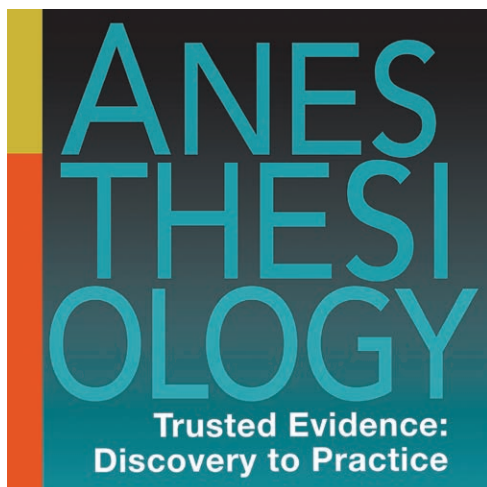


Journal-related Activities and Other Special Activities at the 2019 American Society of Anesthesiologists Meeting

Michael J. Avram, Ph.D., Deborah J. Culley, M.D., Amanda A. Fox, M.D., M.P.H., Evan D. Kharasch, M.D., Ph.D., Martin J. London, M.D., F.A.S.E., James P. Rathmell, M.D.



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 American Society of Anesthesiologists (ASA; Schaumburg, Illinois) 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 Orlando, Florida. The following are summaries of the excellent abstracts that will be presented.

Best Abstracts: Clinical Science

Saturday, October 19, 2019, 1:00 PM to 3:00 PM
W300

Moderators

Michael J. Avram, Ph.D., Assistant Editor-in-Chief, ANESTHESIOLOGY, Northwestern University Feinberg School of Medicine, Chicago, Illinois; James P. Rathmell, M.D.,

Executive Editor, ANESTHESIOLOGY, Brigham and Women's Hospital, Harvard Medical School, Boston, Massachusetts; Martin J. London, M.D., F.A.S.E., Editor, ANESTHESIOLOGY, University of California San Francisco, School of Medicine, and the Veterans Affairs Medical Center, San Francisco, California.

5358

“Improved Safety of Opioid Analgesic Oliceridine Compared to Morphine Assessed by Utility Function Analysis” by Albert Dahan, M.D., Marieke Niesters, M.D., Michael J. Fossler, Ph.D., Mark Demitrack, M.D., Erik Olofsen, Ph.D., Department of Anesthesiology, Leiden University Medical Center, Leiden, The Netherlands; Trevena Inc., Chesterbrook, Pennsylvania. Biased ligands are μ -receptor agonists that selectively engage the G-coupled signaling pathway, which produces analgesia, while avoiding the β -arrestin pathway, which is responsible for full μ -receptor agonist dose-dependent respiratory depression. The respiratory and analgesic effects of three IV doses of the biased ligand, oliceridine, and one morphine dose were assessed in 30 healthy male volunteers using utility function analysis (an assessment of the probability of analgesia relative to the probability of respiratory depression). After treatment with oliceridine, the probability of analgesia exceeded that of respiratory depression over the dose range studied. In contrast, the probability of respiratory depression exceeded that of analgesia after morphine treatment.

7061

“An Interpretable Neural Network for Prediction of Postoperative In-hospital Mortality” by Christine Lee, M.S., Muntaha Samad, B.S., Ira S. Hofer, M.D., Pierre Baldi, Ph.D., Maxime Cannesson, M.D., Ph.D., Biomedical Engineering and Computer Science, University of California Irvine, Irvine, California; Anesthesiology, University of California Los Angeles, Los Angeles, California. A “generalized additive neural network” was developed to help visualize feature patterns

Submitted for publication June 18, 2019. Accepted for publication July 3, 2019. From Northwestern University, Chicago, Illinois (M.J.A.), Brigham and Women's Hospital, Boston, Massachusetts (D.J.C., J.P.R.), University of Texas Southwestern Medical Center, Dallas, Texas (A.A.F.), Duke University, Durham, North Carolina (E.D.K.), University of California San Francisco, and Veterans Affairs Medical Center, San Francisco, California (M.J.L.).

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related to risk of in-hospital mortality using data consisting of 47 features extracted at the end of the surgeries of 59,985 patients. The reported deep neural network had one dense layer with 50 neurons and rectified linear unit activations. The fivefold cross-validation area under the curve was 0.84. From visualizing the feature contributions learned by the model, interesting nonlinear relationships for contributions to mortality risk were found for age, baseline glomerular filtration rate, maximum pulse oximetry value, and minimum mean arterial pressure.

6456

“Association with Etomidate Use and Impaired Coagulation in Trauma Patients” by Ernesto Lopez, M.D., Ph.D., Emily G. Bruner, M.D., Soeun Kim, Ph.D., Olga Y. Kaslow, M.D., Ph.D., Srikanth Sridhar, M.D., Samuel M. Galvagno, D.O., F.C.C.M., John B. Holcomb, M.D., Charles E. Wade, Ph.D., Jean-Francois Pittet, M.D., Evan G. Pivalizza, M.D., Department of Surgery, Center for Translational Injury Research, and Department of Anesthesiology, University of Texas Health Science Center at Houston, McGovern Medical School, Houston, Texas; Department of Anesthesiology, Medical College of Wisconsin, Milwaukee, Wisconsin; Department of Anesthesiology, University of Maryland School of Medicine, Baltimore, Maryland; Department of Anesthesiology and Perioperative Medicine, University of Alabama at Birmingham, Birmingham, Alabama. In nontrauma diseases characterized by hypercoagulation, high corticosteroid concentrations have been shown to be procoagulant, increasing the rate of thrombotic events. A planned secondary analysis of the Pragmatic Randomized Optimal Platelet and Plasma Ratios (PROPPR) trial tested the hypothesis that the rate of hypercoagulable complications would be less in the 87 patients intubated with etomidate, which inhibits steroidogenesis, than in the 579 patients intubated with other induction agents. Characteristics of the patients in the two groups were similar. In seriously injured trauma patients, etomidate was associated with hypocoagulation, as indicated by longer time to clot and decreased clot strength assessed by thromboelastography. These patients subsequently required more platelets and red blood cell unit transfusions.

