Journal-related Activities and Other Special Activities at the 2018 American Society of Anesthesiologists Meeting

Michael J. Avram, Ph.D., J. David Clark, M.D., Ph.D., Andrew Davidson, M.B.B.S., M.D., F.A.N.Z.C.A., Evan D. Kharasch, M.D., Ph.D., Sachin Kheterpal, M.D., M.B.A., Jerrold H. Levy, M.D., F.A.H.A., F.C.C.M.

27th Annual Journal Symposium: Point-of-care Ultrasound in Perioperative, Critical Care, and Pain Medicine

Sunday, October 14, 2018, 8:15 AM to 11:15 AM
Moscone Center South, Room 305

The 2018 Journal Symposium titled "Point-of-care Ultrasound in Perioperative, Critical Care, and Pain Medicine" addresses the latest science on point-of-care ultrasound used to guide diagnosis, treatment, and management of patients across the perioperative, critical care, and pain medicine spectrum. It will feature the following moderators and speakers.

Moderators

J. David Clark, M.D., Ph.D., Editor, ANESTHESIOLOGY, Stanford University, Palo Alto, California; Sachin Kheterpal, M.D., M.B.A., Editor, ANESTHESIOLOGY, University of Michigan, Ann Arbor, Michigan; Jerrold H. Levy, M.D., F.A.H.A., F.C.C.M., Executive Editor, ANESTHESIOLOGY, Duke University, Durham, North Carolina.

Speakers

Mahdav Swaminathan, M.D., M.B.B.S., Department of Anesthesiology, Duke University, Durham, North Carolina
Marcos Silva Restrepo, M.D., M.Sc., F.R.C.P.C., Department of Anesthesia, University of Toronto, Toronto, Ontario, Canada

Description

A stroll through the operating rooms, intensive care units, or clinics of a modern health system demonstrate that we are in the midst of a revolution in the use of point-of-care ultrasound. Just a decade or two ago, large, unwieldy point-of-care ultrasound machines were relegated to high-acuity operating rooms. Now, point-of-care ultrasound is used to guide diagnosis, treatment, and management of patients across the perioperative, critical care, and pain medicine spectrum. As devices have shrunk from large carts to handheld smartphones, they have permeated all phases of care and levels of training; first-year residents comfortably use ultrasound for routine vascular cannulation, and it has replaced invasive hemodynamic monitoring in many high-risk procedures. However, many questions remain regarding the use of point-of-care ultrasound by the anesthesiologist. What diagnostic and management dilemmas could be informed or eliminated by the use of point-of-care ultrasound? Where does convincing, reliable evidence demonstrate the underutilization of point-of-care ultrasound as a standard of care? How much of current point-of-care ultrasound use is evidence based, *versus* technology fad? How has point-of-care ultrasound changed clinical outcomes? What can the history of point-of-care ultrasound teach us about its future applications? What are the next novel frontiers for the use of point-of-care ultrasound by anesthesiologists? The 2018 Journal Symposium will showcase current concepts and current research in the field. Two experts will introduce these topics with 20-min presentations and 10-min discussions.

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These lectures will be followed by oral presentations of eight abstracts, summarized below, that were selected for their relevance to the symposium topic. The full text for each abstract can be found at the American Society of Anesthesiologists (ASA) abstract Web site.

JS01

"Validation of Ultrasonography to Visualize Successful Insertion of Nasogastric Tubes in Pediatric Patients" by Edward Choi, M.D., Andrew Walker, Ph.D., Michael Korostensky, Adam O. Spencer, M.D., Department of Anesthesiology, University of Calgary, Calgary, Alberta, Canada. Enteral access in the form of nasogastric tube placement is essential in the care of many hospitalized pediatric patients. Although radiographic confirmation is the "gold standard," it does not provide real-time information during insertion. This study aims to determine the feasibility of real-time ultrasound use for nasogastric tube insertion in the pediatric population. Thirty pediatric patients requiring nasogastric tube placement were enrolled and stratified into three age groups (between 0 and 2 yr, 2 and 6 yr, and older than 6 yr). Participants were placed supine with their head facing upward to facilitate tube placement. Upon nasogastric tube insertion, ultrasound images were acquired to visualize tube progression through the esophagus and gastric antrum with high-frequency linear probe or low-frequency curvilinear probe. After placement, standard institutional guidelines for final confirmation of nasogastric tube position were followed. To date, 27 patients have been enrolled. The nasogastric tube placement was successfully placed in the stomach in 26 of 27 patients on the basis of standard confirmatory testing. Of the 26 successful placements, the nasogastric tube placement was visualized in the esophagus by ultrasound in all 26 patients. A successful ultrasound view showing nasogastric tube placement in the stomach was limited to 16 of 26 patients. Our study shows that visualization of the nasogastric tube placement through the esophagus is successful regardless of age. Our data suggest that nasogastric tube placement confirmation may be more challenging when scanning with a probe in the epigastric region.

JS02

"Evaluation of Success in Spinal Block Placement between Using Palpation of Landmark *versus* Pocket-Size, Handheld Ultrasound Method in Cesarean Delivery Anesthesia" by Joshua Pan, M.D., Jasveen Kaur Chadha, M.B., B.S., Vernon H. Ross, M.D., Lynne Harris, B.S.N., Peter H. Pan, M.D., Jessica L. Booth, M.D., Department of Anesthesiology, Wake Forest School of Medicine, Winston Salem, North Carolina. Administration of spinal block is commonly achieved by palpating surface landmarks. A newly developed pocket-size ultrasound (Accuro; Rivanna, USA) provides real-time pattern recognition for spinal bony structures and three-dimensional overlay for recognition of the midline spinous process and intervertebral space. We hypothesize this novel device may reduce time and attempts to successfully place spinal block *versus* conventional palpation in obese patients. Sixty patients with body mass index greater than 30 kg/m² having spinal block for cesarean section were planned for consent and randomized into group Palpation or Ultrasound. In group Ultrasound, the needle insertion site was identified and marked by ultrasound and was used by a separate experienced provider to perform spinal block without palpating landmarks. For group Palpation, the usual palpation was used to identify the needle insertion site. The primary outcome was time from spinal needle insertion to cerebrospinal fluid (CSF) return. Forty-five of the 60 planned participants have been enrolled. Median scanning time was 34 s for group Ultrasound *versus* 32 s for group Palpation. Our primary outcome, time from spinal needle insertion to CSF return, was shorter with Ultrasound (median 41 s) than Palpation (118 s). We also observed a higher success rate (71% *vs.* 29%) of single-needle pass to obtain CSF, and a lower median number of needle passes (1 *vs.* 2) and redirections (1 *vs.* 3) to success. Our preliminary results suggest that the ultrasound device shortened time for successful placement of spinal block in obese patients (body mass index greater than 30 kg/m²).

