



ON THE COVER:

Changes in the economy, demographics, and health care may impact the anesthesiology workforce. Baird and his colleagues from the RAND Corporation compare the results of a new survey of anesthesiologists in the United States conducted in 2013 with a similar survey done in 2007. There has been a shift to younger anesthesiologists and an increase in the number and proportion of female anesthesiologists in the workforce; employment arrangements, compensation, and work hours for women differ from those for men. How these trends will impact the field of anesthesiology is uncertain. (Cover photo by Diemut Strebe and James P. Rathmell, Brigham and Women's Hospital, Boston, Massachusetts.)

- Lanier: Changing Trends in the U.S. Anesthesiology Workforce, with a Focus on Geographic Regions and Gender, p. 983
- Baird *et al.*: Regional and Gender Differences and Trends in the Anesthesiologist Workforce, p. 997

◆ THIS MONTH IN ANESTHESIOLOGY	1A
■ SCIENCE, MEDICINE, AND THE ANESTHESIOLOGIST	19A
■ INFOGRAPHICS IN ANESTHESIOLOGY	21A
◆ EDITORIAL VIEWS	
<p>Changing Trends in the U.S. Anesthesiology Workforce, with a Focus on Geographic Regions and Gender</p> <p><i>W. L. Lanier</i></p>	983
<p>CME Stemming the Tide of Obstetric Morbidity: An Opportunity for the Anesthesiologist to Embrace the Role of Peridelivery Physician</p> <p><i>J. M. Mhyre and B. T. Bateman</i></p>	986
<p>Creating an Anesthesiologist-run Pacemaker and Defibrillator Service: Closing the Perioperative Care Gap for These Patients</p> <p><i>M. A. Rozner and P. M. Schulman</i></p>	990
<p>Acquiring New Technical Skills and Aptitude for Mental Rotation</p> <p><i>S. L. Kopp and J. P. Rathmell</i></p>	993
<p>Emergency Cricothyrotomy: Toward a Safer and More Reliable Rescue Method in “Cannot Intubate, Cannot Oxygenate” Situation</p> <p><i>T. Asai</i></p>	995

◆ Refers to This Month in Anesthesiology

◆ Refers to Editorial Views

BA Best Abstract article originally

presented at ANESTHESIOLOGY 2015

See Supplemental Digital Content

CME CME Article

■ PERIOPERATIVE MEDICINE

CLINICAL SCIENCE

- ◆◆ **Regional and Gender Differences and Trends in the Anesthesiologist Workforce** 997
M. Baird, L. Daugherty, K. B. Kumar, and A. Arifkhanova

American Society of Anesthesiologists members were surveyed in 2013 using a similar instrument to one used in 2007. The more recent survey showed increased number and proportion of female anesthesiologists, and these differed from males in employment arrangements, compensation, and work hours. Regional differences were present and unchanged since 2007.

- CME ◆◆◆ **Temporal Trends in Anesthesia-related Adverse Events in Cesarean Deliveries, New York State, 2003–2012** 1013
J. Guglielminotti, C. A. Wong, R. Landau, and G. Li

In a review of approximately 800,000 cesarean deliveries in New York state from 2003 to 2012, the overall rate of anesthesia-related adverse events was 730 per 100,000, and there was a decrease in major events by 43% and minor events by 23% during this time. During the same time period, the incidence of nonanesthesia complications increased 47%. *SUPPLEMENTAL DIGITAL CONTENT IS AVAILABLE IN THE TEXT*

- ◆◆◆ **Initial Experience of an Anesthesiology-based Service for Perioperative Management of Pacemakers and Implantable Cardioverter Defibrillators** 1024
G. A. Rooke, S. A. Lombaard, G. A. Van Norman, J. Dziarsk, K. M. Natrajan, L. W. Larson, and J. E. Poole

The authors describe the successful training of a group of anesthesiologists at their institution to perform perioperative cardiovascular implantable electronic device management. Their experience suggests that an anesthesiology-based service can meet the challenge of providing efficient and high-level care for surgical patients with cardiovascular implantable electronic devices. *SUPPLEMENTAL DIGITAL CONTENT IS AVAILABLE IN THE TEXT*

- ◆◆ **Ultrasound Improves Cricothyrotomy Success in Cadavers with Poorly Defined Neck Anatomy: A Randomized Control Trial** 1033
N. Siddiqui, C. Arzola, Z. Friedman, L. Guerina, and K. E. You-Ten

This is the first study systematically assessing whether ultrasound guidance can reduce the complications associated with cricothyrotomy performed in human cadaver. The incidence of injuries to the larynx and trachea during ultrasound-guided cricothyrotomy was significantly lower compared with conventional digital palpation technique (25 vs. 74%), whereas the insertion time was significantly longer with ultrasound than with digital palpation (196 vs. 110 s). Results of this study suggest that ultrasound guidance of the cricothyroid membrane and neck landmarks should be performed before airway management, particularly in patients with difficult palpable neck landmarks and difficult airways.

