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Current Recommendations for the Perioperative Management of Patients on
Buprenorphine: A Case Study

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UNE Class of 2020

Abstract

According to the US Department of Health and Human Services, more than 2 million Americans suffer from opioid use disorder (DHHS, 2020). Opioid maintenance therapy (OMT) for OUD has been shown to reduce the rates of inpatient hospitalization and overall opioid-related mortality (Quaye & Zhang, 2019). Buprenorphine is a partial mu receptor agonist and kappa receptor antagonist that is used frequently by patients on OMT. Beginning in 2010 annual prescriptions for buprenorphine products have increased dramatically (Lembke, Ottestad, & Schmiesing, 2019).

With the rising level of chronic pain and opioid use nationally, more and more patients taking buprenorphine are presenting to the perioperative setting. The pharmacology of buprenorphine presents a unique challenge to the anesthesia provider particularly with regards to achieving adequate pain control during and after surgery. A review of the literature indicates that there are no unified guidelines on the perioperative management of buprenorphine. The focus of this paper is to discuss the unique pharmacology of buprenorphine and review the current literature on the best perioperative management strategies for patients on buprenorphine. The case study included provides an example of one patient's perioperative experience while on buprenorphine.

Current Recommendations for the Perioperative Management of Patients on Buprenorphine: A Case Study

According to the US Department of Health and Human Services (DHHS), there were 10.3 million misused prescription opioids in 2018. Two million people were considered to have an opioid use disorder (OUD) and more than 130 people die every day from opioid-related drug overdoses. In 2017 the Department of Health and Human Services declared a public health emergency and announced a 5-Point Strategy to Combat the Opioid Crisis. The five strategies include: improving access to treatment and recovery services; promoting the use of overdose-reversing drugs; strengthening our understanding of the epidemic through better public health surveillance; providing support for cutting edge research on pain and addiction; and advancing better practices for pain management (DHHS, 2020).

The epidemic of opioid addiction in the United States is not new. The fight to tackle the addiction problem began as early as 1920. In 1929 the National Research Council and the United States government formed a task force designed to identify non-habit-forming opioids (US Committee on Opportunities in Drug Abuse Research, 1996). The goal was to find a less addictive drug that would provide analgesia without affecting the respiratory drive. Over the years many new drugs were developed, but none that met the criteria of the task force committee. In the 1950s research began to focus on combination narcotic agonists/antagonists as a possible solution and buprenorphine emerged as a promising new drug (Campbell & Lowell, 2012).

Buprenorphine: A Partial Opioid Agonist

Buprenorphine is a semisynthetic opioid first developed in 1966 from thebaine, an alkaloid compound derived from the poppy flower. It was first used in 1978 as an analgesic to treat chronic pain in cancer patients (Davis, Pasternak, & Behm, 2018). Shortly after it was

introduced, clinicians noted that when buprenorphine was administered in higher doses for moderate pain, patients received no relief from other opioids administered for breakthrough pain. Buprenorphine is a partial mu-receptor agonist and kappa-receptor antagonist with an extremely high affinity for these receptors. The affinity is so high that it effectively blocks other opioids from binding to the mu-opioid and kappa-opioid receptors, preventing the patient from experiencing the effects of subsequently administered opioids (Bryson, 2014). For this reason, buprenorphine has become a popular choice in patients with OUD because they do not experience the euphoria from other administered opioids which effectively discourages their opioid abuse. It was officially approved by the Federal Drug Administration for the treatment of opioid addiction in 2002.

Buprenorphine is manufactured for the treatment of opioid addiction in many different sublingual formulations. It is marketed as buprenorphine only (Subutex) and in combination with naloxone (Suboxone). It is also available as buccal, intravenous, intramuscular injections, and as a transdermal patch. When taken sublingually the naloxone has little effect but is included in the formulation to discourage IV use. It is 25-50x more potent than morphine and has a half-life of about 37 hours due to its slow dissociation from the mu receptors. The onset of action is 30-60 minutes with the SL preparation. Buprenorphine is metabolized in the liver, has a high volume of distribution, and is highly protein bound (Jonan, Kaye, & Urman, 2018). Buprenorphine was once thought to be associated with less respiratory depression than full mu-opioid agonists, however according to a systematic review of 28 randomized controlled trials by White et al (2018), this theory has since been disproven. The studies show that there is no difference in analgesia or respiratory depression when compared with morphine.

Transdermal buprenorphine was first used in Europe in 1981 and is now being used for the treatment of chronic pain, neuropathic pain, and cancer pain. The patch is available in 5, 10, and 20 mcg/hour patches called Butrans that provide 7 days of therapy (Vadivelu, Mitra, Kaye, & Urman, 2014). Very low doses are needed to provide analgesia when compared with the doses needed for the treatment of opioid addiction.

