Use of Metoprolol as an Adjuvant for Perioperative Pain Management in Patients with Obstructive Sleep Apnea

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Introduction
Obstructive Sleep Apnea Syndrome (OSAS) occurs in as many as 10% of pediatric and adolescent patients. Sedatives, opioid-based analgesics, as well as the residual effects of inhalation anesthetic agents worsen OSAS by decreasing pharyngeal tone and increasing upper airway resistance. These agents also attenuate the ventilatory and arousal responses to hypoxia, hypercarbia, and obstruction, thereby worsening the underlying sleep apnea (1). As even low doses of these drugs, especially opiates, have been known to cause life-threatening breathing irregularities in OSAS patients (2), it would seem prudent to minimize opioid administration in these patients. Recently, the intraoperative administration of β adrenergic receptor antagonists has been shown to reduce the need for inhalation agents and opioids during surgery as well as for analgesics for up to 72 hours after surgery (3). Here, we report that, when used as an anti-nociceptive supplement, metoprolol reduced the requirement for inhalation agents and eliminated the perioperative need for opiates in a patient with severe OSAS undergoing upper extremity surgery under general anesthesia.

Case Report
Upon presenting to our hospital for right thumb ligament reconstruction and carpal tunnel release, a 17-year-old Caucasian female (173 cm, 60 kg, body surface area 1.71 m²) was given a physical exam, unremarkable except for signs of anxiety. She had a history of sleep apnea, for which she nightly used CPAP. She had undergone a thumb ligament reconstruction on the contralateral upper extremity one year prior, the postoperative course of which was complicated by severe pain requiring rescue opioid administration and resulting in hospital admittance.

After the Bispectral Index System (BIS) and standard ASA monitors were placed, induction with propofol was unremarkable and the airway was secured with a size 4 LMA. Anesthesia was maintained with a propofol infusion of 50 µg/kg/min, inspired isoflurane concentration of 1% in oxygen and nitrous oxide (50-50) using a circle system maintaining normocarbia with the patient breathing spontaneously. When the patient’s right arm tourniquet was inflated to 280 mmHg, she developed sinus tachycardia in the range of 100 beats/min (BPM) as well as tachypnea (RR 28), and her BIS reading increased from the mid 40s to the mid 60s even with an increase in the concentration of isoflurane. Metoprolol tartrate (0.1mg/kg) was administered intravenously over 10 minutes, normalizing her vital signs and BIS reading and allowing the inspired isoflurane concentration to be reduced to 0.5% for the remaining 90 minutes of the operation. Other intraoperative medications included ketorolac and dexamethasone. Upon completion of the procedure, the surgical site was infiltrated with local anesthetic, the LMA removed awake, and the patient transferred to the recovery room. She reported mild pain for which acetaminophen (600mg) was given. She was discharged after an uneventful course and followed up on 24 hours later, at which time she was doing well, having required only one dosage of a combination of acetaminophen [500mg] and hydrocodone [5mg] 12 hours after discharge.

Discussion
Pain in the perioperative period is modulated by the stress response production of catecholamines, which increases the production of cyclic adenosine monophosphate (cAMP). Preclinical studies have
shown that cAMP can enhance hyperalgesia (4). Although the specific mechanism by which β receptor antagonists modulate pain remains currently unclear, one plausible explanation is a reduction in cAMP. β1-adrenergic receptor antagonists block the effect of norepinephrine on the stimulatory G (Gs) protein, preventing the activation of adenyl cyclase, and thereby inhibiting the subsequent production of cAMP (5). Metoprolol, a selective β1-adrenergic receptor antagonist, could be a highly effective adjuvant in the prevention of pain by modulating the cAMP pathway, especially in OSAS patients for whom the administration of opioids poses a significant perioperative risk. Further studies are needed to evaluate the potential benefit of metoprolol as an adjuvant in the perioperative pain management of pediatric and adolescent OSAS patients.

Refs: