◇ This Month in

ANESTHESIOLOGY

■ Postoperative Sleeping Patterns Tracked in Children Undergoing Outpatient Surgery. Kain *et al.* (page 1093)

Kain *et al.* used portable wristwatch-like motion detectors (actigraph technology) to assess pre- and postoperative sleep behavior in children following outpatient surgical procedures. They recruited 77 children from the community to serve as a control group and 92 children scheduled for general anesthesia and outpatient surgery to serve as the study group. To establish their sleep characteristics prior to surgery, the children wore the monitoring devices for three nights prior to surgery. The raw actigraphy data, composed of cumulative counts for all movements *versus* time, were transferred to a computer and analyzed to yield total sleep period, percentage of actual sleep, true sleep time, number of night awakenings, and number of night awakenings lasting more than 5 min.

The community-based control group underwent sleep monitoring for 7 consecutive nights. Parents of both groups of children were asked to complete sleep diaries during the monitoring periods. Both groups also underwent a number of behavioral assessments administered by trained researchers. Information was obtained regarding the child's temperament (Emotionality, Activity, Sociability, Impulsivity [EASI]), baseline behavior, and trait anxiety of the parent (State Trait Anxiety Inventory [STAI]). For the group scheduled for surgery, parents' coping styles were also assessed prior to surgery and while in the preoperative holding area. An independent observer used the modified Yale Preoperative Anxiety Scale (mYPAS) to evaluate each child's behavior upon entering the operating room and upon introduction of the anesthesia mask. For monitoring during the postoperative period, parents attached the actigraph to their children 1 h before bedtime and completed sleep diaries for 5 consecutive nights. Parents also administered the Bieri face scale to assess their child's pain upon awakening. These scores and answers to the Post Hospitalization Behavioral Questionnaire (PHBQ) were collected during telephone calls on postoperative days 1, 2, and 3.

A total of 43 children (47%) in the surgery group experienced sleep disturbances during the first 5 postoperative nights, as determined by either actigraphy or by the PHBQ. In those who experienced postoperative actigraph-based sleep problems, pain scores decreased more slowly. These same children tended to have lower sociability scores on the EASI behavioral instrument. The researchers found little correlation, however, between the PHBQ and actigraphy, since these instruments assess different aspects of the sleep domain. The sleeping problems documented in this study were generally mild and short lived. For children who exhibit more preoperative anxiety, sleep and behavioral disturbances may be prolonged and may have an impact on the child's and their family's quality of life.

■ Does Platelet Polymorphism Contribute to Perioperative Myocardial Injury Following Bypass Graft? Rinder *et al.* (page 1118)

Some researchers have suggested that PI^{A2} polymorphism of the platelet glycoprotein IIIa component of the integrin receptor glycoprotein IIb/IIIa may predispose some patients to increased risk of thrombosis following coronary artery bypass graft (CABG) surgery. Rinder *et al.* conducted a pilot study to explore whether alterations in platelet function produced by PI^{A2} polymorphism might exacerbate the degree of myocardial injury associated with CABG surgery in the early postoperative time period.

The research team determined the PI^{A} genotype of 66 adults undergoing elective CABG at their institution. The genotype distribution paralleled that reported in other studies: 46 patients (70%) were homozygous $PI^{A1, A1}$, 16 (24%) were heterozygous $PI^{A1, A2}$, and 4 patients (6%) were homozygous $PI^{A2, A2}$. Platelet activation status was determined from blood samples drawn at the start of surgery, prior to and immediately after aortic cross-clamp, upon arrival in the ICU, and on the morning of postoperative day 1. Serial blood samples were also drawn at four specific time points for determination of troponin I (cTpnI) concentrations. Cardiac events identified by electrocardiogram were read and classified by two cardiologists blinded to the patients' clinical situations and cardiac enzyme concentration levels. Of the 65 patients with evaluable electrocardiograms, 12 demonstrated evidence of a new post-CABG cardiac event, including one new Q wave, two new rhythm disturbances, and persistent ST segment changes. The difference between patients with A1 and A2 alleles for these electrocardiographically demonstrated events was not statistically significant.

Other results revealed that patients carrying at least one PI^{A2} allele had significantly greater cTpnI concentrations than PI^{A1} homozygotes. However, the authors con-

cede that since blood sampling ended on the first postoperative day, cTpnI concentration surges were also possible later in the postoperative time period. Statistical analysis revealed that the PI^{A2} allele conferred a relative risk of 2.3 for having peak postoperative cTpnI concentrations in the highest 50th percentile. The two PI^{A} allelic groups did not differ significantly with respect to peak platelet activation.