6526

“Patient Selection for Routine Troponin Monitoring after Noncardiac Surgery” by Corien Weersink, M.D., Judith A.R. Van Waes, M.D., Ph.D., Remco B. Grobbee, M.D., Ph.D., Hendrik M. Nathoe, M.D., Ph.D., Wilton A. Van Klei, M.D., Ph.D., Department of Anesthesiology and Department of Cardiology, University Medical Center Utrecht, Utrecht, Netherlands. The aim of this study was to identify patients

undergoing intermediate- to high-risk noncardiac surgery who are at high risk of postoperative myocardial infarction and isolated postoperative troponin elevation, in order to aid selection and to omit redundant laboratory measurements. Postoperative myocardial infarction was present in 180 (3%) and isolated postoperative troponin elevation was present in 920 (18%) of 5,222 patients. Using a risk of postoperative myocardial infarction of 2% or greater to select patients for routine troponin monitoring, routine monitoring would be indicated in patients undergoing emergency surgery or in elective surgery patients with a Revised Cardiac Risk Index greater than 2. The number needed to screen to detect a patient with postoperative myocardial infarction would be 13, and 0.7% of patients with postoperative myocardial infarction would be missed.

6889

“Enhanced Cardio-respiratory Monitoring in the Postoperative Period Reduces Postoperative Cardio-pulmonary Complications in Patients Undergoing Bariatric Surgery” by Mandeep Singh, M.D., Julie Hudson, Ph.D., Frances F. Chung, M.D., Najia Hasan, M.D., Matt Miller, M.D., Timothy Jackson, M.D., David T. Wong, M.D., Jean Wong, M.D., George Tomlinson, Ph.D., Laura Hawryluck, M.D., Toronto Western Hospital, Toronto, Ontario, Canada; University Health Network, Toronto, Ontario, Canada. The effectiveness of a distant, continuous, noninvasive enhanced monitoring system on postoperative cardiorespiratory complications was assessed in a retrospective study of 1,450 patients undergoing elective bariatric surgery with enhanced monitoring or with intermittent monitoring. The enhanced monitoring system used telemetry for pulse oximetry, heart rate, and respiratory rate. Intermittent monitoring included pulse oximetry and vital sign checks by the nursing staff per the institutional standard of care. The incidence of the primary outcome, a composite of respiratory complications, major adverse cardiac events, all-cause mortality, and prolonged hospital stay, in the enhanced monitoring group was less than half that in the nonmonitored group (odds ratio, 0.41; 95% CI, 0.32 to 0.54; $P < 0.001$).

5653

“Impact of Goal-directed Therapy on Major Morbidity after Esophagectomy: A Multicenter Randomized Controlled Trial” by Akira Mukai, M.D., Koichi Suehiro, M.D., Ph.D., Takashi Juri, M.D., Yasue Hayashi, M.D., Katsuaki Tanaka, M.D., Ph.D., Takashi Fujii, M.D., Naoko Ohira, M.D., Yutaka Oda, M.D., Ph.D., Ryu Okutani, M.D., Ph.D., Kiyonobu Nishikawa, M.D., Ph.D., Department of Anesthesiology, Osaka City University Graduate School of Medicine, Osaka City, Japan; Department

of Anesthesiology, Sumitomo Hospital, Osaka City, Japan; Department of Cardiovascular Anesthesiology, Osaka Rosai Hospital, Sakai City, Japan; Department of Anesthesiology, Osaka City Juso Hospital, Osaka City, Japan; Department of Anesthesiology, Osaka City General Hospital, Osaka City, Japan. This multicenter randomized controlled trial assessed the effect of intraoperative goal-directed therapy on postoperative major morbidity and mortality in 232 patients undergoing transthoracic esophagectomy. Goal-directed therapy uses dynamic indices to obtain adequate tissue perfusion. Postoperative major morbidity or mortality (defined as reoperation for bleeding, anastomotic leak, pneumonia, reintubation, ventilation over 48 h, or death) occurred in 22 patients (19.1%) in the goal-directed therapy group, and in 41 patients (35.0%) in the control group ($P = 0.008$). Cox proportional hazard regression analysis showed that goal-directed therapy was an independent predictor of postoperative major morbidity or mortality (hazard ratio, 0.52; 95% CI, 0.31 to 0.88; $P = 0.015$).

5829

“Intraoperative Hypertension and Kidney Injury, Myocardial Injury and Mortality after Noncardiac Surgery” by Tetsuya Shimada, M.D., Dongsheng Yang, M.A., Edward J. Mascha, Ph.D., Hani A. Essber, M.D., Eva Rivas Ferreira, M.D., Ph.D., Daniel I. Sessler, M.D., Outcomes Research and Quantitative Health Sciences, Cleveland Clinic, Cleveland, Ohio. The current retrospective study sought to estimate absolute thresholds for intraoperative systolic hypertension associated with increased odds of postoperative acute kidney injury and a composite of acute postoperative myocardial injury and in-hospital mortality. Data from 76,042 patients who had undergone noncardiac surgery at the Cleveland Clinic with intraoperative blood pressure recorded at 1- to 5-min intervals were analyzed. Visual inspection, multivariable logistic regression, and change-point analysis (to determine whether a change had occurred and the time at which any such change occurred) all suggested there were no obvious thresholds above which systolic blood pressure is statistically related to acute postoperative myocardial injury/mortality or acute kidney injury.

6532

“Long-term Risk of Chronic Kidney Disease and Mortality in Children following Acute Kidney Injury after Noncardiac Surgery” by Theodora Wingert, M.D., Nahda Harati, M.D., Tristan Grogan, M.S., Department of Anesthesiology and Perioperative Medicine, University of California Los Angeles, Los Angeles, California. One- and two-year mortality and decline of renal function were evaluated in children who developed acute kidney injury after noncardiac surgery.

Multivariate analyses of data from 10,317 cases found that children who developed acute kidney injury after noncardiac surgery were more likely to develop a decline in glomerular filtration rate to 60 to $90 \text{ ml} \cdot \text{min}^{-1} \cdot 1.73 \text{ m}^{-2}$ at 1 and 2 yr (odds ratios [95% CIs], 4.38 [2.99 to 6.42] and 3.48 [2.45 to 4.94], respectively). However, no association was found between mortality or glomerular filtration rate less than $60 \text{ ml} \cdot \text{min}^{-1} \cdot 1.73 \text{ m}^{-2}$ at 1 and 2 yr after development of postoperative acute kidney injury.

