Journal of Pain Research

Dovepress
open access to scientific and medical research

Open Access Full Text Article

CASE REPORT

Perioperative Pain Management for Median Sternotomy in a Patient on Chronic Buprenorphine/Naloxone Maintenance Therapy: Avoiding Opioids in Patients at Risk for Relapse

This article was published in the following Dove Press journal:
Journal of Pain Research

Emmanuel Alalade[1]
Jena Bilinovic[1]
Ana Gabriela Walch[1]
Candice Burrier[1,2]
Christopher Mckee[1,2]
Joseph Tobias[1,2]

[1]Department of Anesthesiology & Pain Medicine, Nationwide Children's Hospital, Columbus, OH, USA; [2]Department of Anesthesiology & Pain Medicine, The Ohio State University College of Medicine, Columbus, OH, USA

Abstract: The opioid crisis in the United States has been pandemic. As such, anesthesia providers are frequently faced with patients who have a history of opioid abuse or are currently receiving chronic therapy for such disorders. The chronic administration of medications such as buprenorphine-naloxone can impact the choice of perioperative anesthesia and pain control. Furthermore, the postoperative administration of opioids may lead to relapse in patients with a history of opioid abuse. We present a 26-year-old male with a history of opioid abuse on maintenance therapy with buprenorphine-naloxone, who presented for median sternotomy, cardiopulmonary bypass, and pulmonary valve replacement. The perioperative implications of buprenorphine-naloxone and implementation of multimodal analgesia are discussed, along with options to decrease or eliminate the perioperative use of opioids.

Keywords: buprenorphine/naloxone, cardiac surgery, opioid use disorder, opioid tolerant patients, addiction

Introduction

In response to the increasing incidence of opioid addiction in the United States and developed Western countries, a growing number of patients with this affliction are being transitioned from prescribed opioids and illicit drug use to methadone and buprenorphine for medication assisted treatment. From 2008 to 2016, annual prescriptions for buprenorphine products more than doubled, with steady growth expected after generic approval of buprenorphine-naloxone by the FDA in 2018.[1] Perioperative pain management of patients receiving buprenorphine-naloxone for maintenance therapy is a challenge. Buprenorphine maintenance therapy patients frequently have severe postoperative pain due to buprenorphine induced hyperalgesia and limited efficacy of intraoperative opioids in the presence of buprenorphine.[2,3] We present a 26-year-old man with a history of opioid abuse on maintenance therapy with buprenorphine-naloxone who presented for median sternotomy, cardiopulmonary bypass, and pulmonary valve replacement. The patient requested continuation of buprenorphine-naloxone during the perioperative period and avoidance of additional perioperative opioids in order to decrease the risk of relapse of his opioid addiction. The perioperative implications of buprenorphine-naloxone are discussed and options to decrease or eliminate the postoperative use of opioids are presented.

Correspondence: Emmanuel Alalade
Department of Anesthesiology & Pain Medicine, Nationwide Children's Hospital, 700 Children's Drive, Columbus, Ohio 43205, USA
Tel +1 614 722-4200
Fax +1 614 722-4203
Email Emmanuel.Alalade@Nationwidechildrens.org

submit your manuscript | www.dovepress.com
DovePress
http://doi.org/10.2147/JPR.S222885

Case Report

Institutional Review Board is not required at Nationwide Children's Hospital (Columbus Ohio) for the presentation of single case report. The patient has given his written informed consent to have his case details to be published. A 26-year-old, 115 kg man who was status post-surgical repair of Tetralogy of Fallot (initial Blalock-Taussig-Thomas shunt and subsequent repair) with concomitant bipolar disorder, anxiety, hepatitis C, polysubstance abuse (prescribed opioids, cocaine, and heroin use) presents for pulmonary valve replacement due to progressive, severe pulmonary regurgitation. Current medications include buprenorphine-naloxone 16 mg daily, alprazolam 0.5 mg TID, melatonin 5 mg QHS prn, and lamotrigine 50 mg daily. He requested an opioid-free anesthetic due to his concerns of opioid abuse relapse after having a new achievement of 9 months sobriety. He requested preoperative consultation with the acute pain service for perioperative pain management before undergoing his procedure. The anesthesia pain consultation service recommended a high thoracic epidural be placed the day prior to cardiopulmonary bypass (CPB) for the valve repair in addition to a multimodal perioperative regimen consisting of ketamine, dexmedetomidine, gabapentin, acetaminophen and ketorolac.

