Effects of Prone and Jackknife Positioning on Lumbar Disc Herniation Surgery

Insertion of Laryngeal Mask Airway Does Not Increase the Intraocular Pressure in Children with Glaucoma

A Randomized, Open-Label Study of the Safety and Tolerability of Fospropofol for Patients Requiring Intubation and Mechanical Ventilation in the Intensive Care Unit

“The Paravertebral Lamina Technique: A New Regional Anesthesia Approach for Breast Surgery”
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Objective: Compare intraabdominal and airway pressures in patients undergoing single level lumbar discectomy in either the prone or jackknife position.

This study evaluated the prone (PRO) and jackknife (JAC) positions for patients undergoing lumbar disc surgery. Blood loss, herniated disc volume removed, and length of surgery, lung mechanics and changes in intraabdominal pressure were compared. Included were 40 consecutive patients, ages 18-70 years, ASA I-II, scheduled for elective single-space lumbar discectomy. Exclusion criteria were previous spinal surgery, anticoagulant/antiplatelet therapy, hypertension, obesity (BMI>35) or active cardiac, respiratory, liver or renal disorders.

Patients received a standardized anesthetic; monitoring consisted of standardized modalities, intraabdominal pressures (IAP), urine output and airway parameters.

Demographics were similar; 20 patients were in each group. No significant differences were seen with regard to duration of operation, mean arterial pressure, disc volume, mean and peak airway pressures, tidal volumes, and dead space between groups. Mean and peak airway pressures did increase significantly when patients were repositioned from face-up to face-down; mean arterial pressure did not change more than 10% with position change except in three JAC patients (treated with fluid bolus). Estimated blood loss was 180.0 ± 100 ml with PRO vs. 100.0 ± 63.6 ml with JAC (P=0.018).

IAP was 11.0 ± 3.0 mmHg in PRO vs 8.0 ± 2.0 for JAC (p=0.006). Correlations among IAP, bleeding, surgery duration, disc volume, and patient weight found only 1 significant correlation between IAP and blood loss (p=0.04, r=0.32). In multivariate linear regression testing, a significantly positive relationship was also found between blood loss and IAP (19% of the variability in blood loss was explained by IAP).

Important Findings: JAC positioning for lumbar discectomy was associated with a reduction in IAP and blood loss. More research is indicated.
Objective:
Review the historical and current prospective of venous air embolism.

The author offers a historical and current prospective of venous air embolism (VAE) first described by John Rose Cormack in 1837. More than 50 reports of VAE were made from 1811-1885 with most resulting in death. Two surgeons collaborated to collect and review over 250 case reports of VAE in the late 1800s and were the first to identify the “mill-wheel” murmur and noted the cyanosis, gasping respirations and cardiovascular collapse that are the major signs of severe VAE.

The author was a contemporary of Dr. Peter J. Janetta at the University of Pittsburgh in 1971. Dr. Janetta was the pioneer of the technique for vascular decompression of the 5th cranial nerve to treat tic doloreaux performed with the patient in the sitting position (with knees at the level of heart). Another neurosurgeon, Dr. Joseph Maroon had co-published a paper on the neurosurgical application of the precordial Doppler (PCD) for air-bubble detection. An anesthesia monitoring protocol included the placement of a right atrial line for air aspiration, radial artery line, PCD, end-tidal carbon dioxide analysis, and electrocardiogram.

Their original paper in 1978 delineated in cases where >25.0 ml of air were aspirated through the right atrial catheter, pulmonary perfusion defects were present as long as 11 days postoperatively. An unexpected finding was that VAE could occur in prone (10% of those monitored), supine (7 of 48), and lateral positions (5 of 60) as well as 25% of patients in the sitting position.

Laboratory testing was developed using an artificial right atrial model (described in text) that showed the increased efficacy of a multiorifaced silastic catheter positioned within 2.0 cm below the junction of the superior vena cava and the atrial chamber at an inclination of 80 degrees (allowed as much as 80% aspiration of air). Results confirmed the need for rapid response when Doppler activation and/or decreased end-tidal carbon dioxide occur or the visualization of air using transesophageal echocardiography. This neuroanesthesia laboratory developed the Tung air bubble illumination unit (that magnifies and illuminated any passing air bubble) and Bunegin-Albin multiorifaced air aspiration catheter.

Important Findings:
VAE continues to be complication associated with any surgical position. Aggressive monitoring and rapid treatment are indicated.
Awad H, et al. Inadvertent Placement of a Pulmonary Artery Catheter in the Coronary Sinus: Is It Time to Increase Our Sweep Speed?


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Abstracted by T Tilton, who has nothing to disclose.

Objective:
Report clues of the inadvertent placement of a pulmonary artery catheter in the coronary sinus.

Persistent left superior vena cava (PLSVC), the most common thoracic venous anomaly (diagrams in article), occurs in 0.3-0.5% of the general population: 3-10% of those with congenital heart disease and an estimated 1 in 250 patients per year in the USA undergoing attempted pulmonary artery (PAC) catheterization.

A case report is made of a 48-year-old male for elective open infrarenal abdominal aortic aneurysm repair. Preoperatively, a right internal jugular vein was cannulated with a 9.0 French introducer and a PAC placed. The expected progression of pressure waveforms (WF), at a sweep speed of 25 mm/sec, through the right ventricle (RV) were observed and the final WF were consistent with PA readings. Throughout the case, cardiac output was increased multiple times (8.0-9.0 L/min). A postoperative chest x-ray showed the PAC position in the coronary sinus (CS; x-ray shown). The PAC was removed immediately without complications. Computed tomography showed the PLSVC.

In retrospect, the final WF were from the CS; the RV WF seen during insertion were actually jugular/innominate waves. PLSVC can be suspected when the left jugular vein is distended to a higher level than the right jugular vein. Preoperative transthoracic echocardiography will show a dilated CS and saline contrast injected into the left antecubital vein will first appear in the CS then the RV.

The authors examined the WF at 75 mm/sec, which showed a delay in the jugular/innominate WF compared to the arterial WF. The distal venous WF showed more prominent a, c, and v waves (due to decreased compliance of the CS or close proximity to ventricular impulses).

Important Findings:
Clues to aberrant PAC placement include atypical PA waveforms, monophasic WF from the jugular/innominate vein and overestimated cardiac output. Delayed timing of the monophasic WF in the jugular/innominate region from the QRS should be a consistent finding and will be more readily detectable at a sweep speed of 75 (vs. 25) mm/sec.
Objective:
Report the perioperative use of transthoracic echocardiography as a diagnostic aid for acute chest pain.

The authors report the case of an 82-year-old male for elective right knee arthroplasty. Medical history included sick sinus syndrome with 100% pacing from a permanent pacemaker.

Spinal anesthesia was performed and the surgical procedure was uneventful. In the postanesthesia care unit, the patient complained of severe, intermittent chest pain. Hemodynamics were stable with unchanged ECG and chest xray.

A cardiologist performed a transthoracic echocardiogram (TTE), which was normal during chest pain. Also noted was a 3 x 3.5 cm. hyperechoic mass (images included) posterior to the left atrium in the parasternal and long-axis views (probe placed along the left sternal border in the 3rd-5th intercostal space and the apical, 5-chamber view, with the probe over the apical impulse). Color flow Doppler did not show any vascular flow in the mass. (Video available at http://links.lww.com/AA/A246 and A247).

IV perflutren contrast showed complete left atrial opacification without opacification of the mass and no filling defect within the left atrium. Hiatal hernia (HH) was suspected, so the patient was given a carbonated beverage. TTE showed microbubbles in the mass cavity. Computed tomography confirmed HH. Appropriate treatment resolved the patient’s symptoms.

Important Findings:
Perioperative TTE may be hindered by positioning limitations and HH diagnosis is unreliable. TTE did exclude acute ischemia in this patient through examination of regional myocardial wall motion and isolated the mass as extracardiac and avascular. TTE may be used as an additional diagnostic tool in patients with chest pain.


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Abstracted by T Tilton, who has nothing to disclose.

Objective:
Determine the effect of laryngeal mask airway placement on intraocular pressure and hemodynamics in children with glaucoma undergoing ocular surgery.

This study measured the changes in intraocular pressure (IOP) and hemodynamics in children with glaucoma after insertion of a laryngeal mask airway (LMA). Included were children, ages 1-10 years old, ASA I, scheduled for elective ocular surgery, in a prospective, randomized, single blind study.

All patients were premedicated with oral midazolam (0.5 mg/kg) about 30 min before surgery. Induction was accomplished with halothane followed by placement of an intravenous catheter and administration of atracurium 0.5 mg/kg. When 1 MAC was achieved, either an LMA or an endotracheal tube (ETT) was placed. IOP was measured in both eyes just before airway insertion and 2 and 5 min after airway insertion. Patients were mechanically ventilated.

Demographics were similar between groups. Time for LMA placement was 5.7 ± 3.0 sec vs. 8.5 ± 1.9 sec ETT placement (P=0.004). IOP at baseline was 24.6 ± 4.1 vs. 27.3 ± 5.2 (P=0.245); at 2 min, 24.8 ± 4.7 vs. 31.2 ± 5.4 (P=0.004); and at 5 min, 22.7 ± 5 vs. 28 ± 5.4 (P=0.01), respectively. Heart rate increased significantly immediately after ETT and persisted for 3 minutes; no increase was seen with the LMA. Systolic and diastolic pressures increased significantly 1 minute after ETT but not with LMA.

Important Findings:
Placement of an LMA vs an ETT was not associated with an increase in IOP or hemodynamics in children with glaucoma undergoing ocular surgery.
Objective:
Report the results of a national survey of sleep-related behaviors affecting CRNAs.

