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Perioperative Mortality in Patients with Pulmonary Hypertension Undergoing Major Joint Replacement
Stavros G. Memtsoudis, MD, PhD*, Yan Ma, PhD†, Ya Lin Chiu, MS†, J. Matthias Walz, MD‡, Robert Voswinckel, MD§ and Madhu Mazumdar, PhD†
Authors' affiliations are listed at the end of the article
Address correspondence and reprint requests to Stavros G. Memtsoudis, MD, PhD, Department of Anesthesiology, Hospital for Special Surgery, 535 East 70th St., New York, NY 10021. Address e-mail to memtsoudiss@hss.edu.
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背景：目前缺乏慢性肺动脉高压患者(PHTN)接受非心臟手術的圍手術期的數據。因此，臨床醫生沒有資料來評估這類患者的併發症發病率和死亡率的風險。在這項研究中，作者評估了慢性肺動脈高壓患者，首次接受全髖關節置換術（THA）或全膝關節置換術（TKA）的圍手術期併發症的發生率及死亡率。

方法：根據美國最大的住院患者資料庫，作者收集了1998年和2006年之間行THA及TKA的患者資訊。將明確了PHTN的患者與健康人群資料中的非PHTN對照組配對。主要的結果是圍手術期死亡率。應用多因素logistic回歸模型評估PHTN對住院死亡率的影響。

結果：共收集670,516例TKA及360,119例THA。這些患者中，確診為PHTN的分別有2184例（0.3%）及1359例（0.4%）（THA中PHTN年平均確診率為1180[507-2073]和THA中PHTN年平均確診率為739[467-1054]）。經校正後，相對於配對的對照組，接受THA手術的PHTN患者增加大約4倍死亡風險（2.4%vs6.0%），接受TKA手術的PHTN患者則增加大約4.5倍死亡風險（0.9%vs0.2%），每次比較P<0.001。原發性慢性肺動脈高壓患者接受THA的手術的死亡率最高（5%[95%CI:2.3%-7.7%]）。

結論：這一分析表明，PHTN患者在接受THA和TKA手術後圍手術期死亡率風險增加。
BACKGROUND: There is a paucity of perioperative outcomes data for patients with chronic pulmonary hypertension (PHTN) undergoing noncardiac surgery. Clinicians, therefore, have little information on which to evaluate the risk for morbidity and mortality in this patient population. In this study, we evaluated the incidence and risks of perioperative morbidity and mortality in patients with PHTN undergoing primary total hip arthroplasty (THA) and total knee arthroplasty (TKA).

METHODS: Using the largest inpatient database in the United States (National Inpatient Sample), we identified entries for THA and TKA between the years of 1998 and 2006. Patients with the diagnosis of PHTN were identified and matched to those without the disease based on health-related demographic variables. Perioperative mortality was considered the primary outcome. Multivariate logistic regression models were fitted to assess the impact of PHTN on in-hospital mortality.

RESULTS: We identified 670,516 entries for TKA and 360,119 for THA. Of those patients, 2184 (0.3%) and 1359 (0.4%), respectively, had the diagnosis of PHTN (average annual rate of 1180 for TKA [range, 507–2073] and 739 for THA [range, 467–1054]). Patients with PHTN undergoing THA experienced an approximately 4-fold increased adjusted risk of mortality (2.4% vs 0.6%), and those undergoing TKA a 4.5-fold increased adjusted risk of mortality (0.9% vs 0.2%) compared with patients without PHTN in the matched sample (\(P < 0.001\) for each comparison). Patients with primary PHTN undergoing THA experienced the highest mortality rate (5% [95% CI, 2.3%–7.7%]).

CONCLUSIONS: This analysis demonstrates that patients with PHTN are at increased risk for perioperative mortality after THA and TKA.

滴注法或噴霧法腹膜內給予羅呱卡因的藥代動力學

The Pharmacokinetics of Ropivacaine After Intraperitoneal Administration: Instillation Versus Nebulization

Delphine Betton, PharmD*, Nicolas Greib, MD†‡, Herve Schlotterbeck, MD, PhD†, Girish P. Joshi, MBBS, MD, FFARCSI§, Genevieve Ubeaud-Sequier, PharmD, PhD*‖ and Pierre Diemunsch, MD, PhD†

From the Departments of *Pharmacy and †Anesthesiology, Hautepierre University Hospital, Strasbourg; ‡Clinique des Diaconesses, Strasbourg, France; §Department of Anesthesiology and Pain Management, University of Texas Southwestern Medical Center, Dallas, Texas; and †UMR CNRS 7200, Laboratoire d'Innovation Thérapeutique, Département de Pharmacocinétique, University of Strasbourg, Illkirch, France.

