



Anesthesiology



The Journal of the American Society of Anesthesiologists, Inc.
American Society of Critical Care Anesthesiologists
Society for Obstetric Anesthesia and Perinatology



CONTENTS

- ◇ **THIS MONTH IN ANESTHESIOLOGY** **5A**
- Accuracy of Cardiac Output Monitoring Methods Compared
- Computer Model Evaluates Partial Rebreathing as Pulmonary Blood Flow Measurement Technique
- Exploring Mechanisms of Rapacuronium-induced Fatal Bronchospasm
- Is Increased Analgesic Requirement Associated with Dysfunctional Labor?
- ◆ **EDITORIAL VIEWS**
-
- Procrustes, the Traumatic Penumbra, and Perfusion Pressure Targets in Closed Head Injury **805**
David K. Menon
- Getting Older Is Not Necessarily Getting Better **807**
Harvey G. Klein
- **CLINICAL INVESTIGATIONS**
-
- ◆ **Assessment of the Lower Limit for Cerebral Perfusion Pressure in Severe Head Injuries by Bedside Monitoring of Regional Energy Metabolism** **809**
Carl-Henrik Nordström, Peter Reinstrup, Wangbin Xu, Anna Gärdenfors, and Urban Ungerstedt
- Regional cerebral energy metabolism was monitored bedside using multiple microdialysis probes and was related to cerebral perfusion pressure (CPP) after evacuation of focal traumatic brain lesions in 50 patients. A biochemical perturbation indicating insufficient oxygenation was observed in more-injured (“worse”) parts of the brain at CPP less than 50 mmHg.

- | | |
|---|--|
| ◇ | Refers to This Month in Anesthesiology |
| ◆ | Refers to Editorial Views |
| ⊕ | See Web Site enhancement |

CONTENTS



- ◆ **Influence of Erythrocyte Concentrate Storage Time on Postsurgical Morbidity in Cardiac Surgery Patients** **815**

Santiago R. Leal-Noval, Irene Jara-López, José L. García-Garmendía, Ana Marín-Niebla, Angel Herruzo-Avilés, Pedro Camacho-Laraña, and Jesús Loscertales

Prolonged storage of erythrocytes does not seem to be associated with duration of intensive care unit stay, mechanical ventilation time, and perioperative myocardial infarction rate. However, it could be a risk factor for the development of nosocomial pneumonia.

- The Importance of Prior Stroke for the Adjusted Risk of Neurologic Injury after Cardiac Surgery for Women and Men** **823**

Charles W. Hogue, Jr., Charl J. De Wet, Kenneth B. Schechtman, and Victor G. Dávila-Román

Prior stroke is independently associated with susceptibility for perioperative stroke, particularly for men compared with women, but other risk factors do not appear to be influenced by patient gender.

- ◇ **Noninvasive Cardiac Output Measurement Using Partial Carbon Dioxide Rebreathing Is Less Accurate at Settings of Reduced Minute Ventilation and when Spontaneous Breathing Is Present** **830**

Kazuya Tachibana, Hideaki Imanaka, Muneyuki Takeuchi, Yuji Takauchi, Hiroshi Miyano, and Masaji Nishimura

During controlled mechanical ventilation, minute ventilation rather than tidal volume affected the accuracy of cardiac output measurement using the partial carbon dioxide rebreathing technique. When spontaneous breathing is present, evaluation using the partial carbon dioxide rebreathing system is less accurate, and both tidal volume and respiratory rate increase during carbon dioxide rebreathing.

- The Effects of Hydration on Core Temperature in Pediatric Surgical Patients** **838**

Tiberiu Ezri, Peter Szmuk, Marian Weisenberg, Francis Serour, Arcadi Gorenstein, and Daniel I. Sessler

Conservative fluid management, which decreased body weight by only 1%, prevented intraoperative hypothermia, presumably by reducing dissipation of metabolic heat from the core thermal compartment to peripheral tissues.

