

THIS MONTH IN ANESTHESIOLOGY



845 Ultrasound Evaluation of Gastric Emptying Time in Healthy Term Neonates after Formula Feeding

The current American Society of Anesthesiologists (ASA) Practice Guidelines recommend that formula-fed infants fast for at least 6 h before elective procedures, which is much longer than the 2.5- to 3-h intervals at which infants are typically fed. Prolonged fasting could lead to hypoglycemia and dehydration in this vulnerable population. The hypothesis that gastric emptying time in healthy neonates after formula feeding is less than the current 6-h fasting guideline was tested in 46 healthy full-term neonates by determining gastric emptying times using serial ultrasonography of the gastric antrum after formula feeding. The mean \pm SD gastric emptying time in the 1.5 ± 0.7 days old infants weighing 3.3 ± 0.5 kg after being fed 30 ± 11 ml of formula was 93 ± 43

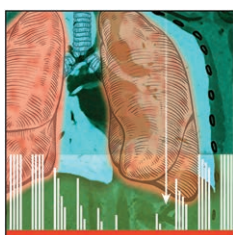
min (range, 45 to 150 min). Only formula-fed neonates were included in this study because of the difficulty of measuring the volume of breast milk ingested by nursing neonates; breast milk has been shown to empty from the stomach more rapidly than formula. See the accompanying Editorial on [page 823](#). (Summary: M. J. Avram. Image: A. Johnson, Vivo Visuals.)



852 Availability of Inpatient Pediatric Surgery in the United States

Pediatric surgical care is becoming consolidated in the United States. The American College of Surgeons' Task Force for Children's Surgical Care developed consensus standards of care in 2014, and in 2015 the college established a Children's Surgery Verification Program to evaluate care within specific hospitals. The hypothesis that pediatric surgical care across the United States was highly concentrated within specialized centers before implementation of the verification program was tested in a two-part, retrospective, cross-sectional analysis that focused on nonambulatory pediatric surgery. The first part used all-encounter datasets from six representative states in 2014 to determine where pediatric inpatient surgery takes place, and the second used the 2016 Kids' Inpatient Database, which excludes hospitals that do not admit children or deliver babies, to evaluate the generalizability

of that data. In the six study states, high-capability, children's, and specialty hospitals accounted for 6.7% of all hospitals (48 of 713) but reported 83.3% of all pediatric procedures (127,869 of 153,587). Nationwide, 8.7% of all Kids' Inpatient Database hospitals (328 of 3,777) accounted for 90.1% of all procedures (793,905 of 881,049). See the accompanying Editorial on [page 826](#). (Summary: M. J. Avram. Image: C. Broadway, A. I. duPont Hospital for Children.)



862 Postoperative Pulmonary Complications' Association with Sugammadex versus Neostigmine: A Retrospective Registry Analysis

Reversal of residual neuromuscular blockade decreases the risk of postoperative pulmonary complications. Residual neuromuscular blockade can be reversed by neostigmine, an acetylcholinesterase inhibitor, and sugammadex, a cyclodextrin that binds muscle relaxants approved by the Food and Drug Administration in 2015. The aim of this single-center, retrospective, observational study of 10,491 general surgery patients was to determine if reversal with sugammadex is associated with a lower risk of pulmonary complications within the 30-day postoperative period compared to reversal with neostigmine. The primary outcome, postoperative pulmonary complications, was defined as a composite of three postoperative respiratory events: pneumonia, requiring mechanical

ventilation for more than 48 h, and unplanned intubation. Of the eligible cases, 7,800 received neostigmine and 2,691 received sugammadex. The incidence of postoperative pulmonary complications was 5.9% for patients receiving neostigmine and 4.2% for those receiving sugammadex. The adjusted odds ratio (95% CI) for the occurrence of postoperative pulmonary complications in patients having residual neuromuscular blockade reversed with sugammadex compared to those reversed with neostigmine was 0.89 (0.65 to 1.22). See the accompanying Editorial on [page 828](#). (Summary: M. J. Avram. Image: A. Johnson, Vivo Visuals.)



874 Association of Gestational Age with Postpartum Hemorrhage: An International Cohort Study

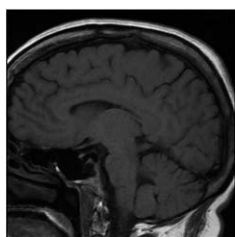
Postpartum hemorrhage is a leading cause of preventable maternal morbidity and death in developed countries. The hypothesis that there is a nonlinear association between gestational age at birth and the odds of postpartum hemorrhage was tested in a retrospective analysis of population-based cohorts from California and Sweden. The incidences of postpartum hemorrhage for delivery hospitalizations were 3.2% (66,583 of 2,079,837) between 2011 and 2015 in California and 7.1% (23,323 of 328,729) between 2014 and 2017 in Sweden. The incidence was highest for deliveries between 41 and 42 weeks: 5.6% (8,921 of 160,267) in California and 9.5% (7,186 of 75,539) in Sweden. Compared to deliveries between 37 and 38 weeks, the adjusted

odds ratio for postpartum hemorrhage for deliveries between 41 and 42 weeks was 2.04 (95% CI, 1.98 to 2.09) in California and 1.62 (95% CI, 1.56 to 1.69) in Sweden. Before term, deliveries between 22 and 27 weeks in California had an adjusted odds ratio of 1.48 (95% CI, 1.33 to 1.65), whereas there was no association observed for deliveries in Sweden between 22 and 27 weeks. See the accompanying Editorial on [page 832](#). (Summary: M. J. Avram. Image: J. P. Rathmell.)