A Case Study

The case involves a 36-year-old female, weighing 68 kg, who presented to the emergency department with fatigue, confusion, nausea, and vomiting. The patient complained of painful hands and bluish discoloration on scattered fingers was noted. She had significant dental decay. Her history included current pack per day smoker and significant intravenous drug abuse. The patient's prescribed medications included buprenorphine 12 mg daily, clonazepam 1 mg daily, and gabapentin 300 mg TID. Her labs on admission were as follows: Na 134 mEq/l, K 2.9 mEq/l, CO₂ 17 mm Hg, Anion gap 19 mEq/L, BUN 43 mg/dl, Cr 2.82 mg/dl, Lactate 1.7 mmol/L, WBC 15,100 u/L, Hgb 10.7 g/dl, Hct 30.7%, and Platelets 114,000 mm³. CT scans of head and abdomen were both negative. The patient was hypotensive in the ED despite two liters of fluid resuscitation and required norepinephrine for blood pressure support. She was given the likely diagnosis of endocarditis given the lesions on her hands and feet which were consistent with Janeway lesions. Vancomycin and Zosyn were initiated per pharmacy dosing and the patient was admitted to the ICU. A TTE was negative for vegetations.

The following day a TEE showed a 1.7 cm vegetation on the mitral valve and an estimated ejection fraction of 69%. Blood cultures tested positive for MSSA and the patient

required two vasopressors for BP support. She was started on a continuous Nafcillin infusion per infectious disease.

After being off buprenorphine for 2 days, the patient was restarted on buprenorphine 12 mg daily and was transferred out of the ICU to the floor. Several days later the patient went to the OR to have her teeth completely removed. The patient's scheduled acetaminophen and gabapentin were held prior to surgery and the patient was in 10 out of 10 pain post dental extractions. Oral lidocaine was ordered. The following day the patient was started on oxycodone 15 mg every 4 hours for pain control and the buprenorphine dose was changed to 8 mg daily. The patient expressed frustration with inadequate pain control, stating that she did okay with 15 mg oxycodone and 12 mg buprenorphine while recovering from a c-section previously. She requested to increase the dose of oxycodone and maintain her usual dose of 12 mg of buprenorphine. The patient was not interested in taking methadone. She was continued on buprenorphine 8 mg daily and oxycodone 10 mg every 4 hours.

A week later the patient was taken to the OR for repair of her mitral valve. Intraoperative medications included; versed 2 mg, fentanyl 350 mcg, ketamine 100 mg in divided doses. She was transferred to the CTICU immediately post operation and remained intubated until later that afternoon. An infusion of ketamine 0.1 mg/kg/hr was initiated along with a hydromorphone PCA without a continuous rate. Her buprenorphine was continued at 8 mg daily. Tylenol 1000 mg every 6 hours and gabapentin 400 mg TID were also initiated for pain control.

On post-operative day one the patient reported feeling generally well with complaints of intermittent incisional pain. The patient appeared to be sleeping comfortably. Her ketamine infusion was discontinued on post-op day 2. The hydromorphone PCA continued with the buprenorphine and gabapentin. The patient reported satisfactory pain relief, but not optimal. On

post-op day 4 the patient reported increased pain after the hydromorphone PCA was discontinued. The buprenorphine continued at the same dose of 8 mg daily. By post-op day 5 the patient was satisfied with her pain control and was taking PO hydromorphone every 3-4 hours as well as Tylenol and gabapentin. Her buprenorphine was maintained at 8 mg daily throughout her hospital stay.

This case study illustrates that the patient's pain was controlled relatively well throughout the perioperative period while continuing a moderate dose of buprenorphine and that by post-op day 5 satisfactory pain relief was achieved on oral medications alone. Additional opioids given appeared to be effective in the management of her pain as evidenced by the fact that upon discontinuation of the hydromorphone PCA the patient reported an increase in pain.

Literature Review

Research Supporting Continuation of Buprenorphine

A retrospective cohort study was published in 2013 by MacIntyre, Russell, Usher, Gaughwin, & Huxtable. The study compared pain relief and opioid requirements in the first 24 hours after surgery in 22 patients on buprenorphine and 29 patients on methadone who were prescribed patient controlled analgesia (PCA). The study concluded that there were no significant differences in pain scores between the patient groups overall, but that the patients taking buprenorphine who did not take their usual dose on the day after surgery used significantly more PCA opioid than those who had taken their dose. It was found that most of those patients had not taken their usual dose of buprenorphine on the morning of their surgery either. Similarly, a 9-year observational study by Vilkens et al, 2017, concluded that there was no meaningful difference in the opioid requirements for women on buprenorphine versus women on methadone who underwent a cesarean section. This study aimed to find out if patients being

maintained on buprenorphine achieve adequate pain control similar to those being treated with methadone during the perioperative period. The continuation of methadone during the perioperative period is considered standard practice, whereas the continuation of buprenorphine remains controversial. The study did point out however that the women on buprenorphine utilized a significant more amount of ketorolac and this may have contributed to the equivalent use of postoperative opioids between the two groups. These studies suggest that the continuation of buprenorphine before and after surgery does not increase opioid requirements.