JS03

"Incidence of Interstitial Alveolar Syndrome on Lung Sonography in Preeclamptic Women with Severe Features: A Prospective Observational Study" by Kajal Jain, M.D., Seshagiri babu Yagini, M.B., B.S., Rashmi Bagga, M.D., Nidhi Bhatia, M.D., Ajay Bahl, M.D., Departments of Anesthesia and Intensive Care, Obstetrics and Gynecology, and Cardiology, Postgraduate Institute of Medical Education and Research, Chandigarh, India. Acute pulmonary edema is a serious manifestation in women presenting with severe preeclampsia. Bedside lung ultrasound was shown to identify lung interstitial edema even before severe deterioration of arterial oxygenation. The aim of this prospective observational study was to assess the ability of bedside lung ultrasound to detect interstitial alveolar syndrome in preeclamptic women with severe features. Seventy preeclamptic women with severe features reporting with critically high blood pressure readings were studied. In all enrolled patients, baseline bedside lung ultrasound and two-dimensional echocardiography were performed on admission (T0), immediately after delivery (T1), and then within 24 h after delivery (T2). The recent history included details of blood pressure readings over the preceding week and reasons for admission to labor room. Sixty-four percent of women showed significant B lines, and 47% showed diastolic dysfunction on echo at admission. The incidence of B lines before delivery was 66%, but it was 59% after delivery. The median values of admission blood pressure were 173 ± 21 mmHg systolic and 108 ± 11 mmHg diastolic. B lines correlated with rapidity of rise in blood pressure

(Pearson correlation; $P = 0.07$). Significantly more patients with the presence of B lines on lung sonography complained of breathlessness ($P = 0.007$) and had facial puffiness ($P = 0.001$). Perinatal outcomes were comparable in those with and without B lines. Bedside lung ultrasound identifies at-risk preeclamptic parturients with severe features for development of pulmonary edema.

JS04

"Perioperative Point-of-care Ultrasound Training: A Survey of Anesthesiology Programs in the United States" by Alexandra H. Reynolds, M.D., Hong Wang, M.D., Daniel C. Sizemore, M.D., Department of Anesthesiology, West Virginia University, Morgantown, West Virginia. The current status of nontransesophageal echocardiography and regional block point-of-care ultrasound training in anesthesiology residency programs is unknown. A 22-question online survey was sent to U.S. Accreditation Council for Graduate Medical Education Programs. The survey questions gauged current levels of training and exposure to ultrasound training in several areas, including regional blocks, transesophageal echocardiography (TEE), and point-of-care ultrasound. Survey questions also gauged the extent to which point-of-care ultrasound teaching occurred in institutional curriculums or at regional or national meetings. There were 130 survey responses from U.S. Accreditation Council for Graduate Medical Education anesthesiology residency programs. Forty-nine percent of responses were from residents and 51% of responses were from faculty. Almost all (96%) residents were in programs of more than 20 residents. Respondents exhibited a high level of ultrasound-guided regional block training, with 96% reporting having a rotation in residency. The extent of TEE training is also universally high, with 90% of respondents having received training. In contrast, only 36% of survey respondents had received non-TEE point-of-care ultrasound training, with even fewer (20%) having a point-of-care ultrasound rotation in residency. However, of the 20% that had a point-of-care ultrasound rotation, most had 4 weeks or more (87%). Less than half of all respondents (43.9%) had attended a point-of-care ultrasound workshop. Only a little more than one third (36%) of U.S. respondents received explicit point-of-care ultrasound training, and even fewer (20%) received specific point-of-care ultrasound rotations during their anesthesia residencies.

JS05

"Intraoperative Point-of-care Ultrasound for Identification of Endotracheal Tube Position in the Pediatric Population" by Davinder S. Ramsingh, M.D., Elizabeth A. Ghazal, M.D., Darren H. Goltiao, M.D., Justin Pugh, B.S., Philip Ross, M.D., Linda J. Mason, M.D., Department of Anesthesiology, Loma Linda University Medical Center, Loma Linda, California. Studies have shown that 18 to 19% of all pediatric intubations result in inappropriate endotracheal tube (ETT) placement, and up to 11% of malpositioned ETTs are not recognized. The usefulness of point-of-care ultrasound to establish accurate position has yet to be determined in pediatrics. Informed consent was provided for patients younger than 10 yr requiring cuffed ETTs for cardiac catherization procedures involving chest fluoroscopy. Patients underwent induction and standard verification of ETT positioning. Then, with an ultrasound linear probe placed in a midline longitudinal tracheal view, the ETT cuff position was identified by assessment of tracheal motion during palpation of the pilot balloon. Measurements of cuff relative to sternal notch, cricoid cartilage, and thyroid cartilage were obtained. Chest fluoroscopy was reviewed to assess ETT in relationship to the carina. Primary comparison was correlation assessment between the ultrasound measurements and the fluoroscopy measurements. Time to perform the point-of-care ultrasound exam was recorded. Preliminary results (n = 32) show an age range of 2 months to 8 yr. Current results indicate 100% detection or visualization of the ETT cuff with the point-of-care ultrasound exam. Average time to perform the exam was 163 s (SD = 67 s). A strong correlation (R = –0.87) was demonstrated between the ultrasound measurements and the fluoroscopy measurements ($P < .001$) after accounting for the patients' heights. Preliminary data suggest that airway point-of-care ultrasound appears to be a fast and effective method to identify the position of the endotracheal tube relative to important landmarks.