7048

“Infant Delirium: Validation of a Bedside Tool and Meeting Challenges in Diagnosis” by Heidi Smith, M.D., M.Sc., Yasas Tanguturi, M.D., JoEllen Wilson, M.D., M.P.H., Marguerite Canter, M.D., Stacey Williams, R.N.P., Sylvia Exum, M.D., Kristina Betters, M.D., Pratik Pandharipande, M.D., M.Sc., D. Catherine Fuchs, M.D., Vanderbilt University Medical Center, Nashville, Tennessee. The objective of this study was to validate the Preschool Confusion Assessment Method for the Intensive Care Unit in 49 patients less than 6 months of age in a tertiary pediatric intensive care unit who were independently assessed for delirium daily by the research team using this instrument and by the psychiatry team (the reference standard). The prevalence of delirium was 41%. Compared with the reference standard, the Preschool Confusion Assessment Method for the Intensive Care Unit performed with a sensitivity of 95%, a specificity of 81%, a negative predictive value of 97%, and a positive predictive value of 69%.

6560

“Perioperative Magnesium Sulfate May Improve Neurological Outcome Six Months after Brain Surgery” by Isabel Gracia, M.D., Neus Fabregas, M.D., Ph.D., Teresa Boget, M.D., Ph.D., Laura Oleaga, M.D., M.P.H., Georgina Casanovas, Ph.D., Paola Hurtado, M.D., Nicolas De Riva, M.D., Ph.D., Roger Pujol, M.D., Joaquin Enseñat, M.D., Ph.D., Ricard Valero, M.D., M.P.H., Anesthesiology, Hospital Clinic, Barcelona University, Barcelona, Spain; Anesthesiology, Neuropsychology, Radiology, and Neurosurgery, Hospital Clinic, Barcelona, Spain; Medical Statistics, Hospital Clinic August Pi i Sunyer Biomedical Research Institute, Barcelona, Spain. The aim of this randomized, placebo-controlled trial was to determine the protective effect of perioperative IV magnesium sulfate administration in 44 intracranial neurosurgery patients stratified by surgery type, tumor, and epilepsy. IV magnesium sulfate administration starting at the induction of anesthesia and continuing for 24 h resulted in macroscopic improvement in magnetic resonance imaging parameters 6 months after surgery, including less gliosis/edema and residual surgical cavity volume in both epilepsy

and tumor surgery patients treated with magnesium sulfate. Neuropsychological tests suggested better performance after 6 months in both epilepsy and tumor surgery patients treated with magnesium.

Best Abstracts: Basic Sciences

Saturday, October 19, 2019, 3:15 PM to 5:15 PM
W300

Moderators

Michael J. Avram, Ph.D., Assistant Editor-in-Chief, ANESTHESIOLOGY, Northwestern University Feinberg School of Medicine, Chicago, Illinois; James P. Rathmell, M.D., Executive Editor, ANESTHESIOLOGY, Brigham and Women's Hospital, Harvard Medical School, Boston, Massachusetts; Martin J. London, M.D., F.A.S.E., Editor, ANESTHESIOLOGY, University of California San Francisco, School of Medicine, and the Veterans Affairs Medical Center, San Francisco, California.

5612

"Differential Effects of Propofol and Sevoflurane on Extracellular Vesicle Associated microRNAs during Cancer Surgery" by Melanie Maerte, M.D., Florian Brandes, M.D., Dominik Buschmann, M.Sc., Marlene Reithmair, V.M.D., Benedikt Kirchner, M.Sc., Michael Pfaffl, Ph.D., Gustav Schelling, M.D., Anesthesiology and Institute of Human Genetics, Ludwig-Maximilians University, Munich, Germany; Division of Animal Physiology and Immunology, School of Life Sciences, Technical University of Munich, Weihenstephan, Germany. Extracellular vesicles are nanosized information carriers detectable in blood that are known to be functional mediators of carcinogenesis and metastasis. Anesthetic-related changes in extracellular vesicles and the profiles of their tumor-related microRNA cargo were compared in matched cohorts of colorectal cancer patients undergoing tumor resection who received either propofol-based total IV anesthesia ($n = 8$) or sevoflurane anesthesia ($n = 9$). *In silico* target analyses indicated an inhibitory effect of propofol-responsive/induced microRNAs on crucial carcinoma-related pathways such as proliferation and migration as well as enhanced carcinoma cell apoptosis associated with propofol. These effects were not observed for microRNA regulation in the sevoflurane group.

6818

"Infant Isoflurane Exposure Affects Social Behaviors but Not Cognitive Functions in Juvenile Non-human Primates" by Viola Neudecker, M.D., Jose F. Perez-Zoghbi, Ph.D., Kristine Coleman, Ph.D., Martha Neuringer, Ph.D., Nicola Robertson, M.Sc., Alexandra Bemis, M.Sc., Bess Glickman, M.Sc.,

Lauren Martin, D.V.M., Gregory Disson, Ph.D., Ansgar Brambrink, M.D., Ph.D., Department of Anesthesiology, Columbia University Medical Center, New York, New York; Oregon National Primate Research Center, Beaverton, Oregon. The hypothesis that multiple, but not single, exposure to isoflurane during infancy impairs cognitive development and social behaviors later in life was tested in nonhuman primates ($n = 7$ to 8 per group) exposed for 5 h to 1.8% isoflurane either once on postnatal day 6 or three times between days 6 and 12 or to 30% oxygen on three occasions. Neither single nor multiple exposures to isoflurane caused impairment in tests of either working memory or cognitive flexibility in the second year of life. However, multiple exposures decreased affiliative social behavior in the home environment, while single exposure was associated with increased behavioral inhibition in response to novel objects.

6283

"Cortical Sensory Processing during Ketamine Anesthesia and Recovery in Non-human Primates" by Yumiko Ishizawa, M.D., Jesus J. Ballesteros, Ph.D., Pamela Huang, M.D., Shaun R. Patel, Ph.D., Emad N. Eskandar, M.D., Anesthesia, Critical Care and Pain Medicine and Neurology, Massachusetts General Hospital, Boston, Massachusetts; Anesthesia and Perioperative Care, University of California San Francisco, San Francisco, California; Neurological Surgery, Albert Einstein College of Medicine, Bronx, New York. Multisensory processing during ketamine anesthesia and recovery was studied in two macaque monkeys by performing intracortical recordings of local field potentials and single neuron activity during ketamine-induced altered states of consciousness in a primary somatosensory and ventral premotor network, which has multisensory integration and cognitive functions. Evoked potentials and single neurons responses suggested a nonaversive tactile signal is processed in a somatosensory and premotor network, but its temporal precision is reduced. Cross-modal sound responses were selectively diminished in these regions. The signals appeared to be altered in or before the primary sensory cortex. The results suggest inhibition of complex multisensory processing and a decrease in spatiotemporal selectivity during ketamine anesthesia and recovery.