A case study by Leighton & Crock (2017) involving 4 obstetric patients on buprenorphine reports good-to-excellent pain management. The first patient was a healthy 22 - year- old parturient whose only medication was buprenorphine/naloxone (Suboxone) 8mg/2mg twice daily. She had spinal anesthesia and was comfortable during cesarean delivery. Post operatively buprenorphine was continued. Pain control was maintained with an epidural infusion of bupivacaine, scheduled doses of 30 mg ketorolac IV every 6 hours for 4 doses and then scheduled 800 mg ibuprofen orally every 8 hours. At 48 hours post-op the epidural was removed, and the patient's pain scores were never higher than 1/10.

The second patient described was a healthy 23 -year -old who took buprenorphine 4 mg three times daily. She also had a combined spinal/epidural for pain management and was comfortable during cesarean delivery. Buprenorphine was continued at the preoperative dose. This patient also received scheduled doses of ketorolac 30 mg every 6 hours, and then ibuprofen 800 mg every 8 hours. The epidural infusion was discontinued on post-operative day 2 and the patient was discharged on ibuprofen. Pain scores were never higher than 3-4/10 during the first 24 hours and for a brief time 10/10 due to a pump failure but this was quickly resolved with an epidural bolus of 10 ml bupivacaine 0.25%.

The third patient was a 34-year-old patient who originally denied substance abuse but later was found to test positive for buprenorphine during the urine drug screen. Patient was comfortable during delivery with spinal anesthesia but refused an epidural for post-op pain control. Three hours after surgery the patient rated her pain as an intolerable 10/10. A hydromorphone PCA was initiated as well as scheduled doses of ketorolac 30 mg every 6 hours for 4 doses and then ibuprofen 800 mg every 8 hours. After the initiation of the PCA, the highest pain score recorded was 5/10. On post-op day two the PCA was discontinued with no increase in pain and the patient was discharged on ibuprofen.

The last patient was a healthy 25-year-old whose only medication was buprenorphine 4 mg daily. The patient was comfortable during delivery with the help of spinal anesthesia. Three hours post-op she rated her pain as 4-5/10. She was given ketorolac 30 mg and her pain decreased to 1-2/10. The patient was continued on her buprenorphine and ketorolac. She was discharged on acetaminophen and diclofenac with pain scores never higher than 2/10. In each of these cases the patients all reached a point within 48-72 hours after surgery in which they only required buprenorphine and nonsteroidal anti-inflammatory agents for pain control. Ketamine and dexmedetomidine have also been successfully added to multimodal analgesia in patients on buprenorphine. Although they did not use either drug in these cases the authors encourage other clinicians to consider doing so.

Mercadente et al (2006) studied 29 cancer patients who were treated with transdermal buprenorphine and were given IV morphine for breakthrough pain. Ninety-two percent of the episodes were treated successfully. Success was defined as a 33% reduction in pain intensity within 15 minutes. Eighty-three percent of the episodes had a more than 50% reduction in pain. Beltrutti et al, (2002) also described two cancer patients who experienced sustained pain relief

after receiving intrathecal morphine and intravenous buprenorphine. A randomized, double-blind, placebo-controlled study compared 45 ASA II and III patients undergoing hysterectomy with general anesthesia. Patients were given either intrathecal morphine or IV buprenorphine (1.3 microgram/kg), or both. The patients who had received both medications concurrently resulted in lower pain scores suggesting that buprenorphine (at analgesic doses) and morphine interact synergistically to reduce pain more effectively than when each medication was administered alone, (Quaye & Zhang, 2019).

In a case study by Kornfeld & Manfredi (2010) five patients were maintained on buprenorphine perioperatively. Adequate pain control was achieved in all patients by oral or IV opioid agonists and, in all but one patient, regional anesthesia. Quaye and Zhang's (2019) review of the literature involving obstetric patients concluded that buprenorphine can successfully be continued throughout the delivery and post-partum period by combining a multimodal analgesic approach.