Unquestionably, the administration of anesthesia requires a high degree of vigilance and performance to avoid endangering patient well-being. Unlike the fields of aviation, long-haul trucking, or the military, no standards or mandates define work hours. The National Study of Sleep-Related Behaviors of Nurse Anesthetists (CRNAs) sought to quantify and elucidate sleep patterns in a large, national, random sample of CRNAs. The questionnaire (included in text) used underwent rigorous development before being sent to 3,170 CRNAs throughout the USA.

Responses were received from 1,284 (41%): 60.8% were women; 85.2% worked full-time; and the majority were aged 30-59 yrs. The average time to bed was before 10 pm in 51.1%; time to onset of sleep was < 10 min in 56.1%, >10 min 43.9% (30-90 min 11.9%); awake during sleep, <3 76.1%; duration of daytime naps, 5-30 min 49.7%, 30-60 min 34%, >60 min 16.3%; overall sleep quality, good 49.7%, okay 35%, poor 15.3%; difficulty falling asleep, rare 53%, sometimes (some) 37.8%, often 9.2%; use of sleep medications, never/rare 75.6%, some 16%, often 8.4%. Nightmares that induced awakening, rare 84.5%, some 15.7%, often 0.8%; sleep walking, never 98.5%, some 1.3%, often 0.2%; restless leg syndrome, never 81.6%, common 15.4%, often 3%; snoring, never or rare 43.8%, some 41.7%, often 14.5%; teeth grinding, never/rare 63.8%, some 27.3%, often 3.9%; wake up too early, never/rare 40.5%, sine46.3%, often 13.2%; wake up excessively tired, never/rare 32%, some 56.5%, often 11.5%; sleepy during work day, never/rare 22.9%, some 65.5%, often 11.6%; sleep disrupted due to child care, yes 10.6%; self-treat to stay awake, yes 0.4%; and consider seeing sleep physician, yes 10.3%. Respondents experiencing sleep-related behavior during a surgical case totaled 15.7% and 48.8% reported witnessing a colleague asleep during a case.

A chart lists the multiple over-the-counter and prescription drugs, alcohol, herbals, marijuana, and respiratory support aids reported. Drugs listed to promote wakefulness include adderall, caffeine (soft drinks, highly caffeinated drinks, tablets), herbal tea, provigil, Ritalin, vivarin, and vyvanse.

Analysis produced 4 categories. Issues provoking/exacerbating loss of sleep included: menopause, need to urinate; shift work/call; anxiety over cases; snoring bed partner; restless leg syndrome; domestic issues; life problems; vicious cycle of sleep problems. Issues re patient and personal safety: falling or at risk for sleep during a case; colleagues sleeping; errors of omission/commission; sleep while driving after a long case; sleep-fatigue and health issues; denial. Suggestions for sleep-fatigue include: work-hour restrictions; improved, scheduled breaks during work; sleep-aid education; start cases later in the day; and safety admitting the problem. Miscellaneous criticisms of the study: worthless study (sleep-related issues not a problem); timely study to stimulate discussion; and does reading or listening to books on tape help/hurt problem?

Important Findings:
Wide ranges of sleep disturbances were reported from a cohort of CRNAs that were common and multifactorial. Sleep issues have significant impact for patient, as well as personal, safety. Further research is vital to identify management of workplace fatigue for anesthesia providers.
Objective:
Examine the use of fospropofol vs. propofol for short-term sedation for patients being mechanically ventilated.

In a randomized, open-label study, the authors assessed the safety and tolerability of fospropofol (FOS) vs propofol (PRO) in ICU patients requiring sedation. Included were patients >18 to <80 years of age, ASA I-IV, expected to require mechanical ventilation for 2-12 hours. Patients were randomly assigned to receive 1 of 3 infusions: Gp. 1 was a continuous infusion of FOS (25 μg/kg/min) titrated to maintain a Ramsay Sedation Score of 2-5 and agitation treated with a 100 mg FOS bolus and increasing the baseline infusion 25 μg/kg/minute every 5 minute; Gp. 2 received the same continuous FOS infusion and agitation treated by only increasing the infusion; and Gp. 3 received PRO at 25 μg/kg/minute with agitation treated by increasing the rate 5-10 μg/kg/minute every 5 minutes. Morphine, fentanyl, or hydromorphone were used for analgesia as needed and all patients received a multivitamin with folic acid and B12 to support metabolism.

A total of 96 patients were screened and 78 were included in the study. One patient in Gp. 2 was discontinued due to insufficient response to FOS. Gp. 1 patients tended to be older with more racial diversity and weighed > 80 kg. Mean total FOS in Gp. 1 (n=18) was 2365.8 mg (range 252.0-6981.0), Gp. 2 (n=20) 1383.1 mg (155.3-4835.6) and Gp. 3 (n=22) 948.5 mg (69.7-3153.5). Median duration of dosing was 5.46 hrs (2.0-12.0), 3.71 (1.5-12.2) and 6.38 (1.75-16.67), respectively. Infusion rates were the highest in the FOS groups at 6-8 hours and 10-12 hours of treatment.

The incidence treatment-emergence adverse events (TEAE) were similar in Gp 1 and Gp 2 except procedural pain, which was 33.3% vs. 5.0%, respectively. Overall, the most frequent TEAE with FOS vs. PRO were procedural pain (18.4% vs. 9.1%), infusion site pain and hyperglycemia (both 5.3% vs. 13.6%), and nausea (10.5% vs. 4.5%), respectively. One patient each in Gp 1 and Gp. 3 had hypotension that was managed with fluids. Five deaths occurred unrelated to the study drugs. Only one serious adverse event was possibly related to FOS (Gp. 1) and that was nonsustained ventricular tachycardia, lasting 5-10 seconds that responded to IV magnesium and potassium.

Phosphorus levels increased to 0.04 mg/dL, 0.64 and decreased to 0.32, respectively. Duration of treatment did not appear to affect phosphorus levels. Formate plasma concentration did not differ significantly between pre and post dosing in any group except 1 36-year-old male in Gp. 1 whose formate increased from 66.3 μg/mL to 212. This patient had severe hepatic and renal dysfunction and did not receive dialysis during the study. Formate decreased slightly in another Gp.1 patient and increased slightly in one patient in Gp. 3; no adverse effects were seen.

RSS was similar between two to five for 91.6%, 95.5%, and 93.4% of the time, respectively. Agitation occurred in six (33%), seven (35%), and five (22.7%) with the mean number of agitation events were similar and very low. One Gp. 2 patient required alternate sedation.

Important Findings:
FOS may be used safely as an infusion/bolus or infusion only for short-term sedation for patients being mechanically ventilated. It is unknown whether FOS could cause propofol-related infusion syndrome.
Objective:
Describe a massive gastrointestinal bleed following transesophageal echocardiography in a patient with a normal coagulation profile.

Transesophageal echocardiography (TEE) morbidity and mortality in more than 17,000 patients has been reported as 0.18-2% and one patient, respectively. A case report is made of a 66-year-old man with a history of severe chronic obstructive pulmonary disease and hypertrophic obstructive cardiomyopathy who underwent septal myomectomy. Early postoperative complications included reoperation due to bleeding, bronchospasm, ventilator dependency, tracheostomy, and prolonged intensive care unit stay.

Recurrent episodes of hypotension over six hours on postoperative day 14 responded to fluid and vasopressors. Transthoracic echo could not identify the problem, so TEE was performed after succioning of gastric contents (no blood seen). TEE was performed by an experienced operator and showed septal hypertrophy with recurrent systolic anterior motion of the mitral valve with dynamic outflow tract obstruction. Hypotension was successfully treated by expanding intravascular volume. The patient’s coagulation profile was normal.

Within one hour, the nurse reported a large volume of blood per rectum and a nasogastric tube was placed that returned bright red blood.

Emergent upper endoscopy (EGD) showed fresh blood with a large clot pooled in the fundus. The only active bleeding was in the proximal cardia area consistent with a Dieulafoy lesion just distal to the gastroesophageal junction (GEJ). A Dieulafoy lesion is characterized by a tortuous arteriole in the GI submucosa. The lesion was injected with epinephrine and 2 hemostatic clips were placed to achieve hemostasis. Repeat EGD 3 days later was negative for additional pathology.

Important Findings:
Dieulafoy lesions (95% occur within six cm. of the GEJ) are responsible for 0.1-6.7% of acute or chronic upper gastrointestinal bleeds. TEE probe placement is close to such lesions and may result in bleeding when seeking deep gastric views. Since gastric complications are rare (<0.2%) with TEE, the authors suggest a national registry of such events may be useful.
Dardashti A, et al. Blood Transfusion After Cardiac Surgery: Is It the Patient or the Transfusion that Carries the Risk?


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Abstracted by T Tilton, who has nothing to disclose.

Objective:
Assess the impact of red blood cell transfusion on long-term survival following coronary bypass grafting.

In a retrospective review, the authors investigated the relationship between red blood cell transfusion (RBCT), preoperative hemoglobin (Hgb), renal function, and long-term mortality in patients who underwent coronary artery bypass grafting (CABG). Data were collected from multiple sources from January 2002 through December 2008 for 5,922 patients. Excluded were patients who had emergent surgery (n=121), who died in the first seven days (34), and patients who received >8 units RBC (506). Patients were divided into four subgroups: high or low Hgb with normal estimated glomerular filtration rate (eGFR) and high or low Hgb with low eGFR. Risk-Injury-Failure-Loss-End Stage (RIFLE) criteria was used to quantify postoperative renal function. Normal Hgb was >136 g/l (8.44 mmol/l) for males and >12.5 (7.58) for females.

