Brief Commentary

Effect of Buprenorphine on Total Intravenous Anesthetic Requirements During Spine Surgery

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Buprenorphine is a partial mu receptor agonist and kappa/delta antagonist commonly used for the treatment of opioid dependence or as an analgesic. It has a long plasma half-life and a high binding affinity for opioid receptors. This affinity is so high, that the effects are not easily antagonized by competitive antagonists, such as naloxone. The high affinity also prevents binding of other opioids, at commonly used clinical doses, to receptor sites – preventing their analgesic and likely minimum alveolar concentration (MAC) reducing benefits.

This case report contrasts the anesthetic requirements of a patient undergoing emergency cervical spine surgery while taking buprenorphine with anesthetic requirements of the same patient undergoing a similar procedure after weaning of buprenorphine. Use of intraoperative neurophysiological monitoring prevented use of paralytics and inhalational anesthetics during both cases, therefore total intravenous anesthesia (TIVA) was maintained with propofol and remifentanil infusions. During the initial surgery, intraoperative patient movement could not be controlled with very high doses of propofol and remifentanil. The patient stopped moving in response to surgical stimulation only after the addition of a ketamine. Buprenorphine-naloxone was discontinued postoperatively. Five days later the patient underwent a similar cervical spine surgery. She had drastically reduced anesthetic requirements during this case, suggesting buprenorphine's profound effect on anesthetic dosing. This case report elegantly illustrates that discontinuation of buprenorphine is likely warranted for patients who present for major spine surgery, which necessitates the avoidance of volatile anesthetic and paralytic agents. The addition of ketamine may be necessary in patients maintained on buprenorphine in order to ensure a motionless surgical field.

Key words: Buprenorphine, anesthesiology, intraoperative, total intravenous anesthesia, pharmacology

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Buprenorphine may be used for the treatment of opioid dependence as an alternative to methadone maintenance, allowing patients to be maintained without the need for frequent clinic visits. It is similarly effective to methadone and has an impressive safety profile. Physicians prescribing buprenorphine for the treatment of opioid dependence must undergo a review by the Substance Abuse and Mental Health Services Administration/Center for Substance Abuse Treatment (SAMHSA/CSAT) and be granted a unique addendum to their DEA number. Two formulations of this drug available for the treatment of opioid dependence are Subutex (buprenorphine) and Suboxone (buprenorphine/naloxone). In contrast, physicians using buprenorphine for the treatment of pain do not require a waiver from the DEA or SAMHSA/CSAT and have an additional transdermal (Butrans) formulation at their disposal (1).

Pharmacodynamically, buprenorphine is a partial mu receptor agonist and kappa/delta antagonist. It has a long plasma half-life and a high binding affinity for opioid receptors. This affinity is so high, that

the effects are not easily antagonized by competitive antagonists, such as naloxone. The high affinity also prevents binding of other opioids, at commonly used clinical doses, to receptor sites – preventing their analgesic and likely minimum alveolar concentration (MAC) reducing benefits.

Case Presentation

A 44-year-old woman presented for emergency anterior cervical corpectomy C6-7 and anterior cervical fusion C5-T1 for treatment of a pathologic C6-7 fracture with spinal cord compression. The patient had a past medical history of HIV, hepatitis C virus related cirrhosis, and IV drug (heroin) abuse. Her medications included Suboxone (buprenorphine 8mg/naloxone 2 mg) 3 sublingual tablets daily, lactulose, zolpidem, dexamethasone, and pantoprazole. She was chronically stable on Suboxone for the treatment of history of opioid dependence. The patient weighed 69 kg, had a Mallampati Class I airway, and bilateral upper extremity weakness.

Intraoperative anesthetic management of decompression and stabilization of a pathologic C6-7 fracture while on buprenorphine:

After an uneventful induction of anesthesia and intubation with propofol 150 mg, fentanyl 250 mcg, and succinylcholine 100 mg, infusions of propofol 150 mcg/kg/min and remifentanil 0.4 mcg/kg/min were started. About one hour into the procedure, the patient began to move her legs and over-breathe the ventilator. Propofol 50 mg, midazolam 2 mg, and remifentanil 100 mcg were bloused, and the IV line checked for infiltration. Propofol infusion was increased to 200 mcg/kg/min; however, the patient continued to move with surgical stimulation. A motionless surgical field was achieved only after the administration of ketamine 50 mg and infusion at 100 mg/hour. The patient remained intubated following the case.