Research Supporting Discontinuation of Buprenorphine

Khelemsky, Schauer, and Loo (2015) present a case study of a woman on buprenorphine undergoing cervical spine surgery. A 44-year-old woman presented for emergency anterior cervical corpectomy and fusion for the treatment of a pathological fracture with spinal cord compression. Among others, her medications included Suboxone 8mg/2mg for the treatment of opioid abuse. Due to the use of neuromonitoring for the surgery, a total IV anesthetic was utilized. Muscle relaxation was avoided. Propofol 150 mcg/kg/min and remifentanyl 0.4 mcg/kg/min infusions were initiated after an uneventful induction and intubation. An hour into the procedure the patient began to move her legs and over-breathe the ventilator. The propofol infusion was increased to 200 mcg/kg/min and a 2 mg versed bolus was given along with a

100 mcg remifentanyl bolus. A motionless surgical field was obtained only after the administration of a ketamine bolus of 50 mg and an infusion at 100 mg/hr. The patient remained intubated following the case. Five days after the initial surgery, the patient returned to the operating room for arthrodesis with posterior segmental instrumentation. She was not given any buprenorphine during those five days and was maintained on short-acting opioids. After an uneventful induction and intubation, a propofol infusion of 125 mcg/kg/min and remifentanyl infusion of 0.2 mcg/kg/min was started. No ketamine was required for the procedure and the patient was extubated at the end of the case. This case is limited in that it describes only a single patient but suggests that the presence of buprenorphine hindered the maintenance of a motionless surgical field. Surgery could only continue after the administration of ketamine.

Bryson (2014) concludes that standard opioid-based analgesic techniques are often not sufficient to achieve adequate pain control in patients maintained on buprenorphine who present for surgery. Because of buprenorphine's unique pharmacology, patients on this drug require substantially higher doses of opioids or alternative non-opioid based techniques in order to achieve an adequate level of pain control in the perioperative setting. Ideally buprenorphine should be discontinued 72 hours before surgery and then restarted once the patient no longer has acute pain requiring opioid analgesics. McCormick et al (2013) reported a case of a 50-year-old patient who presented with compartment syndrome. Pain control was difficult to achieve in this patient who was maintained on buprenorphine for chronic pain and opioid dependence. Successful pain management only occurred 48 hours after admission and involved stopping the buprenorphine and administering escalating doses of hydromorphone. Twelve milligrams of intravenous hydromorphone had little effect on this patient's initial pain scores.

Huang, Katznelson, de Perrot, and Clark (2014) report a 47-year-old woman on buprenorphine for chronic pain who underwent open window thoracoscopy for pulmonary aspergillosis. Her postoperative pain was unbearable despite high doses of intravenous hydromorphone. After buprenorphine was discontinued, her pain improved and her opioid requirement was reduced. Another similar report describes a patient taking buprenorphine who underwent a posterior spinal fusion and had uncontrolled postoperative pain. His pain scores improved only after discontinuing the buprenorphine and being taken to the ICU for dexmedetomidine and high dose opioid therapy (Brummett, Trividi, Dubovoy, & Berland 2009).

Gilmore, Sacchetti, & Cortese (2012) describe a case report of a 22-year-old male who presented to the emergency department with a comminuted distal radial and ulnar fracture caused by a work-related injury. His pain was ineffectively treated despite 10 mg of morphine and a 1 microgram/kg bolus dose of remifentanyl with an infusion of 1.7 microgram/kg/min. When it was found that the patient was on buprenorphine, the opioid analgesics were discontinued, and the pain was successfully relieved with a Bier block.

Discussion

Positron emission tomographic (PET) scans have been used to study the effects of buprenorphine at the receptor level. The data found that at buprenorphine maintenance doses of 16 and 32 mg SL tablets, the brain mu-opioid receptor availability is reduced by 80 and 84% respectively, whereas the reduction is only 41% with the 2 mg dose (Macintyre, Russell, Usher, Gaughwin, & Huxtable, 2013). Studies of mu-opioid receptor availability through PET scans lead to a better understanding of the dose range where buprenorphine can have an additive effect when used with other mu receptor agonists. Zubieta et al, (2000) also found that buprenorphine induced dose-dependent reductions in mu-opioid receptor availability. A 36-50% reduction at a

2 mg dose and 79-95% at a 16 mg dose was found in multiple brain regions including the prefrontal cortex, anterior cingulate, caudate, putamen, thalamus, amygdala, and cerebellum. High dose buprenorphine produced near maximal mu-opioid receptor occupation. At the 32 mg dose, buprenorphine blocked 94-98% of receptors in most regions throughout the brain. These studies show that at moderate doses of buprenorphine (8-12 mg daily), there is up to 20% mu-opioid receptor site availability.

One case study by Martin, Deljou, Weingarten, Schroeder, and Sprung, (2019) involving 32 patients on buprenorphine was entirely inconclusive. The opioid requirements of patients who continued sublingual buprenorphine (SL-BUP) until the day of surgery and those who discontinued SL-BUP preoperatively were compared. There were many limitations including the small sample size and its retrospective design. The small group of patients underwent various types of procedures and received various types of anesthesia ranging from regional only, general only, or both regional and general. Therefore, the authors have stated that best practices for patients receiving SL-BUP cannot be determined based on the findings of this study alone. The opioid requirements of patients being treated with SL-BUP were high in both groups regardless of the type of procedure, type of anesthesia and whether or not they had continued or discontinued their buprenorphine.