JS06

"Empty Gut: Evaluation and Measurement of Preoperative Total Emptying with Gastric Ultrasound Technique" by George Williams II, M.D., Muaz Aijazi, M.D., Nadia Hernandez, M.D., Xu Zhang, Ph.D., Albert K. Xiao, B.S., Daniel A. Contreras, M.D., Navneet K. Grewal, M.D., Velvet M. Patterson, M.D., Robert C. Wegner, M.D., Departments of Anesthesiology and Biostatistics/Epidemiology/Research Design Component, University of Texas Health Science Center at Houston, Houston, Texas. The study assessed the utility of point-of-care gastric ultrasound in guiding nutritional paradigms for the critically ill patient. Using a point-of-care ultrasound technique, we measured the cross-sectional area of the gastric antrum in adult trauma patients scheduled to undergo surgery in a Level I Trauma Center. Images were taken when the patient was supine because of the prevalence of injuries. Ultrasound images were reviewed by an intensivist and were qualitatively classified as "empty" or "not empty." A Wilcoxon rank sum test was used to compare cross-sectional area of "empty" *versus* "not empty" stomachs. A total of 104 separate images from 76 patients were analyzed. Seven percent of scans were taken of patients with postpyloric feeding tubes; 41% of scans were of patients with gastric tubes, and finally 45% of scans were of patients on a regular diet. Eighty-five scans (82%) were taken of patients *non per os* (NPO) since midnight, and 55 (33%) were of stomachs determined to be "empty." Antral cross-sectional area in patients qualitatively determined to have empty *versus* not empty stomach was significantly different ("empty"

cross-sectional area = 4.56 cm^2, "not empty" cross-sectional area = 7.43 cm^2; $P < 0.001$). NPO status was not associated with qualitative assessment of stomach contents ($P = 0.12$). No correlation was seen between the number of hours a patient was NPO and their antral cross-sectional area ($r = -0.096$; $P = 0.38$). NPO status and the number of hours a trauma patient remained NPO had no correlation with the size of their gastric antrum.

JS07

"Ultrasound for Proximal Humeral Intraosseous Vascular Access: A Novel Approach" by Gausan Ratna Bajracharya, M.D., Sergio Bustamante, M.D., Asha Singh, M.D., Shravan Cheruku, M.D., Steve M. Leung, M.D., Guangmei Mao, Ph.D., Negmeldeen F. Mamoun, M.D., Departments of Outcomes Research and Cardiothoracic Anesthesia, Cleveland Clinic, Cleveland, Ohio; Department of Anesthesiology, Duke University, Durham, North Carolina. Intraosseous access is a viable option in situations where venous access is otherwise difficult or impossible; inability to identify anatomical landmarks is an absolute contraindication. Success rates with proximal humeral intraosseous access range from 60 to 91%, likely because of difficult landmark identification by palpation. We hypothesized that point-of-care ultrasonography can successfully identify proximal humeral intraosseous landmarks across human participants of varying body habitus. Thirty participants were separated into three groups: normal weight, obesity, and morbid obesity. Our primary outcome was to identify six anatomical landmarks: the humeral shaft, the surgical neck of the humerus, the lesser tubercle, the greater tubercle, the intertubercular sulcus, and the target site in the greater tubercle for needle insertion on both upper extremities of each patient. Time taken to identify each landmark and depth from the surface were recorded and analyzed. The overall success rate of identifying all six landmarks was 0.87 (0.78, 0.95), with no significant difference among various body mass index groups. Overall time to identify all landmarks was 31 s (27, 38). Overall depth for individual landmark varies from 1.25 ± 0.51 to 2.00 ± 0.84 cm. Ultrasound is reliable and quick in identifying proximal humeral intraosseous landmarks with reasonable accuracy across various body mass index groups.

JS08

"Impact Assessment on the Training and Implementation of a Perioperative Point-of-care Ultrasound Service: A Quality Improvement Initiative" by Davinder S. Ramsingh, M.D., Alec C. Runyon, M.D., Dustin H. Wailes, M.D., Jaron Yang, Student, Mark Ringer, Student, Gina F. Brown, M.D., Justin Pugh, Student, Matthew Alschuler, Student, Jason W. Gatling, M.D., Robert D. Martin, M.D., Department of Anesthesiology, Loma Linda University Medical Center, Loma Linda, California. A comprehensive perioperative point-of-care ultrasound curriculum was successfully implemented at a single academic center in 2015. Ten attending and 20 resident physicians at another academic center were trained with this curriculum after 9 months of weekly sessions using an online platform. Beginning in December of 2016, a perioperative point-of-care ultrasound service was launched as a quality improvement initiative. Of 428 perioperative point-of-care ultrasound examinations performed, nearly half (49%) were performed intraoperatively and a third (33%) were performed preoperatively. Most (54%) triggers for the exams were significant past medical history while 19% were for questionable *non per os* status. Cardiac exams were the most commonly performed (45%) followed by pulmonary (24%) and abdominal (15%). Although a preliminary review found that only 18% of patients who received a perioperative point-of-care ultrasound exam intraoperatively had abnormal physical exam findings, exam findings altered patient care management at a rate of 44% due to new diagnosis (35%), verification of current diagnosis (32%), and confirmation of normal findings (32%).

Initial Results of Major Trials

Sunday, October 14, 2018, 3:45 PM to 4:45 PM

Moderators

Evan D. Kharasch, M.D., Ph.D., Editor-in-Chief, ANESTHESIOLOGY, Duke University, Durham, North Carolina.

