

## ANESTHESIOLOGY

### ■ Association of Minor Airway Injuries with One-lung Ventilation Techniques. Knoll *et al.* (page 471)

In a prospective trial, Knoll *et al.* compared two techniques of achieving one-lung ventilation to determine their possible correlation with postoperative hoarseness, sore throat, and vocal cord injury. The team recruited 60 adult patients, American Society of Anesthesiologists physical status I-III, all scheduled for open pulmonary resections requiring one-lung ventilation.

Patients were randomized into one of two groups, to receive either the wire-guided endobronchial blocker or a double-lumen technique for achieving one-lung ventilation during their procedures. Induction of anesthesia was standardized for both groups, and tracheal intubation was performed 3 min after injection of atracurium. Surgeons were not present during tube placement and were blinded as to patients' group assignments. The surgeons were asked to rate lung collapse after the surgeries, from excellent (complete collapse with perfect surgical exposure), to fair (total collapse, but lung had residual air), to poor (partial collapse with interference in surgical exposure, or no collapse at all).

Before patients emerged from anesthesia, the authors performed bronchoscopic examinations to assess any bronchial lesions, and laryngoscopic examinations to assess vocal cord injuries. An investigator also blinded to group assignment asked questions of patients regarding postoperative hoarseness and sore throat immediately after they emerged from anesthesia, and then on postoperative days 1, 2, and 3. In the 56 included patients, the investigators found a significant increase in postoperative hoarseness and vocal cord lesions in patients in the double-lumen group compared to those in the endobronchial blocker group (44% *vs.* 17%, respectively, for both adverse events). Patients in the double-lumen group also experienced more cumulative days of hoarseness and sore throat. When performing one-lung ventilation, clinicians should be aware of the increased incidence of these minor airway injuries when using a double-lumen tube.

### ■ Search for Biomarkers of Renal Dysfunction after Cardiac Surgery. Wagener *et al.* (page 485)

Renal injury, relatively common after cardiac and aortovascular surgery, can result in acute renal dysfunction

(ARD) and even acute renal failure. Without a definitive early marker of ARD, clinicians usually rely on monitoring urine output, and measuring serum creatinine, blood urea nitrogen, and estimated creatinine clearance to diagnose the condition. In this prospective, observational study, Wagener *et al.* measured urinary neutrophil gelatinase-associated lipocalin (NGAL) before and after cardiac surgery in 81 patients undergoing procedures at their institution. Patients with preexisting renal failure requiring hemodialysis were excluded from the study.

Authors collected urine samples from study participants before surgery; immediately after cardiopulmonary bypass (or after reperfusion of the last bypass graft in off-pump procedures); and at 1, 3, 18, and 24 h after arrival in the intensive care unit or at time of discharge from the intensive care unit, whichever came first. Sixteen of the 81 study patients developed ARD, and five of those developed multiorgan failure and died. The patients who developed ARD had significantly higher peak NGAL concentrations compared to patients who did not develop ARD, although immediately after termination of cardiopulmonary bypass urinary NGAL levels were equivalent in patients with or without ARD. In patients who went on to develop ARD, urinary NGAL levels continued to increase and remained elevated 24 h after surgery. Serum creatinine in patients who developed ARD reached its peak only on postoperative day 4.

The authors suggest that the urinary NGAL:urinary creatinine ratio could be used to predict postoperative ARD at an early stage. The study did have limitations: It was insufficiently powered to establish a direct correlation of urinary NGAL with the probability of postoperative renal dysfunction; a cutoff value for urinary NGAL that would be predictive for ARD was not determined; and, creatinine clearance, which reflects glomerular filtration rates, was not directly measured. However, the association that the authors demonstrated between increased urinary NGAL concentrations and increased occurrence of postoperative ARD after cardiac surgery may show promise for this measure as a screening tool for renal injury, allowing for earlier attempts for treatment.

### ■ Maximizing Pain Control and Function after Ambulatory Orthopedic Surgery. Capdevila *et al.* (page 566)

In a randomized, multicenter study, Capdevila *et al.* compared the effects of continuous perineural and pa-

tient-controlled ropivacaine infusion with patient-controlled intravenous morphine after ambulatory orthopedic surgery. The team recruited 83 patients scheduled to undergo ambulatory, unilateral, acromioplasty, or hallux valgus surgery and who had indicated a preference for perioperative peripheral nerve block. Patients received either an interscalene or popliteal nerve block with 30 ml ropivacaine, 0.5%. They were assigned to one of three groups upon discharge to home: patient-controlled intravenous morphine delivered with a disposable infusion pump (n = 23); perineural 0.2% ropivacaine continuous infusion without bolus (n = 30); or perineural 0.2% ropivacaine basal infusion plus bolus (n = 30).

Patients were given instructions on the use of the elastomeric pumps, and forms in which to record their visual analog scale pain scores. Additional pain medications were standardized, and consumption of morphine, ropivacaine, and rescue analgesics was noted at the end of the study period. Home health nurses visited patients twice a day, and physiotherapists visited each morning to assist with early mobilization. The time until patients could walk unassisted for 10 min was also recorded. During the 72-h postoperative infusion period, both groups of patients receiving ropivacaine experienced significantly less postoperative pain during movement compared with patients receiving patient-controlled intravenous morphine. Those receiving basal-bolus ropivacaine walked sooner, optimized their daily activities, and used less ropivacaine for pain control. The incidence of nausea and vomiting, sleep disturbance, and dizziness was greater in the group of patients receiving morphine, and their satisfaction scores were lower than those reported by the other two groups of patients. For outpatient shoulder and foot surgery, a perineural basal-bolus infusion of 0.2% ropivacaine appears to enhance postoperative functional recovery compared to systemic morphine.

## ■ Morphine's Effects in Rats Enhanced by Coadministration of Fentanyl and DAMGO. Hashimoto *et al.* (page 574)

In a rat model, Hashimoto *et al.* examined whether [D-Ala<sup>2</sup>,MePhe<sup>4</sup>,Gly-ol<sup>5</sup>]enkephalin (DAMGO) and fentanyl could facilitate morphine-induced  $\mu$ -opioid receptor (MOR) endocytosis and potentiate morphine's analgesic effects. After first implanting study rats with intrathecal catheters, the authors characterized fentanyl-induced internalization of MOR in the spinal dorsal horn *in vivo*. MOR internalization in lamina II was quantified (by a researcher blinded as to treatment) by calculating percentage of immunoreactive neurons showing internalization in relation to the total number of immunoreactive neurons examined.

The authors then tested the effect of fentanyl on morphine-induced MOR internalization. In a final set of experiments, they tested whether the acute analgesic effect of morphine could be potentiated when MOR internalization was induced by coadministration of DAMGO or fentanyl. The results showed that, at equal analgesic doses, fentanyl induced MOR internalization to a lesser extent than did DAMGO. Coadministration of subanalgesic doses of DAMGO or fentanyl greatly potentiated morphine's analgesic effects. When given together, the combination of DAMGO, fentanyl, and morphine did not increase morphine's analgesic effect, or increase the internalization of MOR.

Although morphine remains "the gold standard" for clinical pain control, severe side effects often limit its therapeutic use. The observations in this study, building on other related work, suggest that coadministration of morphine with MOR-internalizing agonists could result in effective analgesia with lower doses of morphine and, potentially, fewer or less severe side effects.

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