While an exhausting review of the literature proves that there is no clear consensus on the recommendations for patients on chronic buprenorphine therapy, the evidence suggests continuation of the buprenorphine at moderate doses throughout the perioperative period may lead to the best patient outcomes. There are no randomized controlled trials available and the articles reviewed are limited in that they are based on pharmacologic principles, numerous case studies, and expert opinions. While there are several case reports suggesting that pain control

was achieved only after the discontinuation of buprenorphine, there is also much evidence to support that acute pain control is very challenging in patients on buprenorphine irrespective of continuation. A case report of a 37-year-old woman with chronic pelvic pain on 8 mg buprenorphine had two similar gynecological procedures 6 months apart. For the first case the patient maintained her buprenorphine dose and struggled with postoperative pain control. The decision was made for the second procedure to discontinue the buprenorphine 5 days prior to surgery. The patient's post-operative pain was equally difficult to control (Chern, Isserman, Chen, & Liu, 2012). This study illustrates the challenge that patients taking buprenorphine present regardless of continuation versus discontinuation of the medication.

Acute pain management in patients taking buprenorphine for OUD is complex, multifactorial, and influenced by more than the pharmacologic properties associated with concomitant buprenorphine and full opioid agonist administration (Quaye & Zhang, 2019).

Recommendations

An editorial by Lembke, Ottestad, and Schemiesing (2019) recommends that patients on buprenorphine therapy continue the medication throughout the perioperative period. For those on higher doses (more than 12 mg daily) scheduled to undergo painful procedures such as total joints or open abdominal surgery, a lower dose protocol is recommended. The authors outline four reasons why discontinuing buprenorphine prior to surgery introduce unnecessary risk for patients with opioid use disorder. First, discontinuing buprenorphine is complex and may even delay surgery to allow adequate time to taper. This will require more clinic visits and care coordination between multiple providers, burdening the patient with additional instructions and tasks. Second, the process of re-starting buprenorphine after surgery is likely to be painful and

medically destabilizing for patients because it forces them into a state of active withdrawal before buprenorphine can be re-started. Third, this process is logistically complicated and labor-intensive, especially when multiple providers are involved. Lastly, patients on buprenorphine for opioid use disorder are at increased risk for relapse to opioid misuse and accidental overdose when buprenorphine is discontinued. The recommendation to taper patients down to 12 mg of buprenorphine when possible is based on receptor occupancy theories and clinical experience.

A study by Quaye and Zhang (2019) reviews the literature on the perioperative management of buprenorphine. While the article presents evidence on both sides of the conundrum, it concludes that maintaining buprenorphine perioperatively does not lead to worsened outcomes and that patients can achieve adequate pain control from mu-opioid agonists while continuing to take buprenorphine. The article highlights several studies showing that buprenorphine can be given with full mu-opioid agonists to achieve pain relief. Quaye and Zhang (2019) conclude that it is unnecessary and maybe even harmful to completely stop buprenorphine maintenance before surgery. This practice has been shown to increase the risk of opioid withdrawal, relapse, and the exacerbation of chronic pain.

In the past, popular opinion has been to discontinue buprenorphine several days prior to surgery due to the unique pharmacological properties of buprenorphine and the perceived difficulty in treating postoperative acute pain. More recently there is evidence that the clinical implications of its pharmacology may not be as insurmountable as once believed and that effective pain control is possible when patients are continued on buprenorphine perioperatively (Quaye & Zhang, 2019). The exact dosing is still questionable and further studies would be beneficial to determine an optimal dose, meanwhile a moderate dose (8-12 mg) is considered to be appropriate for continuation in most situations. The nature of the surgery along with the

anticipated level of postoperative pain should be considered when making a plan for these patients and possible intensive care monitoring should be anticipated. Not only is there not any high-level evidence that maintaining buprenorphine leads to worsened outcomes, but abrupt discontinuation is associated with a high risk of relapse in patients with OUD.

The Acute Pain Services (APS) at the University of Michigan created a protocol (Figure 1 & 2) with the assistance of physicians specializing in buprenorphine management. Figure 1 details the considerations for elective surgery and Figure 2 deals with urgent/emergent surgeries. Each of these protocols provides detailed instructions to either continue or discontinue the buprenorphine based on the anticipated level of post-operative pain and opioid requirements. The protocol encourages collaboration with the patient's primary buprenorphine provider and strongly recommends a multimodal approach including regional anesthesia when possible (University of Michigan Health Systems, 2017).