ANESTHESIOLOGY is sponsoring its third Major Trials session at the 2018 Annual Meeting of the ASA. The session will provide a high-profile, large-audience forum for initial presentation of major randomized clinical trial results. It is designed for substantial trials, usually randomized and blinded, with a clinically important primary outcome.

Speakers

Neurodevelopmental Outcome at 2 Years of Age after General Anaesthesia and Awake-regional Anaesthesia in Infancy (GAS): An International Multicentre, Randomised Controlled Trial. Mary Ellen McCann, M.D., M.P.H., Harvard Medical School, Boston Children's Hospital, Boston, Massachusetts

Measurement of Exercise Tolerance before Surgery (METS) Study: An International Multicentre Prospective Cohort Study of Cardiopulmonary Exercise Testing prior to Major Noncardiac Surgery. Brian H. Cuthbertson, M.B.Ch.B., Sunnybrook Health Sciences Centre, Toronto, Ontario

Preoperative Epoetin-α with Intravenous or Oral Iron for Major Orthopedic Surgery: A Randomized Controlled Trial. Xavier Capdevila, Department of Anesthesiology and Critical Care Medicine, Lapeyronie University Hospital, CHU Montpellier, University of Montpellier, Montpellier, France

Triple Low Alerts do not Reduce Mortality: A Real-time Randomized Trial. Daniel I. Sessler, M.D., Editor, ANESTHESIOLOGY, Cleveland Clinic, Cleveland, Ohio

Best Abstracts: Clinical Science and Basic Science

Anesthesiology will sponsor two Best Abstract sessions this year, one in basic science and another in clinical science. These abstracts were chosen by a panel of editors who examined the highest-scoring abstracts from the ASA subcommittees, choosing those with important scientific and clinical application and novelty. Subsequently, a combination of these editors and appointees from the ASA chose one abstract in each category to receive the Best Abstract award for basic and clinical sciences at the meeting in San Francisco, California. The following are summaries of the excellent abstracts that will be presented.

Best Abstracts: Clinical Science

Saturday, October 13, 2018, 1:15 PM to 3:15 PM
Moscone Center, North, Room 20

Moderators

Michael J. Avram, Ph.D., Assistant Editor-in-Chief, Anesthesiology, Northwestern University Feinberg School of Medicine, Chicago, Illinois; Andrew Davidson, M.B.B.S., M.D., F.A.N.Z.C.A., Editor, Anesthesiology, The Royal Children's Hospital and the Murdoch Children's Research Institute, Parkville, Victoria, Australia; Jerrold H. Levy, M.D., F.A.H.A., F.C.C.M., Executive Editor, Anesthesiology, Duke University, Durham, North Carolina.

3532

"Preliminary Results from the Society of Anesthesia and Sleep Medicine (SASM) OSA Registry" by Karen Posner, Ph.D., Norman Bolden, M.D., Frances F. Chung, M.B., B.S., Karen B. Domino, M.D., M.P.H., Department of Anesthesiology and Pain Medicine, University of Washington, Seattle, Washington; Metro Health, Solon, Ohio; Department of Anesthesiology and Pain Medicine, University of Toronto, Toronto, Ontario, Canada. Among 75 case reports for obstructive sleep apnea–related death or near-miss events occurring within 30 days of surgery, most patients were middle aged, ASA physical status III, and obese, had inpatient elective procedures with general anesthesia, and were receiving opioids at the time of the event. Death or severe brain damage occurred in 47 (63%) cases. Death or severe brain damage associated with obstructive sleep apnea was more common when events occurred on the hospital ward or at home. Rescue without significant patient injury was more common in the postanesthesia care unit, intensive care unit, or step-down unit, environments with more intensive monitoring and nursing observation.

3645

"Nociception Level–guided Analgesia: Influence on Opioid Consumption and Hypotensive Events during Propofol/Remifentanil Anesthesia" by Albert Dahan, M.D., Ph.D., Fleur S. Meijer, M.D., Suzanne Broens, M.D., Monique van Velzen, Ph.D., Christian Martini, M.D., Ph.D., Department of Anesthesiology, Leiden University Medical Center, Leiden, The Netherlands. The nociception level index is a multiparameter measure of nociception that ranges from 0 to 100. The effect of the nociception level index–guided analgesia on opioid dose and hemodynamic stability was tested in 80 patients scheduled for elective major surgery under total intravenous anesthesia, randomized to receive standard of care or nociception level index–guided analgesia. Intraoperative remifentanil consumption was less in the nociception level index–guided group (mean, 0.08 $\mu g \cdot kg^{-1} \cdot min^{-1}$) than it was in the group receiving standard care (0.12 $\mu g \cdot kg^{-1} \cdot min^{-1}$). Hypotensive events (mean arterial pressure < 55 Hg) occurred more frequently in the standard care group (n = 11) than it did in the nociception level index–guided group (n = 2).

5004

"A Cluster-randomized Crossover Trial of Multimodal Narcotic-sparing and Conventional Pain Regimens after Discharge from Hip Replacement: Are Opiates Even Necessary?" by Andrew N. Fleischman, M.D., Majd Tarabichi, M.D., Gabriel Makar, B.S., Carol Foltz, Ph.D., William J. Hozack, M.D., Matthew S. Austin, M.D., Antonia F. Chen, M.D., Department of Anesthesiology and the Rothman Institute, Thomas Jefferson University, Philadelphia, Pennsylvania. In a cluster-randomized, crossover trial, 235 patients undergoing total hip replacement were assigned to receive either a multimodal pain regimen with a minimal opiate supply after discharge, a conventional multimodal regimen, or a traditional opiate regimen without multimodal therapy. The multimodal pain regimen consisted of standing dose of 1,000 mg acetaminophen every 8 h, 200 mg gabapentin every 12 h, and 15 mg meloxicam every morning. Daily pain and daily opiate use and duration of use were significantly lower in both multimodal groups. The multimodal pain regimen with a minimal opiate supply after discharge group also had significantly lower daily opiate use than the conventional multimodal regimen group and fewer opiate-related symptoms than the traditional opiate group.

