

ANESTHESIOLOGY

■ Detecting Intraoperative Venous Air Embolism in Children Undergoing Craniosynostosis Repair. Faberowski *et al.* (page 20)

Children undergoing craniectomy for repair of craniosynostosis may be especially at risk for venous air embolism (VAE). Evolving surgical procedures are more involved and entail greater blood loss, further exacerbating this risk. Faberowski *et al.* conducted a prospective study using precordial Doppler to continuously monitor children during surgery for changes characteristic of VAE. From August 1, 1996 to October 1, 1998, 23 children undergoing surgical repair for craniosynostosis were enrolled in the study.

Anesthesia was maintained with isoflurane or halothane in oxygen and air. After patients were positioned for their surgical procedures, the Doppler was secured and its placement verified by observation of characteristic tones following IV injection of 5-10 ml of agitated saline. The audio recording of Doppler tones was later reviewed by a neuroanesthesiologist blinded to intraoperative events.

VAE episodes were noted and correlated with data regarding blood pressure and end-tidal CO₂, and their severity graded on a scale of I-III. If hemodynamically significant changes were noted intraoperatively, therapeutic measures, including administration of fluid, packed red blood cells, bone wax, and flooding the surgical field, were employed. None of the patients developed cardiovascular collapse.

Of the 23 patients in the study, 19 (82.6%) demonstrated 64 episodes of VAE. Six patients (31.6%) had hypotension associated with VAE, and 32 episodes of hypotension were noted in 8 patients. Only one-third of the total episodes of intraoperative hypotension were associated with VAE. Children undergoing craniectomy in the supine position may be more predisposed to VAE than adults, because their heads are larger in comparison to total body weight, and because the volume of entrained air is greater in comparison to their cardiac volume. Preemptive placement of a precordial Doppler appears to be a safe, noninvasive method for early detection of VAE and may expedite institution of therapeutic maneuvers.

■ Does Aging Influence Bispectral Index and 95% Spectral Edge Frequency? Katoh *et al.* (page 55)

Although studies have noted an inverse relationship between age and anesthetic or hypnotic requirement for

sevoflurane and isoflurane, the influence of patient age on bispectral index (BIS) or 95% spectral edge frequency (SEF) has not been documented. Accordingly, Katoh *et al.* designed a study to determine the influence of age on hypnotic requirement, BIS and 95% SEF associated with sevoflurane-induced sedation.

The 96 patients included in the study were assigned to three separate age groups — 18 to 39, 40 to 64, and 65 to 80 — of 32 each. Scheduled for elective surgery, patients fasted for 8 hours but received no premedication. EEG parameters, including BIS and 95% SEF, were recorded continuously throughout the study, and serial output files were collected on a personal computer.

Patients breathed through a face mask connected to a semiclosed circuit, and gas was drawn continuously from the sampling port located between the face mask and the dead space. Concentrations of carbon dioxide, sevoflurane and oxygen were also measured continuously, using an infrared gas analyzer. Patients were sedated with sevoflurane; after maintaining target CO₂ concentrations of between 35 and 45 mmHg for 15 minutes, depth of sedation was assessed using the OAA/S rating scale. Assessments were performed twice per patient at different sevoflurane concentrations, by an observer blinded to the sevoflurane concentration. Multiple regression analysis of the data showed that end-tidal sevoflurane concentration and age significantly affected both BIS and 95% SEF. However, the researchers also found that during sevoflurane, aging reduced MA-Cawake, but did not change BIS and 95% SEF associated with response to a verbal comment. They conclude that in a population with a wide age range, BIS would predict depth of sedation better than end-tidal sevoflurane concentration.

■ Effects of Mild Core Hypothermia on Pharmacokinetics, Pharmacodynamics of Vecuronium. Caldwell *et al.* (page 84)

Using 12 healthy volunteers (6 male, 6 female) Caldwell *et al.* evaluated the influence of temperature on the pharmacokinetics and pharmacodynamics of vecuronium. Anesthesia was induced with alfentanil 30 mcg/kg and propofol 3 mg/kg. Subjects were intubated and anesthesia was maintained with nitrous oxide, 60-70%, in oxygen, and isoflurane 0.7-0.9% end-tidal concentration. Three volunteers were randomly assigned to be studied at each of four core temperature ranges: 37.0 or

greater; 36.0-36.9; 35.0-35.9, and less than 35 C. Core temperatures were manipulated using either forced-air warming or surface cooling, depending upon the desired target temperature.

To measure neuromuscular responses, supramaximal stimuli in a train of four sequence at 2 Hz were applied every 12 seconds via surface electrodes to the ulnar nerve. When temperature was stabilized, vecuronium was infused at $5\text{mcg}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$ until the first response of each TOF had decreased by 70%. For vecuronium analysis, arterial blood was sampled at pre-set intervals until the T1 recovered to at least 90% of its pre-vecuronium level. Vecuronium $20\text{mcg}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$ was then infused for 10 minutes and arterial blood sampled at intervals for up to seven hours from the start of the infusion. Final blood samples and urine samples were collected when subjects emerged from anesthesia. When core temperature decreased from 38.0 to 34.0, the plasma clearance of vecuronium also decreased (11.3% per degree C). The rate of effect site equilibration also decreased, although tissue sensitivity to vecuronium did not appear to be influenced by core temperature. Reduced clearance and rate of effect site equilibration may explain vecuronium's increased duration of action when core temperature is reduced.

■ Who Boosted Acceptance of Obstetric Anesthesia? Caton (page 247)

Many medical historians believe that it was obstetrician James Simpson's championing of obstetric anesthesia and Queen Victoria's later demand for it that influenced its acceptance in clinical practice. However, Caton ar-

gues that another historical figure deserves credit for inclusion of anesthesia in the obstetric armamentarium.

In this issue, he traces the demise of Simpson's arguments for obstetric anesthesia, due mostly to poor anesthetic technique and his own self-promotion, seen as unseemly by the London medical establishment. John Snow, however, conducted extensive experiments with anesthetics, publishing several treatises and books on the subject. Surviving casebooks reveal Snow's techniques for obstetric anesthesia (delaying administration of anesthetic until the second stage of labor and limiting the dose for best results) were more refined than Simpson's.

Furthermore, Snow worked with at least 32 obstetricians, three of whom attended Queen Victoria when Snow anesthetized her. Particularly between 1850 and 1853, the Queen's physicians "had ample opportunity to learn about anesthesia from someone who had mastered the technique." Therefore, Caton contends that the turning point for acceptance of obstetric anesthesia came from the conversion of Snow's colleagues and not from the public announcement of the Queen's anesthetic. Caton analyzed the 28 obstetric anesthetics mentioned in Snow's casebooks to show that there were more of these cases following Queen Victoria's anesthetic than before — 16 compared to two prior, a statistically significant difference. In addition, the social standing of Snow's patients post-Queen Victoria had also changed to include more of London's social elite. The role of Snow has been overlooked, Caton believes, in physicians' acceptance of obstetric anesthesia.

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