CONTENTS



Local Anesthetics Impair Human Granulocyte Phagocytosis Activity, Oxidative Burst, and CD11b Expression in Response to *Staphylococcus aureus* **842**

Ralph-Thomas Kiefer, Annette Ploppa, Wolfgang A. Krueger, Michael Plank, Boris Nohé, Helene A. Haeberle, Klaus Unertl, and Hans-Jürgen Dieterich

Local anesthetics inhibit inflammatory and immunologic functions of human granulocytes *in vitro* in a structure- and concentration-dependent manner. Whereas lidocaine and bupivacaine induced pronounced effects, ropivacaine showed less interference.

Impact of Bispectral Index Monitoring on Fast Tracking of Gynecologic Patients Undergoing Laparoscopic Surgery **849**

Shireen Ahmad, Meltem Yilmaz, R-Jay Marcus, Silas Glisson, and Annette Kinsella

This study demonstrates that when using a standardized anesthetic regimen and strict discharge scoring system, Bispectral Index monitoring does not have a significant effect on the ability to fast track outpatients.

Simultaneous Assessment of Drug Interactions with Low- and High-Extraction Opioids: Application to Parecoxib Effects on the Pharmacokinetics and Pharmacodynamics of Fentanyl and Alfentanil **853**

Andra E. Ibrahim, Jennifer Feldman, Aziz Karim, and Evan D. Kharasch

A cassette dosing or "cocktail" strategy was used to assess clinical opioid drug interactions. Parecoxib, a cyclooxygenase-2 inhibitor, did not alter fentanyl or alfentanil disposition or clinical effects and did not cause significant hepatic cytochrome P450 3A4 (CYP3A) drug interactions. The CYP3A inhibitor troleandomycin decreased the clearance of alfentanil more than fentanyl, confirming that extraction ratio determines the consequence of altered hepatic opioid metabolism.

■ **LABORATORY INVESTIGATIONS**

Neuraxial Morphine May Trigger Transient Motor Dysfunction after a Noninjurious Interval of Spinal Cord Ischemia: A Clinical and Experimental Study **862**

Manabu Kakinohana, Martin Marsala, Christopher Carter, J. Kenneth Davison, and Tony L. Yaksh

Neuraxial morphine administration may trigger motor dysfunction after a transient noninjurious interval of spinal ischemia in humans and rats.

CONTENTS



Dual Effects of Hexanol and Halothane on the Regulation of Calcium Sensitivity in Airway Smooth Muscle **871**

Hayashi Yoshimura, Keith A. Jones, William J. Perkins, and David O. Warner

In the presence of muscarinic receptor stimulation, hexanol, like halothane, decreases calcium sensitivity in airway smooth muscle. However, in the absence of muscarinic receptor stimulation, hexanol and halothane increase calcium sensitivity by a G-protein-mediated process not sensitive to pertussis toxin.

◇ **Sources of Error in Noninvasive Pulmonary Blood Flow Measurements by Partial Rebreathing: A Computer Model Study** **881**

Johnny S. Yem, Yongquan Tang, Martin J. Turner, and A. Barry Baker

This study examines the systematic errors produced by the partial rebreathing technique using a comprehensive mathematical model of the cardiorespiratory system of a healthy, 70-kg adult male.

Optimal Adrenergic Support in Septic Shock Due to Peritonitis **888**

Qinghua Sun, Zizhi Tu, Suzana Lobo, George Dimopoulos, Nathalie Nagy, Peter Rogiers, Daniel De Backer, and Jean-Louis Vincent

In a hyperdynamic septic shock model, the combination of norepinephrine with either dopamine or dobutamine is more efficient than norepinephrine alone in reversing hemodynamic abnormalities, alleviating histologic injury in the major organs, and prolonging survival. In particular, the combination of norepinephrine with dobutamine can limit the increase in arterial lactate concentration and partial pressure of carbon dioxide gap and attenuate anatomic damage to the lung, liver, and small intestine.

Halothane Depresses Glutamatergic Neurotransmission to Brain Stem Inspiratory Premotor Neurons in a Decerebrate Dog Model **897**

Astrid G. Stucke, Edward J. Zuperku, Viseslav Tonkovic-Capin, Mislav Tonkovic-Capin, Francis A. Hopp, John P. Kampine, and Eckehard A. E. Stuth

A decerebrate dog model shows that halothane depresses the activity of inspiratory premotor neurons in the ventral respiratory group *via* reduction of postsynaptic glutamatergic excitation, while overall γ -aminobutyric acid-mediated inhibition remains unaltered.