4526

"Patient Factors Associated with Opioid Consumption in the 30 Days following Major Surgery" by Daniel B. Larach, M.D., M.S., Michael J. Sahara, B.A., Sawsan As-Sanie, M.D., M.P.H., Stephanie E. Moser, Ph.D., Andrew G. Urquhart, M.D., Jules Lin, M.D., Joseph A. Wakeford, B.S., Daniel J. Clauw, M.D., Jennifer F. Waljee, M.D., M.S., M.P.H., Chad M. Brummett, M.D., Departments of Anesthesiology, Obstetrics and Gynecology, Orthopaedic Surgery, and Surgery, University of Michigan, Ann Arbor, Michigan. A single-center, prospective, observational cohort study was conducted to determine preoperative patient characteristics independently associated with home opioid use during the first 30 days after surgery in patients not taking opioids before hysterectomy, thoracic surgery, or total

knee or hip arthroplasty. The median total oral morphine equivalents prescribed after surgery in 688 patients was 600 mg (interquartile range, 450 mg), while median opioid consumption was 187.5 mg (interquartile range, 475 mg). In the 628 patients for whom phenotypic predictor data were available, older age, college graduate status, and increased functional status were significantly associated with decreased opioid consumption, while higher anxiety scores were significantly associated with increased opioid consumption.

3787

"Development of a Novel Self-administered Cognitive Function Assessment for Preoperative Evaluation" by Kenneth C. Cummings, M.D., M.S., Kamal Maheshwari, M.D., M.P.H., Elizabeth Jansen, M.P.H., Anson Rosenfeldt, D.P.T., Tanujit Dey, Ph.D., Linda Skolaris, B.S.N., Jay Alberts, Ph.D., Department of Anesthesiology and Lerner Research Institute, Cleveland Clinic, Cleveland, Ohio. The feasibility of using a mobile application to evaluate cognitive function in a preoperative screening clinic with a self-administered assessment model was evaluated in more than 1,100 patients aged 65 yr or older presenting to the preanesthesia consultation and evaluation clinic between November 2017 and February 2018. All patients completed two self-administered neurocognitive assessments: a processing speed test and Trail Making Test parts A and B on an internally developed iPad application. Patients performed, on average, 1.1 and 1.5 SD worse than their healthy peers on Trail Making Test parts A and B, respectively. Performance on the processing speed test was 0.95 SD worse for patients compared to healthy peers.

4724

"The Impact of Frailty on Delirium and Cognitive Change after Cardiac Surgery" by Andrew Laflam, B.S., Mitsunori Nakano, M.D., Brian P. Bush, M.D., Charles W. Hogue, M.D., Charles H. Brown, M.D., Tufts University School of Medicine, Boston, Massachusetts; Department of Anesthesiology and Critical Care Medicine, The Johns Hopkins University School of Medicine, Baltimore, Maryland; Department of Anesthesiology, Northwestern University Feinberg School of Medicine, Chicago, Illinois. The hypothesis that increased frailty would increase both the risk of delirium and the risk of a decline in a composite measure of cognition was tested in patients more than 65 yr old undergoing elective cardiac surgery. Frailty was evaluated at baseline with a validated binary scoring method of five age-related domains. Delirium was assessed with methodologies including the Confusion Assessment Method. The overall incidence of delirium was 42% (56 of 133); the incidence of delirium was higher in prefrail (48%) and frail (48%) patients than it was in nonfrail patients (13%). The cognitive data available from 83 patients revealed that frail patients were at increased risk of cognitive decline at 30 days, but at 1 yr cognitive change was similar by frailty status.

3827

"A Comparison of Right Ventricular Function between Patients with and without Pulmonary Hypertension due to Left-sided Heart Failure: Assessment by Right Ventricular Pressure Volume Curve" by Eiki Kanemaru, M.D., Kenji Yoshitani, M.D., Shinya Kato, M.D., Yoshihiko Ohnishi, M.D., Department of Anesthesiology, National Cerebral and Cardiovascular Center, Suita, Japan. Right ventricular energetics were evaluated intraoperatively by analysis of right ventricular pressure volume curves with use of three-dimensional transesophageal echocardiography and hemodynamic data obtained with a pulmonary artery catheter in 33 patients undergoing cardiac surgeries for left-sided heart diseases, 10 of whom had pulmonary hypertension due to left-sided heart failure. Although cardiac index was similar in patients with and without pulmonary hypertension, stroke work index and right ventricular minute work index were significantly higher and right ventricular-arterial coupling, which specifically refers to the right ventricle's ability to increase its contractility in response to the increased afterload, were significantly lower in patients with pulmonary hypertension. The pressure volume curves were significantly different between patients with and without pulmonary hypertension.

3711

"Remote Ischemic Preconditioning Increases Serum Extracellular Vesicles in Coronary Artery Bypass Graft Patients and Is Cardioprotective" by Ulrich Frey, M.D., Marina Klaassen, M.D., Crista Ochsenfarth, B.Sc., Matthias Thielmann, M.D., Heinz Jakob, M.D., Eva Kottenberg, M.D., Petra Kleinbongard, Ph.D., Gerd Heusch, M.D., Bernd Giebel, Ph.D., Jürgen Peters, M.D., Department of Anesthesiology and Intensive Care, University Hospital Bochum, Herne, Germany; Departments of Anesthesiology and Pathophysiology, University Hospital Essen, Essen, Germany. Extracellular vesicles contain cell type–specific assemblies of defined lipids, microRNAs, and proteins and can act as complex, very specific intercellular signaling mediators in physiologic and pathophysiologic conditions. To determine whether serum extracellular vesicle concentration and/or their microRNA signature might have a role in remote ischemic preconditioning-induced myocardial protection, extracellular vesicle concentrations and their microRNA signature were measured in regional venous blood draining the reperfused ischemic arm and in arterial blood of 58 patients undergoing coronary artery bypass graft surgery who were randomly assigned to remote ischemic preconditioning or sham groups. Remote ischemic preconditioning decreased postoperative troponin I concentrations. Local venous extracellular vesicle concentrations increased 5 min after remote ischemic preconditioning, and arterial concentrations increased after 60 min. Six upregulated microRNAs were detected after remote ischemic preconditioning compared to sham.