The final analysis included 5,261 patients of which 49.8% received RBCT. Preoperatively, patients who ultimately received RBCT were significantly more likely to be slightly older, male, slightly lower BMI, and have more co-morbidities (e.g., history of cerebral vascular accident (CVA), previous vascular surgery, critical preoperative state, left ventricular ejection fraction <30-50%, New York Heart Association score (NYHA) III-IV, Canadian Cardiovascular score (CCS) IV, higher Euroscore, use of cardiopulmonary bypass (CPB), longer perfusion and cross-clamp times, need for intra-aortic balloon pump (IABP) before surgery, previous cardiac intervention, lower Hgb, higher creatinine, lower eGFR, and lower 30-day survival.

Postoperatively, those who received RBCT were significantly more likely to have: longer ICU stays and ventilator times; re-operation for bleeding; myocardial infarction; sepsis; atrial fibrillation, higher RIFLE risk and failure at discharge; received more units of plasma and platelets; lower Hgb at discharge; and higher 30-day mortality.

In a subgroup (n=2,444) of patients without anemia and normal or mild decrease in renal function, those receiving RBCT were significantly more likely to be slightly older, male, slightly lower BMI, history of CVA, critical preoperative state, higher Euroscore, lower NYHA/CCS, have longer perfusion and cross-clamp times, have IABP, previous CABG, and lower preoperative Hgb, creatinine, and eGFR. Postoperatively, these patients had greater ventilator times; re-operation for bleeding; MI; sepsis; atrial fibrillation; received all blood products; and have lower Hgb at discharge.

Cox proportional hazard ratio analysis, without considering preoperative Hgb and eGFR showed a hazard ratio of 1.097 (95% CI 1.05-1.15, p<0.001) for each RBC infused. Factors associated with poorer outcomes were age, and a history or chronic obstructive pulmonary disease, diabetes, CVA, and longer perfusion times. Better outcomes were seen in females and those who were on CPB. When preoperative Hgb and eGFR were included, the hazard ratio was 1.046 (1.00-1.10, p=0.0650).

In the subgroup, 36.1% received RBCT with a hazard ratio of 1.015 (0.91-1.13, P=0.7873)/unit. Of the 507 patients with lower Hgb and eGFR levels; 75.5% received RBCT with a hazard ratio of 1.016 (0.92-1.12, p=0.7503)/unit. The hazard ratio did not reach significance in the other two groups.

Important Findings:
When factoring preoperative Hgb and renal function into the equation, moderate RBCT after CABG was not associated with decreased long-term survival.
Objective: Determine the rate of perioperative pulmonary aspiration and other anesthesia-related complications in patients who had first and second-trimester surgical abortion during deep sedation without intubation.

Even though endotracheal intubation decreases the risk of perioperative pulmonary aspiration, many outpatient abortion facilities offer general anesthesia or deep intravenous (IV) sedation without intubation for first and second-trimester abortions. The authors determined the rate of perioperative pulmonary aspiration and other anesthesia-related complications in patients who had first and second-trimester surgical abortion during deep sedation without intubation.

Outcome data for all patients who had first and second-trimester abortions using deep sedation without intubation between August 1, 2001 and April 30, 2008 were retrospectively reviewed. Only patients who received IV deep sedation were included. Patients who were hospitalized for adverse events were identified from the facility’s occurrence logs. Occurrence reports and medical records were reviewed for data on direct hospital transfers and delayed hospital admissions. The number of abortions performed, median patient age, gestational age, insurance type, race, and ethnicity were obtained from the facility’s Medical Manager database.

During the study period, the facility provided 62,125 abortions using deep sedation without intubation. Of these, 11,039 occurred after 12 completed weeks’ gestation; 3,014 at greater than 18 weeks’ gestation; and 365 at more than 22 weeks’ gestation. During the 81-month time period, 26 patients were transferred to the hospital for adverse events. No cases of perioperative pulmonary aspiration occurred during the study period.

The results of the study agree with the trend on outpatient abortion facilities to offer general anesthesia or deep IV sedation without endotracheal intubation. This study and several large studies challenge traditional assumptions about risk factors for perioperative pulmonary aspiration and do not support the common belief that routine intubation is warranted to protect against aspiration.

Important Findings: Deep sedation without intubation is a viable method of anesthesia for first and second trimester abortion in the outpatient setting.
Objective:
Determine any significant difference in the duration of adequate sedation levels, consumption of additive sedative anesthetic agents and the requirement for rescue sedatives during magnetic resonance imaging (MRI) in epileptic children with or without phenobarbital monotherapy.

Phenobarbital is the most commonly used anti-epileptic drug (AED) in the pediatric population. The preferred radiologic imaging technique for diagnosis and follow-up of epilepsy is MRI. This study determines if there is any significant difference in the duration of adequate sedation levels, consumption of additive sedative anesthetic agents and the requirement for rescue sedatives during MRI in epileptic children with or without phenobarbital monotherapy.

One hundred twenty-eight children diagnosed with epilepsy, aged 1-10 years, and scheduled to undergo MRI with sedation were included in this double-blinded prospective clinical study. Epileptic children without any AED therapy were assigned to Group I, and the children with phenobarbital monotherapy were assigned to Group II. The initial sedative drugs were IV bolus 0.1 mg.kg-1 midazolam and 2 mg.kg-1 ketamine with additional 1 mg.kg-1 dose of ketamine repeated if needed. Each anesthesia record included the effective duration of initial and consequent additional sedative requirements and the total amount of additional ketamine and rescue propofol administration.

The mean duration of epilepsy was longer in Group II. The initial dose protocol with midazolam and ketamine was sufficient for the entire procedure in 64% of patients in Group I and in 45% of patients in Group II. The duration of initial and two consequent additional sedative requirements was shorter in Group II. Additional sedative administration was required more commonly in children under anti-epileptic therapy.

The authors found the duration of initial and two consequent additional ketamine requirements was shorter and the additive ketamine consumption was greater in epileptic children with phenobarbital monotherapy. By showing that phenobarbital is an effective inducer of CYP3A4 and the induction ratio changes in a concentration-dependent manner, but does not correlate with the duration of phenobarbital therapy, this study correlates with other literature.

Important Findings:
The inconsistency in response to the initial sedative agents required titration of additive sedation with ketamine in epileptic children on phenobarbital monotherapy.
Objective:
Test the feasibility and effectiveness of a new and safer technique for paravertebral catheter placement to provide regional anesthesia and postoperative pain analgesia for breast cancer patients undergoing major breast surgery as part of their treatment.

Paravertebral nerve blocks (PVBs) are becoming increasingly popular in patients undergoing breast cancer surgery. Patients who receive a PVB for major breast surgery have a shorter recovery time, experience less post-operative pain, require fewer analgesics, suffer less postoperative nausea and vomiting, tend to mobilize earlier and are discharged significantly sooner from the hospital. This study tested the feasibility and effectiveness of a new and safer technique for paravertebral catheter placement to provide regional anesthesia and postoperative analgesia for breast cancer patients undergoing major breast surgery as part of their treatment.

Twenty-five consecutive patients scheduled for a unilateral surgical procedure of the breast with or without additional surgery of the axilla were enrolled in the study. The lamina technique for paravertebral catheter placement and nerve block was used as an alternative to the standard PVB approach. At the time of catheter withdrawal, patients and staff nurses were asked to rate their satisfaction with the postoperative pain management on a scale from 1 to 6.

All patients successfully received a paravertebral catheter using the lamina technique. During the procedure, 84% of patients received no additional opioids after endotracheal intubation. Postoperative pain control by PVB was highly effective, and no patient required opioids as rescue medication during their stay in the postoperative recovery ward. Rates of satisfaction with postoperative pain management by patients and staff nurses were very high.

This study shows that the lamina technique for PVB is highly effective, and is well accepted by patients and caregivers. Hemodynamic instabilities described in patients with epidural anesthesia did not occur.

Important Findings:
According to the authors, “The potentially safer lamina technique for placement of a paravertebral catheter is an effective technique for intraoperative and postoperative analgesia in patients scheduled for major breast surgery with or without axillary lymph node resection.”
Objective: Examine the influence of erythrocyte transfusion on acute kidney injury (AKI) after cardiac surgery and whether it differs in anemic and nonanemic patients.

Two closely interrelated potentially modifiable risk factors for acute kidney injury (AKI) are preoperative anemia and perioperative erythrocyte transfusion. This study examines the influence of erythrocyte transfusion on AKI after cardiac surgery and whether it differs in anemic and nonanemic patients.

Data from 12,388 consecutive patients age 18 years or older who underwent cardiac surgery with cardiopulmonary bypass (CPB) from January 2000 to May 2008 and received three or less units of erythrocytes on the day of surgery were included in this single-center cohort study. Propensity score methods were used to match anemic patients to nonanemic patients with approximately similar risk profiles first, and then the effect of erythrocyte transfusion on the rate of AKI in the matched group was measured in order to determine whether the influence of erythrocyte transfusion on AKI differs in anemic and nonanemic patients.

Anemic patients were usually sicker, older, underwent more nonelective surgeries, and had more comorbid conditions such as kidney dysfunction, diabetes, and vascular disease than nonanemic patients.

AKI developed in 4.1% of anemic patients and 1.6% of nonanemic patients. In the matched group, 3.8% of anemic patients developed AKI compared with 2.0% of nonanemic patients. AKI rates increased in direct proportion to the number of units of erythrocytes transfused, with the increase being more pronounced in anemic patients.

The study showed the risk of AKI was nearly twofold higher in anemic than nonanemic patients, and that the risk of AKI increased in direct proportion to the number of erythrocyte transfusions, with this increase being more pronounced in anemic patients. The finding suggests that patients most likely to require multiple erythrocyte transfusions during cardiac surgery are also most likely to be harmed by them.

