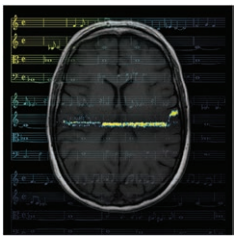
THIS MONTH IN ANESTHESIOLOGY

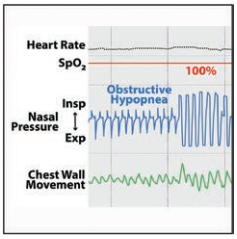


870 Dynamic Cortical Connectivity during General Anesthesia in Healthy Volunteers

Functional disconnection of the frontal cortex from posterior regions has been associated with unconsciousness induced by anesthetics with different molecular and neurophysiologic properties in recent studies of anesthetic-induced unconsciousness. However, many studies of unconsciousness have focused on the averaged connectivity pattern by assuming temporal invariance over data epochs spanning several minutes, despite the fact that cortical connectivity has been shown to fluctuate over time. Functional cortical connectivity was studied by analyzing electroencephalogram data collected from 30 healthy volunteers during prolonged and pharmacologically stable periods of general anesthesia. The analysis found a shifting trajectory of dominant states during anesthesia-induced alterations of consciousness. Cortical connectivity was dynamic during the isoflurane maintenance period. Transition analysis revealed cortical connectivity was more likely to stay in a certain state than switch to another state, but when switches occurred, specific between-state transitions occurred more frequently than expected by chance. In other words, these transitions were structured and suggest the possibility of metastability in brain activity during general anesthesia. *See the accompanying Editorial View on page 861. (Summary: M. J. Avram. Image: S. M. Jarret, M.F.A., C.M.I.)*

958 Intravenous Lidocaine Does Not Improve Neurologic Outcomes after Cardiac Surgery: A Randomized Controlled Trial

Up to half of cardiac surgical patients may experience postoperative cognitive dysfunction at the time of hospital discharge. Multiple preclinical studies suggest a neuroprotective effect of conventional doses of intravenous lidocaine. The hypothesis that intravenous lidocaine administration for 48 h during and after cardiac surgery with cardiopulmonary bypass would reduce the incidence of postoperative cognitive dysfunction in nondiabetic patients at 6 weeks after surgery was tested in a randomized, double-blinded, placebo-controlled trial of 420 patients. Multivariable analysis accounting for the covariable effects of age, years of education, baseline cognition, Caucasian race, and procedure type found there was no difference in the continuous cognitive score change (adjusted mean difference [95% CI] = 0.02 [–0.05 to 0.08]). Similarly, logistic regression analysis of the binary postoperative cognitive dysfunction outcome (defined as more than 1 SD decrease in at least one cognitive domain) indicated no treatment difference (adjusted odds ratio [95% CI] = 0.94 [0.63 to 1.41]). *(Summary: M. J. Avram. Image: J. P. Rathmell.)*



946 Nasopharyngeal Tube Effects on Breathing during Sedation for Dental Procedures: A Randomized Controlled Trial

A common cause of adverse events resulting in the death of patients undergoing dental procedures with sedation is hypoxemia due to abnormal breathing caused by airway obstruction or respiratory depression. A nonblinded randomized controlled study tested the hypotheses that (1) apneas and hypopneas under-detected by pulse oximetry occur frequently during sedation for dental procedures, and (2) insertion of a small-diameter nasopharyngeal tube immediately after induction of sedation will reduce the number of abnormal breathing episodes. Investigators assessed the frequency of abnormal breathing using a portable sleep monitor in 43 patients. In the control group, the median (interquartile range) number of nondesaturated abnormal breathing episodes per hour was 35 (21 to 48), whereas the number of desaturated abnormal breathing episodes per hour was 7 (4 to 19; difference 25 [95% CI, 14 to 36]). The difference between the number of abnormal breathing episodes per hour in the control group, 48 (34 to 64), and that in the nasopharyngeal tube group, 51 (36 to 64), was 2 (95% CI, –15 to 11). *(Summary: M. J. Avram. Image: Adapted from the original article.)*

971 Pediatric Risk Stratification Is Improved by Integrating Both Patient Comorbidities and Intrinsic Surgical Risk

The American College of Surgeons National Surgical Quality Improvement Program Pediatric database was used to determine the relationship between intrinsic surgical risk and 30-day mortality in neonates, infants, and children undergoing noncardiac surgery and to develop and validate a risk stratification model that includes patient comorbidities, physical status, and surgical procedures stratified into intrinsic risk quartiles. A sample of 367,065 surgical cases was obtained for analysis, 1,252 (0.34%) of which involved 30-day mortality. Multivariable logistic regression analysis revealed the following factors to be independent predictors of 30-day mortality: dichotomous weight, American Society of Anesthesiologists Physical Status classification, preoperative sepsis, inotropic support, ventilator dependence, and risk quartile. The risk of 30-day mortality among low-risk surgical procedures ranged from 0.00% (95% CI, 0.00 to 0.01) without comorbidities to 4.74% (95% CI, 3.17 to 7.03) with all comorbidities present. The risk among high-risk surgical procedures ranged from 0.07% (95% CI, 0.05 to 0.09) without comorbidities to 46.7% (95% CI, 43.0 to 50.4) with all comorbidities present. *(Summary: M. J. Avram. Image: J. P. Rathmell.)*

