

ANESTHESIOLOGY

■ Effects of Combined Transdermal Nitroglycerin and Low-dose Intrathecal Neostigmine during Gynecologic Surgery. Lauretti *et al.* (page 943)

Lauretti *et al.* conducted a prospective, placebo-controlled, double-blind trial to assess whether transdermal nitroglycerin would enhance analgesia in patients administered single doses of intrathecal neostigmine during gynecologic surgery. Forty-eight women scheduled for vaginoplasty were randomized to one of four groups: the control group, administered spinal saline and transdermal placebo; the neostigmine group, administered spinal neostigmine and transdermal placebo; the nitroglycerin group, administered spinal saline and a transdermal nitroglycerin patch; or the neostigmine-nitroglycerin group, administered spinal neostigmine and transdermal nitroglycerin.

All patients were premedicated with 0.05–0.1 mg/kg intravenous midazolam and hydrated with 10 ml/kg Ringer's lactate solution preoperatively and after spinal anesthesia. All drugs, both intrathecal and transdermal, were prepared by one anesthesiologist and administered by a second anesthesiologist who was blind to drug preparation. Twenty to 30 min after spinal puncture and hemodynamic stabilization, patches of 5 mg nitroglycerin or placebo were applied at the thorax (ventrally, between T2–T4). Blood pressure, heart rate, and oxyhemoglobin saturation were monitored continuously throughout surgery. Patients scored their levels of nausea with a visual analog scale N intraoperatively, and pain scores and duration of block were assessed postoperatively. Pain was also assessed at the time of first rescue analgesic and 24 h after time of spinal puncture by an anesthesiologist blind to treatment assignment. The group of patients administered neostigmine and nitroglycerin required less rescue analgesic in 24 h than did the control group. The combined treatment also resulted in a longer time to first rescue analgesic (average, 14 h) than in all other groups. Neither intrathecal neostigmine alone nor transdermal nitroglycerin alone delayed the time to first rescue analgesics. None of the patients experienced nausea or vomiting intraoperatively. Episodes of vomiting occurred postoperatively in only one or two patients in three of the four treatment groups. Results from this study suggest that, at the dose studied, neostigmine and nitroglycerin may enhance the antinociceptive effects of each other.

■ Use of Cerebral Oximeters during Carotid Endarterectomy Is Evaluated. Samra *et al.* (page 964)

Samra *et al.* evaluated the ability of the INVOS-3100 cerebral oximeter to detect cerebral ischemia induced by carotid cross-clamping in 99 patients undergoing carotid endarterectomy (CEA) during cervical plexus block. All patients had high-grade carotid artery stenoses (>70%) and were scheduled to undergo CEA during regional anesthesia. In addition to continuous monitoring of blood pressure, hemoglobin saturation, and regional cerebrovascular saturation (rSO₂), bilateral rSO₂ was monitored simultaneously using two cerebral oximeters, with sensors were applied to both sides of patients' foreheads. All rSO₂ readings were stored on a computer for later off-line analysis. Minimal sedation with midazolam was administered before the cervical plexus block; additional 25–50 mg fentanyl was administered intravenously if patients were apprehensive. Neurologic function was assessed at 5-min intervals during occlusion by eliciting patient responses to verbal commands. Duration of carotid cross-clamp, development of any changes in neurologic function, and need for any time of insertion of shunt were recorded. Surgeons were not aware of the rSO₂ values during the operation and did not base their clinical management on the readings.

For analysis purposes, the rSO₂ data were divided into preclamp, cross-clamp, and postclamp phases, and mean values were calculated for each. At the end of the study, patients were assigned to one of two groups: those who did not show a change in neurologic function and those who did. Data from 94 operations were adequate for group comparisons. The mean decrease in rSO₂ after carotid occlusion was significantly greater in the group of patients who had neurologic symptoms (n = 10) than in the group with no symptoms. Researchers also analyzed whether a change in rSO₂ could be used to predict change in neurologic function. They found that a 20% decrease in rSO₂ reading from the preclamp baseline resulted in a sensitivity of 80% and a specificity of 82.2% as a predictor of neurologic compromise. However, the false-positive rate using this cut-off point was 66.7%. The positive predictive value was 33.3%, and the negative predictive value was 97.4%, which suggests that monitoring rSO₂ with a cerebral oximeter does not effectively predict the impending development of cerebral ischemia.

■ Researchers Address Effect of Sodium Bicarbonate on Peripheral Nerve Block Performed with Lidocaine in Rats. Sinnott *et al.* (page 1045)

Using five lidocaine solutions prepared from crystalline lidocaine HCl (0.5%) or commercial lidocaine at concentrations of 0.5% and 1.0%, Sinnott *et al.* performed sciatic nerve blocks on 15 groups of 9 to 10 rats. An additional six groups of four rats each were administered percutaneous injections of 100 ml of one of six control solutions. The authors' goal was to assess the effects on duration of block when lidocaine was alkalinized with sodium bicarbonate (BC). Analgesia was measured every 2 min in the ipsilateral limb for up to 40 min after injection and every 10 min thereafter. Analgesia was reported as the mean withdrawal response to deep pinch \pm SD. Duration of block was defined as the time until response to pinch returned to a value of 3. Time of onset was the time for the response to pinch to reach a value of 2 from a normal response of 4.