6657

"Dopamine D1 Receptor in the Nucleus Accumbens Modulates the Emergence from Propofol Anesthesia in Rats" by Yi Zhang, M.D., Xiaoli Liang, M.A., Chengxi Liu, M.D., Yan Yan, M.A., Huan Gui, M.A., Zikun Duan, M.A., The Second Affiliated Hospital of Zunyi Medical University, Zunyi, China; Zunyi Medical University, Zunyi, China. The nucleus

accumbens, which plays a key role in sleep–wake behavior, contains abundant γ -aminobutyric acid–producing medium spiny neurons expressing dopamine D1 receptors. Using real-time *in vivo* fiber photometry in rats, neuronal activity in the nucleus accumbens was found to be inhibited during propofol anesthesia and markedly disinhibited during recovery from it. Microinjection of a selective D1 receptor agonist into the nucleus accumbens reduced the time to emergence from propofol anesthesia, with a decrease of δ -band power and an increase in β -band power in the cortical electroencephalogram, effects that were prevented by pretreatment with a D1 receptor antagonist.

6232

“Angiopep-2 Modified Pegylated 2-Methoxyestradiol Micelles Contributes to Neuroprotection in a Murine Cardiac Arrest Model” by Dawei Sun, M.D., Ph.D., Xintao Wang, M.D., Derong Cui, M.D., Ph.D., University of California San Francisco, San Francisco, California; Shanghai Jiao Tong University Affiliated Sixth People’s Hospital, Shanghai, China.

Inhibition of hypoxia-inducible factor-1, a key regulator of oxygen homeostasis, after cerebral ischemia is neuroprotective. 2-Methoxyestradiol (2ME2) can decrease hypoxia-inducible factor-1 activity but is rapidly metabolized and does not readily penetrate the blood–brain barrier. Angiopep-2, a low-density lipoprotein receptor-related protein ligand, has significant blood–brain barrier penetrating ability. An 2ME2 micellar system that would better penetrate the blood brain barrier, angiopep-2 modified-polyethylene glycosylated-2ME2/2ME2, was developed based on angiopep-2 capped polyethylene glycosylated 2ME2 conjugates and tested in rats after cardiac arrest had been induced. Angiopep-2 modified-polyethylene glycosylated-2ME2/2ME2 diffused through the blood–brain barrier to injured brain regions better than free 2ME2 and provided neuroprotection against cerebral ischemia injury after cardiac arrest.

6509

“Chronic Naltrexone Therapy Reduced Systemic Inflammation in Experimental Heart Failure” by Lukas Dehe, M.D., Mohammed Shaqura, Pharm.D., Shaaban Mousa, Ph.D., Michael Schäfer, M.D., Ph.D., Sascha Treskatsch, M.D., Ph.D., Anesthesiology and Intensive Care, Charité–Berlin University of Medicine, Berlin, Germany. Upregulation of cardiac kappa and delta opioid receptors as well as their endogenous peptide precursors has been reported in congestive heart failure models. This study examined the effect of chronic naltrexone therapy on inflammatory processes and oxidative phosphorylation in an experimental heart failure model. Congestive heart failure was induced by producing an infrarenal aortocaval fistula in eight male Wistar rats; naltrexone therapy was initiated immediately in four of them.

Four sham-operated rats served as controls. Twenty-eight days after induction of chronic volume overload, chronic naltrexone therapy improved cardiac function (central venous pressure, left ventricular end-diastolic pressure, and maximum rate of change of left ventricular pressure), reduced the activation of inflammatory cytokines (interleukin-6 and interleukin-12) as well as tumor necrosis factor- α , and was correlated with reduced lipid peroxidation (malodialdehyde concentrations).

5626

“Inflammation, Immobilization and Their Combination Impair the Insulin Signaling Pathway in the Skeletal Muscle in a Rat Model” by Thomas Gan, Manfred Blobner, M.D., Heidrun Lewald, M.D., J. A. Jeevendra Martyn, M.D., Stefan J. Schaller, M.D., Department of Anesthesiology and Intensive Care, School of Medicine, Technical University of Munich, Munich, Germany; Massachusetts General Hospital, Harvard Medical School, Boston, Massachusetts.

Immobilization and inflammation are risk factors for muscle wasting accompanied by insulin resistance in critically ill patients. The effects of immobilization and inflammation on insulin signaling in skeletal muscle was studied by examining insulin-dependent Akt activation and phosphorylation of its downstream enzymes glycogen synthase kinase 3 beta and glycogen synthase in 80 male Sprague–Dawley rats. Rats divided into control, immobilization, inflammation, and immobilization with inflammation groups received insulin or sham-insulin treatment. Immobilization and inflammation disrupted the insulin pathway between Akt and glycogen synthase kinase 3 beta, resulting in impaired glycogen synthase kinase 3 beta deactivation, causing an insufficient activation of glycogen synthase in skeletal muscle. The combination of factors had an additive effect impairing the insulin pathway.

6879

“Synaptic Tagging and Capture by Sevoflurane: A Subthreshold High-frequency Synaptic Stimulation Induces Persistent Long-term Potentiation if Preceded or Followed by a Brief 4% Sevoflurane Application in Rat Hippocampal Slices” by Panayiotis Tsokas, Ph.D., Changchi Hsieh, Ph.D., Ira S. Kass, Ph.D., Todd C. Sacktor, M.D., James E. Cottrell, M.D., Anesthesiology, Physiology and Pharmacology, and Neurology, R. F. Furchgott Center for Neural and Behavioral Science, State University of New York Downstate Medical Center, Brooklyn, New York. Protein kinase M ζ , a brain-specific, autonomously active member of the atypical protein kinase C family, is essential for the formation and maintenance of long-term potentiation and long-term memory. Protein kinase M ζ also serves a neuroprotective role. The integrity of pre-existing engrams in the hippocampus may be

achieved *via* compartmentalization of protein kinase M ζ . The hypothesis tested was that protein kinase M ζ synthesized by a brief sevoflurane application can be driven into the synaptic compartment by local synaptic activity induced by a subsequent weak, subthreshold high-frequency synaptic stimulation, through a process similar to “synaptic tagging and capture.” Such a stimulus in slices from the CA1 region of the rat hippocampus elicited persistent long-term potentiation if preceded or followed by a 20-min exposure to 4% sevoflurane.