In the evening prior to the day of surgery, an epidural catheter (20-gauge catheter through a 17-gauge Tuohy) was placed without difficulty at the T_{4-5} interspace under local anesthesia with the patient in the sitting position. Vital signs were monitored during the procedure. The epidural space was identified by the loss-of-resistance technique with saline and 4 cm of the catheter was placed into the epidural space. The catheter was placed with a single needle pass without trauma. The patency of the catheter was checked by a saline flush and a test dose administered (3 mL of 1.5% lidocaine with 1:200,000 epinephrine). A sensory level was assessed after an additional 2 mL of the test dose solution with sensory changes from T_{2-7} bilaterally. A continuous infusion of 0.2% ropivacaine was initiated at 1 mL/hour to keep the catheter patent.

On the morning of surgery, the patient received 600 mg of gabapentin. The patient was transported to the operating room and routine American Society of Anesthesiologists' monitors were placed. Anesthesia was induced with midazolam, dexmedetomidine, and etomidate followed by rocuronium to facilitate endotracheal intubation. Central venous and arterial cannulas were placed. Maintenance anesthesia consisted of sevoflurane (expired concentration 2–3%) in air and oxygen with intermittent bolus dosing of the epidural catheter with 0.5% ropivacaine. Intraoperative infusions of dexmedetomidine (1 μg/kg/hr) and ketamine (0.25 mg/kg/hr) were included for a multimodal analgesia regimen. The patient underwent a successful replacement of his pulmonary valve during cardiopulmonary bypass with a CPB time of 115 mins and cross clamp time of 42 mins. There were no intraoperative concerns, his trachea was extubated in the operating room and he was transferred to the cardiac intensive unit, breathing oxygen at 2 l/min on nasal cannula. Postoperatively the epidural infusion (ropivacaine 0.2%) was infused at 6 mL/hr with the addition of a patient-controlled epidural analgesia (PCEA) mode which allows hourly boluses of 3 mL as needed. Dexmedetomidine (1 μg/kg/hour) and ketamine (0.25 mcg/kg/hr) infusions were continued postoperatively. We continued his current buprenorphine-naloxone and alprazolam dosing in addition to acetaminophen 1000 mg IV every 6 hrs, ketorolac 30 mg IV every 6 hrs and gabapentin 300 mg TID. Overnight on postoperative day 0, he received 5 epidural bolus and his VAS pain scores were 4–6, corresponding to a pain that was manageable according to the patient. On postoperative day 1, the mediastinal and left pleural chest tube were removed and the PCEA component to the epidural was discontinued. Due to excess sedation, The dexmedetomidine infusion was discontinued and clonidine was added to the epidural solution (0.2% ropivacaine with 2 μg/mL clonidine). The epidural level was assessed and noted to cover the T_{2-9} dermatomes bilaterally. Complementary and alternative medicine (CAM) therapies including massage therapy and hypnosis were made available during the post-operative period. Psychology consultation was obtained and coached him through use of strategies such as breathing, distraction, and social support for management of post-operative pain. The patient remained positive about continuing the goal of completing hospitalization without opioids. On postoperative day 3, after consultation with his buprenorphine-naloxone prescriber, his current 16 mg daily dose of buprenorphine-naloxone was supplemented by an additional 8 mg dose at night to ensure adequate pain control. Subsequently on the same day, a break in the sterility of the epidural catheter infusion necessitated its discontinuation 48 hrs earlier than preferred. The patient reported his pain as manageable after discontinuation of epidural infusion. On postoperative day 4, the ketamine infusion was discontinued, oral clonidine (100 μg PO at bedtime) was added and

the gabapentin dose was increased to 400 mg TID. The VAS pain score was 0 at rest and 2 with activity. The patient was discharged home on postoperative day 6 with continuation of the buprenorphine regimen, discontinuation of the gabapentin and clonidine, and oral dosing of ibuprofen and acetaminophen every 6 hrs around-the-clock for one more week. At the time of discharge, the VAS pain was 0 at rest and 1–2 with activity. The increased dose of buprenorphine (24 mg daily) was continued for 1 more week postoperatively until follow-up with his outpatient addiction medicine physician.

