

General

Managing Acute Surgical Pain in Patients on Buprenorphine: A Case-Based Learning Module

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Background

Perioperative pain management in patients maintained on buprenorphine for opioid use disorder presents unique challenges, particularly in urgent surgical settings where proper planning and traditional opioid-based strategies may be ineffective. High-affinity partial μ -opioid receptor binding limits the analgesic efficacy of full opioid agonists often necessitating multimodal approaches.

Case Description

This manuscript presents a fictional teaching case developed exclusively for educational purposes involving a 55-year-old patient maintained on buprenorphine–naloxone who requires emergency lower-extremity surgery following a traumatic injury. The case illustrates the use of regional anesthesia combined with ketamine, to achieve effective perioperative analgesia while continuing baseline buprenorphine therapy.

Educational Value

The case is accompanied by teaching points and multiple-choice practice questions focused on the mechanisms of action of local anesthetics and ketamine, as well as perioperative considerations for buprenorphine management. This teaching case is designed to reflect a highly plausible real-world clinical scenario encountered in orthopedic trauma and perioperative pain management.

Conclusion

This educational case highlights practical perioperative pain management strategies for patients receiving buprenorphine. This scenario does not represent a real patient encounter and is intended solely as a teaching tool for trainees and clinicians.

TEACHING CASE

A 55-year-old male presents to the emergency department after sustaining a gunshot wound to the right lower extremity during an altercation. Initial trauma evaluation reveals a penetrating injury to the distal thigh with associated soft tissue damage and concern for femoral shaft injury. He is hemodynamically stable on arrival and undergoes standard trauma assessment and imaging. Orthopedic surgery determines that urgent operative intervention is required for wound exploration, fracture stabilization, and debridement.

The patient's medical history is notable for opioid use disorder, for which he has been stable on buprenorphine–naloxone 8–2 mg twice daily (total daily dose 16–4 mg) for several years. He reports good adherence, denies re-

cent illicit opioid use, and has not experienced relapse. Additional history includes tobacco use and hypertension, but no chronic kidney or liver disease. He denies current alcohol use. He expresses concern about opioid medications being used given his history of opioid use disorder.

A multimodal, opioid-sparing perioperative analgesic plan is developed collaboratively between anesthesia, pain medicine, and orthopedic surgery. The plan emphasizes regional anesthesia to provide targeted analgesia independent of opioid receptor availability. The patient undergoes ultrasound-guided femoral and sciatic nerve blocks prior to surgery using a long-acting local anesthetic to optimize intraoperative and postoperative pain control.

Intraoperatively, ketamine is administered as an adjunct analgesic. Ketamine is selected specifically to minimize reliance on escalating doses of full μ -opioid agonists, which

may be less effective in the setting of buprenorphine receptor occupancy.

The surgical procedure proceeds without complication. In the immediate postoperative period, the patient receives short courses of intravenous opioid analgesics in the post-anesthesia care unit, which provide effective breakthrough pain control despite ongoing buprenorphine therapy. These medications are administered in combination with non-opioid analgesics, without evidence of excessive sedation or respiratory compromise.

Given the anticipated severity and duration of postoperative pain, a repeat regional anesthetic intervention is performed, and a peripheral nerve catheter is placed to allow for continuous infusion of local anesthetic for extended analgesia. This strategy provides sustained pain control and further minimizes the need for systemic opioid escalation.

Throughout the postoperative course, the patient's baseline buprenorphine–naloxone regimen is continued without interruption. The patient reports satisfactory pain control with no signs of opioid withdrawal or opioid related side effects.

He is monitored closely for analgesic efficacy and substance use stability. The patient expresses satisfaction with the pain management approach and appreciation for the emphasis on opioid-sparing strategies. He is ultimately discharged with a coordinated follow-up plan involving orthopedic surgery, pain management, and addiction medicine.

TEACHING QUESTIONS

Question 1: What is the primary mechanism by which local anesthetics provide analgesia during nerve blocks?

- A. Inhibition of NMDA receptors in the spinal cord
- B. Blockade of voltage-gated sodium channels
- C. Activation of GABA-A receptors
- D. Inhibition of cyclooxygenase enzymes

Question 2: Which mechanism best explains ketamine's role in perioperative pain control for this patient?

- A. μ -opioid receptor agonism
- B. GABA receptor potentiation
- C. NMDA receptor antagonism
- D. Sodium channel blockade

Question 3: Which property of buprenorphine most complicates perioperative opioid analgesia?

- A. Short half-life
- B. Low receptor affinity
- C. Partial μ -opioid agonism with high receptor affinity
- D. Pure κ -opioid agonism

Question 4: What is the most appropriate perioperative approach to buprenorphine in this patient requiring emergency surgery?

- A. Discontinue buprenorphine immediately
- B. Transition to methadone preoperatively
- C. Continue buprenorphine and use multimodal analgesia
- D. Replace buprenorphine with full μ -opioid agonists

Question 5: Abrupt discontinuation of buprenorphine in this patient most increases the risk of which complication?

- A. Respiratory depression
- B. Opioid-induced hyperalgesia
- C. Local anesthetic systemic toxicity
- D. Acute opioid withdrawal and relapse

ANSWERS AND DISCUSSION

QUESTION 1

Correct Answer: B

Local anesthetics reversibly block voltage-gated sodium channels, preventing action potential propagation along peripheral nerves. This interrupts sensory and motor signal transmission, providing effective regional anesthesia independent of opioid receptor activity.¹⁻³

QUESTION 2

Correct Answer: C

Ketamine is a noncompetitive NMDA receptor antagonist, reducing central sensitization, opioid tolerance, and hyperalgesia.^{4,5} This makes it particularly useful in opioid-tolerant patients and those maintained on buprenorphine.

QUESTION 3

Correct Answer: C

Buprenorphine is a partial μ -opioid agonist with very high receptor affinity, which can limit the effectiveness of full μ -opioid agonists administered perioperatively, especially at high doses.⁶⁻⁹ As a result, escalating doses of traditional opioids may yield diminishing analgesic returns, underscoring the importance of multimodal and regional analgesic strategies in this population.

QUESTION 4

Correct Answer: C

Current evidence supports continuing buprenorphine perioperatively, particularly in urgent or emergent settings, to reduce withdrawal risk and relapse.¹⁰ Analgesia should be augmented with regional techniques and both opioid and non-opioid medications. In emergency scenarios, there is often insufficient time or clinical feasibility to taper, discontinue, or transition patients to alternative opioid regimens, making continuation of baseline therapy the most practical and safest approach.

QUESTION 5

Correct Answer: D

Stopping buprenorphine abruptly can precipitate withdrawal symptoms and relapse, particularly in patients with opioid use disorder.¹⁰⁻¹² Maintaining baseline therapy supports stability and improves perioperative outcomes.

EDUCATIONAL DISCLAIMER

This case is a fictional teaching example created solely for educational purposes and does not represent a real patient. The content is intended to illustrate general principles of perioperative pain management and should not be construed as medical advice. Clinical decisions must be indi-

vidualized and guided by current evidence and professional judgment.

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