◇ **A Mechanism for Rapacuronium-induced Bronchospasm: M2 Muscarinic Receptor Antagonism** **906**

Edmund Jooste, Farrah Klaffer, Carol A. Hirshman, and Charles W. Emala

Rapacuronium exhibited a significantly higher affinity for M2 *versus* M3 muscarinic receptors within clinically relevant concentrations. These findings are consistent with a mechanism of M2 muscarinic receptor antagonism by rapacuronium, leading to enhanced acetylcholine release from parasympathetic nerves and thereby potentiating bronchoconstriction.

Dialysis Delivery of an Adenosine A₁ Receptor Agonist to the Pontine Reticular Formation Decreases Acetylcholine Release and Increases Anesthesia Recovery Time **912**

Diana Tanase, Helen A. Baghdoyan, and Ralph Lydic

Pontine administration of an adenosine A₁ agonist delays emergence from halothane anesthesia and decreases acetylcholine release in the medial pontine reticular formation.

Spinal Carbonic Anhydrase Contributes to Nociceptive Reflex Enhancement by Midazolam, Pentobarbital, and Propofol **921**

Bing Wang, Naaznin Samanani, Sheldon H. Roth, and David P. Archer

Systemic administration of sedative doses of pentobarbital, propofol, and midazolam reduces nociceptive withdrawal latency from noxious heat in both forelimbs and hind limbs to approximately 60% of control values. Lumbar intrathecal administration of the carbonic anhydrase inhibitors acetazolamide and ethoxzolamide blocked reflex enhancement in the hind limbs but not the forelimbs. Spinal carbonic anhydrase is an important mediator of drug-induced nociceptive hyperreflexia.

Deactivation of Norepinephrine by Peroxynitrite as a New Pathogenesis in the Hypotension of Septic Shock **928**

Ko Takakura, Wen Xiaohong, Kenji Takeuchi, Yoshikazu Yasuda, and Satoru Fukuda

Peroxynitrite decreased the vasocontractile activity of norepinephrine on rat aorta. This deactivation may account for the hyporeactivities of vasocontraction to norepinephrine in septic shock.

CONTENTS



Mitochondrial Adenosine Triphosphate-regulated Potassium Channel Opening Acts as a Trigger for Isoflurane-induced Preconditioning by Generating Reactive Oxygen Species

935

Katsuya Tanaka, Dorothee Wehrauch, Lynda M. Ludwig, Judy R. Kersten, Paul S. Pagel, and David C. Wartier

The selective mitochondrial adenosine triphosphate-regulated potassium (K_{ATP}) channel blocker 5-hydroxydecanoate abolishes isoflurane-induced reductions in myocardial infarct size and generation of reactive oxygen species when administered before but not after exposure to the volatile anesthetic in rabbits. These data suggest that mitochondrial K_{ATP} channel opening acts as a trigger for isoflurane-induced preconditioning by generating reactive oxygen species.

In Vitro and *In Vivo* Effects of the Phosphodiesterase-III Inhibitor Enoximone on Malignant Hyperthermia-susceptible Swine

944

Marko Fiege, Frank Wappler, Ralf Weisshorn, Mark U. Gerbershagen, Kerstin Kolodzie, and Jochen Schulte am Esch

The phosphodiesterase III inhibitor enoximone induces marked contractures in the muscles of malignant hyperthermia-susceptible swine *in vitro*, but enoximone does not trigger malignant hypothermia in genetically determined swine *in vivo*.

■ PAIN AND REGIONAL ANESTHESIA

Parecoxib Sodium, a Parenteral Cyclooxygenase 2 Selective Inhibitor, Improves Morphine Analgesia and Is Opioid-sparing following Total Hip Arthroplasty

950

T. Philip Malan, Jr., Gregory Marsh, Sam I. Hakki, Evie Grossman, Louise Traylor, and Richard C. Hubbard

Patients who received the parenteral cyclooxygenase 2 selective inhibitor parecoxib sodium, 40 mg intravenously, in addition to postoperative morphine, required 40.5% less morphine over the initial 36 postoperative hours than patients who received morphine plus placebo. Parecoxib sodium-treated patients also experienced significantly improved pain relief and reported a significantly better Global Evaluation rating of their study medication compared with placebo patients.