Discussion

Buprenorphine-naloxone has been shown in clinical practice to be highly effective in the treatment for opioid dependency.[4] It has a unique mechanism of action that entails partial agonist activity at the mu-opioid receptor and full kappa opioid receptor antagonism.[5] Conventional opioids do not have the same efficacy when added on top of buprenorphine-naloxone secondary to the antagonism at the opioid receptors.[5] As medication assisted treatment (MAT) begins to expand for treatment of opioid abuse disorder, the number of patients on buprenorphine-naloxone maintenance therapy presenting for major surgical procedures continues to increase.

The clinical evidence for managing surgical patients on therapeutic buprenorphine-naloxone regimen is based on anecdotal experience from case reports/series and institutional experience with no randomized studies and no long-term outcome results.[2,6] Despite the limited evidence, protocols for the management of these patients have recently been published.[2,6,7] Consensus in the management of patients in advance of procedures with expected moderate to severe postoperative pain is to hold buprenorphine-naloxone 72 hrs prior to surgery.[8,9] However, this option was not optimal in our patient. Our patient wanted to continue buprenorphine-naloxone due to his concerns of relapse if he stopped therapy during the perioperative period.[10]

There are four practical options for perioperative buprenorphine management:[3] (1) continue buprenorphine and use traditional opioids with high μ affinity (hydromorphone or sufentanil)[11] (2) reduce buprenorphine preoperatively to increase availability of μ opioid receptors.[3,12] (3) continue buprenorphine with supplemental postoperative buprenorphine[13] or (4) discontinue buprenorphine preoperatively and start traditional opioid prior to the surgery.[9] With the first and second approach of continuing buprenorphine, there is concern that traditional opioids will not be as effective and pain will be difficult to control. When opioid analgesia is needed, sufentanil and hydromorphone have a similar or higher affinity for the μ receptor and can be used to displace buprenorphine if opioids are needed.[3] With the third approach of continuing buprenorphine, there is some evidence that perioperative buprenorphine may provide some postoperative analgesia and would support this approach.[13] With the last approach of discontinuing buprenorphine and starting a traditional opioid, there is concern of relapse in the patient with opioid abuse history.[10] Finally, the last approach is not always feasible due to the buprenorphine-naloxone half-life of 24–60 hrs, and opioid receptor unavailability.

Our patient's preoperative regimen of 16 mg/day of buprenorphine-naloxone placed him at the higher end of dosing for medication-assisted therapy for opioid use disorders. Buprenorphine-naloxone effect on the mu receptor has been well studied. A dose regimen of 16 mg has been shown to reduce μ opioid receptor binding by 80% or greater, with 24 to 32 mg dosage having 95% occupancy of receptors.[14,15] At these higher doses of buprenorphine-naloxone, traditional opioids may not be able to bind at the mu receptor.

There is no direct evidence to suggest that one should not continue buprenorphine-naloxone perioperatively, especially when the dose is less than 12–16 mg per daily.[6,7] In patients with the potential for relapse such as our patient, the discontinuation of buprenorphine-naloxone should have a strong rationale and complete buy-in from the patient. Weighing the risk of an unfavorable outcome such as withdrawal and relapse with optimum analgesia is critical to an excellent outcome. Especially, when the decision is made to continue higher doses of buprenorphine-naloxone, the use of an opioid-free-perioperative plan, although challenging, maybe the preferred option.