■ Three Reports Explore Influence of Hypovolemia on Propofol Pharmacokinetics. Kazama *et al.* (page 1156), Van Sassenbroeck *et al.* (page 1218), Honan, *et al.* (page 1303)

Conventional clinical wisdom holds that anesthetic doses of propofol should be reduced during hemorrhagic shock and resulting hypovolemia. However, the influence of hypovolemia on the amplitude of plasma propofol concentration has not been fully investigated in continuous propofol infusion. Kazama *et al.* used a stepwise hemorrhagic model in swine to investigate the influence of various levels of blood loss on plasma propofol concentration. After 120 min of steady state infusion of propofol at a rate of 2 $mg \cdot kg^{-1} \cdot h^{-1}$ in nine instrumented swine, the researchers obtained baseline measurements of heart rate, mean arterial pressure, central venous pressure, cardiac output, pH, total protein, hemoglobin, lactate, and arterial blood gases. Hemorrhage was induced by stepwise bleeding of 200 ml every 30 min until 1 h after baseline measurements had been taken. Additional stepwise bleeding of 100 ml was performed every 30 min thereafter until circulatory collapse (defined as persistent low systolic arterial pressure of less than 30 mmHg). Hemodynamic parameters and propofol concentrations were recorded at each step.

Before circulatory collapse, it was possible to drain 976 ± 166 ml of blood (51% of estimated blood volume) from each of the pigs studied. At compensatory shock stage 1, mean blood loss was 556 ml, and the increase in plasma propofol concentration was small. At compensatory shock stage 2, plasma propofol concentration increased by 38%. At the stage of circulatory collapse, plasma propofol concentration increased to 3.75 times its prehemorrhagic value. The magnitude of decrease in infusion rate to maintain a stable plasma concentration appears, therefore, to be dependent on the stage of shock.

In a related investigation, Van Sassenbroeck *et al.* studied the pharmacokinetics and pharmacodynamics of gamma-hydroxybutyrate (GHB) in a hypovolemic rat model. They chose GHB because, in contrast with propofol, it increases blood pressure. The team randomly assigned 32 rats to a hypovolemia or control procedure, after which the rats were subdivided into two groups receiving either an infusion of sodium–GHB (390 $mg \cdot kg^{-1} \cdot 5\ min^{-1}$) or the same volume of an equimolar solution of sodium chloride (6.9%). Arterial blood samples were obtained at regular time points for determination of GHB plasma concentrations, and electrocardiographic measurements were obtained continuously throughout the experiment.

Hypovolemia, induced by removing 30% of each rat's initial blood volume in six increments over 30 min, resulted in significantly lower hematocrit and total plasma protein values but did not influence the overall concentration–time curve of GHB and induced no changes in the electrocardiographic effect. No significant differences were observed in the metabolism of GHB between the hypovolemic and control rats, which contrasts with the marked decrease in clearance observed for propofol. The results may be of some interest since GHB has recently been used as a sedative drug in the ICU setting.

Finally, in a case report submitted by Honan *et al.*, the Bispectral Index (BIS) was an early harbinger of altered drug pharmacokinetics due to hemorrhage. A 70-yr-old woman undergoing elective abdominal aortic aneurysm repair had consented to participate in a clinical investigation of the antioxidant effects of propofol total intravenous anesthesia. Immediately after unclamping, the patient's BIS level decreased rapidly from its steady state value of 35 to a value of 20. Her heart rate and blood pressure remained stable over the next 10 min but then decreased from 120/70 to 65/30, at which time the surgical team also reported major venous bleeding. Despite fluid and inotropic therapy, the patient died from hypotension after 2 h of resuscitation attempts. The authors retained blood samples for analysis and later determined that the final sample drawn following declamping showed a propofol concentration significantly in excess of the target level. The BIS, a processed electroencephalographic variable correlating with depth of hypnosis in general anesthesia patients, is not designed to monitor hemodynamic changes. However, the authors' experience suggests that BIS-derived data may provide useful insights into altered pharmacology, reflecting a "prodromal" change in depth of anesthesia arising from unexpected alterations in drug pharmacokinetics.

■ Survey Conducted of Regional Anesthesia Complications in France. Auroy *et al.* (page 1274)

In order to assess the rate of major complications due to regional anesthesia in France, Auroy *et al.* conducted a 10-month prospective survey of practicing anesthesiologists. Prior to initiating the survey, the team set up a 24-h "hotline" service in which one member of the team would be on call 1 week at a time. A letter mailed to 8,150 French anesthesiologists solicited participants who would voluntarily report all serious adverse events occurring during or after regional anesthesia. For purposes of the survey, serious complications included cardiac arrest, acute respiratory failure requiring tracheal intubation, seizures, peripheral nerve injury, cauda equina syndrome, paraplegia, cerebral complication, meningeal syndrome, or death. Complications described during each telephone call were recorded on a preprinted form, and each expert on call followed up on the reports given. Events were later reviewed by the three experts on the research team and classified according to whether regional anesthesia was related to the event. Participants also received booklets in which to report regional blocks performed.

A total of 487 participants reported 56 major complications out of 158,083 combined regional anesthesia procedures performed during the 10-month study period. Four deaths were reported. Cardiac arrest occurred after spinal anesthesia and posterior lumbar plexus block. In a few cases, systemic local anesthetic toxicity caused seizures but did not cause cardiac toxicity. Lidocaine spinal anesthesia was associated with more neurologic complications than bupivacaine. Most neurologic complications were short lived, but 9 out of 12 occurred when a nerve stimulator was used in conjunction with a nerve block. Based on the results of this prospective survey, the authors estimate that the risk of major complications following regional anesthesia is 3.5 per 10,000 procedures.

Gretchen Henkel