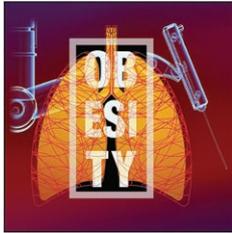


THIS MONTH IN ANESTHESIOLOGY



750 **Body Habitus and Dynamic Surgical Conditions Independently Impair Pulmonary Mechanics during Robotic-assisted Laparoscopic Surgery: A Cross-sectional Study**

Altered intraoperative pulmonary mechanics may contribute to ventilator-induced lung injury and increased risk for postoperative pulmonary complications by exposing alveoli to overdistention, repetitive recruitment and collapse, or atelectasis. The hypothesis that increasing body mass index (BMI) would be associated with evidence of increasing atelectasis, increased driving pressures, and elevated lung elastance, and that these changes would be exacerbated by pneumoperitoneum and Trendelenburg positioning, was tested in an observational study of 91 patients undergoing robotic-assisted laparoscopic abdominal surgery in Trendelenburg position

between 2017 and 2019. Increasing BMI was associated with higher airway plateau and driving pressures, elevated esophageal pressures, augmented lung elastance, and decreased end-expiratory transpulmonary pressures. These differences were exacerbated by pneumoperitoneum and by Trendelenburg positioning with pneumoperitoneum while docked with the surgical robot. Higher BMI was associated with more negative end-expiratory transpulmonary pressures and larger transpulmonary driving pressures, suggesting obese subjects were at higher risk for impaired gas exchange, atelectrauma, and intensified mechanical strain despite use of common lung protective ventilation strategies. *See the accompanying Editorial on [page 695](#). (Summary: M. J. Avram. Image: A. Johnson, Vivo Visuals.)*



764 **Volatile versus Total Intravenous Anesthesia for Cancer Prognosis in Patients Having Digestive Cancer Surgery: A Nationwide Retrospective Cohort Study**

Volatile anesthetics have been reported to have a prometastatic effect on cancer cells and propofol to have a beneficial effect. A meta-analysis of nine retrospective studies and one small randomized controlled trial found that, compared with volatile anesthesia, total intravenous anesthesia was not associated with improved recurrence-free survival of cancer patients but was associated with improved overall survival. The hypothesis that propofol-based total intravenous anesthesia would be associated with better overall and recurrence-free survival than volatile anesthesia was tested in a nationwide retrospective cohort study of patients who

underwent digestive tract cancer surgery between 2010 and 2018: 166,966 with volatile anesthesia and 29,337 with total intravenous anesthesia. The median postoperative follow-up period was 639 days in the volatile anesthesia group and 768 days in the total intravenous anesthesia group. After adjustment for baseline variables, Cox proportional hazard regression analysis found total intravenous anesthesia was not associated with better overall or recurrence-free survival than volatile anesthesia (hazard ratios, 95% CIs: 1.02, 0.98 to 1.07, and 0.99, 0.96 to 1.03, respectively). *See the accompanying Editorial on [page 698](#). (Summary: M. J. Avram. Image: Adobe Stock/J. P. Rathmell.)*



774 **Granger Causality of the Electroencephalogram Reveals Abrupt Global Loss of Cortical Information Flow during Propofol-induced Loss of Responsiveness**

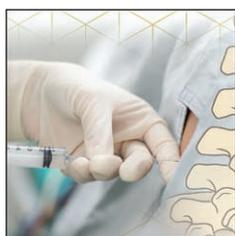
If free information flux between regions allows the brain to generate the complexity associated with the conscious state, then anesthetic-induced loss of consciousness should be accompanied by decreases in information measures. The hypothesis that propofol-induced loss and return of responsiveness is associated with decreased information flow (effective connectivity) between regions of the brain was tested by analysis of 31-channel electroencephalogram datasets recorded from 16 healthy adult volunteers. A target-controlled intravenous infusion of propofol with step increases of 0.2 $\mu\text{g}/\text{ml}$ was used to achieve a maximum

effect site concentration of 4 $\mu\text{g}/\text{ml}$ over 48 min. At propofol-induced loss of responsiveness, cortical information flow assessed by bivariate Granger causality (an effective connectivity metric) abruptly decreased in all parts of the brain, being most pronounced in lateral, frontal, and central networks and in the delta frequency band. These changes were reversed as responsiveness returned. The Granger causality results contrast with those of coherence (a nondirected measure of synchronous activity), suggesting information flow, rather than regional synchrony, is the important indicator of wakefulness. *See the accompanying Editorial on [page 700](#). (Summary: M. J. Avram. Image: J. P. Rathmell/A. Johnson, Vivo Visuals.)*



787 Cost-effectiveness Analysis of Preoperative Screening Strategies for Obstructive Sleep Apnea among Patients Undergoing Elective Inpatient Surgery

The estimated prevalence of obstructive sleep apnea in surgical populations is nearly 20%, a large proportion of which is undiagnosed. Obstructive sleep apnea is associated with increased risk of perioperative complications that may be mitigated by preoperative diagnosis and treatment. The objective of this study was to model the cost-effectiveness of preoperative screening strategies for obstructive sleep apnea, including: no screening; screening only with the STOP-Bang questionnaire; screening with the STOP-Bang questionnaire and confirmation of the diagnosis in STOP-Bang screen positive patients with polysomnography; and screening with the STOP-Bang questionnaire and confirmation of the diagnosis in STOP-Bang screen positive patients with a portable monitor. The cost-effectiveness of preoperative obstructive sleep apnea screening strategies was evaluated over the perioperative time horizon and over a lifetime horizon. In the perioperative time horizon, no screening was favored because the added effectiveness of any screening strategy was cost prohibitive. However, over the lifetime horizon, the favored strategy was to administer the STOP-Bang questionnaire and confirm the diagnosis preoperatively for screen positive patients using polysomnography. See the accompanying Editorial on [page 702](#). (Summary: M. J. Avram. Image: Adobe Stock.)



