45,293,500 pills at a cost of \$26,421,208.32. If we reduce the number of oxycodone pills prescribed to 15 tablets for a total of 27,176,100, which is sufficient according to the data presented, the cost would have been \$15,852,724.99. This represents a possible decrease of 45,293,500 pain pills and a 62.5 percent change in cost yearly if each of these surgeons decreased their prescriptions by 25 tablets.

Although the sample size is small, this study represents promising data for the use of enhanced

recovery after surgery protocols in cosmetic elective procedures, and a likely extension in reconstructive surgery. Any confounding of the results was minimized by a similar spectrum of surgery in each group as opposed to one procedure only. The operations that are isolated are common enough for large group comparison. The postanesthesia care unit nurse's usual and customary practice was to respond to the individual pain level. This study used one postanesthesia care unit nurse, so there was no confounding on practice patterns.

CONCLUSIONS

The results of this prospective study demonstrate that multimodal enhanced recovery after surgery analgesic approaches for elective cosmetic surgery lead to improved pain control. Patients experienced decreased pain scores in the postanesthesia care unit and at discharge, and on average took fewer opioids in the postoperative period. The overprescribing of opioids in the postoperative period is a precursor to opioid abuse and results in an increase in the national opioid reservoir. Historical prescribing practices vastly overestimated the dose numbers required for elective cosmetic surgery procedures; with data provided in this article, enhanced recovery after surgery protocols may help to address overprescribing practices in elective cosmetic procedures.

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