

## ON THE COVER:

Intraoperative lung-protective ventilation can reduce postoperative pulmonary complications. The added protection of positive end-expiratory pressure (PEEP) remains uncertain. In this issue of *ANESTHESIOLOGY*, Pereira *et al.* demonstrate that PEEP requirements vary widely among patients. Individually-titrated PEEP during anesthesia reduces postoperative atelectasis while improving intraoperative oxygenation and driving pressures. In an accompanying Editorial View, Kacmarek and Villar discuss this new clinical trial in the context of previous trials evaluating the risks and benefits of using PEEP in the operating room.

- Pereira *et al.*: Individual Positive End-expiratory Pressure Settings Optimize Intraoperative Mechanical Ventilation and Reduce Postoperative Atelectasis, p. 1070
- Kacmarek and Villar: Lung-protective Ventilation in the Operating Room: Individualized Positive End-expiratory Pressure Is Needed! p. 1057

## ◆ THIS MONTH IN ANESTHESIOLOGY

1A

## ■ SCIENCE, MEDICINE, AND THE ANESTHESIOLOGIST

17A

## ■ INFOGRAPHICS IN ANESTHESIOLOGY

21A

## ◆ EDITORIAL VIEWS



### John (Iain) Glen Wins 2018 Lasker Prize for Development of Propofol: An Award for All of Anesthesiology

*M. Wood and R. Stark*

1055



### Lung-protective Ventilation in the Operating Room: Individualized Positive End-expiratory Pressure Is Needed!

*R. M. Kacmarek and J. Villar*

1057

### Observing Blood Management Programs through the Retrospectroscope

*R. J. Cook and R. B. Weiskopf*

1060

## ■ SPECIAL ARTICLE

### Quality Anesthesia: Medicine Measures, Patients Decide

*L. A. Fleisher*

1063

Quality of anesthesia care can be improved through measurement. We must take shared accountability for all surgical outcomes including cognitive recovery. We must move to listening to patient-oriented outcomes and satisfaction with our care.

◆ Refers to This Month in Anesthesiology

◆ Refers to Editorial Views



This article has an Audio Podcast



See Supplemental Digital Content

CME CME Article



This article has a Video Abstract









Part of the Letheon writing competition




This article has a Visual Abstract

### CLINICAL SCIENCE

- 
**Individual Positive End-expiratory Pressure Settings Optimize Intraoperative Mechanical Ventilation and Reduce Postoperative Atelectasis** 1070  

*S. M. Pereira, M. R. Tucci, C. C. A. Morais, C. M. Simões, B. F. F. Tonelotto, M. S. Pompeo, F. U. Kay, P. Pelosi, J. E. Vieira, and M. B. P. Amato*  
 Optimal positive end-expiratory pressure (PEEP) values for patients with normal lungs and under general anesthesia vary significantly. Application of individualized optimal PEEP intraoperatively not only reduces driving pressure and improves respiratory compliance and oxygenation but also reduces the incidence and severity of postoperative atelectasis. *SUPPLEMENTAL DIGITAL CONTENT IS AVAILABLE IN THE TEXT*
- 
**Patient Blood Management Program Improves Blood Use and Clinical Outcomes in Orthopedic Surgery** 1082  
*P. B. Gupta, V. M. DeMario, R. M. Amin, E. A. Gehrie, R. Goel, K. H. K. Lee, W. W. Yang, H. S. Khanuja, R. S. Sterling, P. M. Ness, and S. M. Frank*  
 A blood management program using a hemoglobin transfusion threshold of 7 g/dl in asymptomatic orthopedic patients reduces blood use by 32.5% and results in similar or improved clinical outcomes. Improved outcomes occurred primarily in patients 65 yr of age and older.
- 
**Comparison of Two Major Perioperative Bleeding Scores for Cardiac Surgery Trials: Universal Definition of Perioperative Bleeding in Cardiac Surgery and European Coronary Artery Bypass Grafting Bleeding Severity Grade** 1092  
*J. Bartoszko, D. N. Wijeyesundera, K. Karkouti, on behalf of the Transfusion Avoidance in Cardiac Surgery Study Investigators*  
 Two consensus-based scoring systems for assessing bleeding were compared in a substudy of the Transfusion Avoidance in Cardiac Surgery trial. Both the Universal score and European Coronary Artery Bypass Graft scores performed well and may be used as validated outcome measures in future clinical trials. *SUPPLEMENTAL DIGITAL CONTENT IS AVAILABLE IN THE TEXT*
- 
**Early Resumption of  $\beta$  Blockers Is Associated with Decreased Atrial Fibrillation after Noncardiothoracic and Nonvascular Surgery: A Cohort Analysis** 1101  
*A. K. Khanna, D. F. Naylor, Jr., A. J. Naylor, E. J. Mascha, J. You, E. M. Reville, Q. M. Riter, M. Diwan, A. Kurz, and D. I. Sessler*  
 Resumption of postoperative  $\beta$ -blocker therapy by the end of postoperative day 1 is associated with reduced incidence of postoperative atrial fibrillation in general surgical patients (noncardiac, nonthoracic, nonvascular surgeries) when compared with patients who resumed  $\beta$ -blocker therapy after postoperative day 1. There was not a significant difference in incidence of postoperative atrial fibrillation for those patients who postoperatively resumed  $\beta$ -blocker therapy on the day of surgery *versus* anytime thereafter.
- 
**Prediction Score for Postoperative Neurologic Complications after Brain Tumor Craniotomy: A Multicenter Observational Study** 1111  
*R. Cinotti, N. Bruder, M. Srairi, C. Paugam-Burtz, H. Beloeil, J. Pottecher, T. Geeraerts, V. Atthar, A. Guéguen, T. Triglia, J. Josserand, D. Vigouroux, S. Viquesnel, K. Lakhal, M. Galliez, Y. Blanloeil, A. Le Thuaut, F. Feuillet, B. Rozec, K. Asehnoune, and the Société Française d'Anesthésie-Réanimation (SFAR) Research Network*  
 The score was developed from 1,094 patients and validated in 830 patients from six French hospitals. Severe complications occurred in about 11% of each cohort. The positive predictive value was poor, but the negative predictive value was excellent and might be used to identify patients who do not need critical care. *SUPPLEMENTAL DIGITAL CONTENT IS AVAILABLE IN THE TEXT*

