

◇ **This Month in ANESTHESIOLOGY** 1A
Science, Medicine, and the Anesthesiologist..... 15A
Infographics in Anesthesiology 19A

◆ **Editorials**

Automated Continuous Noninvasive Ward Monitoring: Validation of Measurement Systems Is the Real Challenge
B. Saugel, P. Hoppe, A. K. Khanna 407

Challenge of Anesthesia Management in Brugada Syndrome
M. Ranucci 411

Global Safe Pediatric Anesthesia Care
M. G. Cooper 413

Preoperative Risk, Blood Pressure, and Acute Kidney Injury
L. Y. Sun 416


Oxidative Stress Response and Delirium after Cardiac Surgery: Can Circulating Biomarkers Refine New Therapeutic Paradigms?
M. V. Podgoreanu, M. J. Deviney Jr., J. P. Mathew 418

Anticoagulation and Antithrombin in Venovenous Extracorporeal Membrane Oxygenation
M. P. Massicotte, M. E. Bauman 421

Perioperative Medicine

CLINICAL SCIENCE

◇ ◆ **Vital Signs Monitoring with Wearable Sensors in High-risk Surgical Patients: A Clinical Validation Study**

 *M. J. M. Breteler, E. J. KleinJan, D. A. J. Dohmen, L. P. H. Leenen, R. van Hillegersberg, J. P. Ruurda, K. van Loon, T. J. Blokhuis, C. J. Kalkman* 424

In high-risk surgical patients admitted to a step-down unit, heart rate was accurately measured by the two wearable patch sensors (SensiumVitals [Sensium Healthcare Ltd., United Kingdom] and HealthPatch [VitalConnect, USA]) and by the bed-based contactless mattress sensor (EarlySense [EarlySense Ltd., Israel]) and by the patient-worn monitor (Masimo Radius-7 [Masimo Corporation, USA]). The highest precision for heart rate was seen with the HealthPatch sensor. For respiratory rate, the accuracies of the Masimo Radius-7, EarlySense, and SensiumVitals were within a predefined acceptable range, while the HealthPatch overestimated respiratory rate.

◆ **Electrocardiographic Effects of Propofol versus Etomidate in Patients with Brugada Syndrome**

P. Flamée, V. Varnavas, W. Dewals, H. Carvalho, W. Cools, J. T. Bhutia, S. Beckers, V. Umbrain, C. Verborgh, P. Forget, G.-B. Chierchia, P. Brugada, J. Poelaert, C. de Asmundis 440

This study was a prospective randomized double-blind trial that compared groups receiving propofol (n = 43) versus etomidate (n = 37) for induction of general anesthesia. No significant difference in electrocardiographic changes was observed between these two groups.

◇ Refers to This Month in Anesthesiology

◆ Refers to Editorials

 This article has an Audio Podcast

 See Supplemental Digital Content

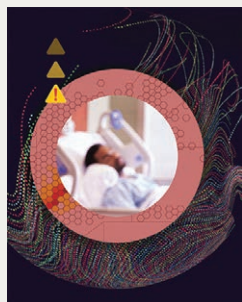
 CME Article

 This article has a Video Abstract

 Part of the Letheon writing competition

 This article has a Visual Abstract

 Readers' Toolbox



ON THE COVER: Vital signs are recorded infrequently on hospital wards, missing early signs of deterioration. Wireless sensors have been developed that may capture patient deterioration earlier. In this issue of ANESTHESIOLOGY, Breteler *et al.* tested whether wearable sensors could reliably measure heart rate and respiratory rate continuously in patients recovering from major surgery. In an accompanying Editorial, Saugel *et al.* call for meticulous validation of the measurement performance of these new wearable sensors before they are used to guide everyday clinical practice. Cover illustration: A. Johnson, Vivo Visuals.

- Breteler *et al.*: Vital Signs Monitoring with Wearable Sensors in High-risk Surgical Patients: A Clinical Validation Study, p. 424
- Saugel *et al.*: Automated Continuous Noninvasive Ward Monitoring: Validation of Measurement Systems Is the Real Challenge, p. 407

◆◆ Pediatric Perioperative Mortality in Kenya: A Prospective Cohort Study from 24 Hospitals



M. W. Newton, S. E. Hurt, M. D. McEvoy, Y. Shi, M. S. Shotwell, J. Kamau, S. Nabolindo, Z. W. W. Ngumi, W. S. Sandberg, B. Sileshi452

In a series of 24 Kenyan hospitals, an innovative, robust data tool for collecting more accurate mortality rates found cumulative rates of 0.8% at 24 h, 1.1% at 48 h, and 1.7% at 7 days postoperatively. In this sample, the 7-day mortality was more than 100 times higher than in high-resource settings and associated with American Society of Anesthesiologists Physical Status III or more, surgery at night or over the weekend, and not using the Safe Surgical Checklist. Mortality was also higher in primary hospitals compared to secondary or tertiary hospitals.