A multimodal approach to analgesia is generally recommended in this population to limit or avoid the need for opioid analgesia. Multimodal analgesicsincluding acetaminophen, gabapentanoid agents, dexmedetomidine, clonidine, local anesthetics, non-steroidal anti-inflammatory agents and ketamine have been used to improve postoperative pain and to reduce postoperative opioid use in various clinical scenarios and it is applicable to this case.[16] Furthermore, the addition of regional anesthesia is integral given its ability to effectively control postoperative pain without opioids.

Analgesia for sternotomy via regional anesthesia is complicated when compared to blocks for the extremities due to chest wall innervation. However, in order to achieve consistent pain relief via peripheral nerve block, a para-axial or

muscular fascia plane blocks would have to be considered such as bilateral erector spinae blocks, paravertebral blocks and pectoral fascia blocks. Studies are ongoing to show their non-inferiority to neuraxial anesthesia.[17,18]

As our case illustrates, successful neuraxial anesthesia may provide effective analgesia without the need for systemic opioids so that maintenance therapy can be sustained. Even with an effective epidural placement, patients may require an increase in concentration of local anesthesia for excellent pain control due to resistance to local anesthetic agents in opioid tolerant patients.[19] Clinical evidence for local anesthetic resistance in opioid tolerant patients is sparse but should be considered when treating this patient population. He was able to maintain adequate pain control with standard local anesthetic agent solution (ropivacaine 0.2% with 2 μg/mL clonidine) but consideration should be given to increasing the concentration if pain control is suboptimal despite an adequate sensory level.

A high thoracic epidural analgesia (HTEA) offers a distinct opportunity to allow for intraoperative and postoperative analgesia following sternotomy. The greatest limitation is the potential risk of epidural hematoma with anticoagulation during cardiopulmonary bypass and the catastrophic possibility of paralysis.[20] Additional complicating factors include the potential for ongoing coagulation disturbances following surgery with cardiopulmonary bypass.[20] Previous recommendations for initiating systemic heparin regimens after neuraxial instrumentation is to delay heparin administration at least 1 hr after placement of the epidural catheter, assuming an atraumatic placement.[21] With traumatic placement of an epidural catheter, recommendations are to wait 24 hrs after the traumatic epidural attempt before systemic heparinization.[21] Taking these guidelines into consideration, we decided to place the epidural catheter in our patient the day prior to the surgical procedure to allow at least 24 hrs after epidural placement in the event of bloody or difficult epidural placement. In routine clinical practice, the risk of epidural hematoma is exceedingly low.[22,23] In a meta-analysis involving more than 10,000 neuraxial anesthetics performed before systemic anticoagulation with heparin for vascular surgery and cardiothoracic surgery, no cases of epidural hematoma were reported.[24,25] The investigators reported important precautions that should be ensured in these patients, such as patient selection with no clinical signs of coagulopathy and objective normal coagulation function test before needle placement, avoiding regional anesthesia technique if needle placement is challenging, delaying surgery for 24 hrs in the event of traumatic needle placement, and allowing at least 60 mins between needle placement and heparin administration.[25,26] They also caution to minimize heparin usage and only remove the epidural with normal coagulation function which was followed in our case. However, there have been two recent case reports of epidural hematoma with the epidural placement for cardiac surgery.[27,28] The epidural hematomas developed on postoperative day 1 after post-operative anticoagulation was initiated. The epidural placements were both atraumatic and greater than 60 mins elapsed from epidural placement to systemic heparinization. Although rare, epidural hematoma is a significant risk and must be discussed with the patient to determine the risk-benefit ratio. In our patient, we decided that an epidural would provide optimal pain control and was the most likely way to avoid opioids postoperatively. With successful high thoracic epidural analgesia and adjunctive agents, we were able to continue buprenorphine-naloxone without using additional opioid agonists.

Preoperative consultation with the buprenorphine-naloxone patient allows an opportunity to develop a perioperative pain management plan, set reasonable expectations for the patient, and address patient concerns. A multidisciplinary approach involving the patient, anesthesiologist, inpatient pain specialist, surgeon, and outpatient buprenorphine-naloxone prescriber is suggested for optimal patient management.