## CONTENTS

- ◆  **Hospital-, Anesthesiologist-, and Patient-level Variation in Primary Anesthesia Type for Hip Fracture Surgery: A Population-based Cross-sectional Analysis** 1121  
*D. I. McIsaac, D. N. Wijeyesundera, G. L. Bryson, A. Huang, C. J. L. McCartney, and C. van Walraven*

Canadian administrative data demonstrate that approximately 60% of the variation in neuraxial use is attributable to patient factors, 20% to provider factors, and 20% to hospital factors. The specific anesthesiologist or hospital a patient receives care from affects the likelihood of neuraxial use more than most clinical factors. *SUPPLEMENTAL DIGITAL CONTENT IS AVAILABLE IN THE TEXT*

### ■ CRITICAL CARE MEDICINE



#### CLINICAL SCIENCE

-  ◆ **Ultrasound Is Superior to Palpation in Identifying the Cricothyroid Membrane in Subjects with Poorly Defined Neck Landmarks: A Randomized Clinical Trial** 1132  
*N. Siddiqui, E. Yu, S. Boulis, and K. E. You-Ten*

In this randomized clinical trial, 223 adult patients with neck pathologies such as previous neck surgery, irradiation, and/or neck mass who were scheduled for a neck computed-tomography scan were randomly allocated to either the ultrasound group or the external-palpation group. Accuracy in identification of the cricothyroid membrane, defined as the distance from a point determined by the computed tomography within 5 mm, was 10-fold greater in the ultrasound group (81%, n = 114) than the external-palpation group (8%, n = 109).

-  **Oropharyngeal Bacterial Colonization after Chlorhexidine Mouthwash in Mechanically Ventilated Critically Ill Patients** 1140  
*B. La Combe, A. Mahérault, J. Messika, T. Billard-Pomares, C. Branger, L. Landraud, D. Dreyfuss, F. Dib, L. Massias, and J. Ricard*

Bacterial colonization was evaluated in 30 mechanically ventilated patients before and after application of 0.12% chlorhexidine. Chlorhexidine did not reduce colonization and may, therefore, be less effective than previously assumed. *SUPPLEMENTAL DIGITAL CONTENT IS AVAILABLE IN THE TEXT*

- ◆   **Morbidity and Mortality of Crystalloids Compared to Colloids in Critically Ill Surgical Patients: A Subgroup Analysis of a Randomized Trial** 1149  
*N. Heming, L. Lamothe, S. Jaber, J. L. Trouillet, C. Martin, S. Chevret, and D. Annane*

In a preplanned subgroup analysis of a previous trial, the authors compared 28-day mortality in 741 surgical patients with hypovolemic shock who were randomized to crystalloids or colloids. Mortality at 30 and 90 days was similar in the two groups, and colloid administration did not increase the need for dialysis. Colloid administration did not improve mortality but also did not cause renal injury. *SUPPLEMENTAL DIGITAL CONTENT IS AVAILABLE IN THE TEXT*

### ■ CLASSIC PAPERS REVISITED

- Succinylcholine and Intracranial Pressure** 1159  
*J. E. Cottrell*

### ■ EDUCATION

#### IMAGES IN ANESTHESIOLOGY

- Diagnosis of Atrial Tachycardia with Transesophageal Echocardiography** 1163  
*D. Contou, J. Laforêt, J. Tirolien, and H. Mentec*

- Profound Vasoconstriction: Implications for Percutaneous Arterial Access** 1165  
*D. G. Taylor and L. Camporota*