Intraoperative anesthetic management of C5-T1 arthrodesis with posterior instrumentation while off buprenorphine:

Five days after the initial surgery, the patient returned to the operating room for arthrodesis of C5-T1, with posterior segmental instrumentation. She was maintained on short-acting opioids prior to this procedure. After an uneventful induction of anesthesia with propofol 150 mg, fentanyl 150 mcg, and succinylcholine 100mg, and intubation, anesthetic maintenance was achieved with propofol 125 mcg/kg/min and remifentanil 0.2 mcg/kg. No ketamine was required for the procedure. The patient was extubated at the end of the case. Please refer to Figs. 1 and 2 for intraoperative requirements of propofol and remifentanil, respectively.

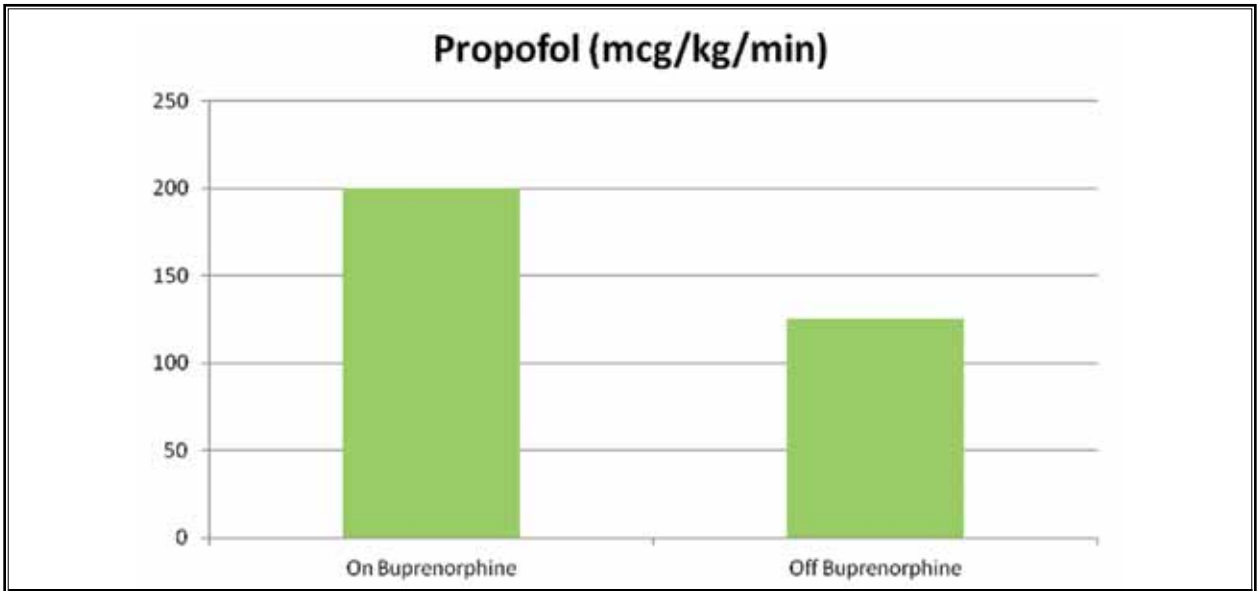

Fig. 1. *Intraoperative propofol requirements.*

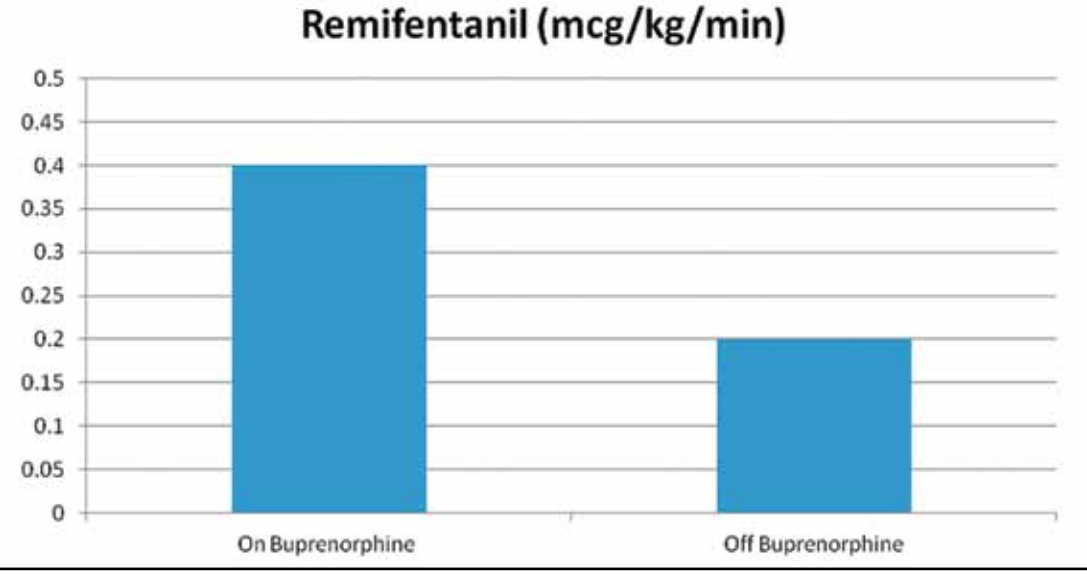

Fig. 2. *Intraoperative remifentanil requirements.*

Discussion

A recent study revealed that buprenorphine (8 mg) causes blockade of hydromorphone's analgesic activity for up to 5 days after discontinuation that is similar to that conferred by naltrexone (100 mg) (1). This indicates that a daily dose of buprenorphine 8 mg can produce a similar degree of opioid blockade achieved by therapeutic doses of naltrexone.

The use of buprenorphine for opioid addiction and analgesia has greatly increased the number of patients presenting for surgery while taking this medication. There are several options for the management of patients on buprenorphine undergoing major elective surgery. The first is to increase buprenorphine dosing by 25%, utilize non-opioid analgesic strategies such as nonsteroidal anti-inflammatory drugs (NSAIDs), acetaminophen, and regional anesthesia, and admit the patient to a stepdown unit in order to administer the much higher doses of opioid likely to be required to confer analgesia (2- 4). However, evidence supporting continuation of buprenorphine into the perioperative period originates from a case series in which most patients also had a regional anesthetic (3).