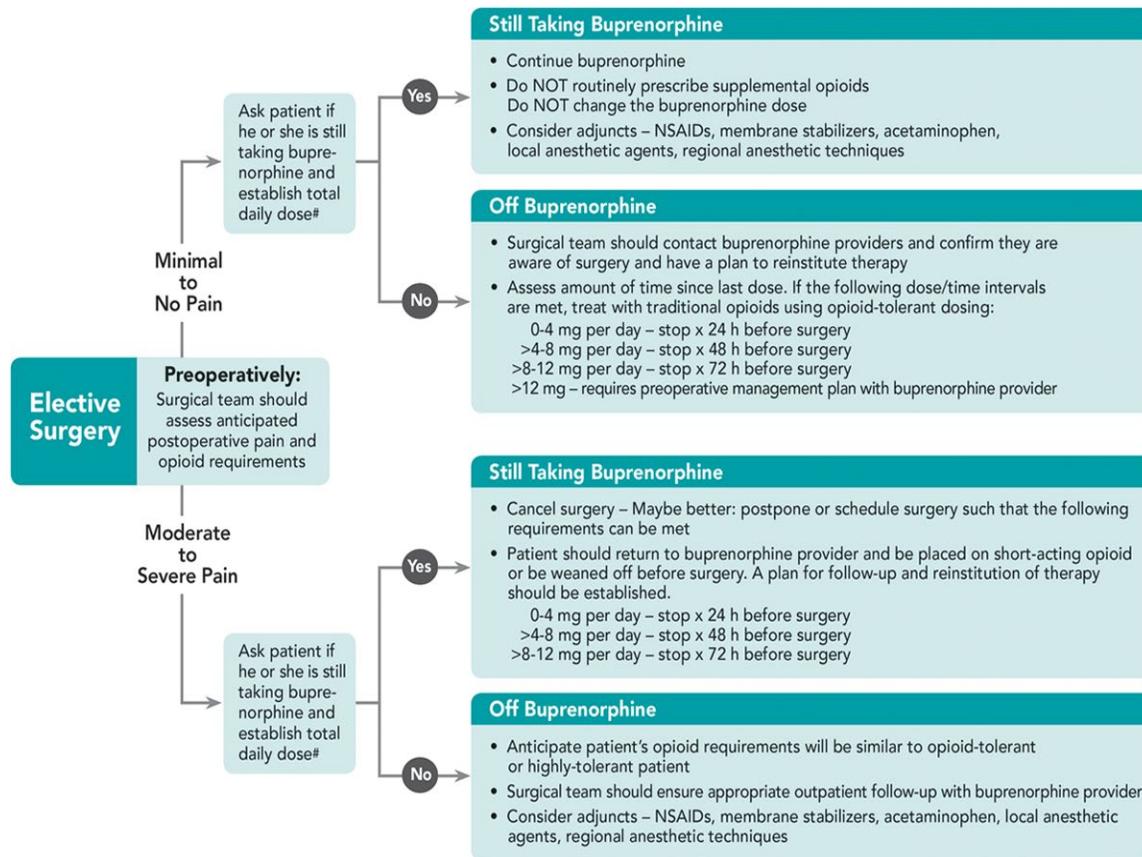


Figure 1. Acute Pain Services (APS) Protocol for elective procedures at the University of Michigan. Reprinted from: University of Michigan Health Systems. (2017) Management of sublingual buprenorphine (suboxone and subutex) in the acute perioperative setting. Retrieved from: https://anes.med.umich.edu/vault/1003149-buprenorphine_suboxone_subutex_perioperative_management.pdf