6306

“Aging Sensitizes Heterozygous Carriers of Mitochondrial Mutations to Neurotoxic Effects from Volatile Anesthetics and Hyperoxia” by Michael Perouansky, M.D., Zachariah P. G. Olufs, B.S., David A. Wassarman, Ph.D., **Anesthesiology, and Medical Genetics, University of Wisconsin, Madison, Wisconsin.** The hypothesis that heterozygous carriers of mutations in Complex I of the mitochondrial electron transport chain become sensitive to anesthetic-induced neurotoxicity with age was tested in a fruit fly (*Drosophila melanogaster*) model of Leigh syndrome, the most common disorder caused by mutations affecting the mitochondrial electron transport chain. Exposure of 33- to 40-day-old flies heterozygous for the ND2360114 allele of Complex I of the mitochondrial electron transport chain to isoflurane in 75% O₂ for 2h increased mortality to different extents in different genetic backgrounds. The contribution of oxygen to increased mortality also varied in different genetic backgrounds.

6885

“Sevoflurane but Not Propofol Provided Dual Effects of Neuroprotection and Neurotoxicity in Alzheimer Disease Cells” by Huafeng Wei, M.D., Ph.D., Xue Gao, M.D., Xiu Wang, M.D., Lei Zhang, M.D., Ge Liang, M.D., Rachel Mund, **Department of Anesthesiology and Critical Care, University of Pennsylvania, Philadelphia, Pennsylvania.** The potencies of propofol and sevoflurane on cell survival and their mechanisms *via* effects on cytosol or on mitochondria calcium concentrations were determined in wild-type and Alzheimer disease cells. Propofol caused cell damage with equal potency in both cell types only at extremely high concentrations. Sevoflurane at 4% for 3h or 2% for 12h promoted cell survival, but at concentrations as low as 1% for 24h produced cell damage in both cell types. Both Ca²⁺ influx from extracellular space and Ca²⁺ release from the endoplasmic reticulum contributed to sevoflurane-mediated elevation of cytosol or mitochondria calcium concentrations. Propofol at clinically relevant concentrations affected intracellular Ca²⁺ homeostasis primarily through Ca²⁺ influx.

Initial Results of Major Trials

Sunday, October 20, 2019, 3:00 PM to 5:00 PM
W320 Chapin Theater

Moderators

Evan D. Kharasch, M.D., Ph.D., Editor-in-Chief, ANESTHESIOLOGY, Duke University, Durham, North Carolina; Deborah J. Culley, M.D., Executive Editor, ANESTHESIOLOGY, Brigham and Women's Hospital, Boston, Massachusetts.

Description

ANESTHESIOLOGY is sponsoring its fourth Major Trials session at the 2019 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.



28th Annual Journal Symposium: What's New in the Old?

Monday, October 21, 2019, 9:30 AM to 12:30 PM
W320 Chapin Theater

Moderators

Deborah J. Culley, M.D., Executive Editor, ANESTHESIOLOGY, Brigham and Women's Hospital, Boston, Massachusetts; Amanda A. Fox, M.D., M.P.H., Editor, ANESTHESIOLOGY, University of Texas Southwestern Medical Center, Dallas, Texas.

Speakers

“The Coalition for Quality in Geriatric Surgery” by Ronnie Rosenthal, M.D., M.S., Department of Surgery, Yale

University School of Medicine, New Haven, Connecticut “Preserving Brain Health in Older Adults Undergoing Surgery” by Charles H. Brown IV, M.D., Department of Anesthesiology and Critical Care Medicine, Johns Hopkins University School of Medicine, Baltimore, Maryland.

Description

With advances in medical care, patients are living longer and are presenting for surgery at later ages and with multiple comorbidities. Anesthesiologists are frequently faced with the challenges of guiding increasingly elderly and frail patients through surgery to the desired endpoints of enhanced recovery and optimal quality of life. Many questions come to mind when planning anesthetic management of these patients. How do anesthesiologists identify older patients at risk for adverse perioperative outcomes? What are the best strategies to use for perioperative optimization and management of the elderly? When should frailty result in a change in surgical approach or anesthetic plan? How can delirium best be avoided?

The 2019 ANESTHESIOLOGY Journal Symposium will feature two plenary lectures by invited experts who will address current concepts and current research related to advancing care and improving outcomes of the geriatric surgical patient. The first lecture will focus on the Coalition for Quality in Geriatric Surgery and what can be learned from this resource to promote research and optimal care. The second lecture will focus on recent research related to preserving brain health in elderly patients undergoing surgery. In addition to the plenary lectures, 11 research abstracts will be presented orally during the second half of the symposium. These abstracts span basic, translational, and clinical science as well as quality improvement.

These abstracts were selected for their relevance to the symposium topic. The full text for each abstract can be found at the ASA abstract website (<http://www.asaabstracts.com/strands/asaabstracts/search.htm>).

JS01

“Preoperative Blood Pressure Complexity and Frailty in Cardiac Surgical Patients” by Valluvan Rangasamy, M.D., Pujja Shankar, M.D., Teresa S. Henriques, Ph.D., Xinling Xu, Ph.D., Balachundhar Subramaniam, M.D., Department of Anesthesia, Critical Care and Pain Medicine, Beth Israel Deaconess Medical Center, Boston, Massachusetts; Institute for Systems and Computer Engineering, Technology and Science, Porto, Portugal. Frailty is a state of decreased physiologic reserve that has been associated with adverse postoperative outcomes. Recent evidence suggests that autonomic dysregulation is a pathophysiologic mechanism underlying this association. This single-center prospective observational study of 500 cardiac surgical patients aims to assess the association between frailty and complexity indices of autonomic dysfunction. Preoperative