Important Findings: In this study, anemic patients were found to be more susceptible to transfusion-related AKI than nonanemic patients, necessitating clinical studies assessing the renal-protective effects of interventions that reduce perioperative transfusions in anemic patients.
Objective:
Compare two different doses of remifentanil infusion on hemodynamics, the recovery period, and complications in children undergoing pediatric diagnostic cardiac catheterization.

Remifentanil can be used for pediatric cardiac catheterization because of its sedative effects, rapid pharmacokinetics, and associated stable hemodynamics even after long infusions. This study compares two different doses of remifentanil infusion on hemodynamics, the recovery period, and complications in children undergoing pediatric diagnostic cardiac catheterization.

Sixty children age 2-12 years who were scheduled for elective diagnostic cardiac catheterization under sedation were included in this prospective study conducted between November 2007 and September 2008. Standard monitoring was performed, and baseline vital signs were recorded before premedication. The patients were assigned randomly to two groups. Patients in Group 1 received a remifentanil infusion of 0.1 µg/kg/min, and patients in Group 2 received a remifentanil infusion of 0.2 µg/kg/min. Thirty minutes after premedication with midazolam, the remifentanil infusion was started. A face pain scale was used in the assessment of pain. The remifentanil infusion was discontinued when the cardiac catheterization procedure was completed, and a bandage was applied to the groin.

The duration of anesthesia was shorter in Group 2. Baseline HR, systolic BP, and diastolic BP were similar between the groups. HR and systolic and diastolic BPs progressively decreased for 10 minutes after the catheterization procedure and increased to baseline values during recovery. Additional drugs were required for 15 children in Group 1, but only 3 of 30 children in Group 2 required additional drugs.

Anxiety relief and control of excessive movement and pain are the major goals of sedation during pediatric diagnostic cardiac catheterization. It is important that anesthetic agents with a minimal hemodynamic effect be chosen during catheterization, especially in children with a right-to-left shunt. The hemodynamic parameters may be evaluated to obtain a detailed hemodynamic effect of remifentanil.

Important Findings:
This study shows that after premedication with oral midazolam and infiltration of the local anesthetic into the groin, remifentanil provided adequate sedation without any hemodynamic alterations or respiratory compromise during pediatric diagnostic cardiac catheterization. Recovery period was also not prolonged.
Objective:
Evaluate incidence of acute kidney injury renal replacement therapy (AKI-RRT) and verify earlier identified pre- and perioperative factors related to 30-day, late, and overall mortality in patients with this complication after cardiac surgery.

As one of the major complications of cardiac surgery, acute kidney injury (AKI) has been shown to be an independent risk factor for both early and late postoperative death. This study evaluates the incidence of AKI-RRT and verifies earlier identified pre and perioperative factors related to 30-day, late, and overall mortality in patients with this complication after cardiac surgery.

This retrospective case-control study included all adult patients who developed AKI-RRT in the postoperative cardiac surgical intensive care unit at a single academic center from February 2002 through June 2008. Hospital mortality was assessed by analyzing patient files and hospital discharge letters. Continuous venovenous hemofiltration (CVVH) was started when either urine output fell below 0.5 mL/kg/h in 6 hours despite treatment or if more than a four-fold increase in plasma creatinine concentration was observed.

The risk of AKI-RRT depended on the type of cardiac surgical procedure performed with the lowest incidence of AKI-RRT observed in patients undergoing uncombined coronary artery bypass graft (CABG) surgery. CPB use for CABG surgery did not alter AKI-RRT incidence. 30-day mortality was 61%, in-hospital mortality was 69%, and overall mortality was 82%. The median survival time in nonsurvivors was 14 days. During the first 30 days after surgery, the prevailing cause of death was refractory multiple-organ dysfunction syndrome. Between 31 and 190 days, multiple-organ dysfunction syndrome was the main cause of death in seven of 17 and myocardial ischemia in two of 17 patients. Only the postoperative need for intra-aortic balloon pump (IABP) use and resternotomy proved stable in a multivariate model.

The data from this study confirm previous observations that the type of surgery is important for the development of AKI-RRT. Age, less advanced New York Heart Association (NYHA) class, postoperative myocardial infarction, and the need for resternotomy and IABP use all significantly increased the risk of death during long-term follow-up.

Important Findings:
According to the authors, “This study revealed a decrease of AKI-RRT incidence in common cardiac surgical procedures and confirmed the influence of severe perioperative heart function deterioration requiring IABP use and the need for mediastinal reexploration as two major risk factors for both early and overall mortality.”
Objective: Compare hemodynamic responses to the Airway Scope during tracheal intubation with those of conventional laryngoscopy in both normotensive and hypertensive patients.

Hemodynamic responses to laryngoscopy and tracheal intubation are more pronounced in hypertensive patients than in normotensive patients. This study compares hemodynamic responses to the Airway Scope during tracheal intubation with those of conventional laryngoscopy in both normotensive and hypertensive patients.

Forty-six normotensive patients and 46 hypertensive patients aged 20-80 years, scheduled for elective surgery were included in the study. The normotensive and hypertensive patients were randomly divided into equal-sized groups according to the device to be used for tracheal intubation. Only one attempt at intubation was allowed using the assigned airway device. Systolic blood pressure, diastolic blood pressure and heart rate were recorded before anesthesia (baseline); when train-of-four count was zero after the administration of vecuronium; immediately after intubation; and 1, 2, 3, 4, and 5 minutes after intubation.

The full interactive term of the airway devices, the time points and the groups was significant for the systolic and diastolic pressure results. Changes in heart rate were significantly less with the Airway Scope at and around intubation, compared with the Macintosh laryngoscope.

The results of the study show that the Airway Scope produces less stimulation than the conventional laryngoscopy. In hypertensive patients, the Airway Scope technique failed to satisfy hemodynamic responses to tracheal intubation compared with the Macintosh laryngoscope technique. The study did not show any difference in the incidence of sore throat and hoarseness after extubation between the two techniques.

Important Findings:
The authors believe they have, “Demonstrated that the Airway Scope technique attenuates the hemodynamic response to tracheal intubation compared with the Macintosh laryngoscope technique in normotensive patients. However, in hypertensive patients, no difference was found between the two intubation techniques.”
Objective:
Evaluate the efficacy of levosimendan in the prevention of heart failure after cardiac surgery.

Cardiac surgery often results in myocardial contractile dysfunction and severe heart failure postoperatively, causing increased morbidity, multiorgan failure, and death. This study evaluated the efficacy of levosimendan in the prevention of heart failure after cardiac surgery.

Two hundred eight patients scheduled for elective heart valve or combined heart valve and coronary artery bypass grafting (CABG) surgery with cardiopulmonary bypass (CPB) were studied. Patients >18 years of age were included in this prospective, randomized, placebo-controlled study. Patients were randomly allocated to receive study drug infusion scheduled after anesthesia induction and continuing for 24 hrs. Levosimendan or placebo was administered as an intravenous infusion, starting with 24 µg/kg over 30 minutes and continuing thereafter at a dose of 0.2 µg/kg/min. The primary outcome measure was heart failure. Secondary outcome measures were any cause in-hospital and six-month mortality or predefined major organ morbidity.

All operative procedures involved heart valve surgery, and most were combined CABG and heart valve surgeries or double-valve operations, with no difference between groups.

There was a significant difference in preoperative myocardial infarctions, which were more common in the placebo compared to the levosimendan group. Heart failure after CPB occurred in 15 patients in the levosimendan and 59 patients in the placebo group. Preoperative myocardial infarction did not have an effect on the risk for heart failure after CPB. In the majority of patients, heart failure was present immediately after CPB. More patients suffered from low blood pressure and required vasoconstrictor therapy in the levosimendan compared to the placebo group.

In this study levosimendan reduced the rate of postoperative heart failure after high-risk cardiac valve surgery and significantly reduced the requirements for rescue inotropic drug or mechanical ventricular support; however, the decreased incidence of heart failure was not supported by lower incidence of in-hospital mortality, six-month mortality, or major organ morbidity. Hypotension was more common in the levosimendan group.

Important Findings:
Levosimendan was effective in reducing heart failure, requirement for rescue therapy, and severe, life-threatening cardiac insufficiency after heart valve surgery, but no mortality or morbidity benefit was achieved in these patients.
Objective:
Determine the subsets of patients which might benefit from the use of perioperative ketamine and the factors which might influence the efficacy of ketamine in postoperative pain management.

Acute pain management is important for adequate post operative analgesia. This study focuses on randomized controlled trials (RCTs) reporting the perioperative use of intravenous ketamine using subgroup analysis to determine the subsets of patients who might benefit most from the use of perioperative ketamine and the factors that might influence the efficacy of ketamine in postoperative pain management.

The authors conducted a literature search using Medline, EMBASE, the Cochrane Library, and hand searching relevant reference lists and existing systematic reviews. The criteria included double-blinded randomized placebo-controlled trials, administration of perioperative ketamine, administration of intravenous ketamine, and measurement of postoperative analgesic use or pain. Due to the difficulty in merging various methods of reporting pain scores into a meaningful quantitative analysis, pain scores and side effects were analyzed qualitatively.

Seventy studies met the inclusion criteria and included a total of 4,701 patients. Forty-seven studies were initially analyzed quantitatively, with an additional 17 used to corroborate the results within the quantitative analysis, and six were added to the qualitative analysis. The analysis of the 47 core studies using the random effects model demonstrated an opioid sparing effect with treatment. The standard difference in means (SDM) for time to first analgesic demonstrated a significant increase in the time to first postoperative analgesic. The least opioid reduction was found in patients undergoing head and neck surgery, dental surgery, or tonsillectomy. Upper abdominal and thoracic procedures showed the greatest decrease in ketamine used. Despite the use of more opioid, 78% of the placebo groups experienced significantly more pain than the ketamine treatment groups when ketamine was efficacious.