- ◆ **Intubation Biomechanics: Laryngoscope Force and Cervical Spine Motion during Intubation in Cadavers—Cadavers versus Patients, the Effect of Repeated Intubations, and the Effect of Type II Odontoid Fracture on C1-C2 Motion** 1042
B. J. Hindman, R. P. From, R. B. Fontes, V. C. Traynelis, M. M. Todd, M. B. Zimmerman, C. M. Puttlitz, and B. G. Santoni

Biomechanics during laryngoscopy revealed similarity of laryngoscope forces and cervical spine motion between humans and cadavers. Repeated intubation procedures changed biomechanics during laryngoscopy in cadavers. In cadavers with a type II odontoid fracture, cervical motion during intubation with either the Macintosh or the Airtraq (Airtraq LLC, USA) did not greatly exceed the range observed in intact cervical spines during the same procedures. *SUPPLEMENTAL DIGITAL CONTENT IS AVAILABLE IN THE TEXT*

- ◆ **Preoperative Surgical Risk Predictions Are Not Meaningfully Improved by Including the Surgical Apgar Score: An Analysis of the Risk Quantification Index and Present-On-Admission Risk Models** 1059
M. A. Terekhov, J. M. Ehrenfeld, and J. P. Wanderer

Both the Risk Quantification Index and Present-On-Admission Risk predicted mortality well. Adding the Surgical Apgar Score did not substantively improve predictions.

BASIC SCIENCE

Altered Mitochondrial Dynamics Contributes to Propofol-induced Cell Death in Human Stem Cell–derived Neurons

1067

D. M. Twaroski, Y. Yan, I. Zaja, E. Clark, Z. J. Bosnjak, and X. Bai

In supratherapeutic doses, propofol increased mitochondrial fission; key proteins involved in fission were increased. Suppression of these proteins mitigated the increases in mitochondrial fission and reduced toxicity. Propofol accelerated mitochondrial permeability transition pore (mPTP) opening; blockade of fission rescued the mPTP opening time. The data indicate that propofol, when administered in supratherapeutic concentrations, may induce neurotoxicity *via* a mitochondria fission and mPTP pathway.

Multiple Anesthetic Exposure in Infant Monkeys Alters Emotional Reactivity to an Acute Stressor

1084

J. Raper, M. C. Alvarado, K. L. Murphy, and M. G. Baxter

Rhesus monkey infants subjected to three 4-h exposures to sevoflurane manifested increased anxious behavior when confronted with an intruder. The increased anxiety was not attributable to changes in physiologic function during anesthesia. Vocalizations, fear, and irritability behavior, in an age-specific manner, were similar between exposed and nonexposed monkeys. Within a spectrum of behavioral changes induced by neonatal anesthetic exposure, attention should be focused on altered emotional behavior. *SUPPLEMENTAL DIGITAL CONTENT IS AVAILABLE IN THE TEXT*

Identification and Characterization of GAL-021 as a Novel Breathing Control Modulator

1093

F. J. Golder, S. Dax, S. M. Baby, R. Gruber, T. Hoshi, C. Ideo, A. Kennedy, S. Peng, V. Puskovic, D. Ritchie, R. Woodward, R. L. Wardle, M. R. Van Scott, J. C. Mannion, and D. Euan MacIntyre

Intravenously administered GAL-021 attenuated opiate-induced respiratory depression in rats and nonhuman primates without affecting morphine analgesia in rats. GAL-021 ventilatory stimulation in rats was attenuated by carotid sinus nerve transection. GAL-021 ventilatory stimulation was attenuated in mice lacking the pore-forming α -subunit of the $K_{Ca}1.1$ channel.

■ CRITICAL CARE MEDICINE

CLINICAL SCIENCE

Risk of a Diagnosis of Dementia for Elderly Medicare Beneficiaries after Intensive Care

1105

C. Guerra, M. Hua, and H. Wunsch

By using an extended Cox model in a random sample of Medicare beneficiaries who received intensive care in 2005 in the United States and survived to hospital discharge matched with general population controls (age, sex, and race) with 3 yr follow-up, it was found that the rate of incidence of diagnoses of dementia among elderly survivors of critical illness was 60% higher than in the matched general population controls, but translated into only a 3% absolute increase in risk over 3 yr. This increased incidence was not accounted for by risk factors for dementia before the critical illness. *SUPPLEMENTAL DIGITAL CONTENT IS AVAILABLE IN THE TEXT*

Physiological Effects of the Open Lung Approach in Patients with Early, Mild, Diffuse Acute Respiratory Distress Syndrome: An Electrical Impedance Tomography Study

1113

G. Cinnella, S. Grasso, P. Raimondo, D. D'Antini, L. Mirabella, M. Rauseo, and M. Dambrosio

In 15 patients with early, mild, diffuse acute respiratory distress syndrome, application of an open lung approach (*vs.* a standard management protocol that does not target an “open” lung) resulted in lower driving pressure, improved oxygenation, and more homogeneous distribution of ventilation (assessed by electric impedance tomography).