Continued on page 19A

CONTENTS



- ◇ **Local Anesthetic Requirements Are Greater in Dystocia Than in Normal Labor** **957**

Moeen K. Panni and Scott Segal

Dystocia is a common contemporary indication for cesarean delivery in the United States. Using an up-down sequential allocation technique, the authors found a higher minimum local analgesic concentration and hence local anesthetic requirement in early labor in parturients who later require a cesarean section delivery for dystocia than in those who deliver vaginally.

- ⊗ **Sub-Tenon Anesthesia: A Prospective Study of 6,000 Blocks** **964**

Philip A. Guise

In a prospective study of 6,000 cases, sub-Tenon block for eye surgery has been shown to be highly effective, with no sight-threatening complications occurring in this series.

- Nerve Stimulators Used for Peripheral Nerve Blocks Vary in Their Electrical Characteristics** **969**

Admir Hadzic, Jerry Vloka, Nihad Hadzic, Daniel M. Thys, and Alan C. Santos

Peripheral nerve stimulators commonly used for regional anesthesia vary in their accuracy and characteristics of current output.

■ **REVIEW ARTICLE**

- Mechanical Function of the Left Atrium: New Insights Based on Analysis of Pressure-Volume Relations and Doppler Echocardiography** **975**

Paul S. Pagel, Franz Kehl, Meir Gare, Douglas A. Hettrick, Judy R. Kersten, and David C. Wartier

Analyses of left atrial pressure-volume relations and Doppler echocardiography have substantially advanced the understanding of left atrial function in the normal and diseased heart. This article reviews how the active and passive mechanical actions of the left atrium play critical roles in determining overall cardiovascular performance.

■ **SPECIAL ARTICLE**

- ⊗ **Norman's War: Norman B. Kornfield, M.D., World War II Physician-Anesthetist** **995**

David B. Waisel

Norman Kornfield was a World War II combat physician-anesthetist who recorded his experiences in a photograph album and case ledger. Kornfield's documents contribute to the understanding of the effect of World War II on the development of the medical practice of anesthesiology.

CONTENTS



■ CASE REPORTS

- Subdural Spread of Local Anesthetic Agent following
Thoracic Paravertebral Block and Cannulation **1005**

Ignacio Garutti, Monica Hervias, Jose Maria Barrio, Fernando Fortea, and Jesus de la Torre

- Somatostatin Does Not Prevent Serotonin Release and
Flushing during Chemoembolization of Carcinoid Liver
Metastases **1007**

Christian Zimmer, Peter Kienbaum, Richard Wiesemes, and Jürgen Peters

- Skin Burn Caused by Operating Light during a Long
Operation after Photodynamic Therapy **1011**

Taiga Itagaki, Matsuyuki Doi, Shigehito Sato, and Shigeru Kato

- Inadvertent Spinal Anesthesia during Continuous Epidural
Anesthesia in an Infant **1014**

Andreas H. Taenzer

■ LABORATORY REPORT

- Lack of Lung Tissue and Systemic Accumulation after
Consecutive Daily Aerosols of Amikacin in Ventilated
Piglets with Healthy Lungs **1016**

Fabio Ferrari, Ivan Goldstein, Ania Nieszkowszka, Marilia Elman, Charles-Hugo Marquette, Jean-Jacques Rouby, and the Experimental ICU Study Group