This study suggests that intravenous ketamine has an opioid sparing effect by reducing the quantity of opioid administered and prolonging time to first analgesic across all studies.

Important Findings:
The authors believe, “Intravenous ketamine is effective in reducing total opioid requirements and delaying the time to first analgesic dose for many patients with postoperative pain….ketamine has a clinical benefit when used perioperatively in certain clinical circumstances while potentially causing harm in others.”
Objective:
Evaluate whether new trends in regional anesthesia have been associated with any new complications.

New trends and regional blocks have brought about enthusiasm for the use of regional anesthesia for surgery. This study evaluates whether new trends in regional anesthesia have been associated with any new complications in order to provide a more current assessment of liability associated with regional anesthesia.

Peripheral nerve block claims from 1990 or later in the acute pain and surgical setting were obtained from a database of 8,954 claims. The analysis identified 189 patients who had peripheral nerve blocks performed in the acute surgical setting.

The most common types of peripheral nerve blocks were interscalene, axillary, and intravenous regional anesthesia. Nerve injury was the most common complication associated with peripheral nerve block claims in the database followed by death, pneumothorax, and brain damage. Nerves most commonly injured were the brachial plexus, median, ulnar, spinal cord, and phrenic, with 32% of these claims associated with permanent and/or disabling injuries. Peripheral nerve block claims associated with death or brain damage had multiple damaging events. No claims were associated with ultrasound-guided blocks, TAP/rectus sheath blocks, or paravertebral blocks. Anesthesia care was assessed as appropriate in 65% of 189 claims, and impossible to judge in 10% of claims. The percentage of peripheral nerve block claims with payment was significantly lower than the percentage of claims with payment for neuraxial anesthetics, general anesthetics, or monitored anesthesia care claims.

Data from this study show that injury to the nerves is the most common outcome leading to claims associated with peripheral nerve blocks, and that local anesthetic toxicity remains a significant cause of death and brain damage associated with peripheral nerve blocks.

Important Findings:
Most of the peripheral nerve block claims are associated with temporary injury, with one-third of all peripheral nerve block claims resulting in high-severity complications, and approximately half of these injuries associated with the block itself. High-severity, block-related injuries consisted mainly of nerve damage and local anesthetic toxicity.
Objective:
Delineate the observed deleterious effects of anesthetics.

Causality dilemmas are difficult, at best, to decipher: the unanswerable question of which came first, the chicken or the egg. In the anesthesia theatre, the question relates to the relationship between low bispectral index values (BIS) and poor outcomes: “Are poor outcomes the result of low BIS values or are the low BIS values secondary to existing poor or fragile patient health”? This article discusses relationships among the low BIS values, anesthesia administration, and additional factors that may impact long-term outcomes following general anesthesia, and presents the concept of “relative anesthetic evidence.” Dose requirements for anesthesia are widely variable, both inter- and intra-personally, and the anesthesia provider must estimate the adequacy of the anesthesia administered, typically using the end-tidal volatile agent concentration to accomplish this estimation. Even with adjustments for age, weight, and additional medications, predicting with assurance, an individual’s anesthetic requirement remains elusive; that which is adequate for one patient may be excessive or inadequate for the same individual in subsequent circumstances.

The relationship between BIS values and the effect-site concentration of either volatile agents or propofol is monotonic but not linear; however, BIS values do decrease with increasing doses of these agents. BIS value monitoring does afford administration of lower doses of anesthetics, thus a more rapid emergence and allows for identification of patient doses of anesthetics in excess of what is necessary. As a result, there does appear to be an association among the no BIS value titration, relative anesthetic overdose, and low BIS value, but not having BIS value titration is not the sole cause of a relative anesthesia overdose. “Cumulative deep hypnotic time” is defined as the portion of an anesthetic where BIS values or less than 45 and, in a previous study, has demonstrated a correlation with patient mortality at one year. This finding was originally received with considerable skepticism and demands for the finding to be replicated. Replication was subsequently produced in three separate studies. The contention that relative anesthesia overdose is detrimental to the patient separate from other factors suggests that there is a toxic and dose-dependent effect by anesthetic agents on the brain and other organs.

Important Findings:
While this hypothesis seems to be supported by previous studies in animals and humans, both old and young, the apparent mechanism appears to be, at a molecular level, deleterious effects by the anesthetic, which are mutable in various human and animal studies, anesthetics have: provoked an inflammatory response, increased the deposit of Alzheimer’s proteins, induced neuronal apoptosis, and resulted in prolongation of postoperative cognitive dysfunction. These observed effects yield an, as yet, unproven clinical implication: the inherent dose-dependent anesthetic toxicity necessarily requires a lower dose of anesthetic. Logically, inordinately deep anesthesia may be viewed as wasteful. The relative antithesis is that of the “low MAC paradox,” which suggests that poor patient outcomes are associated with low inspired concentrations of volatile agent. Administration of low concentrations of volatile agents are typically the response of the anesthesia provider to low BIS values, hypotension, or other indications of a relative anesthesia overdose while serving as a marker of intolerance to the anesthetic. The continued association of low anesthetic concentrations with poor outcomes and/or mortality seems to suggest a lack of controllability by the anesthesia provider.
Objective:
Discuss the 3 major clinical implications developed from the study on depression and surgical patients by Linnen, et al.

Depression frequently occurs in patients suffering from a medical illness, with the frequency estimated between 15% and 50%. The relationship between perioperative depression and anesthesiology has been explored to a limited extent to date. Effective intervention and treatment requires a detailed evaluation by both anesthesiologist and psychotherapist to best assess any association of depression with essential health risk factors important to anesthesia and perioperative health. This article presents an investigation on the frequency of depression, any association with essential health risk factors—alcohol abuse, smoking, age, gender, sleep disturbances, and sociodemographic characteristics. The primary aim of this study was to assess the frequency with which depression states are found in the preoperative anesthesia screening clinic and to determine their impact on the hospital length of stay (LOS). Secondarily, the investigators evaluated whether there were differences relative to gender, age, partnership, education, employment status, alcohol abuse, smoking, body mass index (BMI), physical exercise, ASA classification, surgical field, and severity of sleep disturbance between patients with high vs. low scores on the World Health Organization 5-item Well-Being Index (WHO-5), while also endeavoring to determine if any of the risk or protective factors demonstrate a statistically significant independent impact on the prediction of depression. The study was conducted on 5,429 consecutive patients from February 2006 through December 2007, with 50.63% of the study participants being male. The data from this study demonstrated that clinically significant depressive states do occur frequently in surgical patients presenting for a preoperative anesthesia assessment. These depressive states were also associated with an increased hospital LOS and the estimated prevalence was 29.7%. Hospital LOS is reflective of the patient’s physical recovery, the pertinent healthcare utilization, and the associated costs in total. From this study, the data revealed that the potential for a hospital LOS greater than the median expected LOS was 52% greater for patients with depression. This study demonstrated and confirmed an association of depression with poorer socioeconomic, psychological, and physical states, while also confirmed the independent factors correlated with depression to be: sleep disturbances, sense of coherence, subjective experience of health, and regular physical exercise. Smoking tobacco and alcohol abuse were not demonstrated as independent associates for depression as seen in other studies.

Important Findings:
This study yielded 3 major clinical implications: first, clinically significant depression among surgical candidates occurs frequently and may be demonstrated during the preoperative anesthesia assessment. This depression has a significant impact on physical and mental health and hospital LOS. As a result, a brief depression screening is recommended for all patients during the preoperative anesthesia assessment. Second, with greater knowledge regarding preoperative depression and the potential health and financial cost implications, detection in the preoperative anesthesia assessment may afford initiation of prophylactic measures to bolster the patient and counteract many of the untoward effects of depression. Finally, the patient with depression should have a different healthcare pathway instituted tailored to account for their subjective health status and sense of coherence to ultimately help reduce the associated greater hospital LOS.
Objective:
Describe the potential neuroprotective effect of alcohol (EtOH) for traumatic brain injury (TBI).

The risk of any type of injury is significantly increased in periods of alcohol intoxication. As many as one-third of trauma-related deaths and 50% of traumatic brain injuries are associated with acute intoxication. Coagulation abnormalities frequently develop as a result of severe traumatic brain injury (sTBI). Yet, there is considerable controversy regarding the impact of alcohol on outcomes following sTBI. This study was undertaken to determine: 1) the impact of serum alcohol (EtOH) on the incidence of coagulopathy associated with sTBI; and 2) any effect of EtOH on sTBI patient outcome. This study was a retrospective review of sTBI patients admitted between June 2005 and December 2008, whose serum EtOH level was measured. In this patient cohort, 46.5% were EtOH-positive and overall, males constituted 84.1% of the 439 patients in the study. EtOH has been shown to decrease platelet aggregation as well as inhibit platelet adhesion to fibrinogen under flow. In addition, even moderate EtOH consumption is associated with decreased plasma fibrinogen concentrations, but the observed effects on fibrinolysis are conflicting, resulting in an unclear estimation of the net impact if EtOH on coagulation following trauma. The effect of EtOH on coagulation in sTBI patients is particularly concerning. In sTBI where there is no serum EtOH, the tissue factor “injected” into the circulatory system by the injured brain parenchyma activates the coagulation system yielding initial uncontrolled procoagulant activity resulting in micro-vascular thrombosis, clotting factors consumption, and platelet depletion. In this study the patients who were EtOH (+) demonstrated a significantly lower incidence of admission coagulopathy. The positive EtOH level found to be an independent protective factor for the presence of an admission coagulopathy. In terms of clinical implications, EtOH seems to exert a beneficial effect on the coagulation system after sTBI and may contribute to the observed greater survival of the EtOH (+) brain-injured patients. The data in this study also demonstrated a significantly lower complication rate, particularly reduced occurrence of sepsis, in EtOH (+) patients.