◆◆ Preoperative Risk and the Association between Hypotension and Postoperative Acute Kidney Injury



M. R. Mathis, B. I. Naik, R. E. Freundlich, A. M. Shanks, M. Heung, M. Kim, M. L. Burns, D. A. Colquhoun, G. Rangrass, A. Janda, M. C. Engoren, L. Saager, K. K. Tremper, S. Kheterpal, on behalf of the Multicenter Perioperative Outcomes Group Investigators461

In a large cohort of noncardiac surgical patients, the incidence of acute kidney injury was 9%. Major factors identifying patients at risk for acute kidney injury included anemia, estimated glomerular filtration rate, elevated risk surgery, American Society of Anesthesiologists Physical Status, and expected anesthesia duration. The relationship between hypotension and acute kidney injury varied by underlying patient and procedural risk. Patients with low risk demonstrated no associated increased risk of acute kidney injury across all blood pressure ranges, whereas patients with the highest baseline risk demonstrated an association between even mild absolute intraoperative hypotension ranges and acute kidney injury.

Positive End-expiratory Pressure and Distribution of Ventilation in Pneumoperitoneum Combined with Steep Trendelenburg Position

A. Shono, N. Katayama, T. Fujihara, S. H. Böhm, A. D. Waldmann, K. Ugata, T. Nikai, Y. Saito476

In patients undergoing robot-assisted laparoscopic prostatectomy, 15 but not 5 cm H₂O of positive end-expiratory pressure increased ventilation in the dorsal parts of the lung, resulting in more normal lung mechanics and gas exchange. High positive end-expiratory pressure did not improve postoperative lung function.

◆ Influence of St. John's Wort on Intravenous Fentanyl Pharmacokinetics, Pharmacodynamics, and Clinical Effects: A Randomized Clinical Trial

M. J. Loughren, E. D. Kharasch, M. C. Kelton-Rehkopf, K. L. Syrjala, D. D. Shen491

The pharmacokinetics and pharmacodynamics (pupillary diameter over time) were examined in volunteers before and after treatment with St. John's wort. No differences were seen, suggesting that this herbal medication does not influence the clinical behavior of fentanyl.

◆◆ Information Integration and Mesoscopic Cortical Connectivity during Propofol Anesthesia



Z. Liang, L. Cheng, S. Shao, X. Jin, T. Yu, J. W. Sleight, X. Li504

Using electrocorticography in subjects anesthetized with propofol, the genuine permutation cross mutual information demonstrated that, with loss of consciousness, there was a loss of efficient global information transmission and increased local functional segregation in the cortical network.

Transfusion of Uncrossmatched Group O Erythrocyte-containing Products Does Not Interfere with Most ABO Typings

M. H. Yazer, P. C. Spinella, L. Doyle, R. M. Kaufman, R. Dunn, J. R. Hess, L. A. Filho, M. Fontaine, B. Gathof, B. Jackson, M. F. Murphy, J. Pasion, J. S. Raval, K. Rosinski, J. Seheult, A. W. Shih, J. Sperry, J. Staves, E. E. Tuott, A. Ziman, D. J. Triulzi, on behalf of the Biomedical Excellence for Safer Transfusion Collaborative525

ABO typing in 665 of 695 (95.7%) non-group O recipients could be accurately determined on the first type and screen sample obtained by the blood bank after the transfusion of uncrossmatched type O erythrocyte-containing products.

BASIC SCIENCE



◆ Reduced Sensitivity to Anesthetic Agents upon Lesioning the Mesopontine Tegmental Anesthesia Area in Rats Depends on Anesthetic Type

A. Minert, M. Baron, M. Devor535


Targeted microinjection of ibotenic acid into the mesopontine tegmental anesthesia area in adult rats led to an up to twofold loss in anesthetic potency of etomidate and propofol. In contrast, the potency of ketamine, medetomidine, and alfaxalone/alfadolone were unaffected. These observations suggest that the mesopontine tegmental anesthesia area of the brainstem may serve as a key structure to selectively mediate transition from wakefulness into an anesthetic state in response to γ -aminobutyric acid-mediated anesthetics.