■ CORRESPONDENCE

- Thiopental and Nuclear Factor κ B: Some Questions **1020**

Helene A. Haeberle and Ralph T. Kiefer

- In Reply *Torsten Loop and Benedikt H. J. Pannen* **1020**

- Is the Combitube Traumatic? **1021**

Ricardo M. Urtubia and Rodrigo R. Gazmuri

- Is It Unethical to Use the Combitube in Elective Surgery
Patients? **1022**

Peter Krafft, Thomas Hartmann, Felice Agro, Luis A. Gaitini, and Sonia J. Vaida

- In Reply *Joseph R. Brimacombe and Christian Keller* **1022**

Continued on page 21A

CONTENTS



Myocardial Protection with Esmolol during Coronary Artery Bypass Grafting Surgery	1024
<i>Hans J. Geissler, Uwe Mehlhorn, Glen A. Laine, and Steven J. Allen</i>	
In Reply <i>John V. Booth and Debra A. Schwinn</i>	1025
Use of Recombinant Activated Factor VII in Patients with Severe Coagulopathy and Bleeding	1025
<i>Anthony M.-H. Ho, Peter W. Dion, and Manoj K. Karmakar</i>	
In Reply <i>Richard B. Weiskopf</i>	1026
In Reply <i>Robert Slappendel, Frank C. Huvers, Bart Benraad, Irena Novakova, and Gijs G. van Hellemond</i>	1027
In Reply <i>Erik Svartholm, Veronica Annerhagen, and Toste Lanne</i>	1027
Propofol Preservation of Myocardial Function in Patients Undergoing Coronary Surgery Using Cardiopulmonary Bypass is Dose Dependent	1028
<i>David M. Ansley and Zhengyuan Xia</i>	
In Reply <i>Stefan G. De Hert, Pieter W. ten Broecke, and Inez E. Rodrigus</i>	1028
Effect of Nitrous Oxide on Sevoflurane Vaporizer Setting	1029
<i>Chung-Yuan Lin</i>	
In Reply <i>Andre M. De Wolf and Jan F. A. Hendrickx</i>	1029
Isoflurane Causes Vasodilation in the Coronary Circulation	1030
<i>George J. Crystal and M. Ramez Salem</i>	
Unusual Cause of Intraoperative Urinary Retention	1030
<i>Bradley D. Bergman and Juraj Sprung</i>	
The Use of Three-dimensional Computed Tomography to Visualize Thoracic Epidural Catheters	1031
<i>Shih-Tai Hsin, Kee-Min Yeow, Chih-Hsiang Tsou, Hung-Pin Liu, Hsiang-Ning Luk, and Hong-Zhi Ren</i>	

Continued on page 25A

CONTENTS



Unilateral Presentation of a Large Epidural Hematoma 1032

*Michael Zink, Manfred Rath, Andreas Waltensdorfer, Jörg Engler,
Gudrun Rumpold-Seitlinger, Wolfgang Toller, and Frank Reinhardt*

■ REPORT OF SCIENTIFIC MEETING 1034

■ REVIEWS OF EDUCATIONAL MATERIAL 1035

INSTRUCTIONS FOR AUTHORS

The Instructions for Authors are published in the January and July issues and are available at www.anesthesiology.org. Please refer to the Instructions for the preparation of any material for submission to ANESTHESIOLOGY.

WEB SITE ANNOUNCEMENT

Full-text articles are now available on-line at www.anesthesiology.org

ANESAV is a code word ("coden") used by the Chemical Abstract Service to identify the journal.

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>). Manuscripts may also be submitted via computer disk and mailed to the Editorial Office or via e-mail (anesthesiology@uiowa.edu). 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>). A print version of the Instruction for Authors appears in the January and July issues. Books and educational materials should be mailed to David O. Warner, M.D., Department of Anesthesia, Mayo Clinic, 200 First Street SW, Rochester, MN 55905. Requests for permission to duplicate materials published in ANESTHESIOLOGY should be submitted in electronic format, to the Editorial Office (anesthesiology@uiowa.edu). All articles accepted for publication are done so with the understanding that they are contributed exclusively to this Journal and become the property of the American Society of Anesthesiologists, Inc. Statements or opinions expressed in the Journal reflect the views of the author(s) and do not represent official policy of the American Society of Anesthesiologists unless so stated. Advertising and related correspondence should be addressed to Advertising Manager, ANESTHESIOLOGY, Lippincott Williams & Wilkins, 530 Walnut Street, Philadelphia, Pennsylvania 19106 (Web site: <http://www.lww.com/advertisingratecards/>). 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.

Continued on page 25A