Important Findings:
The mechanism(s) associated with these observed effects are yet unclear but may indicate a neuroprotective effect of EtOH. EtOH blunts the adrenergic response by reducing the surge of catecholamines and may thus provide a survival advantage for EtOH (+) patients. An additional plausible mechanism may be mitigation of the early coagulopathy associated with sTBI by EtOH. The survival advantage of EtOH(+) sTBI patients may also be enhanced by the withdrawal prophylaxis administered over the course of an ICU stay; this prophylaxis frequently entails administration of barbiturates, benzodiazepines, dexmedetomidine, or propofol, all of which have demonstrated a decrease in adrenergic activity and cerebral metabolism after TBI.
Objective:
Recall the suggested implications derived from the treatment of acute severe hypertension in the STAT registry.

Despite the good understanding of the best management of chronic hypertension, that understanding has yet to transfer to the management of hospitalized patients experiencing acute severe increases in blood pressure. These elevations in blood pressure may be precipitated by central nervous system (CNS) injury. The pressor response may be triggered by stroke, traumatic brain injury, or other neurological emergency and may aggravate brain edema and intracranial pressure. Optimal hypertension management for patients with acute brain injury is controversial. This article presents the results of the “Studying the Treatment of Acute hyperTension (STAT) investigation, encompassing 25 participating institutions. The investigators evaluated demographic and clinical features, hospital complications, and predictors of 90-day mortality for 1,566 STAT registry patients having a primary diagnosis of stroke, trauma, or other CNS injury. The patients were classified as Neurological, 432 patients, or Non-Neurological, 1,134 patients; the groups were 50% and 52% male, respectively. There is a significant rate of mortality for patients with a primary neurological diagnosis who are hospitalized for acute severe hypertension. Among patients with a neurological emergency, 90-day mortality was 24% compared to 6% for non-neurological patients. The results of this investigation confirmed the life or death nature of the occurrence of acute severe hypertension in the presence of brain injury. A significant sympathetic surge usually accompanies an acute brain injury; concomitant activation of proinflammatory and prothrombotic cascades may result in systemic inflammatory response culminating in secondary organ damage. The risk of death increases in association with blood pressure extremes when experienced in the presence of all types of hemorrhagic and ischemic stroke. Additionally, acute severe hypertension can contribute significantly to the increase in risk of CNS bleeding, systemic cardiovascular stress, myocardial demand ischemia, subsequent exacerbation of brain edema and elevation of intracranial pressure. However, overly aggressive blood pressure control may produce a secondary ischemic injury in the penumbral and perihematomal regions secondary to compromised cerebral blood flow and/or autoregulation. As a result, such neurocritical patients’ blood pressure is maintained within narrow limits with parenteral medications. Among the patients in the STAT registry, the neurologic patients experienced hospital lengths of stay twice that of those of the non-neurologic patients in the STAT registry as well as experiencing a higher complication rate.

Important Findings:
The data from the STAT registry demonstrate an association between mortality and excess blood pressure reduction in the hypertensive neurologic patients, most notable during the initial phase of treatment—a time of heightened vulnerability to secondary injury. Those patients who did achieve a significantly lower blood pressure with less rebound hypertension and attained the targeted blood pressure faster than surviving patients while also requiring discontinuation of treatment because of excessive hypotension. The authors suggest four implications from these data: 1) the pressor response appears to be more “fragile” with more severe brain injury; 2) more severe brain injury leaves the pressor response more prone to overtreatment; 3) the overtreatment yields an increased risk of secondary ischemic injury; and 4) the risks of overtreatment and secondary ischemic injury is also heightened by impaired autoregulation.
Objective:
Discuss the observed critical factor for reduction of vomiting in pediatric patients following minor surgical procedures.

The optimal timing for resumption of oral intake following surgery has yet to be established based on scientific data; rather, currently this resumption takes place based on the experience of the clinician. Typically, pediatric patients who have undergone a relatively minor abdominal procedure may resume oral intake about 2 hours following the emergence from anesthesia and the resumption is frequently a prerequisite for discharge from the facility. Previous studies have indicated the resumption of oral intake one hour following emergence from anesthesia by children who have had minor surgery is appropriate because of the return of gastric motility within that one hour. Other reports suggest that oral intake should not be a prerequisite for discharge. Gastric motility is affected by intake of hot or cold food and/or drink, as is gastric emptying time. This article presents a prospective, randomized study that examined the hypothesis that early intake by pediatric patients following minor surgery would not increase the risk of vomiting and that the first oral intake is at body temperature rather than room temperature, the incidence of vomiting would be decreased.

The study was conducted between November 2007 and December 2009 and involved 240 male children ranging in age from two to seven years. The results of this study demonstrated that vomiting incidence was not increased by early resumption of oral intake and that the incidence of vomiting was reduced when the fluids consumed were at body temperature rather than room temperature. The two groups in this study who drank fluids at room temperature experienced more incidences of vomiting than those who drank body temperature fluids no matter whether the fluids were consumed at one hour post-emergence or at the more conventional two hours post-emergence. This difference may be explained by the alteration of gastric contractility that is observed when cold (4°C) or hot (50°C) fluids are consumed, which alters the transpyloric flow to result in delayed gastric emptying time.

Important Findings:
From these data it appears that the more important factor for reducing the incidence of vomiting postoperatively in pediatric patients is the temperature of the fluid: those at body temperature resulting in fewer instances of vomiting than fluids at room temperature. As a result, vomiting was observed to cease one hour earlier in the group allowed to resume oral intake one hour following emergence from anesthesia, which affords a possible earlier discharge from the hospital.
Objective:
Recall the relationship between the velocity time index increase following a 100 mL colloid bolus over 1 minute (ΔVTI100) and the increase following a 500 mL colloid fluid challenge (ΔVTI500).

Treating hypovolemia in ICU patients is a challenge requiring: balancing the need for rapid fluid administration while minimizing or avoiding the potential untoward effects of peripheral and pulmonary edema, compromise of microvascular perfusion, and oxygen delivery. Prediction of fluid responsiveness is most accurately assessed by dynamic indicators such as stroke volume variation, pulsed pressure variation (PPV), respiratory variation of aortic blood flow, and aortic peak velocity; however, the dynamic indicators are not useable in patients breathing spontaneously or who have cardiac dysrhythmias. A new concept is that of a non-invasive fluid challenge whereby passive elevation of a leg simulates an infusion of 300 mL. This maneuver has been shown to accurately predict fluid responsiveness. There are situations in which this maneuver is contraindicated, such as leg and/or pelvic trauma. These authors report a test of the hypothesis that a 100 mL volume of colloid fluid infused over one minute results in sufficient change in the velocity time index (VTI), the ΔVTI100, to accurately predict fluid responsiveness after a 500 mL cumulative fluid challenge administered over 15 minutes, ΔVTI500. The study was conducted from February through December 2009. The final study cohort was 39 patients, 76.9% of which were male.

Important Findings:
The data from this study revealed that following a rapid, one minute, infusion of 100 mL of hydroxyethyl starch, a 10% increase in the VTI was observed and that this ΔVTI100 did accurately predict the 15% increase in VTI (ΔVTI500) that ensued following the 15 minute, 500 mL infusion. The predictive ability of the ΔVTI100 for fluid responsiveness was greater than either PPV or central venous pressure (CVP). Moreover, there was a high correlation coefficient (r = 0.81) between the ΔVTI100 and ΔVTI500, which was interpreted to indicate that the greater observed increase in the ΔVTI100 brings the expectation of a similarly greater ΔVTI500. The authors also suggest that greater fluid volumes can be administered and/or additional fluid challenges may be attempted in patients demonstrating a large ΔVTI100. If the ventricular outflow chamber diameter is assumed to remain constant for a particular patient and variations in heart rate are low, then cardiac output variations are related to VTI variations. Therefore, VTI measurements, and the observed variations of VTI, directly correlate with cardiac output variations, which avoid the potential error in measurement of the left ventricle outflow chamber diameter. Assessment of volume status has been accomplished via individual measurements of static parameters such as cardiac filling pressures or volumes. In accordance with the Frank-Starling curve, the relationship between ventricular preload and cardiac output varies with cardiac function. These authors posit that significant increases in the VTI following the low volume, rapid infusion corresponds to the steeply sloped portion of the Frank-Starling curve without regard its cardiac function. Administration of 100 mL boluses may be done so long as there continues to be a significant VTI increase following the bolus. The boluses should be stopped when the ΔVTI does not increase following a bolus.
Objective:
Assess gastric contents and air volumes and the time course of gastric emptying in healthy children by magnetic resonance imaging (MRI) after overnight fasting and ingestion of a defined amount of standardized clear fluid.

Current fasting times in children of 2 h for clear fluids improve hydration, patient comfort, and cooperation at time of induction of anaesthesia. This study assesses gastric contents and air volumes and the time course of gastric emptying in healthy children by MRI after overnight fasting and ingestion of a defined amount of standardized clear fluid.

Sixteen healthy children, age 6-14 years, ASA physical status class I or II and with the absence of any gastrointestinal disease or functional disturbances volunteered for the study. MRI scans to assess residual gastric volumes immediately before and after drinking 7 ml kg⁻¹ of a standardized clear fluid syrup and after 30, 60, 90, and 120 min. Random string codes were used to identify all MRI scans and allow for blinded evaluation.

Ninety-six MRI scans with median gastric fluid volume (GFV) 33 and gastric air volume (GAV) 33 ml were acquired in 16 volunteers. After 90 and 120 min, indexed GFV (GFVw) was less than the initial value after overnight fasting in 10 of 16 participants. Indexed GAV (GAVw) showed more variation compared with GFVw, especially after overnight fasting and immediately after fluid ingestion. Median GAVw was larger than median GFVw, except for the examinations immediately and 30 min after drinking.