-  **Interscalene Brachial Plexus Block: “Stoplight” That Lit Up Red** 1166  
*A. W. Amundson and H. M. Smith*

*SUPPLEMENTAL DIGITAL CONTENT IS AVAILABLE IN THE TEXT*

## CONTENTS

-  **Thoracoscopic and Ultrasound Guidance for Optimization of Medication Spread during Thoracic Paravertebral Nerve Blockade** 1167  
*M. Visoiu and S. Scholz*

*SUPPLEMENTAL DIGITAL CONTENT IS AVAILABLE IN THE TEXT*

- Blue Rubber Bleb Nevus Syndrome** 1169  
*C. A. Sullivan*

- Simultaneous Color Change at Opposite Ends of Carbon Dioxide Absorbent Canisters** 1170  
*R. G. Loeb and N. Gravenstein*

## REVIEW ARTICLE

- ◇ **Prothrombin Complex Concentrates for Perioperative Vitamin K Antagonist and Non-vitamin K Anticoagulant Reversal** 1171  
*J. H. Levy, J. Douketis, T. Steiner, J. N. Goldstein, and T. J. Milling*

Patients who are anticoagulated with warfarin often require emergency surgery. Although fresh frozen plasma is still frequently used, guidelines for rapid reversal recommend four-factor prothrombin complex concentrates. We review the current evidence supporting these recommendations.

## MIND TO MIND

-  **KW** 1185  
*J. Dereske*
- Among Body Parts and Colleagues: Finding My Team in the Rubble on 9/11** 1186  
*J. M. Raiten*

## CORRESPONDENCE

- In-training Exams, Performance, and Exam Fatigue** 1189  
*D. J. Berman*

- Does the American Board of Anesthesiology BASIC Examination Really Affect Anesthesiology Resident Knowledge Acquisition?** 1189  
*E. G. Pivalizza, O. O. Nwokolo, S. J. Ghebremichael, T. H. Markham, S. Guzman-Reyes, S. D. Gumbert, and G. W. Williams*

- In Reply*  
*D. J. Murray and J. R. Boulet*

- In Reply*  
*D. O. Warner, Y. Zhou, M. T. Keegan, C. A. Lien, and H. Sun*

- 
- When Checklists Fail: Human Factors Learning from Aviation and Safety by Design** 1192  
*M. Z. A. Mariyaselvam and P. J. Young*

## REVIEWS OF EDUCATIONAL MATERIAL

1194

## ACKNOWLEDGMENT

1196

## ERRATUM

1199

## ANESTHESIOLOGY REFLECTIONS FROM THE WOOD LIBRARY-MUSEUM

- Daily Nitrous Oxide for “Pupblic” Patients of Dr. C. C. Haskell** 1120  
*George S. Bause*

## CONTENTS

<b>Warding Off Quacks: Ward's Laudanum in Pittsburgh</b>	<b>1131</b>
<i>George S. Bause</i>	
<b>York Dentist Kurwin Eisenhart Provided "Any Anesthetic Desired"</b>	<b>1158</b>
<i>George S. Bause</i>	
<b>Chloroforming a Hoosier Holiday Turkey</b>	<b>1162</b>
<i>George S. Bause</i>	

## CAREERS & EVENTS

23A

### INSTRUCTIONS FOR AUTHORS

The most recently updated version of the Instructions for Authors is available at [www.anesthesiology.org](http://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. The preferred method is via the Journal's Web site (<http://www.anesthesiology.org>). Detailed directions for submissions and the most recent version of the Instructions for Authors can be found on the Web site (<http://www.anesthesiology.org>). Books and educational materials 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, 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 [customercare@copyright.com](mailto:customercare@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.

**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 © 2018, the American Society of Anesthesiologists, Inc.

**Annual Subscription Rates:** *United States*—\$930 Individual, \$2054 Institution, \$374 In-training. *Rest of World*—\$981 Individual, \$2281 Institution, \$374 In-training. Single copy rate \$207. Subscriptions outside of North America must add \$55 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](http://www.lww.com).

Individual and in-training subscription rates include print and access to the online version. Online-only subscriptions for individuals (\$308) and persons in training (\$308) 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 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](http://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; email: [journal@wkjapan.co.jp](mailto:journal@wkjapan.co.jp).

**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; email: [membership@ASAhq.org](mailto: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, Advertising Field Sales Representative, Health Learning, Research & Practice, Medical Journals, Wolters Kluwer Health, Inc.; phone: 609-304-9187; e-mail: [Hilary.Druker@wolterskluwer.com](mailto:Hilary.Druker@wolterskluwer.com). For classified advertising: Dave Wiegand, Recruitment Advertising Representative, Wolters Kluwer Health, Inc., Two Commerce Square, 2001 Market Street, Philadelphia, PA 19103; phone: 847-361-6128; e-mail: [Dave.Wiegand@wolterskluwer.com](mailto:Dave.Wiegand@wolterskluwer.com).