4262

"Effect of the Sitting *versus* the Supine Position on Microbubble Clearance Times from the Right Atrium, Right Ventricle, and Pulmonary Artery" by James A. Nelson, M.B., B.S., Arney S. Abcejo, M.D., William J. Perkins, M.D., Department of Anesthesiology, Mayo Clinic, Rochester, Minnesota. A central venous catheter at the cavoatrial junction is expected to retrieve venous air embolism when entrainment occurs during neurosurgical procedures in the sitting position because it is expected that under buoyant forces entrained air will settle in the least-dependent cardiac chamber, the right atrium. A prospective study in 20 patients in both the supine and sitting positions evaluated clearance of microbubbles through the right atrium, right ventricle, and pulmonary artery after injection of 1 ml of air agitated in 10 ml of isotonic sodium chloride. No statistically significant difference in right atrium, right ventricle, or pulmonary artery clearance times were found between sitting and supine patients. This finding suggests blood fluid dynamics are more important than microbubble buoyant forces.

3949

"The Relationship between Intraoperative Urine Output and Postoperative Acute Kidney Injury after Nephrectomy" by Seoyeong Park, M.D., Min Hur, M.D., Won Ho Kim, M.D., Ph.D., Department of Anesthesiology and Pain Medicine, Seoul National University Hospital, Seoul-City, Republic of Korea. Because intraoperative urine output is influenced by many factors, a conventional cutoff defining oliguria (less than 0.5 ml $\cdot$ kg^{-1} $\cdot$ h^{-1}) may not reliably predict acute kidney injury in surgical settings. A retrospective study investigated the relationship between intraoperative urine output during nephrectomy and the risk of postoperative acute kidney injury in 742 patients who underwent radical or partial nephrectomy. Postoperative acute kidney injury developed in 220 (29.6%) patients. In multivariable logistic regression analysis, hypertension, higher preoperative hemoglobin concentration, transfusion, and intraoperative urine flow rate less than 1.0 ml $\cdot$ kg^{-1} $\cdot$ h^{-1} were identified as significant predictors of postoperative acute kidney injury. With the minimum P value approach, the optimal threshold of intraoperative urine output was 0.9 ml $\cdot$ kg^{-1} $\cdot$ h^{-1}.

Best Abstracts: Basic Sciences
Sunday, October 14, 2018, 1:15 PM to 3:15 PM
BCE Moscone Center, North, Room 20

Moderators

Michael J. Avram, Ph.D., Assistant Editor-in-Chief, ANESTHESIOLOGY, Northwestern University Feinberg School of Medicine, Chicago, Illinois; Andrew Davidson, M.B.B.S., M.D., F.A.N.Z.C.A., Editor, ANESTHESIOLOGY, The Royal Children's Hospital and the Murdoch Children's Research Institute, Parkville, Victoria, Australia; Jerrold H. Levy, M.D.,

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4732

"Molecular Interactions between Dexmedetomidine and Human μ-Opioid Receptor" by Renyu Liu, M.D., Ph.D., Thomas T. Joseph, M.D., Ph.D., Jin Xi, M.S., Yi Zhou, M.D., Ph.D., Jiafu Ji, M.D., Andrew McKinstry, M.D., Ph.D., Hasan Babazada, Ph.D., Department of Anesthesiology and Critical Care, University of Pennsylvania, Philadelphia, Pennsylvania. The antinociceptive effect of dexmedetomidine, a highly selective α_2-adrenergic agonist, is partially blocked by an opioid receptor antagonist. This effect suggests that dexmedetomidine interacts with opioid receptors. The molecular interactions between dexmedetomidine and the μ-opioid receptor were characterized with three different approaches: affinity determination, molecular dynamics simulations, and affinity photolabeling. Dexmedetomidine interacted directly with the human μ-opioid receptor with a Ki of 0.3 μM, an affinity that is much weaker than that of butorphanol, a classic μ-opioid receptor agonist. Both the molecular dynamics simulation and photoaffinity experiment indicate that dexmedetomidine interacts with V236 and K233 in a water-soluble analog of a μ-opioid receptor, and thus it has the same binding site as classic opioid receptor ligands.

4266

"Functional Fluorescent Imaging of Anesthetic Induction" by Christopher W. Connor, M.D., Ph.D., Mehraj Awal, B.S., Gregory Wirak, B.S., Christopher V. Gabel, Ph.D., Department of Anesthesiology, Perioperative, and Pain Medicine, Brigham and Women's Hospital, Boston, Massachusetts; Department of Physiology and Biophysics, Boston University, Boston, Massachusetts. Fluorescent labeling in *Caenorhabditis elegans* allows the activity of multiple individual neurons to be captured in parallel, in real time, and *in vivo* while undergoing anesthesia. A significant technical advance in the number of neurons that can be simultaneously tracked and recorded allows investigation of the worm brain during anesthesia in new ways: gross activity of entire brain regions compared to the individual neuron activity within those regions; activity of subsets of neurons that are γ-aminobutyric acid–mediated (GABAergic), cholinergic, or glutamatergic; larger circuits containing more neurons; and even globally the induction of and recovery from anesthesia. As proof of concept, two worm brains were imaged over the progressive induction of anesthesia, from 0 to 10% isoflurane. These images demonstrate the onset of loss of neuronal correlation and a "checkerboarding" indicative of phase locking between proximate neurons.