beat to beat systolic, diastolic, and mean arterial pressures and pulse pressures were obtained from individual patient's time series of blood pressure waveforms. Multiscale entropy analysis, was computed from preoperative blood pressure time series larger than 750 data points ($n = 88$). Three complexity indices were calculated: (1) complexity index, as the sum of the entropy values for scales 1 to 5; (2) slope, as the slope of the linear regression of the entropy values per scale; and (3) the product of the previous two. For each subject, the median value of index of each blood pressure was considered. Frailty index was calculated based on the patient parameters of: age greater than 70 yr, preoperative body mass index less than 18.5 kg/m^2 , hematocrit less than 35%, albumin less than 3.4 g/dl , and creatinine greater than 2.0 mg/dl . The complexity indices were summarized with mean and SDs, by frailty group. Three hundred sixty-three patients were included in the final analysis. Frailty was present in 190 (52%) patients. The study's complexity measures of preoperative autonomic dysfunction (multiscale entropy slope and the product of multiscale entropy complexity index and multiscale entropy slope for systolic and diastolic blood pressures and multiscale entropy complexity index for pulse pressure and mean arterial pressure time series) significantly associate with presence of patient frailty. Mean \pm SD values of the product of multiscale entropy complexity index and multiscale entropy slope between patients with and without frailty were, systolic, 0.17 ± 0.8 versus -0.17 ± 0.8 ; $P < 0.001$. These findings suggest that blood pressure complexity indices can be used as an indicator of preoperative frailty in cardiac surgical patients.

JS02

“Age Modifies the Effects of Anesthetics and Hyperoxia on Traumatic Brain Injury Outcomes” by Michael Perouansky, M.D., Hannah Schiffman, B.A., David A. Wassarman, Ph.D., Department of Anesthesiology and Department of Medical Genetics, University of Wisconsin, Madison, Wisconsin. Traumatic brain injury induced by blunt trauma in fruit flies reproduces key characteristics of traumatic brain injury in mammals. This study used a model of traumatic brain injury in the fruit fly (*Drosophila melanogaster*) to investigate the effects of anesthetics on brain pathophysiology in the context of traumatic brain injury. The primary hypothesis is that age modifies the interaction between anesthetics, oxygen, and traumatic brain injury. Traumatic brain injury was induced using a high-impact trauma device. Mortality was compared in young versus old adult flies (1 to 8 and 43 to 50 days old, respectively). Flies were exposed to equipotent concentrations of isoflurane or sevoflurane for 2 h either before or after traumatic brain injury. Anesthetics were administered in either 21% or 98% oxygen. The principal outcome measure was the mortality index 24 h after traumatic brain injury (percent mortality under test conditions minus percent mortality under control conditions).

Generalized linear models (either Poisson regression or log-binomial regression) were used to estimate mortality as a function of the experimental conditions. Sevoflurane after traumatic brain injury increased the mortality index 24 h after traumatic brain injury by 27.6% in old flies ($P < 0.001$) but did not affect young flies. Isoflurane after traumatic brain injury had no significant effect in old flies but increased the mortality index 24 h after traumatic brain injury by 26.1% in young flies ($P = 0.025$). Neither sevoflurane nor isoflurane before traumatic brain injury had significant effects in old flies, and both sevoflurane and isoflurane before traumatic brain injury had reduced the mortality index 24 h after traumatic brain injury (by 48.6 and 51.4% for sevoflurane and isoflurane; $P < 0.001$ and $P = 0.001$, respectively) in young flies. One hundred percent oxygen either before or after traumatic brain injury increased the mortality index 24 h after traumatic brain injury only in old flies (by 13.1% for isoflurane and 37.8% for sevoflurane; $P = 0.047$ and < 0.0001 , respectively). Administration of anesthetics in conjunction with hyperoxia modulated the mortality index 24 h after traumatic brain injury only in old animals. These data indicate that aging influences the impact of volatile gas anesthetics and of hyperoxia on traumatic brain injury in fruit flies and that the effects of volatile gas anesthetics and of hyperoxia should be considered in the design and interpretation of experimental studies of traumatic brain injury.

JS03

“Impact of a Delirium Prevention and Treatment Pathway on Perioperative Administration of Beers Criteria Medications” by Anne Donovan, M.D., Matthias R. Braehler, M.D., Ph.D., David L. Robinowitz, M.D., Elizabeth L. Whitlock, M.D., M.Sc., **Anesthesia and Perioperative Care, University of California San Francisco, San Francisco, California.** The American Geriatric Society has created a Beers List of Potentially Inappropriate Medications for Older Adults aimed to improve safe prescribing of medications in older patient populations. We studied rates of perioperative administration of potentially inappropriate medications before and after an education program and rollout of a delirium risk postanesthesia care unit order set as part of a multidisciplinary delirium prevention pathway. All surgical and nonsurgical patients 65 yr of age and older receiving anesthesia care at Moffitt-Long and Mission Bay hospitals after implementation of the delirium prevention pathway (July 2018 and February 2019, $n = 5,736$) were compared to a historical control group of patients having surgery before implementation of the delirium prevention pathway (August and November 2017, $n = 2,629$). Perioperative administration of potentially inappropriate medications was significantly lower after the implementation of the delirium prevention pathway (24% *vs.* 31% before intervention; $P < 0.001$), and Beers list antiemetic

use decreased (3.8% *vs.* 2.3% before intervention; $P < 0.001$) after the implementation of the delirium prevention pathway. Education about potentially inappropriate medications in older adults and institution of a multidisciplinary delirium prevention pathway was associated with lower use of potentially inappropriate medications in older adults, particularly midazolam and prochlorperazine.

JS04

“Preoperative Ultrasound Based Frailty Assessment as a Predictor of Surgical Outcomes” by Cecilia Canales, M.D., M.P.H., Einat Mazor, M.S., Craig S. Flath, M.D., Susana Vacas, M.D., Ph.D., Victor Duval, M.D., Maxime Cannesson, M.D., Ph.D., Soban Umar, M.D., Ph.D., Sumit P. Singh, M.D., **University of California Los Angeles, Los Angeles, California.**

The frailty phenotype is associated with decreases in mobility, muscle mass, nutritional status, strength, and endurance and is associated with adverse patient outcomes. Sarcopenia has recently been identified as a biological marker for frailty that can be objectively quantified using computed tomography scans and point-of-care ultrasound. In this study, patients presenting to the preoperative evaluation clinic with computed tomography scan were recruited. The Fried Frailty assessment was administered to identify the presence of frailty, and ultrasound measurements of the quadriceps were performed, as were psoas muscle measurements from the computed tomography scans. Of the 12 patients recruited into the study, 7 of them were frail based upon the Fried frailty assessment. The psoas muscle measurements for patients who were frail was 11.5 cm ($SD \pm 1.4$) and 13.9 cm ($SD \pm 1.6$) in those who were not frail. Quadriceps thickness in frail patients was 1.8 cm ($SD \pm 0.5$) and 2.71 cm ($SD \pm 0.8$) in those who were not frail. Correlation between frailty and psoas muscle measurements was $r^2 = 0.676$ and $r^2 = 0.627$ between frailty and quadriceps thickness. This study suggests that point-of-care ultrasound can be used to identify frailty in older patients.