In part 1 of the experiments, researchers compared the effects of alkalinization by BC *versus* sodium hydroxide (NaOH) to pH 7.8 on 0.5% lidocaine, with and without epinephrine, prepared from crystalline salt. They used 0.5 and 1.0% commercial lidocaine solutions, with and without epinephrine, in part 2 of the experiments, comparing effects of unalkalinized solutions with those of solutions alkalinized with BC or NaOH. In solutions alkalinized with NaOH, pH was adjusted to 7.8.

Results of tests in part 1 showed that adding NaOH or BC to 0.5% lidocaine without epinephrine produced a faster onset than did unalkalinized lidocaine, but that degree or duration of block was not affected. Solutions containing epinephrine produced no differences in onset, degree, or duration of block with BC- or NaOH-alkalinized lidocaine. In part 2, using commercial lidocaine solutions, researchers noted that adding BC decreased the degree and duration of block by 25% compared with unalkalinized lidocaine, and by more than 50% compared with lidocaine alkalinized with NaOH. In the lidocaine solutions containing epinephrine, BC hastened onset of block without affecting degree and duration, compared with unalkalinized solution.

Although sodium bicarbonate may reduce onset time, as shown in this study, it also decreases the degree and duration of analgesia. The authors call for further clinical investigation to illuminate the role of sodium bicarbonate alkalinization of plain lidocaine and lidocaine con-

taining epinephrine in the quality of peripheral nerve block.

■ Complications from Dye Injected during Sentinel Node Biopsy Surface. Vokach-Brodsky *et al.* (page 1002); Lyew *et al.* (page 1145); Rizzi *et al.* (page 1146)

Sentinel node biopsy is used increasingly in the surgical management of various malignancies. In this issue of ANESTHESIOLOGY, three groups of authors report a variety of complications after injection of isosulfan blue (IB) dye used to identify sentinel lymph nodes.

Before their prospective study, Vokach-Brodsky *et al.* noted a prolonged decrease in SpO_2 readings when using IB. The authors then enrolled 33 women with invasive breast cancer scheduled for sentinel lymph node biopsy using IB or IB with technetium sulfur colloid. The majority of patients were administered general anesthesia and 5 ml IB dye, 1%, was injected into the breast tissue around the tumor or previous breast biopsy cavity. Pulse oximetry readings were recorded continuously for up to 130 min after injection of the dye. SpO_2 values were significantly different from baseline values at 5, 10, 20, 30, 40, 50, and 60 min post-IB dye injection, leading the authors to conclude that administration of 50 mg IB causes significant interference with SpO_2 . In a typical patient, a maximal SpO_2 decrease of 3% occurred 25 min after injection of the dye.

In the third report, Lyew *et al.* describe a 48-yr-old woman scheduled for sentinel node biopsy and excision of a ductal carcinoma of the left breast. Technetium sulfur colloid was injected near the lump 2 h before surgery, which was performed during general anesthesia. Five minutes after injection of 1% IB in four quadrants around the breast mass, the patient's blood pressure decreased to 75/30 mmHg, with a heart rate of 80 beats/min and an SpO_2 of 94 to 95%. She was administered a total of 50 mg ephedrine, which raised her heart rate but did not affect her blood pressure. Fifty milligrams diphenhydramine, 1 g methylprednisolone, and 20 mg famotidine were administered; blood pressure was maintained at 85-90/40-50 mmHg with repeat doses of phenylephrine. After 15 min, her blood pressure increased (as did heart rate, to 100 beats/min), and the surgeons were able to proceed with axillary lymph node dissection. Her facial swelling receded by the following morning. Four weeks later, intradermal skin testing with 0.02 ml IB, 0.1%, yielded a 5-mm wheal within 20 min. This case highlights the need to suspect anaphy-

laxis when hemodynamic instability occurs after injection of IB dye.

Rizzi *et al.* report two cases of factious desaturation occurring after injection of IB dye in 31 sentinel node biopsy procedures. In a 58-yr-old woman, the SpO₂ decreased quickly to 91% 8 min after injection of 5 ml IB dye, returning to baseline 45 min later. In a 50-yr-old woman, the SpO₂ decreased to 89% 12 min after injection

of the dye. Her reading, too, returned to baseline 25 min after the initial event. After these two cases, one of the authors volunteered to participate in an informal experiment and was injected with the dye *via* a peripheral venous line. An SpO₂ of 94% was obtained after administration of 0.5 ml IB dye, and this decreased to 89% after 1.0 ml dye was injected.

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