The second approach is to stop buprenorphine 72 hours preoperatively and start full agonist opioids during the early stages of withdrawal, in order to assure that full opioid agonists will be optimally effective during the perioperative period (5). It is worth noting that a longer period of preoperative cessation may be required due to the long half-life of this drug.

The use of buprenorphine for treatment of opioid addiction has increased the number of patients presenting for elective surgery while on this medication. The controversy regarding the perioperative management of buprenorphine in elective major surgery was circumvented in our case due to its emergency nature. It was clear that the presence of buprenorphine in this patient hindered the maintenance of a motionless surgical field even at very high doses of intravenous anesthetics, and surgery proceeded only after the addition of ketamine. Anesthetic requirements for a similar procedure after the cessation of buprenorphine were drastically reduced. This report, which is limited as it only describes a single patient, suggests that patients scheduled for major spine surgery in which paralytic agents and volatile anesthetics are contraindicated due to required neurophysiologic monitoring should be weaned off buprenorphine prior to the perioperative period. Additionally, use of ketamine and prolonged intubation should be considered for patients presenting for such procedures under emergency conditions.

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Disclaimer

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Conflict of interest

Each author certifies that he or she, or a member of his or her immediate family, has no commercial association (i.e., consultancies, stock ownership, equity interest, patent/licensing arrangements, etc.) that might pose a conflict of interest in connection with the submitted manuscript.

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