JS05

“Predicting Adverse Discharge to Skilled Nursing Facility after Inpatient Surgery” by Kadhiresan Murugappan, M.D., Friederike Althoff, M.S., Katharina Sophie Platzbecker, M.S., Dana Raub, M.S., Bijan Jamil Teja, M.S., Matthias Eikermann, M.D., **Department of Anesthesiology, Beth Israel Deaconess Medical Center, Boston, Massachusetts.**

A large percentage of older patients require long-term care in a facility after surgery. We aimed to create and validate a simple score to predict adverse discharge after inpatient surgery using information available to clinicians preoperatively. Adverse discharge was defined as in-hospital mortality, discharge to a skilled nursing facility, or discharge to a long-term care facility. A scoring system predictive of adverse

discharge was created from hospital registry data. Stepwise backward regression and bootstrap resampling were used to eliminate insignificant predictors (alpha error level $P = 0.01$). The model was externally validated using registry data from an independent hospital network. A total of 96,699 patients were included in the development cohort, and 15,375 (15.9%) experienced adverse discharge. Patient-related factors predictive of adverse discharge included age, sex, body mass index, insurance status, ethnicity/race, ASA physical status, history of atrial fibrillation, chronic heart failure, cerebrovascular disease, peripheral vascular disease, chronic pulmonary disease, diabetes, chronic kidney disease, liver disease, and oxygen therapy at home. Procedure-related predictors included type of surgery, length of hospital stay before surgery, and work relative value units. The prediction model demonstrated excellent discriminative ability with an area under the receiver operating characteristics curve of 0.86 (95% CI, 0.85 to 0.86) in the derivation cohort and an area under the receiver operating characteristics curve of 0.85 (95% CI, 0.85 to 0.86) in the external validation cohort ($n = 91,936$), of whom 8.2% ($n = 7,557$) experienced adverse discharge. Brier scores of 0.099 in the training cohort and 0.065 in the validation cohort signified strong accuracy of the model.

JS06

“Comparative Evaluation of Acetaminophen Administration Strategies in Preventing Delirium after Cardiac Surgery” by Puja Shankar, M.D., Ariel Mueller, M.A., Valluvan Rangasamy, M.D., Shahzad Shaefi, M.D., Balachundhar Subramaniam, M.D., **Anesthesia, Beth Israel Deaconess Medical Center, Boston, Massachusetts.** Postoperative delirium is a common complication after cardiac surgery and has been associated with postoperative pain and treatment with opioids. We compared the effectiveness of IV acetaminophen to placebo and routine postoperative care in preventing the development of delirium after cardiac surgery. Data were pooled from two randomized controlled trials of patients undergoing cardiac surgery. One group was randomized to eight doses of IV acetaminophen every 6 h ($n = 60$), a second group was randomized to receive placebo ($n = 60$), and the third group of patients received the usual standard of care ($n = 100$). The primary outcome was the incidence of in-hospital postoperative delirium. Secondary outcomes included delirium severity, duration of intubation, and intensive care unit and hospital lengths of stay. The incidence of postoperative delirium was significantly lower in the IV acetaminophen group (10%) when compared to both the placebo (28%) and standard of care groups (31%; $P = 0.01$). Intensive care unit length of stay was decreased in the IV acetaminophen group (median, 29.5 [interquartile range, 25 to 49]) compared to placebo (46.2 [28 to 81]) and standard of care groups (37 [29 to 78]; $P = 0.001$). There

was no difference in delirium severity, intubation time, or hospital length of stay between the groups.

JS07

“Anesthesia and Surgery Induce Cognitive Dysfunction in Elderly Male Mice: The Role of Gut Microbiota” by Gaofeng Zhan, M.D., Dongyu Hua, M.D., Chun Yang, M.D., Ph.D., Ailin Luo, M.D., Ph.D., **Anesthesiology, Tongji Hospital, Wuhan, China.** Postoperative cognitive dysfunction is common after surgery and anesthesia, but the underlying mechanisms involved remain unclear. The gut microbiota has been associated with the pathogenesis of central nervous system disorders. This study compared the gut microbiota in mice with and without postoperative cognitive deficits. Eighteen-month-old male C57BL/6J mice were treated with isoflurane before tibial fracture internal fixation surgery. Cognitive performance was evaluated using a Morris water maze, and locomotor activity was assessed in an open field chamber for 5 min. Fecal samples were collected immediately after behavioral testing for 16S ribosomal RNA sequencing analysis. Mice with cognitive deficits showed a significant decrease in α -diversity value when compared mice without cognitive deficits. A total of 24 gut bacteria at six phylogenetic levels (phylum, class, order, family, genus, and species) were significantly different in fecal samples of mice with and without cognitive deficits. We firstly analyzed the correlation between gut bacteria levels and escape latency and found a total of 13 gut bacteria were positively or negatively correlated with cognitive performance. The family Dehalobacteriaceae and genus *Dehalobacterium* were identified as sensitive indicators for cognitive impairment after surgery and anesthesia in this rodent model.