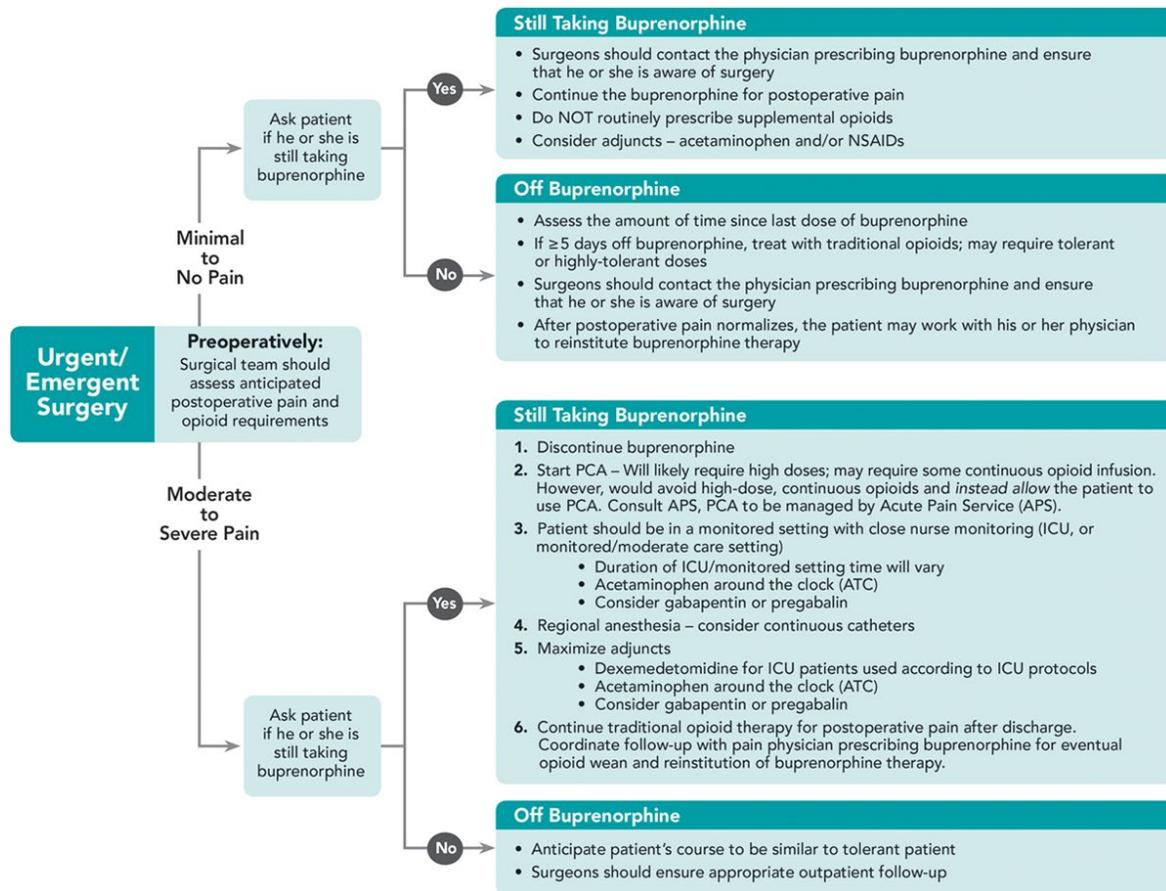


Figure 2. Acute Pain Services (APS) Protocol for elective procedures at the University of Michigan. Reprinted from: University of Michigan Health Systems. (2017) Management of sublingual buprenorphine (suboxone and subutex) in the acute perioperative setting. Retrieved from: https://anes.med.umich.edu/vault/1003149-buprenorphine_suboxone_subutex_perioperative_management.pdf

The University of Michigan APS protocol is not without opposition. According to Alford, 2014 the idea of discontinuing buprenorphine 5 days prior to surgery is based on the theoretical concern of pharmacological principles and has never been properly evaluated. This practice risks causing a disruption in the patient's recovery from opioid addiction by stopping buprenorphine during a high anxiety preoperative period. Alford also debates the certainty of the ceiling effect of buprenorphine stating that there is no published data indicating an analgesic ceiling in humans. The work by Alford confirms that a clear consensus among providers regarding the management of patients on buprenorphine during the perioperative setting is lacking.

Prior to January 2018, the practice at Massachusetts General Hospital was to withhold buprenorphine 72 hours before surgery and supplement with opioid agonists to prevent withdrawal. This practice met several challenges including patients who were fearful of stopping buprenorphine due to concerns of relapse and providers who were concerned with the legal aspects of providing opioids to patients with a history of OUD. Due to these issues and the lack of high-level evidence, a multidisciplinary clinician group was formed to help guide practice. The group consisted of twenty clinicians with experience in the following disciplines: perioperative pain management, chronic pain management, addiction medicine, psychology, psychiatry, and anesthesia. This algorithm also takes into consideration the anticipated pain level of the specific surgery, similar to Figures 1 & 2. Instead of a plan to discontinue buprenorphine all together, a dose of less than 16 mg is recommended up until the day of surgery and then a reduced dose of 8 mg during the postoperative period to be given along with other opioids as needed until surgical pain subsides. The group reached a revised consensus resulting in the algorithm shown in Figure 3.

