◇ This Month in

ANESTHESIOLOGY

■ Can Spinal Anesthesia in Pediatric Open Heart Surgery Reduce the Stress Response? Humphreys *et al.* (page 1113)

Effective control of the stress response during cardiopulmonary bypass can potentially improve outcomes in pediatric cardiac surgery. In a randomized controlled study, Humphreys *et al.* compared high-dose intravenous opioid anesthesia *versus* high-dose intravenous opioid anesthesia plus spinal anesthesia, evaluating their effects on the stress response.

Sixty children up to the age of 2 yr who were undergoing elective cardiac surgery with cardiopulmonary bypass were enrolled in the study, and randomly assigned to one of the two groups. Anesthesia was induced using sevoflurane or intravenous midazolam, and maintained using isoflurane and fentanyl. All patients were given gentamicin, flucloxacillin, and dexamethasone before the start of surgery. The group allocated to receive spinal anesthesia had indwelling intrathecal catheters inserted before surgery. When bypass started, the patients randomized to spinal anesthesia received an intrathecal bupivacaine bolus and the fentanyl infusion was discontinued. A further dose of intrathecal bupivacaine was given during rewarming.

In the spinal anesthesia group, postoperative analgesia consisted of an intrathecal bupivacaine and morphine infusion *via* the spinal catheter, which was retained for 24–48 h postoperatively and then removed when normal coagulation and platelet count had been confirmed. Postoperative analgesia in the opioid group was provided by intravenous morphine infusion according to unit protocols. Plasma epinephrine and norepinephrine concentrations were significantly lower in the spinal anesthesia group at the time of cross clamp removal and 30 min later. One infant in the spinal anesthesia group died 72 days after surgery, from peritonitis and systemic sepsis. The study showed that using a combination of high-dose spinal and intravenous opioid techniques controls the sympathetic responses to cardiopulmonary bypass and improves the plasma lactate markers associated with adverse outcomes. Inflammatory markers were not different between groups. This technique may offer advantages over conventional high-dose intravenous opioid anesthesia in the management of infants and children undergoing cardiopulmonary bypass.

■ Laryngeal Reflex Responses to Propofol and Sevoflurane in Children. Oberer *et al.* (page 1142)

To compare the laryngeal reflex responses in children anesthetized with either propofol or sevoflurane under two levels of hypnosis, Oberer *et al.* recruited 70 children, aged 2 to 6 yr, who were scheduled for elective surgery. The children were randomly allocated to undergo propofol or sevoflurane anesthesia after initial induction of anesthesia while breathing spontaneously through a laryngeal mask airway. Anesthesia was deepened in the propofol group with an initial bolus of 3 mg/kg followed by additional boli if necessary and in the sevoflurane group with an inspiratory fraction of 8%. The study participants were also randomly assigned to a different order of level of hypnosis: bispectral index score (BIS) of 40 followed by BIS 60; or BIS 60 followed by BIS 40.

To elicit laryngeal and respiratory responses, the authors sprayed water on the laryngeal mucosa while a reviewer blinded to anesthetic assignment assessed the patient's response. These stimulations were performed at least 5 min after ensuring that respiratory parameters and BIS values were stable. The respiratory responses elicited by the stimulation were classified into seven categories, ranging from apnea with laryngospasm (complete closure of the glottis on video images lasting longer than 5 s) to spasmodic panting (more than 60 rapid, shallow breaths per minute, lasting longer than 10 s).

At the start of their study, the authors had hypothesized that the incidence of apnea with laryngospasm evoked by stimulation would not differ between sevoflurane and propofol. However, apnea with laryngospasm occurred more often during anesthesia with sevoflurane compared with propofol, independent of the level of hypnosis. Cough and expiration reflex occurred more frequently, though, in children anesthetized with propofol.

Because exaggerated laryngeal or respiratory reflexes can lead to serious complications in children, reduction of these reflexes can potentially enhance the safety of anesthesia in this population. Results from this study suggest that the anesthetic agent might have major effects on the pattern of potentially harmful defensive airway reflexes.

■ Mechanisms of Rapacuronium's Detrimental Airway Effects Investigated. Jooste *et al.* (page 1195)

Rapacuronium can lead to life-threatening bronchospasm, and was removed from practice shortly after its introduction in the clinical setting. To determine the specific mechanism by which the blocking agent contributes to fatal bronchospasm, Jooste *et al.* performed a series of experiments on intact guinea pig tracheal rings. Such information could be useful as researchers develop and test new neuromuscular blocking agents. Building upon their own and others' investigations, the team postulated that rapacuronium's detrimental airway effects occur as a result of interactions with muscarinic receptors, allergic reactions, or histamine release.

Tracheal rings in organ baths were exposed to clinical concentrations of muscle relaxants, with or without subthreshold concentrations of acetylcholine, and airway smooth muscle force was measured. The team performed antagonism of muscarinic, histamine, neurokinin, leukotriene receptors, or blockade of L-type calcium channels or depletion of nonadrenergic, noncholinergic neurotransmitters.

Rapacuronium contracted tracheal rings when in the presence of acetylcholine, but not in the absence of it. The agent's allosteric action was demonstrated by the slowing of atropine-induced dissociation of [^{3}H]N-methylscopolamine. It appears that positive cooperativity at the M3 muscarinic receptor is unique to rapacuronium. The agent did not affect the other tracheal receptors. These findings should be considered in the evaluation of the airway safety of any new neuromuscular blocking agents developed for clinical practice.

■ Can Nonsteroidal Antiinflammatory Drugs Reduce Morphine Requirements in Early Postoperative Period? Cepeda *et al.* (page 1225)

In their randomized, controlled, and double-blind trial, Cepeda *et al.* devised a direct comparison of the efficacy of morphine and the nonsteroidal antiinflammatory drug ketorolac to treat postoperative pain in the postanesthesia care unit. From May 2003 until November of 2003, the researchers recruited 1,003 adult patients between the ages of 18 and 60 to participate in the study. Upon arrival in the postanesthesia care unit, patients were asked to describe their pain (none; mild; moderate; or severe). If their pain was at least moderate, patients were randomized to receive an infusion of 30 mg intravenous ketorolac or 0.1 mg/kg morphine over 3-5 min. Patients' pain was then assessed every 10 min after administration of analgesic, using the 0–10 numerical rating score.

If pain intensity was 5 or higher 30 min after initiation of analgesic infusion, patients in both groups received a bolus of 2.5 mg intravenous morphine every 10 min until their pain intensity decreased to 4 or less. This regimen meant that one group of patients received only morphine and the other group received ketorolac followed by morphine. Observers blinded to patient drug assignment conducted the clinical evaluations. In addition to pain intensity, patients were asked to rate the presence and severity of sedation, nausea, vomiting, pruritus, and dizziness.

Results showed that 50% of the patients in the morphine group achieved a 50% or greater decline in pain intensity *versus* 31% of patients in the group initially receiving ketorolac. The incidence and severity of side effects were higher in the morphine group, although the occurrence of nausea and vomiting was similar in both groups. Even though historic data from meta-analyses have yielded similar numbers needed to treat for opioids and nonsteroidal antiinflammatory drugs, these authors found in a head-to-head comparative study in the postanesthesia care unit that morphine was a more efficacious analgesic. However, adding nonsteroidal antiinflammatory drugs to the opioid treatment reduced morphine requirements and opioid-related side effects in the early postoperative period.

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