◇ This Month in

ANESTHESIOLOGY

■ Effects of Sleep Deprivation on Anesthesiologists' Performance Studied. Howard *et al.* (page 1345)

Sleep deprivation decreases reaction time, increases response time variability, and increases the likelihood of falling asleep on the job. Howard *et al.* hypothesized that performance patterns during a long anesthetic procedure would be different for anesthesiology residents who were sleep deprived as opposed to well rested.

Accordingly, the team devised a study to test the performance of anesthesiology residents during routine, long surgical cases after different sleep conditions. Each of 12 anesthesia residents recruited for this study performed a 4-hour anesthetic on a simulated patient the morning after one of two sleep conditions: extended sleep and sleep deprivation. The extended sleep condition consisted of an increase in nocturnal sleep time by allowing study participants to arrive at work at 10 AM for 4 consecutive days. Sleep deprivation was accomplished by keeping participants awake for at least 25 h, performing a regular day's work in the operating room, and then completing a pseudocall night while being monitored by an investigator, who ensured that they did not fall asleep.

The two simulated sessions, of laparoscopic surgery cases, were conducted no more than 30 days apart. Participants were given 20 min to set up their anesthesia equipment and were allowed to interview the simulated patient. An investigator played the role of surgeon, and a retired operating room nurse was also present. Prescripted events (bronchospasm, atrial fibrillation, myocardial ischemia, and atelectasis) were initiated at predetermined but randomly distributed intervals throughout the case. In addition, investigators also included "vigilance probes" to test subjects' alertness: illumination of a red light next to the physiologic monitor; a sudden change of the normal arterial waveform to a flat line reading 0 mmHg; and a ramp up or down of either blood pressure or heart rate.

In addition to undergoing a battery of psychomotor tests before the cases, participants were videotaped during the entire procedure. A total of 96 h of videotape were analyzed by a trained observer, who identified tasks that were later grouped by custom software into 37 categories. After sleep deprivation, subjects' Total Mood Disturbance was worse than after the extended sleep conditions. Performance on probed recall memory and psychomotor vigilance task tests were significantly worse in the deprived, as opposed to extended sleep condition. There was no significant difference in the way residents managed clinical situations (machine checks, induction, detecting abnormal clinical events), but those in the sleep-deprived condition had lower alertness scores than those with extended sleep. Given its small number of subjects, low statistical power, and use of simulated patients, the study should be considered a pilot study, according to its authors. They recommend that future investigations include anesthesiologists from different age groups to determine whether work practices for older clinicians should be modified.

■ Plasma Concentrations Determined During Intra-Amniotic Administration of Sufentanil in Sheep. Strumper *et al.* (page 1400)

The growth of fetal surgery has increased the need to achieve adequate analgesia in the fetus without measurably increasing anesthetic concentrations in the mother. To investigate whether intra-amniotic administration of analgesics might induce greater concentrations in the fetus than in the mother, Strumper *et al.* used an instrumented pregnant sheep model. After placement of arterial and venous catheters in 10 ewes and their fetuses, the investigators monitored maternal and fetal vital signs, blood gases, and uterine blood flow after 25- or 50-μg doses of sufentanil administered intra-amniotically. Experiments using the two dosages were separated by at least 48 h. Maternal mean arterial blood pressure, heart rate, amniotic fluid pressure, fetal mean arterial blood pressure, and heart rate were recorded at baseline and at set intervals after injection of the test compound. All animals were euthanized after the last experiment and fetal body weights were obtained. Mean fetal body weight at autopsy varied between 2.5 and 5.0 kg, resulting in a dosage of 7.5 μg/kg and 15.0 μg/kg sufentanil, respectively.

Fetal and maternal sufentanil plasma concentrations were later determined using mass spectrometry. Significantly greater plasma concentrations were obtained in the fetal lamb than in the ewes, indicating preferential delivery of the drug to the fetus. The authors found that the 25-μg dose of sufentanil did not affect either maternal or fetal hemodynamics, whereas fetal heart rate did increase after administration of 50 μg sufentanil. Given that instruments must be placed in the amniotic cavity to facil-

itate intrauterine surgical procedures, this method of delivering anesthetic to the fetus bears further investigation.

■ Does Intravenous Regional Anesthesia Increase Tolerance to Tourniquet Pain? A New Model. Hartmannsgruber *et al.* (page 1427)

Hartmannsgruber *et al.* investigated the addition of ketorolac to ropivacaine in an effort to improve tolerance to tourniquet pain for patients scheduled for upper and lower limb surgical procedures. The team used a new model of simultaneous bilateral intravenous regional anesthesia to the upper arm with ropivacaine in 10 healthy volunteers. After bilateral inflation of proximal tourniquet cuffs, volunteers received 30 ml ropivacaine 0.2% combined with 2 ml of normal saline in one arm, and 30 ml of ropivacaine 0.2% combined with 30 mg of ketorolac in the contralateral arm. Investigators were blinded to the study solutions, which had been provided by the hospital pharmacy.

Measurements of participants' response to pain stimuli (pinprick and tetanic stimulation) were performed before and every 5 min during tourniquet inflation, as well as at set intervals after release of the distal tourniquet. Study subjects rated their pain on a verbal numeric scale (0–10). Onset of surgical anesthesia was defined as a VNS of 5 or less to the tetanic stimulus, and anesthesia was complete when the score reached 0. Other measurements included noninvasive blood pressure, ECG, and pulse oximetry. Adding ketorolac to the ropivacaine did not increase participants' tolerance for tourniquet pain. Following release of the distal tourniquets, half of the volunteers experienced mild dizziness. The authors believe that their simultaneous bilateral intravenous regional anesthesia model might aid further research into additional additives to local anesthetic solutions for bloodless limb surgery.

■ Exploring Hormone Mediation of Systemic and Intrathecal Effects of Morphine. Shin *et al.* (page 1467)

Studies have shown that opioids given intrathecally during the first stages of labor are more effective than those administered systemically. Shin *et al.* set out to determine whether the reduction in morphine efficacy observed with systemic administration reflects a reduction in opioid action in the spinal cord. They hypothesized that estrogen would not reduce the efficacy or potency of intrathecal injection of morphine intended to inhibit the visceromotor response to uterine cervical distension (UCD).

The team first performed ovariectomies in female Sprague-Dawley rats and randomized the animals to receive either placebo or estrogen replacement using a 21-day sustained-release estradiol pellet. The animals were allowed to recover for 1 week before the start of the experiments. Rats were anesthetized and the electromyographic response in the rectus abdominus muscle to UCD was recorded with and without cumulative dosing of intrathecal morphine. The authors found that the stimulus-response relationship between UCD and reflex muscle contraction was not altered in the rats receiving estrogen replacement. Intrathecal morphine reduced the visceromotor reflex response to UCD in a dose-dependent manner, unaffected by estrogen supplementation.

The data suggest that intrathecal morphine can effectively reduce the visceromotor response to UCD, and that the reduction in efficacy of systemic morphine does not reflect a reduction of morphine efficacy at the spinal level.

Gretchen Henkel