In summary, acute pain management in patients with a history of opioid abuse or dependence while on buprenorphine-naloxone is challenging and requires a more creative approach to the analgesic regimen in the perioperative period. Traditional use of opioids for intraoperative and postoperative pain management will likely not be effective. The high affinity of buprenorphine for the μ receptor can be expected to block the effects of traditional opioids with a lower affinity for mu receptor than buprenorphine. However, continuation of buprenorphine with the use of non-pharmacological treatment options, multimodal analgesia with non-opioid adjuncts, and regional anesthesia when applicable based on the type of surgery, can help to eliminate or decrease the use of opioids in patients undergoing surgery. These therapies may aid in the successful provision of postoperative analgesia while limiting the possibility of relapse in an opioid dependent patient on medication assisted therapy.

Disclosure

The authors report no conflicts of interest in this work.

References

1. Roberts AW, Saloner B, Dusetzina SB. Buprenorphine use and spending for opioid use disorder treatment: trends from 2003 to 2015. *Psychiatr Serv*. 2018;69(7):832–835. doi:10.1176/appi.ps.201700315
2. Anderson TA, Quaye ANA, Ward EN, Wilens TE, Hilliard PE, Brummett CM. To stop or not, that is the question: acute pain management for the patient on chronic buprenorphine. *Anesthesiology*. 2017;126(6):1180–1186. doi:10.1097/ALN.0000000000001633
3. Leighton BL, Crock LW. Case series of successful postoperative pain management in buprenorphine maintenance therapy patients. *Anesth Analg*. 2017;125(5):1779–1783. doi:10.1213/ANE.0000000000002498
4. Bryson EO, Lipson S, Gevirtz C. Anesthesia for patients on buprenorphine. *Anesthesiol Clin*. 2010;28(4):611–617. doi:10.1016/j.anclin.2010.08.005
5. Lutfy K, Cowan A. Buprenorphine: a unique drug with complex pharmacology. *Curr Neuropharmacol*. 2004;2(4):395–402. doi:10.2174/1570159043359477
6. Goel A, Azargive S, Lamba W, et al. The perioperative patient on buprenorphine: a systematic review of perioperative management strategies and patient outcomes. *Can J Anaesth*. 2019;66(2):201–217. doi:10.1007/s12630-018-1255-3
7. Lembke A, Ottestad E, Schmiesing C. Patients maintained on buprenorphine for opioid use disorder should continue buprenorphine through the perioperative period. *Pain Med*. 2018;20(3):425–428. doi:10.1093/pm/pny019
8. Huang A, Katznelson R, de Perrot M, Clarke H. Perioperative management of a patient undergoing Clagett window closure stabilized on Suboxone(R) for chronic pain: a case report. *Can J Anaesth*. 2014;61(9):826–831. doi:10.1007/s12630-014-0193-y
9. Harrington CJ, Zaydfudim V. Buprenorphine maintenance therapy hinders acute pain management in trauma. *Am Surg*. 2010;76(4):397–399.
10. Bentzley BS, Barth KS, Back SE, Book SW. Discontinuation of buprenorphine maintenance therapy: perspectives and outcomes. *J Subst Abuse Treat*. 2015;52:48–57. doi:10.1016/j.jsat.2014.12.011
11. Kornfeld H, Manfredi L. Effectiveness of full agonist opioids in patients stabilized on buprenorphine undergoing major surgery: a case series. *Am J Ther*. 2010;17(5):523–528. doi:10.1097/MJT.0b013e3181be0804
12. Greenwald MK, Comer SD, Fiellin DA. Buprenorphine maintenance and mu-opioid receptor availability in the treatment of opioid use disorder: implications for clinical use and policy. *Drug Alcohol Depend*. 2014;144:1–11. doi:10.1016/j.drugalcdep.2014.07.035
