



ON THE COVER:

Thoracic epidural analgesia provides some benefits in the acute postoperative period, but whether these outweigh the risks of epidural hematoma are uncertain:

- Royse: Epidurals for Cardiac Surgery: Can We Substantially Reduce Surgical Morbidity or Should We Focus on Quality of Recovery?, pp. 232
- Svircevic *et al.*: Thoracic Epidural Anesthesia for Cardiac Surgery: A Randomized Trial, pp. 262
- Svircevic *et al.*: Meta-analysis of Thoracic Epidural Anesthesia versus General Anesthesia for Cardiac Surgery, pp. 271
- Caputo *et al.*: Thoracic Epidural Anesthesia Improves Early Outcomes in Patients Undergoing Off-pump Coronary Artery Bypass Surgery: A Prospective, Randomized, Controlled Trial, pp. 380

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■ SPECIAL ARTICLES



Practice Advisory for the Perioperative Management of Patients with Cardiac Implantable Electronic Devices: Pacemakers and Implantable Cardioverter-Defibrillators—An Updated Report by the American Society of Anesthesiologists Task Force on Perioperative Management of Patients with Cardiac Implantable Electronic Devices

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The American Society of Anesthesiologists Task Force on Perioperative Management of Patients with Cardiac Implantable Electronic Devices presents a Practice Advisory for the Perioperative Management of Patients with Cardiac Implantable Electronic Devices: Pacemakers and Implantable Cardioverter-Defibrillators. *SUPPLEMENTAL DIGITAL CONTENT IS AVAILABLE IN THE TEXT*

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■ PERIOPERATIVE MEDICINE

- ◆ **Thoracic Epidural Anesthesia for Cardiac Surgery: A Randomized Trial** 262
Vesna Svircevic, Arno P. Nierich, Karel G. M. Moons, Jan C. Diephuis, Jacob J. Ennema, George J. Brandon Bravo Bruinsma, Cor J. Kalkman, and Diederik van Dijk

A randomized controlled trial in 654 cardiac surgical patients failed to demonstrate a beneficial effect of thoracic epidural anesthesia on the rate of major complications.

- ◆ **Meta-analysis of Thoracic Epidural Anesthesia versus General Anesthesia for Cardiac Surgery** 271
Vesna Svircevic, Diederik van Dijk, Arno P. Nierich, Martijn P. Passier, Cor J. Kalkman, Geert J.M.G. van der Heijden, and Leon Bax

This meta-analysis showed that the use of thoracic epidural anesthesia in cardiac surgery patients reduces postoperative supraventricular arrhythmias and respiratory complications. These benefits have to be weighed against potential side effects of thoracic epidural anesthesia.

- ◆◆ **Association between Intraoperative Blood Transfusion and Mortality and Morbidity in Patients Undergoing Noncardiac Surgery** 283
Laurent G. Glance, Andrew W. Dick, Dana B. Mukamel, Fergal J. Fleming, Raymond A. Zollo, Richard Wissler, Rabih Salloum, U. Wayne Meredith, and Turner M. Osler

The impact of intraoperative erythrocyte transfusion on outcomes of anemic patients undergoing noncardiac surgery has not been well characterized. This study examined the association between blood transfusion and mortality and morbidity in patients with severe anemia (hematocrit less than 30%) who were administered one or two units of erythrocytes intraoperatively. A retrospective analysis of the association of blood transfusion and 30-day mortality and 30-day morbidity in 10,100 patients undergoing general, vascular, or orthopedic surgery was undertaken. Intraoperative blood transfusion was associated with an increased risk of death (odds ratio, 1.29; 95% confidence interval, 1.03 to 1.62) and complications compared with patients not receiving an intraoperative transfusion. It is not known whether this association is due to the adverse effects of blood transfusion or is the result of increased blood loss in patients receiving blood.

- ◆ **Lipid Emulsion Reverses Levobupivacaine-induced Responses in Isolated Rat Aortic Vessels** 293
Seong-Ho Ok, Ju-Tae Sohn, Ji-Seok Baik, Jae-Gak Kim, Sang-Seung Park, Hui-Jin Sung, Mi-Kyung Shin, Yong-Hyun Kwon, Chang-Shin Park, Il-Woo Shin, Heon-Keun Lee, and Young-Kyun Chung

Lipid emulsion reverses vasodilation caused by high-dose levobupivacaine mainly through the attenuation of levobupivacaine-mediated inhibition of L-type calcium channel–dependent contraction and, partly, by inhibiting levobupivacaine-induced nitric oxide release.