BASIC SCIENCE

Gradually Increased Oxygen Administration Improved Oxygenation and Mitigated Oxidative Stress after Resuscitation from Severe Hemorrhagic Shock

1122

X. Luo, Y. Yin, G. You, G. Chen, Y. Wang, J. Zhao, B. Wang, L. Zhao, and H. Zhou

Gradually increased oxygen administration improved systemic/tissue oxygenation and mitigated oxidative stress simultaneously after resuscitation from severe hemorrhagic shock.

■ PAIN MEDICINE

CLINICAL SCIENCE

◇ **BA Trends in Pain Medicine Liability** 1133

K. A. Pollak, L. S. Stephens, K. L. Posner, J. P. Rathmell, D. R. Fitzgibbon, R. P. Dutton, E. Michna, and K. B. Domino

In a review of the Anesthesia Closed Claims Project database, the proportion of malpractice claims in pain medicine increased from 3% in 1980–1989 to 18% in 2000–2012, accompanied by increasing severity of injury, including death and permanent disabling injury. Claims related to cervical procedures were out of proportion to the frequency with which they are performed.

Methadone Pharmacogenetics: CYP2B6 Polymorphisms Determine Plasma Concentrations, Clearance, and Metabolism 1142

E. D. Kharasch, K. J. Regina, J. Blood, and C. Friedel

Compared with wild-type individuals, methadone metabolism and clearance were diminished in *CYP2B6*6* carriers and increased in *CYP2B6*4* carriers. Methadone metabolism and clearance were significantly lower in African Americans because of a larger proportion of *CYP2B6*6* carriers and the absence of *CYP2B6*4* carriers. These results may permit identification of individuals at risk for methadone overdose and may suggest genetically guided methadone dosing.

BASIC SCIENCE

Spinal IL-33/ST2 Signaling Contributes to Neuropathic Pain *via* Neuronal CaMKII–CREB and Astroglial JAK2–STAT3 Cascades in Mice 1154

S. Liu, W.-L. Mi, Q. Li, M.-T. Zhang, P. Han, S. Hu, Q.-L. Mao-Ying, and Y.-Q. Wang

Blocking or genetically deleting the interleukin-33 receptor ST2 greatly diminished allodynia in a spared nerve injury model of neuropathic pain. Interleukin-33 works through the calcium–calmodulin-dependent kinase II–cyclic adenosine monophosphate response element–binding protein and janus kinase 2–signal transducer and activator of transcription signaling pathways to enhance *N*-methyl-D-aspartate receptor subunit 1 expression and support allodynia in this model.

Activation of Adenosine Monophosphate–activated Protein Kinase Suppresses Neuroinflammation and Ameliorates Bone Cancer Pain: Involvement of Inhibition on Mitogen-activated Protein Kinase 1170

H. Song, Y. Han, C. Pan, X. Deng, W. Dai, L. Hu, C. Jiang, Y. Yang, Z. Cheng, F. Li, G. Zhang, X. Wu, and W. Liu

Activation of adenosine monophosphate–activated kinase by resveratrol significantly inhibited spinal neuroinflammation in a rat model of bone cancer pain. Resveratrol also reduced pain-related behaviors in these animals.

■ EDUCATION

IMAGES IN ANESTHESIOLOGY

Spontaneous Hyphema after Cardiac Surgery 1186

D. W. Barbara, J. N. Pulido, J. A. Leavitt, and S. M. Gillespie

Harlequin Syndrome Associated with Thoracic Epidural Analgesia 1187

J. J. Thomas and D. Polaner

ORIGINAL INVESTIGATIONS IN EDUCATION

◆ **Visuospatial Ability as a Predictor of Novice Performance in Ultrasound-guided Regional Anesthesia** 1188

A. Shafqat, E. Ferguson, V. Thanawala, N. M. Bedforth, J. G. Hardman, and R. A. McCahon

Visuospatial testing predicts novice performance in performing ultrasound-guided needle placement on a benchtop model, and anxiety adversely affects performance. These factors may prove useful in creating tailored training of ultrasound-guided regional anesthesia designed to meet individual learner's needs.

CONTENTS

REVIEW ARTICLE

- ◇ **Cardiac Output and Cerebral Blood Flow: The Integrated Regulation of Brain Perfusion in Adult Humans** 1198

L. Meng, W. Hou, J. Chui, R. Han, and A. W. Gelb

Cardiac output causally affects cerebral blood flow. A conceptualization is proposed for the purpose of integrating at the level of cerebral resistance vessel various mechanisms that regulate the cerebral circulation and jointly determine the brain perfusion.