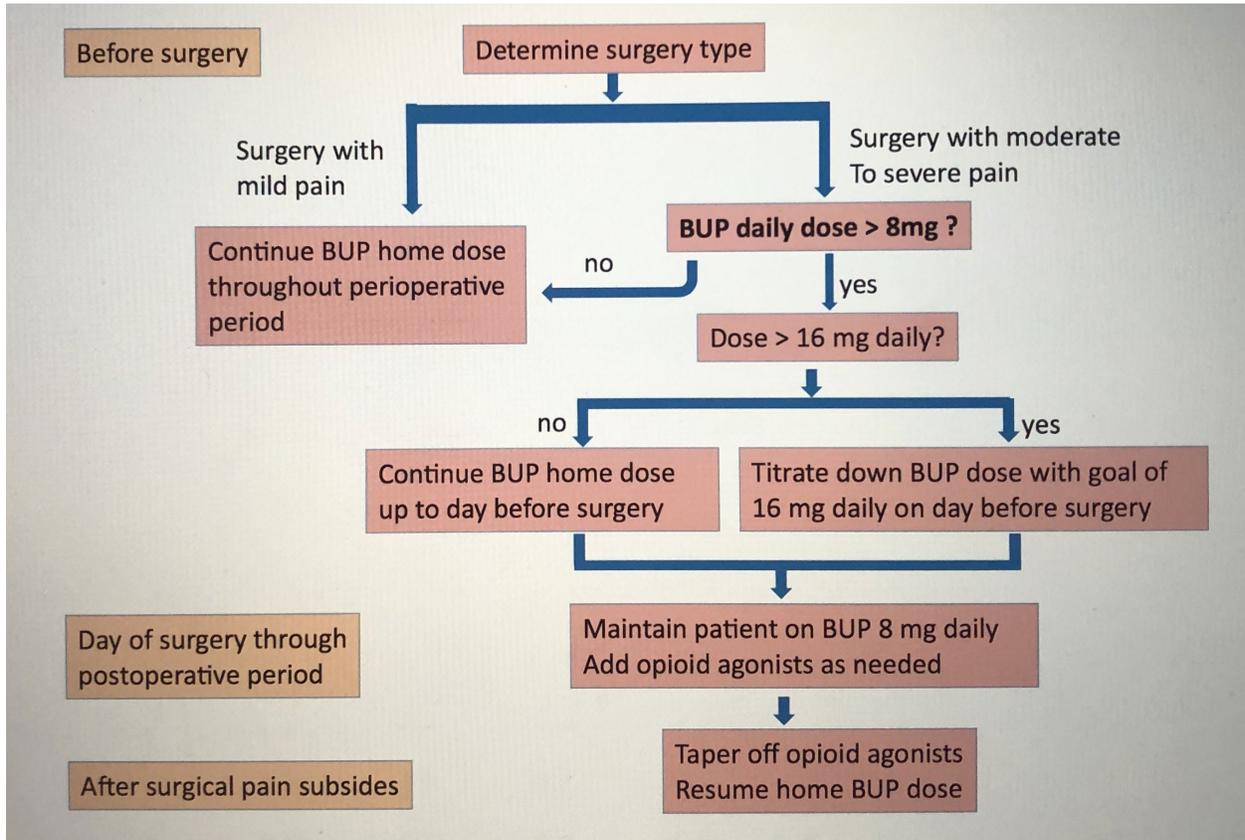


Figure 3. Algorithm for perioperative management of buprenorphine at Mass General.

Reprinted from: Perioperative Management of Buprenorphine: Solving the Conundrum, by Quaye and Zhang, 2019 in *Pain Medicine*; 20 (7). p 1395-1408. Doi: 10.1093/pm/pny217.

While it has been established by multiple case studies that there is no clear consensus on the perioperative management of these patients, there are some recommendations that are agreed upon in all the studies. These recommendations include proper preoperative planning involving a pain management specialist and mental health professional when possible. Thorough preoperative education is crucial in setting realistic expectations of the likelihood for increased post-operative pain. Another recommendation is the use of multimodal analgesia to include regional techniques when appropriate. Multi modal analgesia simultaneously targets pain pathways at different sites using different mechanisms and is associated with superior pain relief and decreased opioid consumption. This includes the use of NSAIDs, gabapentinoids, ketamine, alpha-2 agonists, lidocaine, and magnesium (Anderson et al, 2016).

There may be some instances where discontinuation of the buprenorphine completely may be appropriate. All patients should be treated on an individual basis taking into account all aspects of the patient's history and nature of the upcoming surgery. Optimal management begins in the preoperative period and is on the basis of a thorough patient assessment and development of a plan of care tailored to the individual and the surgical procedure involved, with follow up assessments and adjustments as needed (Chou et al, 2016).

Conclusion

The pharmacokinetic and pharmacodynamic properties of buprenorphine make it especially appealing for the treatment of chronic pain and addiction. Pain management during the perioperative period is complex, especially in patients who are taking buprenorphine. There are many different angles to consider when planning for these patients.

More studies are needed, specifically randomized controlled trials to determine the best perioperative management of patients taking buprenorphine. Meanwhile, the recommendation

can be made to continue buprenorphine perioperatively at a moderate dose (8-12 mg) in most cases where postoperative pain is not expected to be severe. Formulation of a plan during the preoperative period and education of the patient regarding the plan and postoperative expectations is vital to success. Lastly, and perhaps most important, is to implement a multimodal approach for treating postoperative pain targeting as many different receptors as possible to provide the best possible outcome for the patient.

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