13. Book SW, Myrick H, Malcolm R, Strain EC. Buprenorphine for postoperative pain following general surgery in a buprenorphine-maintained patient. *Am J Psychiatry*. 2007;164(6):979. doi:10.1176/ajp.2007.164.6.979
14. Greenwald MK, Johanson CE, Moody DE, et al. Effects of buprenorphine maintenance dose on mu-opioid receptor availability, plasma concentrations, and antagonist blockade in heroin-dependent volunteers. *Neuropsychopharmacology*. 2003;28(11):2000–2009. doi:10.1038/sj.npp.1300251
15. Zubieta J, Greenwald MK, Lombardi U, et al. Buprenorphine-induced changes in mu-opioid receptor availability in male heroin-dependent volunteers: a preliminary study. *Neuropsychopharmacology*. 2000;23(3):326–334. doi:10.1016/S0893-133X(00)00110-X
16. Urman RD. Buprenorphine formulations: clinical best practice strategies recommendations for perioperative management of patients undergoing surgical or interventional pain procedures. *Pain Physician*. 2018;21:E1–E12. doi:10.36076/ppj.2018.1.e1
17. Scarfe AJ, Schuhmann-Hingel S, Duncan JK, Ma N, Atukorale YN, Cameron AL. Continuous paravertebral block for post-cardiothoracic surgery analgesia: a systematic review and meta-analysis. *Eur J Cardio-Thorac Surg*. 2016;50(6):1010–1018. doi:10.1093/ejcts/ezw168
18. Nagaraja P, Ragavendran S, Singh NG, et al. Comparison of continuous thoracic epidural analgesia with bilateral erector spinae plane block for perioperative pain management in cardiac surgery. *Ann Card Anaesth*. 2018;21(3):323. doi:10.4103/aca.ACA_16_18
19. Brennan TJ, Lennertz RC, Kang S. Are opioid-tolerant patients resistant to local anesthetic nerve blockade?: we need more information. *Anesthesiology*. 2016;125(4):625–626. doi:10.1097/ALN.0000000000001240
20. Sanchez R, Nygard E. Epidural anesthesia in cardiac surgery: is there an increased risk? *J Cardiothorac Vasc Anesth*. 1998;12(2):170–173. doi:10.1016/S1053-0770(98)90326-3
21. Horlocker TT. Regional anaesthesia in the patient receiving antithrombotic and antiplatelet therapy. *Br J Anaesth*. 2011;107(Suppl 1):i96–106. doi:10.1093/bja/aer381
22. Ruppen W, Derry S, McQuay H, Moore RA. Incidence of epidural hematoma, infection, and neurologic injury in obstetric patients with epidural analgesia/anesthesia. *Anesthesiology*. 2006;105(2):394–399. doi:10.1097/00000542-200608000-00023
23. Landoni G, Isella F, Greco M, Zangrillo A, Royse C. Benefits and risks of epidural analgesia in cardiac surgery. *Br J Anaesth*. 2015;115(1):25–32. doi:10.1093/bja/aev201
24. Ruppen W, Derry S, McQuay HJ, Moore RA. Incidence of epidural haematoma and neurological injury in cardiovascular patients with epidural analgesia/anaesthesia: systematic review and meta-analysis. *BMC Anesthesiol*. 2006;6:10. doi:10.1186/1471-2253-6-10
25. Rao Tadikonda LK, El-Etr Adel A. Anticoagulation following placement of epidural and subarachnoid catheters: an evaluation of neurologic sequelae. *Anesthesiology*. 1981;55(6):618–620. doi:10.1097/00000542-198155060-00002
26. Hammer GB. Regional anesthesia for pediatric cardiac surgery. *J Cardiothorac Vasc Anesth*. 1999;13(2):210–213. doi:10.1016/S1053-0770(99)90091-5
27. Rosen DA, Hawkinberry DW, Rosen KR, Gustafson RA, Hogg JP, Broadman LM. An epidural hematoma in an adolescent patient after cardiac surgery. *Anesth Analg*. 2004;98(4):966–969. doi:10.1213/01.ANE.0000103267.37895.5B
28. Bang J, Kim JU, Lee YM, et al. Spinal epidural hematoma related to an epidural catheter in a cardiac surgery patient -A case report. *Korean J Anesthesiol*. 2011;61(6):524–527. doi:10.4097/kjae.2011.61.6.524