Critical Care Medicine

CLINICAL SCIENCE

- 

◆ Intraoperative Oxidative Damage and Delirium after Cardiac Surgery
*M. G. Lopez, C. G. Hughes, A. DeMatteo, J. B. O'Neal, J. B. McNeil,
 M. S. Shotwell, J. Morse, M. R. Petracek, A. S. Shah, N. J. Brown,
 F. T. Billings IV*551


In a cohort of 400 cardiac surgery patients, intraoperative plasma concentrations of F₂-isoprostanes and isofurans (markers of oxidative damage) were independently associated with both increased postoperative delirium and increased plasma concentrations of ubiquitin carboxyl-terminal hydrolase isozyme L1, a marker of neuronal injury. The association between increased systemic markers of oxidative damage and increased neuronal injury was stronger in patients with elevated plasma S100 calcium-binding protein B, a marker of blood–brain barrier disruption. This suggests that blood–brain barrier disruption may increase susceptibility to neuronal injury associated with systemic oxidative damage.

- 
◆ Anticoagulation Management and Antithrombin Supplementation Practice during Venovenous Extracorporeal Membrane Oxygenation: A Worldwide Survey
A. Protti, G. E. Iapichino, M. Di Nardo, M. Panigada, L. Gattinoni562

Based on 273 responses from 50 countries, unfractionated heparin is used in 96.6% of centers, with partial thromboplastin time monitoring in 41.8%, activated clotting time in 30.0%, and anti-factor Xa activity in 22.7% of centers. Antithrombin is monitored in 48.7% of centers and actively repleted in 38.1% of centers, mainly in high-income regions and in pediatric patients.

Pain Medicine

CLINICAL SCIENCE



- 
◆ Pain Response to Open Label Placebo in Induced Acute Pain in Healthy Adult Males
*T. Schneider, J. Luethi, E. Mauermann, O. Bandschapp,
 W. Ruppen*571


Using a well-characterized electrical pain sensitization model in human volunteers, the effects of short *versus* detailed placebo educational protocols were measured. Open label placebo treatment reduced pain sensitization in the volunteers, but the extent of placebo education did not modify these responses.

Education


IMAGES IN ANESTHESIOLOGY

- Button Battery Ingestion: A True Surgical and Anesthetic Emergency**
T. W. Templeton, B. J. Terry, S. H. Pecorella, M. G. Downard581

- 

◆ Ultrasound-guided Medial Branch Blocks, Facet Joint, and Multifidus Muscle Injections: How It Is Done under One Needle Insertion Point!
C. P. C. Chen, J.-L. Chen, C.-S. Ho, A. Suputtitida582

- 
◆ Not All Pericardial Fluid Is Pericardial: Ultrasound of Pericardial Effusion and Two of Its Mimics
Y. S. Bronshteyn, J. N. Hauck, R. A. Schroeder, A. Barbeito584

REVIEW ARTICLE

- 

◆ Controversies in Perioperative Antimicrobial Prophylaxis
*B. K. Decker, A. Nagrebetsky, P. A. Lipsett, J. P. Wiener-Kronish,
 N. P. O'Grady*586

This is a review of perioperative antimicrobial prophylaxis focusing on areas where clinical practice varies from guideline recommendations.

MIND TO MIND

- The Waiting Room**
D. T. Mattingly598

Correspondence

- Sparking the Discussion about Vaping and Anesthesia**
M. M. Feinstein, D. Katz599

Announcements 600

Erratum 602

Careers & Events 21A

INSTRUCTIONS FOR AUTHORS

The most recently updated version of the Instructions for Authors is available at www.anesthesiology.org. Please refer to the Instructions for the preparation of any material for submission to ANESTHESIOLOGY.

Manuscripts submitted for consideration for publication must be submitted in electronic format via Editorial Manager (<https://www.editorialmanager.com/aln>). Detailed directions for submission and the most recent version of the Instructions for Authors can be found on the Journal's Web site (<http://www.anesthesiology.org>). Books and educational materials for review should be sent to Alan Jay Schwartz, M.D., M.S.Ed., Director of Education, Department of Anesthesiology and Critical Care Medicine, The Children's Hospital of Philadelphia,

ANESTHESIOLOGY (ISSN 0003-3022) is published monthly by Wolters Kluwer Health, Inc., 14700 Citicorp Drive, Bldg 3, Hagerstown, MD 21742. Business office: Two Commerce Square, 2001 Market Street, Philadelphia, PA 19103. Periodicals postage paid at Hagerstown, MD, and at additional mailing offices. Copyright © 2020, the American Society of Anesthesiologists, Inc. All Rights Reserved.

