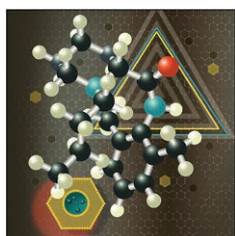


890 Topographical Features of Pediatric Electroencephalography during High Initial Concentration Sevoflurane for Inhalational Induction of Anesthesia

Different brain regions mature at different times, and mechanisms producing reversible loss of consciousness during anesthesia may depend on grey matter maturity. The hypothesis that induction of anesthesia in school-aged children using a high initial sevoflurane concentration would produce different changes in spectral power between age groups was tested by calculating absolute, relative, and total electroencephalographic (EEG) power at induction. Three school-aged groups were included in this observational study: 5 to 6 yr ($n = 7$), 7 to 8 yr ($n = 8$), and 9 to 10 yr ($n = 8$). Using a high-density electrode montage, total power, driven primarily by delta power changes, was found to increase for all age groups during induction, especially in fronto-central channels, with no age-related differences. The broad changes in relative band power observed were comparable to those observed in adults. Because anesthetic administration was not standardized and adjuvant agents known to potentiate

sevoflurane were used at the discretion of the anesthetist, the results of this study are a representative snapshot of clinical anesthesia. See the accompanying Editorial on page 863. (Summary: M. J. Avram. Image: Photograph, C. Brodoway, Nemours/A. I. duPont Hospital for Children; illustration: A. Johnson, Vivo Visuals Studio.)



906 Analgesic Effectiveness of Liposomal Bupivacaine versus Plain Local Anesthetics for Abdominal Fascial Plane Blocks: A Systematic Review and Meta-analysis of Randomized Trials

Liposomal bupivacaine has been reported by some to prolong the duration of analgesia when used for abdominal fascial plane blocks compared to that produced by traditional plain local anesthetic agents. This systematic review and meta-analysis compared the analgesic effectiveness of liposomal bupivacaine to that of plain local anesthetics in adult patients receiving abdominal fascial plane blocks. Thirteen randomized trials of 874 patients were included in the analysis of the primary outcome, the mean difference in the area under the curve for pain severity scores at rest between 24 and 72 h postoperatively. There was no difference in area under the curve for pain severity

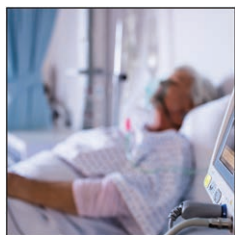
scores at rest between 24 and 72 h postoperatively between the liposomal bupivacaine group and the plain local anesthetics group. There were also no clinically important differences between the groups in secondary outcomes including rest pain scores and opioid consumption up to 72 h postoperatively and no statistical differences in time to first analgesic request, time to hospital discharge, and incidence of opioid-related side effects. See the accompanying Editorials on pages 865, 868, 871, and 874. (Summary: M. J. Avram. Image: A. Johnson, Vivo Visuals Studio.)



920 Association of Mechanical Energy and Power with Postoperative Pulmonary Complications in Lung Resection Surgery: A Post Hoc Analysis of Randomized Clinical Trial Data

Mechanical ventilation can lead to ventilator-induced lung injury. Mechanical power (MP) is the amount of energy transferred from the ventilator to the respiratory system during mechanical ventilation per unit time. Total mechanical energy (ME) reflects both the rate of energy delivery (MP) and the time over which the energy exposure occurred. The hypothesis that time-weighted average MP (MP_{TWA}) and ME were independently associated with pulmonary complications within 7 days after lung resection surgery was tested in a *post hoc* analysis of data from a multicenter randomized clinical trial of driving pressure–guided ventilation in lung resection surgery. Patients were randomly

allocated to either the driving pressure group, in which positive end-expiratory pressure (PEEP) was individualized to deliver the lowest driving pressure, or the conventional protective ventilation group, in which PEEP was set at 5 cm H₂O. Postoperative pulmonary complications occurred in 41% of patients (431 of 1,055). Intraoperative ME was independently associated with the occurrence of postoperative pulmonary complications after adjustment for confounders. MP_{TWA} was also associated with postoperative pulmonary complications in cases of prolonged mechanical ventilation. See the accompanying Editorial on page 877. (Summary: M. J. Avram. Image: Adobe Stock.)