801 Mepivacaine versus Bupivacaine Spinal Anesthesia for Early Postoperative Ambulation: A Randomized Controlled Trial

Hip arthroplasty performed under spinal anesthesia has reduced operative time, complications, and blood transfusions compared to that performed under general anesthesia, but spinal anesthesia can be a drawback for outpatient total hip arthroplasty if weakness and sensory impairment delay ambulation and discharge. The hypothesis that patients undergoing primary total hip arthroplasty receiving mepivacaine spinal anesthesia would ambulate earlier than those receiving hyperbaric bupivacaine or isobaric bupivacaine spinal anesthesia was tested in a randomized, double-blind trial of 154 patients. Seventy percent of patients administered mepivacaine met the primary outcome of ambulation between 3 and 3.5 h, which was met by 37.7% administered hyperbaric bupivacaine and 17.6% administered isobaric bupivacaine. Patients who received mepivacaine were more likely to ambulate at 3.5 h than those who received hyperbaric bupivacaine (odds ratio 3.9; 95% CI, 1.7 to 8.8) or isobaric bupivacaine (odds ratio 10.8; 95% CI, 4.2 to 27.8). Patients in the mepivacaine group were more likely to be discharged home on the day of surgery than those in either bupivacaine group. (Summary: M. J. Avram. Image: J. P. Rathmell.)



879 Assessment of Right Heart Function during Extracorporeal Therapy by Modified Thermodilution in a Porcine Model

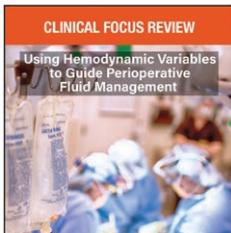
Venoarterial extracorporeal membrane oxygenation (ECMO) is used to treat circulatory shock states. Although measuring cardiac output during ECMO therapy may be critical for evaluation of treatment success, echocardiography is the only method established for its measurement during ECMO. Thermodilution is a well-established method for measuring cardiac output but thermodilution during ECMO may overestimate it because of indicator loss into the ECMO circuit. A modified thermodilution model based on the hypothesis that injectate volume is divided into the ECMO circuit and the lung circuit, depending on the different flows, was tested in 16 healthy pigs undergoing venoarterial ECMO at ECMO flows of 1 to 4 l/min with the aim of estimating pulmonary blood flow and right ventricular function. Calculated pulmonary blood flows correlated well with flow probe measured flows ($r^2 = 0.74$); bias was -6 ml/min (95% CI ± 48 ml/min), with clinically acceptable limits of agreement (668 ml/min). Right ventricular ejection fraction increased from 15.6 to 18.2% with ECMO flow reductions with a marked increase in measured stroke volume. See the accompanying Editorial on [page 708](#). (Summary: M. J. Avram. Image: J. P. Rathmell.)



921 Technological Assessment and Objective Evaluation of Minimally Invasive and Noninvasive Cardiac Output Monitoring Systems (Clinical Focus Review)

Maintenance of adequate cardiac output is a mainstay of hemodynamic management in perioperative and intensive care medicine. While invasive indicator dilution methods remain the clinical reference methods for cardiac output measurement, numerous minimally invasive and noninvasive methods for estimating cardiac output have been developed in recent years. Minimally invasive cardiac output monitoring methods include arterial catheter-based pulse wave analysis and the esophageal Doppler. Methods for noninvasive cardiac output estimation include noninvasive pulse wave analysis, pulse wave transit time, and thoracic electrical

bioimpedance and bioreactance. To be able to select the appropriate method for the individual patient and clinical setting, it is important to understand the basic measurement principles of these systems and their inherent limitations. This Clinical Focus Review describes minimally invasive and noninvasive cardiac output monitoring technologies available in clinical practice and discusses how a new monitoring method is evaluated objectively against a reference method in a method comparison study. (Summary: M. J. Avram. Image: J. P. Rathmell.)



929 Using Dynamic Variables to Guide Perioperative Fluid Management (Clinical Focus Review)

The general principles of perioperative fluid management may not be helpful in determining individual patient needs at any specific moment. Individual fluids needs may be better assessed by determining the patient's fluid responsiveness status, which is the degree by which a modification of preload affects the stroke volume. Fluid responsiveness is best determined by measuring the change in cardiac output following administration of a fluid challenge, but using a fluid challenge to determine fluid responsiveness has shortcomings. Dynamic variables that quantify the variations in the arterial pressure and plethysmographic waveforms during mechanical ventilation reflect fluid responsiveness and may be helpful in identifying occult hypovolemia and in preventing unnec-

essary fluid administration. Protocols that use stroke volume variation greater than 12% or plethysmographic variability index greater than 13% as triggers for fluid administration result in less fluid being administered and in better outcome compared with standard care. This important value of dynamic variables stems from their ability to identify nonresponders and to prevent administration of ineffective fluid challenges. (Summary: M. J. Avram. Image: J. P. Rathmell.)