◇ This Month in

ANESTHESIOLOGY

■ Effects of Positioning and General Anesthesia on Intraocular Pressure Examined. Cheng *et al.* (page 1351)

Episodes of visual loss after spine surgery seem to be related to changes in hemodynamics affecting optic nerve perfusion. The balance between the opposing effects of general anesthesia and prone positioning may have a role in net ocular perfusion pressure, defined as the difference between mean arterial pressure and intraocular pressure (IOP). Cheng *et al.* studied 20 patients scheduled to undergo spine surgery in the prone position to understand the contributions of IOP to the "ocular perfusion pressure puzzle."

Using a handheld tonometer, investigators obtained baseline IOP readings of patients in the supine position before premedication. Anesthesia was standardized for all patients. Mean arterial pressure was kept within 20% of awake value, and ventilation was adjusted to keep end-tidal carbon dioxide in the range of 30–35 mmHg throughout the intraoperative period. Ten minutes after intubation, the IOP was again measured, with patients in the supine position.

Patients were then turned to the prone position. Their heads were held in a neutral position using pin fixation to avoid extraocular pressure. Neck flexion and extension were limited to less than 15° from horizontal. IOP was then measured before incision in the prone position, at conclusion of surgery in the prone position, and in the supine position before reversal of muscle relaxants and emergence from anesthesia. In addition to standard monitoring, length of time in the prone position was recorded for each patient, as was hematocrit, preoperatively and postoperatively. Patients were asked about any vision changes or eye discomfort in the recovery room.

The authors found that the prone position increases IOP in anesthetized patients, suggesting that a concurrent decrease in mean arterial pressure could be deleterious to the eye. Because none of the study participants experienced postoperative visual loss, the authors were unable to draw conclusions about the possible role of IOP in intraoperative visual loss. There was a direct correlation between the amount of time spent in the prone position and the magnitude of the last prone IOP measurement, suggesting a linear relation. Hemodynamic and ventilatory parameters remained unchanged while patients were in the prone position.

■ Sheep Lung Injury Model Used to Study Effect of Vaporized Perfluorocarbon. Hübler *et al.* (page 1414)

After inducing lung injury in nine anesthetized sheep with oleic acid injection, Hübler *et al.* randomized the sheep to one of two ventilation protocols. Animals in the treatment group (n = 4) were ventilated for 30 min with vaporized perfluorocarbon using a modified isoflurane vaporizer. The remaining animals (n = 5) served as controls. The multiple inert gas elimination technique was used to assess gas exchange at five time points during the experiments: at baseline, at time of oleic acid–induced injury, and at 30, 60, and 120 min after injury. Exhaled gas specimens were collected and maintained at a temperature of less than 40°C before analysis to avoid condensation. Concentrations of inert gases were measured using gas chromatography.

Changes in relative pulmonary blood flow ($\dot{Q}_{rel}$) were assessed using fluorescent-labeled microspheres injected at the same time intervals as gas specimen measurements. The sheep were killed at the conclusion of experiments, and their lungs were excised, dried, and coated with foam to facilitate core slicing. Samples were then examined for presence of fluorescence using a luminescence spectrophotometer. Animals treated with perfluorocarbon vapor showed improved gas exchange by a higher ventilation/perfusion ratio than the control animals. The microsphere data revealed a redistribution of $\dot{Q}_{rel}$ due to oleic acid injury. The $\dot{Q}_{rel}$ shifted from initially high-flow areas to areas that had been low-flow, and this was true of both experimental and control group animals. After lung injury, $\dot{Q}_{rel}$ in the control animals was redistributed to the nondependent lung areas, whereas in the animals receiving perfluorocarbon, there was no change in $\dot{Q}_{rel}$ redistribution.

■ Susceptibility of Nerve Fibers to Local Anesthesia: "Size Principle" Challenged. Gokin *et al.* (page 1441)

Gokin *et al.* studied features of conduction blockade in different classes of rat sciatic nerve fibers after injection of lidocaine *via* procedures resembling those used inhumans. Thirty adult male Sprague-Dawley rats were ini-

tially anesthetized with either urethane or pentobarbital. Longitudinal skin incisions were made to rats' posterior right hind legs. In each rat, the sciatic nerve and its main branches (posterior tibial, common peroneal, and sural nerves) were exposed. Impulses in different classes of sensory axons (large, Aα, Aα/β; small, Aδ myelinated fibers and unmyelinated C fibers) and motor axons (large, Aα; small, Aγ myelinated fibers) were recorded and classified by conduction velocity. The sciatic nerve was stimulated distally, and impulses were recorded from small filaments teased from the L4–L5 dorsal and ventral roots sectioned from the spinal cord. Lidocaine, in concentrations ranging from 0.05 to 1%, was injected at the sciatic notch. The team then assessed both tonic and use-dependent impulse inhibition by lidocaine.

The minimal effective lidocaine concentrations (capable of blocking conduction in 10% of fibers) ranged from 0.03 to 0.1% for sensory and 0.03 to 0.05% in motor fibers. The overall order of fiber susceptibility (ranked by the concentration needed to block conduction in 50% of fibers) was Aγ > Aδ = Aα > Aα/β > C. Compound action potentials recorded simultaneously from both large myelinated sensory and motor sciatic nerve fibers showed no difference in the degree and rate of tonic block at relatively high lidocaine concentrations (0.25–1%). However, at lower concentrations of lidocaine, large motor fibers were suppressed significantly more than large sensory fibers. Faster-conducting C fibers were more susceptible to lidocaine block than slower ones. The researchers concluded that susceptibility to lidocaine does not always follow the generally accepted size principle, *i.e.*, that susceptibility to local anesthesia depends inversely on fiber diameter.

■ Elucidating Links between Cardiopulmonary Bypass and Neurocognitive Function in the Rat. Mackensen *et al.* (page 1485)

After using identical surgical preparations and anesthetics in a group of 20 rats, Mackensen *et al.* then randomized the animals to receive either cardiopulmonary bypass (CPB) or a sham operation without CPB. All animals were allowed to recover and, within 24 h after CPB or sham operation, underwent testing that included assays of prehensile traction, strength, and balance beam performances. The animals were graded on a 0–9 scale (9 = best) and then tested again on the 3rd and 12th postoperative days. Beginning on the 3rd postoperative day, an investigator blinded to group assignment began behavioral testing of the rats in the Morris water maze to evaluate neurocognitive outcomes after CPB and sham operations. The time to locate a submerged platform was measured to test for impairment of visuospatial learning and memory. Rats underwent daily testing with four trials per testing period until the 12th postoperative day, when all were killed.

The rats that had undergone CPB had worse neurologic outcomes compared with sham-operated control group rats on the 1st, 3rd, and 12th postoperative days. Rats in the CPB group also had longer water maze latencies compared with controls, although the rats' average swimming speeds, evaluated with a video tracking system, did not differ between groups. Histologic analysis of brain sections with light microscopy revealed no difference between the two groups of rats regarding the amount of necrosis observed in hippocampal neurons. Use of this rodent model of CPB may allow advances in the understanding of clinical neurocognitive injury often associated with CPB.

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