950 Serum Neurofilament Light and Postoperative Delirium in Cardiac Surgery: A Preplanned Secondary Analysis of a Prospective Observational Study

A preplanned secondary analysis of data from 220 patients undergoing elective cardiac surgery tested the hypotheses that postoperative serum neurofilament light concentrations would be higher in those who developed postoperative delirium and that baseline concentrations would be correlated with preoperative cognitive status and identify patients at risk of postoperative delirium. Preoperative cognitive status was scored by averaging the z scores for five neuropsychological tests. Serum neurofilament light concentrations were measured before anesthesia, 2 h after intensive care unit admission, and on postoperative days 1, 2, and 5. Patients were screened for postoperative delirium until hospital discharge. The incidence of postoperative delirium was 29.5% (65 of 220 patients). Neurofilament light concentrations increased after surgery in all the patients. Pre- and postoperative concentrations were higher in patients who experienced delirium. The time trends of postoperative concentrations normalized to preoperative concentrations overlapped. Baseline concentrations were correlated with cognitive z scores. A Cox proportional hazard regression analysis excluding cognitive results found that higher baseline concentrations increased the hazard of developing postoperative delirium. See the accompanying Editorial on page 884. (Summary: M. J. Avram. Image: Adobe Stock.)

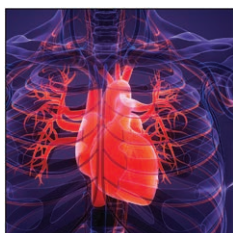
tions increased after surgery in all the patients. Pre- and postoperative concentrations were higher in patients who experienced delirium. The time trends of postoperative concentrations normalized to preoperative concentrations overlapped. Baseline concentrations were correlated with cognitive z scores. A Cox proportional hazard regression analysis excluding cognitive results found that higher baseline concentrations increased the hazard of developing postoperative delirium. See the accompanying Editorial on page 884. (Summary: M. J. Avram. Image: Adobe Stock.)



935 State-related Electroencephalography Microstate Complexity during Propofol- and Esketamine-induced Unconsciousness

Electroencephalographic (EEG) activity reveals rich cerebral spatiotemporal dynamics. The hypothesis that spatiotemporal complexity may serve as a state-related, but not drug-related, EEG indicator of an unconscious state was tested in patients in whom anesthesia was induced and maintained with propofol or esketamine (N = 10 each). The three conventional EEG microstate parameters assessed were (1) coverage, reflecting involvement of different brain regions in underlying neural processes; (2) occurrence, a measure of the stability of underlying neural processes; and (3) duration, reflecting the temporal dynamics of underlying neural processes. Three EEG microstate complexities were assessed: Lempel–Ziv complexity and mean information gain, type I complexity approaches that measure randomness of the time series, and fluctuation complexity, a type II complexity method that quantifies time-series complexity. State-related conventional microstate parameters were coverage and occurrence in one microstate and duration in another. The EEG microstate complexity measures mean information gain or fluctuation complexity had consistent tendencies under two scenarios, but there were overlaps in microstate complexity between conscious and unconscious states and fluctuations in the awake state. *See the accompanying Editorial on page 881. (Summary: M. J. Avram. Image: Adobe Stock.)*

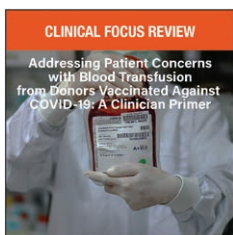
Electroencephalographic (EEG) activity reveals rich cerebral spatiotemporal dynamics. The hypothesis that spatiotemporal complexity may serve as a state-related, but not drug-related, EEG indicator of an unconscious state was tested in patients in whom anesthesia was induced and maintained with propofol or esketamine (N = 10 each). The three conventional EEG microstate parameters assessed were (1) coverage, reflecting involvement of different brain regions in underlying neural processes; (2) occurrence, a measure of the stability of underlying neural processes; and (3) duration, reflecting the temporal dynamics of underlying neural processes. Three EEG microstate complexities were assessed: Lempel–Ziv complexity and mean information gain, type I complexity approaches that measure randomness of the time series, and fluctuation complexity, a type II complexity method that quantifies time-series complexity. State-related conventional microstate parameters were coverage and occurrence in one microstate and duration in another. The EEG microstate complexity measures mean information gain or fluctuation complexity had consistent tendencies under two scenarios, but there were overlaps in microstate complexity between conscious and unconscious states and fluctuations in the awake state. *See the accompanying Editorial on page 881. (Summary: M. J. Avram. Image: Adobe Stock.)*



