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Research Article

Opioid-free Anesthesia Results in Reduced Post-operative Opioid Consumption

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Abstract

Opioid addiction has become a national problem. This retrospective analysis shows that a general anesthetic can be provided safely without opioids. We reviewed all surgical cases by an anesthesiologist who changed his anesthesia regimen from opioid-sparing anesthesia (OSA) to opioid-free anesthesia (OFA). We compared groups of patients from the last 2 months of 2013 (OSA) and the last 2 months of 2015 (OFA) and another control group when a substitute used a standard opioid anesthesia (OA) regimen. Both the OA and OSA groups needed twice the amount of opioids in the PACU as the OFA group ($p < 0.007$).

Keywords: Opioid-Free Anesthesia, Intraoperative narcotics, Patient safety

Introduction

There are an increasing number of undesirable side effects of opioids. The well-known effects such as respiratory depression, sedation, nausea/vomiting, Constipation and ileus can lead to significant morbidity and mortality. Additionally, evidence is now mounting that opioid induced immunosuppression may affect the outcome of surgery including the increased risk of infection and increased risk of metastasis in the cancer population [1]. Furthermore, short-acting opioids used during an anesthetic may lead to acute opioid induced tolerance and hyperalgesia [2]. This problem is further perpetuated because surgeons often prescribe large quantities of post-operative pain medications so that the patient does not need to return for a follow-up pain prescription. Recent reports highlight that post-operative prescription of narcotics are excessive and poorly regulated leading to uncontrolled use in the population. Not many years ago, a great deal of emphasis was placed by national agencies on adequate pain relief and patient satisfaction because it has been named a fundamental human right and is a major risk factor for developing chronic postoperative pain [3,4].

Evidence-based multimodal opioid-sparing analgesia has become an alternative to managing post-surgical pain in the last two decades [5]. The perioperative use of multi-modal non-opioid analgesics allows for preemptive blocking of receptors in the complex pain pathway both centrally and peripherally. Preoperative use of Cox inhibitors, GABA analogues and acetaminophen have been shown to decrease use of opioids postoperatively. Intraoperative use of agents that lead to opioid sparing effects via sodium channel blockade, blockade of G protein-coupled receptors, NMDA blockade, central alpha-2 agonists and anti-inflammatory effects can make opioid-free anesthesia (OFA) possible [6,7].

The first-author of this manuscript (DS) changed his anesthesia regimen to use opioid-sparing anesthesia (OSA). He is the sole anesthesia provider for four surgeons who perform a variety of procedures including breast reconstructions, cochlear implants, stapedectomies, and mastoidectomies. He further modified his anesthesia practice in 2015 by completely eliminating the use of all opioid anesthesia (OFA). We conducted a retrospective chart review to evaluate whether patients that received less opioids or no opioids intraoperatively required more anesthesia post-operatively. We reviewed all patients anesthetized over a two-month time span in 2013 (November - December) when he was using an opioid-sparing anesthesia (OSA) regimen and the equivalent two-month time span in 2015 (November- December) when he was using an opioid-free anesthesia regimen. To better understand our results, we also reviewed patients who were operated on by the same group of surgeons when this

primary anesthesiologist was on vacation and a substitute anesthesiologist was staffed. The substitute anesthesiologist used a standard opioid anesthesia (OA) regimen. All of these factors created a unique model for us to study the effects of opioid anesthesia regimens on patient outcomes.

Materials and Methods

We were granted approval from the University of South Florida Institutional Review Board (Pro00024846) to conduct this chart review and were granted a waiver for the informed consent process. We retrospectively reviewed charts of patients being operated on by a group of four surgeons performing a variety of procedures such as breast reductions/reconstructions, cochlear implants, stapedectomies, tympanoplasties, mastoidectomies. These four surgeons have a single anesthesia provider (DS). This anesthesia provider recently adopted an opioid-sparing anesthesia (OSA) regimen (2013) and eventually transitioned to an opioid-free anesthesia (OFA) regimen (2015). As a control group for our chart review, we reviewed patient charts who were operated on by this group of surgeons but who received anesthesia from a secondary provider while the primary anesthesiologist for this group was on vacation. This control group received standard anesthesia with opioids (OA). These circumstances created a unique study paradigm for us to study the effects of an opioid-sparing anesthesia regimen and opioid-free anesthesia regimen.

All patients received general anesthesia utilizing varying concentrations of inhalational agent, Sevoflurane. The OA cases were done with a typical dosing of intraoperative opioids (average 17mg morphine equivalent). The OSA cases were performed with sparing use of Fentanyl (average of 1.8mg morphine equivalent). The OFA cases were performed with no opioids at all. Three preoperative oral medications (1000mg acetaminophen, 400mg gabapentin, and 400mg celecoxib) and 3 intraoperative intravenous medications (2g magnesium, 0.15mg/kg ketamine, 0.3 mg/kg dexmedetomidine) were used instead of opioids after induction and prior to incision. Postoperative pain management was similar in all groups with nurses medicating patients based on pain levels. Primary endpoint consisted of post-operative opioid consumption and secondary endpoints included postoperative Ondansetron and length of stay. We utilized t-tests with Bonferroni corrections to determine significance of differences of opioid use and Ondansetron use between the three groups.