The authors mainly found that GFV decreased rapidly with a median half-life of <30 min after drinking 7 ml kg⁻¹ of a standardized clear fluid. Baseline GFVw of 0.62 ml kg⁻¹ measured with MRI was higher than most gastric volumes in other pediatric studies. The short fasting period provided advantages of prevention of dehydration, hypoglycemia, improved quality of induction, and patient comfort.

Important Findings:
MRI is a suitable, non-invasive, and safe technique for determining gastric volumes in children, and shows that gastric emptying after ingestion of clear fluid occurs with a median half-life of <30 min with significant inter-individual variation.
Objective:
Recall the secondary effect of clevidipine observed in adolescent patients undergoing spinal surgery.

Controlled hypotension (CH) is one of many available methods employed to help limit or avoid any need for blood transfusions. Other methods include administration of direct-acting vasodilators, calcium channel antagonists, β-adrenergic antagonists, ganglion-blocking agents, and inhalational anesthetic agents. Clevidipine is an intravenous calcium channel antagonist in the dihydropyridine class. This is a short-acting drug, with a half-life of one to three minutes, that is rapidly metabolized by non-specific blood and tissue esterases. This drug is currently approved for use to reduce blood pressure when oral drug administration cannot be achieved. This article reports these authors’ experiences with clevidipine during spinal surgery on adolescent patients.

This study was a retrospective review of all patients having spinal surgery who received clevidipine over a two-year period. The study cohort consisted of 20 patients ranging in age from 14 to 18 years; the cohort was 55% male. The chemical structure and hemodynamic effects of clevidipine are similar to those of nicardipine. In previous studies on adults, clevidipine was administered as a continuous infusion within the range of 0.4-8 mcg/kg/minute, resulting in a reduction of systolic blood pressure (SBP) of ≥15% in 92.5% of the study cohort. The median time to achieve the desired SBP level was six minutes. There was an observed mild increase in heart rate (HR) observed with this treatment. Prior to this report, only two studies investigated the use of clevidipine in children. In those studies the infusions were administered at 0.5-3.5 mcg/kg/minute in one study and 1-7 mcg/kg/minute in the other study. In the current study, clevidipine was infused at an initial rate of 0.5-1 mcg/kg/minute with incremental increases of 0.5-1 mcg/kg/minute every two to three minutes. The targeted mean arterial pressure (MAP) of 50 to 65 mmHg was reached in under five minutes in 75% of this cohort and in under 10 minutes for the entire study cohort. This pressure was maintained with the infusion rate ranging from 1-5 mcg/kg/minute. In this study, administration of a β-adrenegic blocking agent was required in 15% (3) of the patients for control of reflex tachycardia.

Important Findings:
These authors observed few adverse effects in conjunction with administration of clevidipine in adolescent patients undergoing spinal surgery. Excessive hypotension was not observed in this study and there was an expected reflex tachycardia that occurred in a few patients. The observed reflex tachycardia was greater than that manifested by adults receiving clevidipine or what was observed in studies utilizing nicardipine. A second effect observed in this study was a decrease in PaO2. This decrease was believed to be secondary to an inhibition of hypoxic pulmonary vasoconstriction due to the drug’s vasodilation actions. For the patients in this limited cohort, the decreased PaO2 was not clinically significant; however, the authors recommend clevidipine not be considered for use in patients who are at risk for hypoxemia because of intrinsic lung disease.
Objective:
Discuss the optimal methods for cerebral perfusion pressure monitoring during pediatric cardiac monitoring.

Sedation and depth of anesthesia can be monitored by the processed electroencephalograph, the bispectral index (BIS). Deep anesthesia is indicated by a low BIS value while electrical silence of the brain is indicated by a value of 0. The BIS value may also decrease from hypoxia, hypotension, or hypoventilation resulting in cerebral dysfunction. From this association, it may be a useful tool to monitor cerebral hypoperfusion in both adults and children. And, even though BIS values are most accurate for children ≥2 years of age, employing BIS monitoring may be helpful for detection of cerebral hypoperfusion during pediatric cardiac surgery when used in conjunction with cerebral perfusion pressure (CPP) monitoring. This article details the combination of BIS monitoring with transcranial Doppler ultrasonography (TCD) monitoring of cerebral blood flow (CBF) during pediatric cardiac surgery. For this procedure, the authors report the usefulness of this monitoring combination in detecting cerebral hypoperfusion and for aid in the placement of the aortic cross-clamp. This patient was a two-day old infant weighing 2.8 kg, with the diagnosis of coarctation of the aorta, who presented for emergent surgical correction of the aorta. Neurological complications during pediatric cardiac surgery occur in 2% to 25% of such cases. Hemodynamics are routinely, and relatively easily, monitored throughout such procedures but, neurological status/function monitoring is neither easily accomplished nor routinely utilized historically for such patients.

Important Findings:
Electroencephalograph (EEG), TCD, jugular bulb oxygen saturation, and near-infrared spectroscopy (NIRS) are monitoring methods historically employed in neurological status monitoring. Employing BIS values may be indicative of cerebral hypoperfusion conditions, but BIS should not be the exclusive method because of the reduction of BIS values that may occur from anesthesia depth or hypothermia—changes that require time to be registered and indicated. The optimal method would be a multimodal approach as that employed in this case report. During the case presented, anesthesia depth, rectal temperature, and end-tidal carbon dioxide (ETCO2) concentration were maintained at a constant level when aortic cross-clamping was occurring, during which time the CBF became undetectable using TCD. This was followed by a fall of the BIS value to 0. The dramatic change was interpreted to be the result of cerebral hypoperfusion. The most optimal method for CPP monitoring is a direct method, but such a method is both invasive and, for this patient, impractical. Non-invasive tools: CPP, NIRS, and TCD should be considered for use during pediatric cardiac surgery. Of these three, TCD provides a direct, continuous, real-time measure of CBF, which is useful for confirmation of cerebral hypoperfusion in instances of BIS values that are very low or 0, or low cerebral oxygen saturation measured by NIRS.
Objectives:
Recall the potential advantages of intramuscularly administered ephedrine to treat postoperative nausea and vomiting.

This article presents a case report detailing the use of ephedrine in the treatment of postoperative nausea and vomiting. In this case, a 45-year-old woman presented to the operating room for an exploratory laparotomy, partial hepatectomy and cholecystectomy secondary to a ruptured hepatic adenoma. She presented with an otherwise unremarkable past medical history. The patient did report a very significant history of postoperative nausea and vomiting as well as very significant motion sickness. For postoperative analgesia, this patient was prescribed a patient-controlled epidural (PCEA) with 0.5% bupivacaine plus hydromorphone 10 mcg/mL. Upon admission to the postanesthesia care unit (PACU), the patient complained of nausea and dizziness. Once her vital signs and urine output were stabilized, she received a 25 mg dose of ephedrine by intramuscular (IM) injection. The ephedrine quelled her nausea at the time and subsequent reports of nausea were managed with ondansetron and perchlorperazine, though with limited success. Her nausea and dizziness returned later in the day and movement exacerbated both. She reported good analgesia from the PCEA.

Because of the limited success of ondansetron and perchorperazine, a 1.5 mg scopolamine patch was ordered, but due to the significant time lag between patch placement and the onset of action, the patient was given another 25 mg IM dose of ephedrine to bridge this time lag. Within 30 minutes she reported relief from her symptoms. Although the alpha-adrenergic effects of ephedrine are well known, the mechanism by which ephedrine produces anti-emetic effects are not well understood and the effectiveness of this treatment has been historically well documented. Previous studies have documented equal effectiveness for droperidol, 0.04 mg/kg IM, and ephedrine 0.5 mg/kg IM.

Important Findings:
The anti-emetic effect of ephedrine may be accomplished by minimizing hypotension, but in other studies both normotensive and hypotensive patients have benefited from administration of ephedrine. Although not immediately apparent, neither blood pressure, heart rate, nor other sympathetic effects are increased following an IM dose of ephedrine, which is particularly important for patients with hypertension or organic heart disease. Additional advantages of IM ephedrine for treatment of nausea and/or vomiting include an absence of sedation, no potential for a prolongation of the QT interval, low cost, and it does not delay discharge from the PACU. The anesthesia provider must remember that ephedrine is contraindicated in patients being treated with monoamine oxidase inhibitors (MAOIs), those with dysrhythmias, and those with angle-closure glaucoma. Ephedrine is likely best avoided for patients with coronary artery disease, hypertension, seizure disorder, diabetes, thyroid dysfunction, vascular disorders, and elderly patients.
Objective:
Recall the additional risk factors associated with respiratory adverse events in the perioperative period for children undergoing rigid bronchoscopy.

Aspiration of a foreign body (FB) in pediatric patients is a life-threatening event. The definitive intervention is rigid bronchoscopy. There are risks associated with rigid bronchoscopy that are classified as patient-related, surgery-related, and anesthesia-related. Respiratory events occur frequently in children following rigid bronchoscopy. This article details a prospective, single-institution review of anesthesia for pediatric patients under seven years of age undergoing rigid bronchoscopy due to FB aspiration. The study was conducted from January 2007 through December 2009. The goal of the study was to identify factors associated with adverse respiratory events following the procedure. Two criteria defined adverse events: 1) minor events including hemorrhage, minor desaturation, and partial laryngospasm; 2) major events included major desaturation, complete laryngospasm, and pneumothorax. Over the course of this investigation, there were 48 instances (9.5%) of adverse respiratory events.