- ◆ **State-specific Effects of Sevoflurane Anesthesia on Sleep Homeostasis: Selective Recovery of Slow Wave but Not Rapid Eye Movement Sleep** 302
Dinesh Pal, William J. Lipinski, Amanda J. Walker, Ashley M. Turner, and George A. Mashour

This study demonstrates that, unlike propofol, sevoflurane affects slow wave sleep homeostasis without altering rapid eye movement sleep homeostasis, suggesting that sleep–anesthesia interfaces are agent and state specific.

- ◆ **Perioperative Nerve Injury after Total Knee Arthroplasty: Regional Anesthesia Risk during a 20-Year Cohort Study** 311
Adam K. Jacob, Carlos B. Mantilla, Hans P. Sviggum, Darrell R. Schroeder, Mark W. Pagnano, and James R. Hebl

The overall incidence of perioperative nerve injury after total knee arthroplasty is reported at 0.79% in this single-center cohort study. The use of neuraxial anesthesia or peripheral nerve blockade did not increase the risk for perioperative nerve injury.

Efficacy, Safety, and Pharmacokinetics of Sugammadex for the Reversal of Rocuronium-induced Neuromuscular Blockade in Elderly Patients 318

David L. McDonagh, Patrick E. Benedict, Anthony L. Kovac, David R. Drover, Neil W. Brister, Jovino B. Morte, and Terri G. Monk

Sugammadex facilitates rapid recovery from rocuronium-induced neuromuscular blockade and is well tolerated in all age groups, although a slower rate of recovery is seen in elderly patients compared with younger adults.

◆ **Combination of EuroSCORE and Cardiac Troponin I Improves the Prediction of Adverse Outcome after Cardiac Surgery** 330

Jean-Luc Fellahi, Yannick Le Manach, Georges Daccache, Bruno Riou, Jean-Louis Gérard, and Jean-Luc Hanouz

Simultaneous use of reclassification tables and receiver operating characteristic curves suggest that the combination of The European System for Cardiac Operative Risk Evaluation and postoperative cardiac troponin I provides an effective model that improves early identification of high-risk patients after cardiac surgery.

Neuroprotective Effect of Orexin-A Is Mediated by an Increase of Hypoxia-inducible Factor-1 Activity in Rat 340

Li-bang Yuan, Hai-long Dong, Hao-Peng Zhang, Rui-ni Zhao, Gu Gong, Xiao-mei Chen, Li-na Zhang, and Lize Xiong

Orexin A can induce neuroprotective effects on transient cerebral ischemia in rats. The neuroprotection of exogenous orexin A is mediated by hypoxia-inducible factor-1 α activation and von Hippel-Lindau inhibition.

■ **CRITICAL CARE MEDICINE**

◆ **Midazolam Suppresses Maturation of Murine Dendritic Cells and Priming of Lipopolysaccharide-induced T Helper 1-type Immune Response** 355

Noriyuki Ohta, Yoshifumi Ohashi, Chihiro Takayama, Takashi Mashimo, and Yuji Fujino

Midazolam suppresses the maturation of bone marrow-derived dendritic cells and inhibits the elicitation of lipopolysaccharide-induced T helper 1-type immune response. This process suggests that peripheral benzodiazepine receptors mediate the suppressive effects of midazolam on dendritic cells.

◆ **Isoflurane Activates Intestinal Sphingosine Kinase to Protect against Renal Ischemia-Reperfusion-induced Liver and Intestine Injury** 363

Minjae Kim, Sang Won Park, Mihwa Kim, Vivette D. D'Agati, and H. Thomas Lee

Isoflurane protects against acute renal, hepatic, and intestinal dysfunction after renal ischemia-reperfusion injury *via* activation of sphingosine kinase 1/sphingosine-1-phosphate signaling in the small intestine.