Results

Patients and surgeons reported being satisfied with both the opioid-sparing and opioid-free anesthesia regimens during the post-operative follow-up visit with the anesthesiologist. The patient age, duration of surgery, and BMI for the opioid anesthesia control group, opioid-sparing anesthesia regimen, and opioid-free anesthesia regimen were all similar, making it reasonable to compare patient outcomes between the three groups (Table 1).

As detailed in Table 2, both the OA and OSA groups needed double ($p < 0.007$) the opioids in the PACU as the OFA group. This difference persisted in the surgical post-operative unit (SPU). The OFA group also required less Ondansetron, but this difference was not significant. Most interestingly, 73% of the OFA patients required no postoperative opioids, compared to 37% of the OSA patients and 52% of OA patients. Patients in the OFA group experienced less nausea and vomiting, as interpreted by their lower use of Ondansetron in the PACU. We noted longer PACU

Anesthesia Regimen	N	Average Age	Duration of Surgery (hh:mm)	Average BMI
Opiate Anesthesia (OA) – Control	36	54.0	1:21	29.7
Opiate-Sparing Anesthesia (OSA)	143	54.4	1:39	28.5
Opiate-Free Anesthesia (OFA)	177	54.6	1:38	29.2

Table 1. Patient Demographics. Patients in the three groups had similar ages, duration of surgeries, and average BMIs.

Anesthesia Regimen	Avg. PACU (hh:mm)	Opiate Usage Intraop	Opiate Usage in PACU	Ondan-setron in PACU	Opiate Usage in SPU	Ondan-setron in SPU
Opiate Anesthesia (OA) - Control	3:24	17.4 ± 14.6	4.5 ± 6.1	0.78 ± 1.7	0.19 ± 0.4	0
Opiate-Sparing Anesthesia (OSA)	1:52	1.8 ± 2.6	5.03 ± 6.5	0.73 ± 1.6	0.25 ± 0.4	0.11 ± 0.7
Opiate-Free Anesthesia (OFA)	1:51	0	2.05 ± 4.2	0.59 ± 1.5	0.06 ±0.2	0.11 ± 0.7

Table 2: Opioid use in opioid anesthesia, opioid-sparing anesthesia, and opioid-free anesthesia patients. Opioid dosage in milligram of morphine equivalent ± 1 SD. Patients receiving OFA had the least requirement of opioid in PACU and in SPU (Stage 2 Recovery). (Note: * denotes significance between indicated groups)

times in the OA group but this result could be attributed to factors other than the anesthesia regimen because of the retrospective nature of this study did not consist of patient discharge criteria. Even though the opiate-sparing group received only small amounts of opiates intraoperatively, this group had PACU and SPU opiate requirements that were more similar to the control OA group than the OFA group. This observation suggests that exposure to even marginal amounts of opiates intraoperatively increases the need for opiates in the post-operative course. Furthermore, in the anesthesiologist's subjective experience, patients on opioid-sparing and opioid-free anesthesia, were more promptly waking up from their surgery with pain well-controlled, and had "clearer heads."

Discussion

The availability of opioids perpetuates the problem of non-medical use of opioids with approximately 4 to 20% of all opioid pills prescribed in the United States being used nonmedically [8,9]. Only 20% of non-medical users of opioids obtained them from their own physician, with a majority of non-medical users consuming drugs intended for someone else [9]. Since pharmacy take-back programs to dispose unconsumed opioids have not been entirely successful, alternate solutions must be devised [10]. By reducing the need for opioid medications to manage pain post-surgically, we can target the problem of opioid abuse at its root. Though counterintuitive, our retrospective study demonstrates that giving fewer opioids intraoperatively, reduces the need for opioids both in the PACU and post-operatively. Thus, if fewer opioids are needed in by patients, physicians will be more inclined to prescribe smaller quantities of opioids. In turn, the availability of opioids to patients and others is for non-medical use is automatically reduced. Furthermore, reducing the amount of opioids used will allow us to sidestep many of its related side effects such as nausea, vomiting--most importantly--respiratory depression, and mental confusion. Opioid usage is linked to sleep-related respiratory disorders, including sleep hypoventilation and sleep apnea. Sleep hypoventilation results in hypercapnia due to blunter hypercapnic ventilatory response, decreased respiratory drive, and possibly reduction in upper airway muscle tone. These changes in physiological function because of opioids can, in their most extreme form, cause complete airway obstruction and eventual death while the patient in sleeping a phenomenon termed dead-in-bed syndrome. In conclusion, reduced intraoperative opioid use correlated with reduced requirement of opioids in the PACU and SPU with patients experiencing less nausea and vomiting. Patients had shorter PACU stays. As this was a retrospective chart review, we were not able to follow these patients after discharge. Limitations of this study include that it is only one anesthesiologist's experience with four surgeons for specific surgical interventions and that the sample size is small. Still, our retrospective study has laid the foundation for a future prospective study that will allow us to collect more robust data for a larger patient population and better monitor their post-operative opioid needs after OSA and OFA regimens.

Author Roles

DS was involved in study design, data collection, and manuscript writing. AA was involved in data collection and analysis. PD was involved in regulatory practices, data collection, data analysis, and manuscript writing. DM was involved in study design and data analysis. EC was involved in study design, data collection, data analysis, regulatory practices, and manuscript writing.

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