Annual Subscription Rates: *United States*—\$1026 Individual, \$2451 Institution, \$413 In-training. *Rest of World*—\$1082 Individual, \$2721 Institution, \$413 In-training. Single copy rate \$245. Subscriptions outside of North America must add \$57 for airfreight delivery. Add state sales tax, where applicable. The GST tax of 7% must be added to all orders shipped to Canada (Wolters Kluwer Health, Inc.'s GST Identification #895524239, Publications Mail Agreement #1119672). Indicate in-training status and name of institution. Institution rates apply to libraries, hospitals, corporations, and partnerships of three or more individuals. Subscription prices outside the United States must be prepaid. Prices subject to change without notice. Subscriptions will begin with currently available issue unless otherwise requested. Visit us online at www.lww.com.

Individual and in-training subscription rates include print and access to the online version. Online-only subscriptions for individuals (\$339) and persons in training (\$339) are available to nonmembers and may be ordered by downloading a copy of the Online Subscription FAXback Form from the Web site, completing the information requested, and faxing the completed form to 301-223-2400. Institutional rates are for print only; online subscriptions are available via Ovid. Institutions can choose to purchase a print and online subscription together for a discounted rate. Institutions that wish to purchase a print subscription, please contact Wolters Kluwer Health, Inc., 14700 Citicorp Drive, Bldg 3, Hagerstown, MD 21742; phone: 800-638-3030; fax: 301-223-2400. Institutions

34th Street and Civic Center Blvd., Room 9327, Philadelphia, Pennsylvania 19104-4399. Article-specific permission requests are managed with Copyright Clearance Center's Rightslink service. Information can be accessed directly from articles on the journal Web site. More information is available at <http://anesthesiology.pubs.asahq.org/public/rightsandpermissions.aspx>. For questions about the Rightslink service, e-mail customer-care@copyright.com or call 877-622-5543 (U.S. only) or 978-777-9929. Advertising and related correspondence should be addressed to Advertising Manager, ANESTHESIOLOGY, Wolters Kluwer Health, Inc., Two Commerce Square, 2001 Market Street, Philadelphia, Pennsylvania 19103 (Web site: <http://www.wkadcenter.com/>). Publication of an advertisement in ANESTHESIOLOGY does not constitute endorsement by the Society or Wolters Kluwer Health, Inc. of the product or service described therein or of any representations made by the advertiser with respect to the product or service.

that wish to purchase an online subscription or online with print, please contact the Ovid Regional Sales Office near you or visit www.ovid.com/site/index.jsp and select Contact and Locations.

Address for non-member subscription information, orders, or change of address (except Japan): Wolters Kluwer Health, Inc., 14700 Citicorp Drive, Bldg 3, Hagerstown, MD 21742; phone: 800-638-3030; fax: 301-223-2400. In Japan, contact Wolters Kluwer Health Japan Co., Ltd., Forecast Mita Building 5th floor, 1-3-31 Mita Minato-ku, Tokyo, Japan 108-0073; phone: +81 3 5427 1969.

Address for member subscription information, orders, or change of address: Members of the American Society of Anesthesiologists receive the print and online journal with their membership. To become a member or provide a change of address, please contact the American Society of Anesthesiologists, 1061 American Lane, Schaumburg, Illinois 60173-4973; phone: 847-825-5586; fax: 847-825-1692; e-mail: membership@ASAHQ.org. For all other membership inquiries, contact Wolters Kluwer Health, Inc., Customer Service Department, P.O. Box 1610, Hagerstown, MD 21740; phone: 800-638-3030; fax: 301-223-2400.

Postmaster: Send address changes to ANESTHESIOLOGY, P.O. BOX 1610, Hagerstown, MD 21740.

Advertising: Please contact Hilary Druker, National Account Manager, Health Learning, Research & Practice, Medical Journals, Wolters Kluwer Health, Inc.; phone: 609-304-9187; e-mail: Hilary.Druker@wolterskluwer.com. For classified advertising: Dave Wiegand, Recruitment Advertising Representative, Wolters Kluwer Health, Inc.; phone: 847-361-6128; e-mail: Dave.Wiegand@wolterskluwer.com.