4421

"Desflurane Alters Layer-specific Neuronal Interactions in Rat Visual Cortex" by Anthony G. Hudetz, Ph.D.,

Siveshigan Pillay, Ph.D., Department of Anesthesiology, University of Michigan, Ann Arbor, Michigan; Department of Anesthesiology, Medical College of Wisconsin, Milwaukee, Wisconsin. The effect of desflurane on neuronal interactions between supragranular and infragranular layers of primary and secondary visual cortex was determined in rats. Microelectrode arrays targeting supragranular (shallow) and infragranular (deep) layers in primary and secondary visual cortex (V1Shallow, V1Deep, V2Shallow, and V2Deep, respectively) were chronically implanted in the visual cortex. Extracellular unit activity was recorded in wakefulness and consecutively increasing and decreasing desflurane concentrations. Mutual information between selected regions and subregions was calculated from the probability distribution of coincident spike configurations. Suppression of mutual information between the shallow recording sites of V1 and V2 suggests anesthetic interference with supragranular hierarchical integration. Reduction in mutual information between V1Deep and V2Shallow sites may be due to complex polysynaptic interactions between V1 and V2. These results are consistent with the hypothesis of functional disintegration in sensory cortex during suppressed consciousness.

4566

"Dynamics of Return of Consciousness and Recovery of Performance following Propofol Anesthesia across Primate Neocortex" by Yumiko Ishizawa, M.D., Shaun Patel, Ph.D., Pamela Huang, B.S., Jessica Briscoe, B.S., Omar J. Ahmed, Ph.D., Emery N. Brown, M.D., Emad N. Eskandar, M.D., Department of Anesthesia, Critical Care, and Pain Medicine, and Department of Neurology, Massachusetts General Hospital, Boston, Massachusetts; Boston University School of Medicine, Boston, Massachusetts; Departments of Psychology, Neuroscience, Biomedical Engineering, University of Michigan, Ann Arbor, Michigan; Department of Neurosurgery, Albert Einstein College of Medicine, New York, New York. Neuronal dynamics during a transition from propofol-induced unconsciousness into consciousness and through task performance recovery were studied by directly recording intracortical local field potentials in the primate somatosensory (S1, S2) and ventral premotor networks. During early recovery before return of consciousness, the higher-order ventral premotor cortex and the sensory cortex appeared to be dissociated in a frequency-dependent manner. Return of consciousness, defined as return of task engagement, was associated with an abrupt return of coherent beta oscillations and a concurrent decrease in the slow-delta oscillations in these regions. The return of preanesthetic performance level, defined as recovery of correct performance, was associated with a significant increase in interregional (S1 and ventral premotor) coherence of the beta oscillations.

4373

"Parabrachial Neurons Promote Electroencephalographic and Behavior Arousal from Propofol Anesthesia" by

Tianyuan Luo, Ph.D., Shouyang Yu, Ph.D., Shuang Cai, M.S., Yingfu Jiao, Ph.D., Weifeng Yu, Ph.D., Tian Yu, M.S., Guizhou Key Laboratory of Anesthesia and Organ Protection, Zunyi Medical College, Zunyi, China; Department of Anesthesiology, Shanghai Renji Hospital, Shanghai Jiaotong University School of Medicine, Shanghai, China. The parabrachial nucleus, which is located in the dorsolateral pons and contains a large population of glutamatergic neurons, plays a crucial role in the ascending arousal system. To determine whether the parabrachial nucleus participates in the process of general anesthesia, a calcium fiber photometry system was used to check the activity of parabrachial neurons in the process of propofol anesthesia in rats, including loss of righting reflex induced by propofol and emergence from anesthesia. Parabrachial neurons were highly activated during recovery from propofol anesthesia, without being inhibited at the onset of propofol-induced unconsciousness. Chemogenetic activation of parabrachial neurons did not prolong the induction time to loss of righting reflex but did accelerate behavioral and cortical arousal from propofol anesthesia.

4613

"Orexin Receptor Blockade Preserves the Ability to Awake in Response to Aversive Stimuli" by Shouhei Iwakawa, M.D., Erika Uchino, M.D., Yuichi Kanmura, M.D., Kuwaki Tomoyuki, Ph.D., Department of Anesthesiology and Critical Care Medicine and Department of Physiology, Kagoshima University, Kagoshima, Japan. Retention of the ability to awake from sleep in response to dangerous situations is an ideal characteristic of safe hypnotics. The effects of a dual orexin receptor antagonist, dual orexin receptor antagonist 22, and the γ-aminobutyric acid type A receptor modulator triazolam on the ability to awake in response to different types of aversive stimuli (olfactory, auditory, and vestibular stimuli) were studied in mice. When the animal was sleeping for more than 1 min, one of the three stimuli was applied for 30 s. In the case of olfactory stimulation, the average latencies to arousal after vehicle, dual orexin receptor antagonist 22, and triazolam administration were 2.6, 4.8, and 330 s, respectively. Latencies to resleep after cessation of stimulation were 445, 156, and 57 s, respectively. Similar results were obtained for auditory and vestibular stimuli-induced arousal and resleep.

4905

"Dantrolene Inhibits Impairment of Neurogenesis and Synaptogenesis in the Stem Cells from Alzheimer Disease Patients" by Huafeng Wei, M.D., Ph.D., Yong Wang, M.D., Ph.D., Liang Ge, M.D., Yun Shi, M.D., Department of Anesthesiology and Critical Care, Perelman School of Medicine, Hospital of the University of Pennsylvania, Philadelphia, Pennsylvania; The First Affiliated Hospital of Guangzhou, University of Chinese Medicine, Guangzhou, China; Children's Hospital of Fudan University, Shanghai, China. The role of overactivation of the ryanodine

receptor Ca^{2+} channel in neurogenesis and synaptogenesis and the potential beneficial effects of dantrolene were studied in induced pluripotent stem cells from normal controls, sporadic Alzheimer disease patients, and familial Alzheimer disease patients. These were cultured and developed into neuroprogenitor cells that were then cultured into cholinergic neurons in the presence or absence of dantrolene. Decreased differentiation of neuroprogenitor cells into cortical neurons in both sporadic and familial Alzheimer disease patient cells was ameliorated by dantrolene treatment. Dantrolene also inhibited impairment of cell viability and proliferation and impaired autophagy of both sporadic and familial Alzheimer disease patient cells. Dantrolene significantly inhibited N-methyl-D-aspartate–mediated elevation of cytosolic calcium concentrations by primary antagonism of the ryanodine receptor in both sporadic and familial Alzheimer disease patient cells.