MIND TO MIND

- Sounds** 1209

J. M. Berry

- Beyond the Mask** 1210

R. Jose

■ CORRESPONDENCE

- Bleeding Risk in Surgical Patients Receiving Sugammadex: Definitive Conclusions Are Not Yet Possible** 1212

M. Carron

In Reply

N. Rahe-Meyer

-
- Incidence of Intraoperative Hypersensitivity Reactions: What's This About?** 1213

P. Dewachter and C. Mouton-Faivre

In Reply

L. Saager and D. I. Sessler

■ ANESTHESIOLOGY REFLECTIONS FROM THE WOOD LIBRARY-MUSEUM

- Licorice-flavored Morphine for Babies: Winchell's Teething Syrup** 1066

George S. Bause

- "Fac-Simile" Confederate \$10 Bill Advertising Odontunder by Dr. A. B. Cobb** 1092

George S. Bause

- Signed Simpson Stereoscopic Photoportrait, Blind-stamped Lennie** 1132

George S. Bause

■ REVIEWS OF EDUCATIONAL MATERIAL

1216

■ CAREERS & EVENTS

23A

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. 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. Requests for permission to duplicate materials published in ANESTHESIOLOGY should be submitted in electronic format, to the Permissions Department (journalpermissions@lww.com). Advertising and related correspondence should be addressed to Advertising Manager, ANESTHESIOLOGY, Lippincott Williams & Wilkins, 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 Lippincott Williams & Wilkins, 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 Lippincott Williams & Wilkins, 16522 Hunters Green Parkway, Hagerstown, MD 21740-2116. Business office: Two Commerce Square, 2001 Market Street, Philadelphia, PA 19103. Periodicals postage paid at Hagerstown, MD, and at additional mailing offices. Copyright © 2015, the American Society of Anesthesiologists, Inc.

Annual Subscription Rates: *United States*—\$799 Individual, \$1566 Institution, \$319 In-training. *Rest of World*—\$843 Individual, \$1739 Institution, \$319 In-training. Single copy rate \$145. Subscriptions outside of North America must add \$52 for airfreight delivery. Add state sales tax, where applicable. The GST tax of 7% must be added to all orders shipped to Canada (Lippincott Williams & Wilkins' 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 (\$257) and persons in training (\$257) 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 301-223-2400/44 (0) 20 7981 0535. 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 Lippincott Williams & Wilkins, 16522 Hunters Green Parkway, Hagerstown, MD 21740-2116; phone: 1-800-638-3030 (outside the United States 301-223-2300/44 (0) 20 7981 0525); fax: 301-223-2400/44 (0) 20 7981 0535. 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 and select Contact and Locations.

Address for non-member subscription information, orders, or change of address: Lippincott Williams & Wilkins, 16522 Hunters Green Parkway, Hagerstown, MD 21740-2116; phone: 1-800-638-3030 (outside the United States 301-223-2300/44 (0) 20 7981 0525); fax: 301-223-2400/44 (0) 20 7981 0535; email: customerservice@lww.com. In Japan, contact LWW Japan Ltd., 3-23-14 Hongo, Bunkyo-ku, Tokyo 113, Japan; phone: 81-3-5689-5400; fax: 81-3-5689-5402; email: bclaim@lwwis.co.jp. In Bangladesh, India, Nepal, Pakistan, and Sri Lanka, contact Globe Publications Pvt. Ltd., B-13 3rd Floor, A Block, Shopping Complex, Naraina, Vihar, Ring Road, New Delhi 110028, India; phone: 91-11-25770411; fax: 91-11-25778876; email: info@globepub.com.

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. For all other membership inquiries, contact Lippincott Williams & Wilkins Customer Service Department, P.O. Box 1580, Hagerstown, MD 21741-1580; phone: 1-800-638-3030 (outside the United States 301-223-2300/44 (0) 20 7981 0525); fax: 301-223-2400/44 (0) 20 7981 0535; email: memberservice@lww.com.

Postmaster: Send address changes to ANESTHESIOLOGY, P.O. BOX 1550, Hagerstown, MD 21740.

Advertising: Please contact Mike Prinzi, Field Sales Rep, Medical Journals, Lippincott Williams & Wilkins, 333 Seventh Avenue, 19th Floor, New York, NY 10001; tel: (800) 933-6525, fax: (646) 607-5479, e-mail: Mike.Prinzi@wolterskluwer.com. For classified advertising: Keida Spurlock, Recruitment Advertising Representative, Lippincott Williams & Wilkins, Two Commerce Square, 2001 Market Street, Philadelphia, PA 19103; tel: (215) 521-8501, fax: (215) 689-2453. e-mail: Keida.Spurlock@wolterskluwer.com.