Salvinorin A Produces Cerebrovasodilation through Activation of Nitric Oxide Synthase, κ Receptor, and Adenosine Triphosphate-sensitive Potassium Channel 374

Diansan Su, John Riley, Willis J. Kiessling, William M. Armstead, and Renyu Liu

Salvinorin A produces cerebrovasodilation in normal vessels as well as those constricted *via* induced hypocarbia and endothelin. The mechanism of action involves activation of nitric oxide synthase, adenosine triphosphate-sensitive potassium channels, and the κ opioid receptor.

PAIN MEDICINE

- ◆ Thoracic Epidural Anesthesia Improves Early Outcomes in Patients Undergoing Off-pump Coronary Artery Bypass Surgery: A Prospective, Randomized, Controlled Trial 380
Massimo Caputo, Hazaim Alwair, Chris A. Rogers, Katie Pike, Alan Cohen, Christopher Monk, Sally Tomkins, Ian Ryder, Cesare Moscariello, Vincenzo Lucchetti, and Gianni D. Angelini

This randomized trial of 226 patients undergoing off-pump coronary artery bypass surgery demonstrated that adding thoracic epidural anesthesia to general anesthesia reduced the incidence of arrhythmias and improved pain control, allowing earlier extubation and discharge. *SUPPLEMENTAL DIGITAL CONTENT IS AVAILABLE IN THE TEXT*

- 🌐 Celecoxib Impairs Heart Development *via* Inhibiting Cyclooxygenase-2 Activity in Zebrafish Embryos 391
Dao-jie Xu, Ji-wen Bu, Shan-ye Gu, Yi-meng Xia, Jiu-lin Du, and Ying-wei Wang

Celecoxib caused defects in the heart looping and valve development of zebrafish larvae. Heart defects were prevented by prostaglandin E₂ and mimicked by the cyclooxygenase-2 inhibitor NS398, suggesting that such defects are the result of cyclooxygenase-2 inhibition. *SUPPLEMENTAL DIGITAL CONTENT IS AVAILABLE IN THE TEXT*

- S(+)-Ketamine Suppresses Desensitization of γ -Aminobutyric Acid Type B Receptor-mediated Signaling by Inhibition of the Interaction of γ -Aminobutyric Acid Type B Receptors with G Protein-coupled Receptor Kinase 4 or 5 401
Yuko Ando, Minoru Hojo, Masato Kanaide, Masafumi Takada, Yuka Sudo, Seiji Shiraishi, Koji Sumikawa, and Yasuhito Uezono

S(+)-Ketamine suppresses the desensitization of γ -aminobutyric acid type B receptor-mediated signaling by inhibition of the protein complex formation of γ -aminobutyric acid type B receptor subunit 2 with G protein-coupled receptor kinase 4 or 5.

- Effect of Inhibition of Spinal Cord Glutamate Transporters on Inflammatory Pain Induced by Formalin and Complete Freund's Adjuvant 412
Myron Yaster, Xiaowei Guan, Ronald S. Petralia, Jeffery D. Rothstein, Wei Lu, and Yuan-Xiang Tao

Spinal cord glutamate transporters clear synaptically released glutamate to maintain normal sensory transmission. This study shows that spinal cord glutamate transporter inhibition relieves inflammatory pain by activating inhibitory presynaptic group III metabotropic glutamate receptors.

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Bryan S. Williams, David Wong, and Sandeep Amin

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- Possible Intravascular Caudal Injection 431
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- Glycemic Control in the Intensive Care Unit and during the Postoperative Period 438
Diane Lena, Pierre Kalfon, Jean-Charles Preiser, and Carole Ichai

Maintaining blood glucose levels less than 8.25 mM during surgery and in intensive care units improves the outcome of patients. However, tight glycemic control cannot be implemented regardless of the risk of hypoglycemia and the patient's condition.

REVIEW ARTICLE

Preoperative Pain Sensitivity and Its Correlation with Postoperative Pain and Analgesic Consumption: A Qualitative Systematic Review 445

Amir Abrishami, Joshua Chan, Frances Chung, and Jean Wong

This study is a systematic review of literature evaluating preoperative assessment of pain sensitivity and its correlation with postoperative pain intensity or analgesic consumption.

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Acute Postoperative Negative-pressure Pulmonary Edema

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