◇ This Month in

ANESTHESIOLOGY

■ Shedding Light on Brain Function and Antinociception during the Hypnotic State. Faymonville *et al.* (page 1257)

Faymonville *et al.* selected 11 healthy volunteers (4 women, 7 men) who scored high on the Stanford Hypnotic Susceptibility Scale to participate in a study exploring the mechanisms of pain perception during the hypnotic state. Semi-structured interviews conducted during the selection process yielded information about the subjects' "pleasant life experiences" that were later used for the mental imagery portion of experimental sessions. For purposes of the study, hypnosis was defined by the presence of slow ocular movements in isolation or interspersed with rapid eye movement shifts; relaxed body posture; and response by a prearranged foot movement to verbal cue.

The volunteers were subjected to stimulation, both non-noxious (with warm water) and noxious (hot water, at about 47°C), during three different states: at rest (immobile, and told to "empty their mind"); while imagining a pleasurable memory; and during a hypnotic state. Two PET scans were performed during each of the six conditions, for a total of 12 scans per volunteer. Immediately after each scan, subjects were asked to rate the intensity and unpleasantness of the stimulus on a scale from 0 to 10. The order of the resting and mental imagery states was varied, but to avoid multiple hypnotic inductions, the fifth to eighth scans were performed in all subjects while they were under hypnosis.

Both pain sensation and unpleasantness of the noxious stimuli were reduced by hypnosis. The PET scans revealed an increase in regional cerebral blood flow in the thalamic nuclei, anterior cingulate, and insular cortices after noxious stimulation. An interaction analysis of the scans showed that the activity in the mid cingulate cortex related differently to pain perception and unpleasantness during the hypnotic state.

■ Does Diabetic Neuropathy Increase Risk of Intraoperative Hypothermia? Kitamura *et al.* (page 1311)

In normal patients, progression of core hypothermia after induction of general anesthesia is usually halted by reemergence of thermoregulatory vasoconstriction. In diabetic patients with impaired peripheral neurovascular function, this thermoregulatory mechanism may not reappear. To determine the extent to which diabetic patients may be at greater risk of intraoperative hypothermia, Kitamura *et al.* compared the threshold for intraoperative vasoconstriction in diabetic and nondiabetic patients scheduled for elective abdominal surgery.

The diabetic (n = 27) and nondiabetic (n = 36) patients were divided into younger (less than 60 years old) and older (more than 60 years old) groups. Autonomic function was assessed in all participants before the study using three standard noninvasive tests: heart rate variation at deep periodical breathing, Valsalva's maneuver, and head-up tilt. Anesthetic techniques were standardized for each patient, using fentanyl/propofol for induction and vecuronium to facilitate endotracheal intubation. Intraoperative monitoring included blood glucose levels, core temperature measured continuously at the tympanic membrane, mean skin temperature, and fingertip blood flow. Patients were covered with a single surgical drape in a 23°C environment, and rewarmed after the study with a forced-air warmer. Most of the procedures (70–90%) lasted more than 2 h, with mean blood loss at 265 ml. Changes in core temperature were similar in all groups at 75 min after induction of anesthesia, but from 120 min onward, the core temperature of diabetics with previously established autonomic dysfunction was significantly lower, decreasing to 34.6°C at 180 min. The researchers found that the vasoconstriction threshold decreased in relation to autonomic insufficiency in the diabetic patients. Thermoregulatory vasoconstriction was also more inhibited in the elderly than in the younger control patients.

By combining three tests of autonomic response, the authors believed they obtained a higher specificity for defining dermatosympathetic responses in diabetics. Accordingly, a simple form of autonomic screening combined with the clinical history might provide useful information to the anesthesiologist when planning anesthetic management of the diabetic patient.

■ Contributing Factors to Core Hypothermia during Spinal Anesthesia. Frank *et al.* (page 1330)

Although body temperature is not commonly monitored during regional anesthesia, a study by Frank *et al.* suggests there may be situations in which monitoring is warranted. In 44 patients scheduled for radical retropubic prostatectomy, the team monitored core temperature of all patients before spinal anesthesia, at 15 min

after spinal, at two intervals after removal of the prostate, and then at set intervals in the post anesthesia care unit. They also assessed the following clinical variables as possible predictors of core temperature reductions: duration of surgery, ambient operating room temperature, body mass, body mass index, percent body fat, age, and spinal block height.

The mean core temperature of patients when admitted to the post anesthesia care unit was 35.1 ± 0.6°C. A high spinal block and increasing age were the best predictors of hypothermia. The duration of surgery, ambient operating room temperature, body mass, and body fat were not predictors of hypothermia, but the study was not large enough to conclusively rule out these factors. Vasomotor tone and shivering are inhibited below the level of spinal block, so the greater the proportion of the body that is blocked, the greater the level of thermoregulatory dysfunction that can be expected. Controlling and monitoring body temperature in older patients and in those with high spinal blocks could decrease risk of hypothermia and its complications.

■ Does P-glycoprotein Limit Opioid-induced Analgesia *In Vivo*? Thompson *et al.* (page 1392)

P-glycoprotein, a transmembrane protein, was first identified in tumor cells, but is also present at the luminal borders of other normal tissues, including intestinal and bronchial epithelium, and renal tubules, where it acts to either secrete xenobiotics or to prevent their absorption. P-glycoprotein has also been identified in mouse, rat, bovine, and human brain capillary endothelium, and believed to be a vital component of the blood–brain barrier.

The team of Thompson *et al.* used P-glycoprotein knockout mice and wild-type mice to determine whether P-glycoprotein limits opioid-induced analgesia *in vivo*. After baseline assessment of thermal analgesia using the animals' response to the standard hotplate test, each mouse received subcutaneous injections of morphine, morphine-6-glucuronide (M-6-G), methadone, fentanyl, and meperidine. Morphine was studied at doses of 1, 5, 10, and 20 mg/kg in the wild-type mice and 1, 3, and 5 mg/kg in the knockout mice; M-6-G at doses of 1, 3, and 5 mg/kg in both groups of animals; methadone at 5 mg/kg; fentanyl at 50 μg/kg; and meperidine at 50 mg/kg. Hot plate tests were repeated and each animal's latency to hind paw licking behavior was recorded. The effect of cyclosporine (100 mg/kg), a P-glycoprotein inhibitor, on morphine analgesia in both types of mice was also assessed in separate experiments.

Morphine induced greater analgesia in knockout mice than in wild-type mice; morphine brain concentrations were also greater in knockout mice. The authors also verified greater analgesia in knockout mice with methadone and fentanyl, but not with meperidine or M-6-G. Pretreatment with cyclosporine significantly increased analgesia in wild-type mice but had no effect in knockout mice. Results suggest that, at least in mice, P-glycoprotein limits morphine entry into the brain.

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