JS08

“Closed-loop Intravenous Anesthesia and Postoperative Cognitive Dysfunction after Non-cardiac Surgery” by Guillaume Besch, M.D., Ph.D., Yanis Bouhake, M.D., Lucie Vettoretti, Ph.D., Thierry Chazot, M.D., Ngai Liu, M.D., Ph.D., Emmanuel Samain, M.D., Ph.D., Sebastien Pili-Floury, M.D., Ph.D., **Anesthesiology and Intensive Care Medicine, Regional University Hospital of Besancon, Besancon, France; Anesthesiology, Hôpital Foch, Suresnes, France.** Postoperative cognitive dysfunction is common in patients over 60 yr of age undergoing major noncardiac surgery. The purpose of this trial was to assess whether closed-loop *versus* manual target-controlled infusion of propofol and remifentanyl decrease the incidence of postoperative cognitive dysfunction after major noncardiac surgery. Patients were randomized (ratio 2:1) to closed-loop target-controlled infusion of propofol and remifentanyl ($n = 143$) or Bispectral Index

(BIS)-guided manual target-controlled infusion of propofol and remifentanyl ($n = 61$, control, BIS target range: 40 to 60). Cognitive assessments were performed the day before surgery (baseline) and within 72 h after surgery, using a battery of seven validated neuropsychologic tests. The primary outcome was the absolute difference of each test between the baseline and postoperative assessments between the two treatment groups. There was no statistically significant difference in the absolute change in any of the cognitive test between the two groups, suggesting that closed-loop IV anesthesia did not allow for a reduction of postoperative cognitive dysfunction after elective major noncardiac surgery compared to BIS-guided manual target-controlled infusion of propofol and remifentanyl.

JS09

“The SANDMAN Study: Sleep Apnea, Neuroinflammation, and Cognitive Dysfunction Manifesting after Non-cardiac Surgery” by Thomas Bunning, B.S., Michael Devinney, M.D., Ph.D., Andrew Spector, M.D., Jeffrey Browndyke, Ph.D., Patrick Smith, Ph.D., Jennifer E. Dominguez, M.D., Victor Cai, Mary Cooter, M.S., Joseph P. Mathew, M.D., Miles Berger, M.D., Ph.D., Anesthesiology, Neurology, Psychiatry and Behavioral Sciences, Duke University Medical Center, Durham, North Carolina. Postoperative cognitive dysfunction is common in older surgical patients and associated with decreased quality of life, subsequent cognitive decline, and increased mortality. Obstructive sleep apnea is prevalent in elderly surgical patients and may be a risk factor for the development of postoperative cognitive dysfunction as it is associated with increased peripheral inflammation. This study is part of a larger study involving 200 patients over the age of 60 yr undergoing noncardiac/nonneurologic surgery and will collect blood, cerebrospinal fluid, and cognitive testing data before and up to 6 weeks after surgery. Eighty of these patients will be a part of the Sleep Apnea, Neuroinflammation, and Cognitive Dysfunction Manifesting after Non-cardiac Surgery study that will also undergo diagnostic testing for obstructive sleep apnea. Thus far, 35 patients have been enrolled and have undergone diagnostic testing for obstructive sleep apnea, of whom 33 had complete testing. Fifty-five percent of the patients were diagnosed with obstructive sleep apnea, and two exhibited Cheyne–Stokes respirations. The authors hypothesize that obstructive sleep apnea will be associated with a higher incidence of postoperative cognitive dysfunction and higher preoperative markers of inflammation.

JS10

“Influence of Age on the Onset and Duration of Neuromuscular Blockade of Rocuronium: Comparison Between Septuagenarian and Octogenarian” by Yoshifumi Kotake, M.D., Ph.D., Yuichi Maki, M.D., Daisuke Toyoda, M.D., Makiko

Tabuchi, M.D., Lisa Abe, M.D., Sayuri Kawahara, M.D., Tatsuo Yamamoto, M.D., Yasumasa Sakamoto, M.D., Junki Kinoshita, M.D., Anesthesiology, Toho University Ohashi Medical Center, Tokyo, Japan. The available data would suggest that there are age-dependent effects in the onset of rocuronium, but little is known about these effects in patients in their eighties. We hypothesized that the patients in their eighties will have different response to rocuronium compared to those in their seventies. Patients were anesthetized with propofol, remifentanyl, and a thoracic epidural block. After the loss of consciousness, neuromuscular transmission was continuously monitored at the adductor pollicis muscle and corrugator supercilli muscle using accelerometry. Rocuronium (0.9 mg/kg body weight) was administered intravenously. During surgery, a continuous infusion of rocuronium was initiated when a response was registered at either the adductor pollicis or corrugator supercilli. After the completion of surgery, the neuromuscular blockade was antagonized with sugammadex. The primary outcome was the interval between administration of intubating dose of rocuronium and the establishment of complete neuromuscular blockade. Nineteen patients were in their seventies and 17 were octogenarians. The onset of neuromuscular blockade among patients in their seventies was 115 ± 22 s whereas the onset time among patients in their eighties was 174 ± 56 s ($P < 0.01$). This study demonstrates that the onset of neuromuscular blockade by rocuronium is slower in patients in their eighties when compared to those in their seventies and should be considered during anesthetic induction in older geriatric patients.

JS11

“Increased Plasma Alpha Synuclein in Brain Derived Exosomes Is Associated with Postoperative Delirium” by Yi Yuan, M.D., Jun Yi, M.D., Zhengqian Li, M.D., Ning Yang, M.D., Yongzheng Han, M.D., Xiaojuan Ji, M.D., Geng Wang, M.D., Xiangyang Guo, M.D., Beijing Ji Shui Tan Hospital, Beijing, China; Peking University The Third Hospital, Beijing, China. α -Synuclein is a key protein that regulates synaptic function and may be associated with the development of postoperative delirium. We explored plasma exosomal α -synuclein variation in elderly patients with postoperative delirium identified by the Confusion Assessment Method after hip fracture surgery. Preoperative and postoperative plasma interleukin-1 β , interleukin-6, tumor necrosis factor- α , and exosomal α -synuclein concentrations were measured in 17 patients with postoperative delirium and compared to 175 patients without delirium using a multivariate analysis. Postoperative concentrations of plasma exosomal α -synuclein were either elevated or lowered. The difference between pre- and postoperative α -synuclein in patients with postoperative delirium was higher than in patients without delirium (21 ± 29 pg/ml vs. 2 ± 20 pg/ml; $P = 0.047$). There was also a correlation between changes in

plasma interleukin-6 and exosomal α -synuclein ($r = 0.383$; $P = 0.25$) but no relationship between exosomal α -synuclein and plasma interleukin-1 β or tumor necrosis factor- α . This study suggests that changes in α -synuclein could be associated with the development of postoperative delirium.

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

**Monday, October 21, 2019, 1:00 PM to 3:00 PM
W415D Valencia**

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 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, Australia.

Tips for Reviewing Statistics and Methods for Nonstatisticians

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Creating a Culture of Civility in Peer Review

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Questions 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.