Important Findings:
Wheezeing and coughing that mimic that seen in FB aspiration may be produced by chronic asthma, pneumonia, or airway inflammation to cause recurrent or persistent bronchospasm with symptoms of air-flow obstruction. These authors observed the incidence of postoperative impairment to be significantly greater in the negative FB group, at 77.8%, while in the positive FB group, the incidence was only 16.2%. Postoperative airway impairment occurred in 36.7% of the children with preoperative airway impairment. Postoperative respiratory adverse events were associated with additional risk factors including respiratory symptoms, eczema, familial history of asthma, rhinitis, or exposure to tobacco smoke. The authors summarize the study suggesting that “preoperative respiratory impairment is associated with a high risk of postoperative adverse respiratory events in preschool children undergoing rigid bronchoscopy.”
Assessment

1. According to Akinci, et al., jackknife positioning for patients undergoing lumbar discectomy compared to a prone position resulted in:
   a. Less blood loss
   b. More blood loss
   c. Longer surgical duration
   d. Shorter surgical duration

2. According to Albin, et al., venous air embolism occurs in what operative patient position?
   a. Sitting
   b. Lateral
   c. Prone
   d. All of the above

3. According to Awad, et al., clues to aberrant pulmonary artery catheter placement include:
   a. Atypical pulmonary waveforms
   b. Monophasic waveform from the jugular/innominate vein
   c. Overestimated cardiac output
   d. All of the above

4. According to Berger, et al., perioperative transthoracic echocardiography may be difficult due to:
   a. Patient age
   b. Positioning limitation
   c. Patient acceptance
   d. None of the above

5. According to Bhardwaj, et al., in children with glaucoma undergoing ocular surgery, placement of an LMA vs an endotracheal tube resulted in:
   a. Higher IOP
   b. Higher heart rates
   c. Stable IOP
   d. Higher systolic blood pressure

6. According to Biddle, et al., some suggestions for the management of sleep-fatigue included:
   a. Work-hour restrictions
   b. Start cases later in the day
   c. Improved break schedule
   d. All of the above

7. According to Candiotti, et al., when comparing the use of fospropofol with propofol for patients being mechanically ventilated, the incidence of agitation was:
   a. Higher with fospropofol
   b. Similar between groups
   c. Lower with fospropofol
   d. Higher with propofol

8. According to Cobey, et al., Dieulafoy lesions are responsible for what percent of acute or chronic upper gastric bleeding?
   a. 0.1-6.7%
   b. 0.2-5%
   c. 3-6%
   d. 1-2%
9. According to Dardashti, et al., the impact of preoperative hemoglobin levels and renal function on long-term survival in patients receiving red blood cell transfusions after coronary bypass grafting was:
   a. Decreased survival
   b. Increased survival
   c. No impact
   d. None of the above

10. What did Dean, et al., find when studying the safety of deep sedation without intubation for outpatient abortion?
    a. Perioperative pulmonary aspiration occurred in most of the cases.
    b. The risk of aspiration appears lower as gestational age increases.
    c. The findings oppose the trend in outpatient abortion facilities.
    d. Deep sedation without intubation is a viable method of anesthesia for first and second trimester abortion in the outpatient setting.

11. What did Eker, et al., find when studying the use of sedation agents in epileptic children on phenobarbital monotherapy?
    a. The inconsistency in response to the initial sedative agents required titration of additive ketamine sedation.
    b. The duration of initial ketamine requirements was longer.
    c. The additive ketamine consumption was less.
    d. Additional sedative administration was not required in these children.

12. What did Jüttner, et al., learn when they evaluated the lamina technique for placement of a paravertebral catheter?
    a. Not equally effective in all patients
    b. Difficult to adopt
    c. Not well accepted by patients and caregivers
    d. Highly effective

13. According to Karkouti, et al., how does the influence of erythrocyte transfusion on AKI after cardiac surgery differ in anemic and nonanemic patients?
    a. The risk of AKI was nearly twofold higher in nonanemic than anemic patients.
    b. Patients likely to require multiple erythrocyte transfusions during cardiac surgery are also most likely to be harmed by them.
    c. The risk of AKI decreased in direct proportion to the number of erythrocyte transfusions.
    d. The increased risk of AKI is less pronounced in anemic patients.

14. What did Kaynar, et al., find provided adequate sedation without any hemodynamic alterations or respiratory compromise during pediatric diagnostic cardiac catheterization?
    a. Propofol
    b. Ketamine
    c. Dexmedetomidine
    d. Remifentanil

15. Kowalik, et al., observed the lowest incidence of AKI-RRT in which type of surgery?
    a. Surgery of the thoracic aorta
    b. Heart valve surgery
    c. Uncombined coronary artery bypass graft surgery
    d. Surgery for acute ventricular septal rupture

16. What did Koyama, et al., find when comparing hemodynamic responses to tracheal intubation using the Airway Scope and Macintosh laryngoscope in normotensive and hypertensive patients?
    a. The Airway Scope satisfies the hemodynamic response to tracheal intubation compared with the Macintosh laryngoscope in normotensive patients but not in hypertensive patients.
    b. The Airway Scope produces more stimulation than the conventional laryngoscopy.
    c. In hypertensive patients, the Airway Scope satisfies hemodynamic responses to tracheal intubation.
    d. The Airway Scope offers a significant advantage in reducing postoperative sore throat and hoarseness.
17. According to Lahtinen, et al., what were the effects of Levosimendan when used after heart surgery?
   a. Significantly increased the requirements for rescue inotropic drug support
   b. Reduced the rate of postoperative heart failure
   c. Lower incidence of in-hospital mortality
   d. Decreased hypotension

18. According to Laskowski, et al., which procedure(s) showed the greatest decrease in ketamine used?
   a. Head and neck surgery
   b. Dental surgery
   c. Upper abdominal and thoracic surgery
   d. Tonsillectomy

19. What did Lee, et al., find was the most common complication associated with peripheral nerve block claims?
   a. Nerve injury
   b. Death
   c. Pneumothorax
   d. Brain damage

20. According to Leslie, et al., which of the following effects have been produced by anesthetics?
   a. Provocation of the inflammatory response
   b. Increased deposition of Alzheimer’s disease proteins
   c. Induced neuronal apoptosis
   d. All of the above

21. According to Linnen, et al., which of the following statements is true regarding clinically significant depressive states in surgical patients?
   a. Such depressive states are uncommon and do not warrant evaluation during the preoperative anesthesia assessment.
   b. Patients with clinically significant depression should follow a routine perioperative pathway and be discharged routinely with a referral for psychotherapy follow-up.
   c. Gaining knowledge of the depressive state during the preoperative anesthesia evaluation will afford institution of appropriate prophylactic measures to bolster the patient and counteract many of the untoward effects of depression.
   d. None of the above.

22. According to Lustenberger, et al., which of the following may contribute to greater survival of ethanol-positive [EtOH (+)] patients with traumatic brain injury?
   a. Blunting of adrenergic response by reduced catecholamine surge.
   b. Mitigation of early coagulopathy associated with severe traumatic brain injury
   c. Significantly lower complication rate
   d. All of the above

23. According to Mayer, et al., which of the following is NOT an implication derived from the treatment of acute severe hypertension in the STAT registry?
   a. The pressor response is remarkably sturdy and resolute even in severe brain injury.
   b. Severe brain injury leaves the pressor response more prone to overtreatment.
   c. Pressor response overtreatment increases the risk of secondary ischemic injury.
   d. Impaired autoregulation also increases the risk of pressor overtreatment and secondary ischemic injury.

24. According to Mercan, et al., which of the following appears to be most important for reducing the incidences of vomiting in children after minor surgical procedures?
   a. Fluids that are at body temperature
   b. Fluids that are at room temperature (20-22 oC)
   c. The sugar content of the fluid
   d. Waiting for the passage of the entire conventional 2 hours following emergence from anesthesia.
25. According to Muller, et al., the high correlation between $\Delta VTI_{100}$ and $\Delta VTI_{500}$ suggests which of the following?
   a. The greater the $\Delta VTI_{100}$ yields a smaller $\Delta VTI_{500}$.
   b. The greater $\Delta VTI_{100}$ represents the flat slope of the Frank-Starling curve.
   c. Large $\Delta VTI_{100}$ suggests greater fluid volumes and/or additional fluid challenges may be appropriate.
   d. None of the above.

26. What did Schmitz, et al., find when using MRI to study gastric emptying after overnight fasting and clear fluid intake?
   a. Median half time for gastric emptying was >30 min.
   b. Baseline GFV$_w$ of 0.62 ml kg$^{-1}$ was lower than most gastric volumes in other pediatric studies.
   c. Gastric emptying after ingestion of clear fluids occurs with a median half-life of <30 min.
   d. MRI is unsuitable for determining gastric

27. According to Tobias, et al., which of the following patients likely should NOT receive clevidipine for controlled hypotension during spinal surgery?
   a. A patient with intrinsic lung disease
   b. A patient with cerebral palsy
   c. A patient with Duchenne muscular dystrophy
   d. All of the above.

28. According to Toyama, et al., which of the following non-invasive tools provides a direct, continuous, real-time measurement of cerebral blood flow?
   a. BiSpectral Index
   b. Cerebral Perfusion Pressure
   c. Near-infrared Spectroscopy
   d. TransCranial Doppler ultrasonography

29. According to Wuhrman, et al., advantages of intramuscularly administered ephedrine for the treatment of postoperative nausea and vomiting include all the following, EXCEPT:
   a. Low cost treatment
   b. Prolongation of the QT interval
   c. Lack of sedation
   d. Does not delay discharge from the PACU

30. According to Zhang, et al., which of the following is an additional risk factor for respiratory adverse events in the perioperative period for children undergoing rigid bronchoscopy?
   a. Eczema
   b. Exposure to tobacco smoke
   c. Rhinitis
   d. All of the above

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