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Volume 132

Issue 3

March 2020

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## 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



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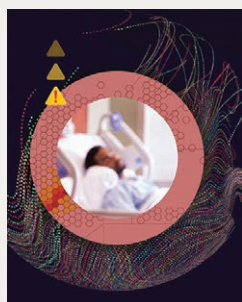
This article has a Video Abstract

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. Nabulindo, Z. W. W. Ngumi, W. S. Sandberg,  
B. Sileshi .....452

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 Investigators .....461

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. *SUPPLEMENTAL DIGITAL CONTENT IS AVAILABLE IN THE TEXT*

# 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,  
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In patients undergoing robot-assisted laparoscopic prostatectomy, 15 but not 5 cm H<sub>2</sub>O 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,  
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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. Li .....504

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. *SUPPLEMENTAL DIGITAL CONTENT IS AVAILABLE IN THE TEXT*

# 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 Collaborative .....525

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. Devor .....535



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  $\gamma$ -aminobutyric acid-mediated anesthetics. *SUPPLEMENTAL DIGITAL CONTENT IS AVAILABLE IN THE TEXT*

## 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  $F_2$ -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. *SUPPLEMENTAL DIGITAL CONTENT IS AVAILABLE IN THE TEXT*

- 

**Anticoagulation Management and Antithrombin Supplementation Practice during Veno-venous Extracorporeal Membrane Oxygenation: A Worldwide Survey**  
A. Protti, G. E. Iapichino, M. Di Nardo, M. Panigada, L. Gattinoni .....562

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. *SUPPLEMENTAL DIGITAL CONTENT IS AVAILABLE IN THE TEXT*

## Pain Medicine

### CLINICAL SCIENCE


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**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.


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**Controversies in Perioperative Antimicrobial Prophylaxis**  
 B. K. Decker, A. Nagrebetsky, P. A. Lipsett, J. P. Wiener-Kronish,  
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This is a review of perioperative antimicrobial prophylaxis focusing on areas where clinical practice varies from guideline recommendations.

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