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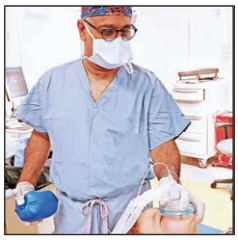
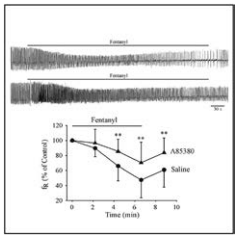


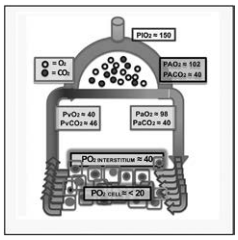
936 Opioid Sensitivity in Children with and without Obstructive Sleep Apnea

The prevalence of childhood obstructive sleep apnea, defined by periodic, partial, or complete obstruction of the upper airway during sleep, is as high as 5.7%. Published guidelines recommend decreasing opioid doses in all patients with sleep apnea for fear of respiratory depression. The hypothesis that children with obstructive sleep apnea have increased sensitivity to the miotic and respiratory depressant effects of the μ-opioid agonist remifentanil was tested in 15 children with and 15 children without obstructive sleep apnea. The μ-opioid-induced miosis, measured using dark adapted pupillometry, as a function of infusion duration for three different fixed-dose remifentanil infusions (0.05, 0.1, or 0.15 μg · kg^{-1} · min^{-1}) was similar in both obstructive sleep apnea and nonobstructive sleep apnea patients as was the relationship between plasma remifentanil concentration and miosis. Neither respiratory rate nor end-expired carbon dioxide was appreciably altered in any of the patients during the 15-min remifentanil infusion. *(Summary: M. J. Avram. Image: S. Suresh.)*



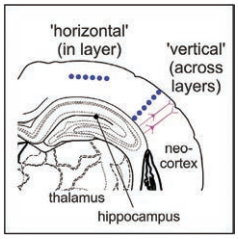
1017 Activating α4β2 Nicotinic Acetylcholine Receptors Alleviates Fentanyl-induced Respiratory Depression in Rats

Opioid-induced respiratory depression results in part from direct activation of μ-opioid receptors expressed in the inspiratory rhythm generator located in the ventrolateral medulla, the preBötzinger complex. Respiratory neurons within the medulla also express nicotinic acetylcholine receptors that are made up of five subunits, arranged symmetrically around a central pore. Activation of the nicotinic acetylcholine receptor α4, α7, and β2 subunits increases respiratory rhythm, whereas activation of the nicotinic acetylcholine receptor α4β2 or α7 subunits induces analgesia in multiple forms of pain. The hypothesis tested was that activation of nicotinic receptors expressed within respiratory rhythm-generating networks would counter opioid-induced respiratory depression without compromising analgesia. The nonselective nicotinic acetylcholine receptor agonist nicotine and the α4β2 nicotinic acetylcholine receptor agonist A85380, but not the α7 nicotinic acetylcholine receptor agonist PNU282987, reversed respiratory depression induced by activation of μ-opioid receptors in rats both *in vitro* and *in vivo*. Coadministration of A85380 with fentanyl not only markedly reduced respiratory depression and apneas but also enhanced fentanyl-induced analgesia. *(Summary: M. J. Avram. Image: Adapted from the original article.)*



1064 Respiratory Physiology for the Anesthesiologist (Review Article)

An understanding of the basic principles of respiratory physiology is needed for safe and effective implementation of induction and maintenance of general anesthesia, delivery of mechanical ventilation, discontinuation of mechanical and pharmacologic support, and return to the preoperative state. The present work provides a review of classic respiratory physiology, emphasizing features important to the anesthesiologist. The material is divided in two main sections, gas exchange and respiratory mechanics, developing four main themes: hypoxemia, hypercarbia, respiratory mechanics, and the mechanics of the lung and chest wall. Topics covered include ventilation/perfusion inequality, the most common mechanism of hypoxemia, which is present in acute respiratory failure, chronic lung diseases, and during general anesthesia, and the five variables (pressure, flow, volume, resistance, and compliance), which are intimately intertwined in determining the mechanical process of breathing. *(Summary: M. J. Avram. Image: Adapted from the original article.)*



1049 Understanding the Effects of General Anesthetics on Cortical Network Activity Using *Ex Vivo* Preparations (Review Article)

Despite significant advances in the understanding of the molecular-level pharmacologic effects of anesthetics, comparatively little is known about how they alter brain dynamics to cause unconsciousness. This review begins with a brief introduction to the methodology of *ex vivo* brain slice preparations, which have been used to study anesthetic drug effects on neural networks because drug actions can be examined in isolated, locally connected networks under highly controlled but flexible conditions. To illustrate the important contribution *ex vivo* models have made to the understanding of anesthesia mechanisms, the context of related *in vivo* experimental and clinical studies is then presented. The review concludes by exploring the contribution that acute and organotypic slices can make to understanding and substantiating cortical anesthetic action, including evidence suggesting cortical network activity may underlie bidirectional communication within the cortical hierarchy, a breakdown in which may disrupt the integrative processes central to conscious experience. *(Summary: M. J. Avram. Image: Adapted from the original article.)*