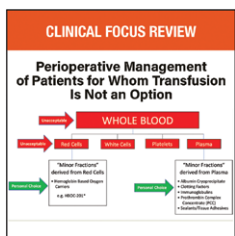
887 Individualized versus Fixed Positive End-expiratory Pressure for Intraoperative Mechanical Ventilation in Obese Patients: A Secondary Analysis

General anesthesia with invasive ventilation can lead to the formation of atelectasis and impair arterial oxygenation in obese patients. Atelectasis can be reopened using recruitment maneuvers and kept open through adequate positive end-expiratory pressure (PEEP). The hypothesis that individualized PEEP titration improves oxygenation and better restores ventilation distribution to the dependent lung than fixed PEEP values of 4 to 5 or 12 cm H₂O was tested in a secondary analysis of data from obese patients undergoing elective laparoscopic abdominal surgery included in two clinical trials. In both trials, patients were randomized to an intervention group and a control group. For obese patients, a recruitment maneuver followed by electrical impedance tomography–guided individualized PEEP resulted in higher PEEP (median 18 cm H₂O; interquartile range, 16 to 22), better arterial oxygenation, lower driving pressures, and redistribution of ventilation to dependent lung areas compared with a recruitment maneuver followed by a fixed PEEP of 12 cm H₂O or low PEEP of 4 or 5 cm H₂O without a recruitment maneuver. See the accompanying Editorial on [page 838](#). (Summary: M. J. Avram. Image: J. P. Rathmell.)



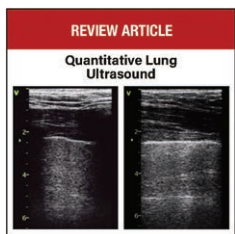
901 Mitochondrial Function and Anesthetic Sensitivity in the Mouse Spinal Cord

Disrupting mitochondrial complex I, the rate limiting step in the electron transport chain, results in profound hypersensitivity to volatile anesthetics. The *Ndufs4* knockout (KO) mouse lacks a subunit of mitochondrial complex I and is profoundly hypersensitive to volatile anesthetics. The hypotheses that volatile anesthetics disrupt presynaptic function or other neuronal characteristics in spinal cord motor neurons of *Ndufs4*(KO) mice were tested by comparing both synaptic activity and intrinsic membrane properties of mutant and wild-type neurons. There were few differences in presynaptic function between *Ndufs4*(KO) and control neurons. Extremely low isoflurane concentrations (0.6%) induced an outward potassium leak in noncholinergic neurons of the ventral spinal cord of mutants that was only seen in spinal cord neurons (cholinergic and noncholinergic) from wild-type animals at much higher concentrations (1.8%). This increased potassium current produced a corresponding transmembrane hyperpolarization of ventral horn neurons. Pharmacologic blockade of the currents with norfluooxetine indicated that TREK type two-pore domain potassium channel activity is altered in *Ndufs4*(KO) mice, providing a link between mitochondrial and potassium channel functions. See the accompanying Editorial on [page 835](#). (Summary: M. J. Avram. Image: J. P. Rathmell.)



939 Perioperative Management of Patients for Whom Transfusion Is Not an Option (Clinical Focus Review)

Perioperative management of patients for whom transfusion is not an option requires careful planning. After documentation of acceptable blood management techniques, anemia and its etiology should be identified and treated to optimize hemoglobin concentration preoperatively. Elective surgeries may need to be delayed to optimize hemoglobin concentration, which can take more than a month. The guiding principle for intraoperative management of patients without transfusion is preserving the patient's own blood. The primary intraoperative blood conservation methods include cell salvage for blood lost during surgery and acute normovolemic hemodilution while preventing excessive blood loss and coagulopathy. During surgery, hypothermia and large volumes of crystalloid should be avoided because they may result in coagulopathy. Antifibrinolytics can promote stable clot formation. In the immediate postoperative period, one should remain vigilant for surgical bleeding that necessitates an immediate return to the operating room. After postoperative bleeding and coagulopathy have been addressed, attention should focus on management and tolerance of postoperative anemia. (Summary: M. J. Avram. Image: From original article.)



949 Quantitative Lung Ultrasound: Technical Aspects and Clinical Applications (Review Article)

As a result of recent advances, lung ultrasound is becoming a powerful diagnostic and monitoring tool in multiple fields, including in the perioperative setting and in both critically ill and chronically ill patients. The number and type of artifacts visualized by lung ultrasound change with lung density, and the loss of lung aeration can be quantified on the basis of the number and type of artifacts visualized. Different scoring systems have been validated to improve the use of lung ultrasound for not only diagnosis but also monitoring lung aeration. Each technical and quantitative approach addresses different clinical needs and should be applied in the appropriate clinical context, where it can improve patient management in terms of time to diagnosis and time to advanced examinations. Although ultrasound examination is operator-dependent and requires adequate training, computer-aided diagnosis is becoming part of lung ultrasound equipment, with the computer output assisting physicians in image interpretation. (Summary: M. J. Avram. Image: From original article.)