1002 Modified Thermodilution for Simultaneous Cardiac Output and Recirculation Assessment in Venovenous Extracorporeal Membrane Oxygenation: A Prospective Diagnostic Accuracy Study

Veno-venous extracorporeal membrane oxygenation (VV-ECMO) is a rescue technique for severe hypoxemic respiratory failure. Assessment of recirculation fraction and the ratio of extracorporeal blood flow to cardiac output, major determinants of patient oxygen saturation, is essential to optimize treatment. This *in vitro* study tested whether recirculation fraction and pulmonary blood flow can be assessed simultaneously with an adapted thermodilution technique. The *in vitro* system consisted of a VV-ECMO circuit and a cardiopulmonary circuit running in parallel and sharing the right atrium, with extra limbs for recirculation and pulmonary shunt. Ranges of ECMO

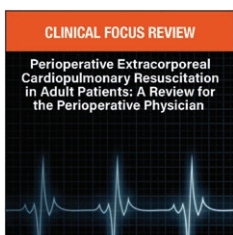
flows, cardiac outputs, recirculation fractions, and pulmonary shunts were simulated. Thermistors in both ECMO limbs and the pulmonary artery measured temperature changes induced by cold bolus injections into the arterial ECMO limb. Recirculation fractions were calculated from the ratio of the areas under the temperature curve in the ECMO limbs and from partitioning of the bolus volume (flow based). Cardiac output was calculated based on partitioning of bolus volumes between ECMO limb and the pulmonary artery. This technique allowed estimation of recirculation and, if recirculation fraction was not more than 40%, cardiac output with clinically acceptable accuracy and precision. *See the accompanying Editorial on page 887. (Summary: M. J. Avram. Image: Adobe Stock.)*



1020 Addressing Patient Concerns with Blood Transfusion from Donors Vaccinated Against COVID-19: A Clinician Primer (Clinical Focus Review)

Patient requests to avoid blood products from donors vaccinated against COVID-19 are increasing even though the high prevalence of COVID-19 antibodies among blood donors has not been associated with adverse outcomes in transfusion recipients. The current blood banking infrastructure is unable to distinguish units of blood from donors vaccinated against COVID-19 from those from unvaccinated donors. Therefore, it is important that clinicians be prepared to discuss with patients both the safety of the donor blood supply and alternatives to allogeneic transfusion as well as their associated risks and limitations in a collaborative, unhurried, and nonjudgmental manner using a shared decision-making framework. If the patient insists on wanting to avoid blood products from donors vaccinated against

COVID-19, their options include not receiving blood products or seeking autologous or directed blood donations, each of which has associated serious risks and not all of which are available for each patient or at each institution. An institutional policy should be developed to help ensure a consistent approach for clinicians presented with these requests. *(Summary: M. J. Avram. Image: Adobe Stock.)*



1026 Perioperative Extracorporeal Cardiopulmonary Resuscitation in Adult Patients: A Review for the Perioperative Physician (Clinical Focus Review)

Extracorporeal cardiopulmonary resuscitation (CPR) is the rapid deployment of venoarterial extracorporeal membrane oxygenation (ECMO) in patients with cardiac arrest who have not achieved sustained return of spontaneous circulation with conventional CPR. Unique aspects of perioperative cardiac arrest allow for improved decision-making regarding implementation of extracorporeal CPR and reduced time to initiation of conventional and extracorporeal CPR, which may lead to improved patient outcomes. This Clinical Focus Review begins with an overview of extracorporeal CPR and describes the evidence and indications for its use. It presents a potential algorithm for the perioperative implementation of extracorporeal CPR based on available evidence and society recommendations as well as suggested patient

selection criteria. Technical and management considerations for patients receiving extracorporeal CPR are discussed, including monitoring and management of its major complications such as left ventricular distention and differential hypoxemia. The review concludes with consideration of the practical, economic, and ethical concerns of this resource-intensive therapy. *(Summary: M. J. Avram. Image: Adobe Stock.)*