4541

"Inhalational Anesthetics Induce Neuronal Protein Aggregation and Affect Endoplasmic Reticulum Trafficking" by Jason T. Maynes, M.D., Ph.D., Matthew Coghlan, M.D., Pablo Rossi, M.D., Saumel Ahmadi, M.D., Ph.D., Mark W. Crawford, M.D., Department of Anesthesia and Pain Medicine and Department of Molecular Medicine, Hospital for Sick Children, Toronto, Ontario, Canada. Onset of congenital central hypoventilation syndrome (Ondine's curse), which is caused by mutations in the transcription factor Phox2B, occurs after routine exposure to anesthesia. Precipitation of congenital central hypoventilation syndrome by anesthetic drugs was studied to provide insight into the etiology of postoperative cognitive dysfunction. Tagged models of the graded disease severity of congenital central hypoventilation syndrome were created and transfected into SH-SY5Y (neuroblastoma) cells, which were exposed to isoflurane. Isoflurane caused misfolding and aggregation of neuronal transcription factors, which was coupled with an activation of endoplasmic reticulum stress and unfolded protein response pathways, in particular pathways involved in glycoprotein folding. The isoflurane effect was likely directly at the protein level, because modulation of endoplasmic reticulum and unfolded protein response activity did not alter protein aggregation.

4206

"Endoplasmic Reticulum Stress Is Involved in Peripheral Mechanisms of Complex Regional Pain Syndrome" by Ming-Chang Kao, M.D., Ph.D., Hung-Chieh Wan, M.S., Po-Ting Pan, M.D., Ching-Wei Chuang, M.D., Department of Anesthesiology, Taipei Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation, New Taipei City, Taiwan. Endoplasmic reticulum stress is a cellular process triggered by a variety of conditions that results in abnormal accumulation of unfolded proteins in the endoplasmic reticulum. The involvement of endoplasmic reticulum stress in the peripheral mechanisms of complex regional pain syndrome I was studied in rats with chronic postischemic pain, a model of complex regional pain syndrome I. Rats with chronic postischemic pain had increased expression of endoplasmic reticulum stress proteins, including protein kinase R–like endoplasmic reticulum kinase, inositol-requiring kinase 1, and activating transcription factor 6 in sciatic nerves. In addition, inducing chronic postischemic pain in rats activated expression of nuclear factor-κB in sciatic nerves as an indicator of neuroinflammatory response.

3556

"Ultra-low-tidal-volume Ventilation Increases Lung Perfusion after Experimental Cardiopulmonary Resuscitation" by Robert Rummler, M.D., Frances Kuropka, Alexander Ziebart, M.D., Bastian Dünges, Ph.D., Jens Kamuf, M.D., Christian Moellmann, M.D., Erik K. Hartmann, M.D., Ph.D., Department of Anesthesiology, University Medical Center of the Johannes Gutenberg University, Mainz, Germany. The optimal ventilation method for patients receiving cardiopulmonary resuscitation remains highly controversial. The effects of ultra-low-tidal-volume ventilation, a new protective ventilation scheme derived from "lung-rest" ventilation used during extracorporeal membrane oxygenation therapy on intensive care units, were assessed during mechanical cardiopulmonary resuscitation in 30 swine. Anesthetized animals with ventricular fibrillation were left untreated and without ventilation for 4 min and then randomized to receive standard intermittent positive-pressure ventilation, modified chest-compression-only resuscitation with 10 l/min passive oxygen insufflations, or ultra-low-tidal-volume ventilation. Lower driving pressures, better lung perfusion, and sufficient decarboxylation were observed in animals receiving ultra-low-tidal-volume ventilation without negative effects on rates of return of spontaneous circulation.

High-quality Peer Review: Why and How for Authors and Reviewers, from the Editors of ANESTHESIOLOGY

Tuesday, October 16, 2018, 9:00 AM to 11:00 AM
Moscone Center West, Room 3022
The editors of ANESTHESIOLOGY have organized this session to inform reviewers how to prepare a review that will help identify the best clinical and basic science research for publication. Authors will benefit from this session as well by getting a better understanding of what is expected of both research that is considered the best and the manuscript describing it.

Introduction - The Peer Review Imperative

Evan D. Kharasch, M.D., Ph.D., Editor-in-Chief, ANESTHESIOLOGY, Duke University, Durham, North Carolina.

How to Review a Manuscript

Andrew Davidson, M.B.B.S., M.D., F.A.N.Z.C.A., Editor, ANESTHESIOLOGY, The Royal Children's Hospital and the Murdoch Children's Research Institute, Parkville, Victoria, Australia.

Tips for Reviewing Statistics and Methods for Nonstatisticians

Timothy T. Houle, Ph.D., Statistical Editor, Anesthesiology, Harvard Medical School, Massachusetts General Hospital, Boston, Massachusetts.

Creating a Culture of Civility in Peer Review

Deborah J. Culley, M.D., Executive Editor, Anesthesiology, Harvard Medical School, Brigham and Women's Hospital, Boston, Massachusetts.

Question and Answers

Michael J. Avram, Ph.D., Assistant Editor-in-Chief, Anesthesiology, Northwestern University Feinberg School of Medicine, Chicago, Illinois.

Competing Interests

The authors declare no competing interests.