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背景：腹腔鏡手術中，在腹膜內給予局麻藥可以起到圍手術期鎮痛的效果。本研究比較了兩種不同的腹膜內羅呱卡因給藥途徑，即滴注法和噴霧法的藥代動力學。方法：本研究用5只豬進行病例交叉試驗，這5只豬都給予標準的麻酔方法，其CO₂氣腹壓為12mmHg，各維持1小時。每只豬都以其本身為對照組，間隔8天分別進行兩次試驗，試驗順序隨機。即按3mg/kg羅呱卡因的劑量在氣腹排氣的時間以滴注法給藥或在氣膚時連續噴霧給藥。每隔10min採取動脈血樣直到給藥後120min，然後每隔1h直到6h。用高效液相色譜儀和紫外可見光檢測儀測量羅呱卡因濃度。
BACKGROUND: Intraperitoneal local anesthetic administration provides perioperative analgesia during laparoscopic procedures. We compared the pharmacokinetics of intraperitoneal ropivacaine administered by instillation or nebulization.

METHODS: A crossover study was performed on 5 pigs under standardized general anesthesia with a carbon dioxide pneumoperitoneum of 12 mm Hg for 1 hour. Each animal, acting as its own control, was studied twice with an 8-day interval and received, in a randomized sequence, 3 mg/kg ropivacaine either by intraperitoneal instillation at the time of pneumoperitoneum exsufflation or by continuous nebulization in the carbon dioxide insufflation tubing. Arterial blood samples were taken every 10 minutes up to 120 minutes, and then hourly up to 6 hours. Ropivacaine concentrations were measured using high-performance liquid chromatography with ultraviolet-visible detection. The plasma-free fraction was evaluated after plasma ultracentrifugation. Pharmacokinetic parameters were calculated using both noncompartmental and compartmental analysis. The mean values were compared using the Student t test, or Wilcoxon test for paired series.

RESULTS: The data were described by a 1-compartment model for both ropivacaine administration techniques, with a delay of 10 minutes for the nebulization group. The maximal ropivacaine concentrations were 0.96 μg/mL for the nebulization group and 0.92 μg/mL for the instillation group (P = 0.66). The ropivacaine absorption constant was lower in the nebulization group (0.043 vs 0.083 min⁻¹, P = 0.02). There were no differences in the elimination half-life, elimination constant, mean total body clearance, distribution volume, mean area under the curve, and mean residence time. The free fraction of ropivacaine was also similar in the 2 groups.

CONCLUSIONS: The pharmacokinetic profile of ropivacaine nebulization is similar to direct intraperitoneal instillation, but with a lower absorption rate.
BACKGROUND: High-frequency jet ventilation is an optimal mode of ventilation for many surgical procedures of the trachea and larynx but has limited monitoring modalities to assess adequacy of oxygenation and/or ventilation. Respiratory inductance plethysmography is a noninvasive monitor of chest and abdominal wall movement with well-established applications in the sleep laboratory. We performed an observational pilot study of respiratory inductance plethysmography as a detector of jet ventilation.

METHODS: Twenty-five patients underwent microdirect suspension laryngoscopy with high-frequency jet ventilation under general anesthesia with total IV anesthesia. Inductotrace® bands (Ambulatory Monitoring Inc., Ardsley, NY) were applied to the chest and abdomen in all patients and data collected from oxygen administration through emergence at 50-Hz sampling frequency in the DC mode using a 12-bit A-D converter and custom programmed LabVIEW interface. The raw data were filtered and a detector was developed based on a type I, IIR peak comb filter to differentiate apnea, cardiogenic oscillations, and jet ventilation–associated respiratory excursion. The primary end point was the ability of the detector to identify the presence of jet ventilation. Receiver operating characteristic curves were generated for the aggregate data of all patients.

RESULTS: Respiratory inductance plethysmography reliably detected jet ventilation. The data analysis program effectively extracted a relatively small amplitude jet ventilation signal from a baseline signal contaminated by cardiogenic noise. Sensitivity was in the range of 85%, with a filter bandwidth of 0.055 Hz. Increased sensitivity with increasing filter bandwidth was offset by a detection delay of 12.5 seconds.

CONCLUSIONS: Respiratory inductance plethysmography was successfully used to detect high-frequency jet ventilation in patients undergoing laryngotracheal surgery. This
pilot study demonstrates the feasibility of respiratory inductance plethysmography as a monitor for use during jet ventilation.

**Implantation of 3951 Long-Term Central Venous Catheters: Performances, Risk Analysis, and Patient Comfort After Ultrasound-Guidance Introduction**

Adriano Peris, MD*, Giovanni Zagli, MD*, Manuela Bonizzoli, MD*, Giovanni Cianchi, MD*, Marco Ciapetti, MD*, Rosario Spina, MD*, Valentina Anichini, MD*, Francesco Lapi, PharmD, PhD† and Stefano Batacchi, MD*

+ From the *Anesthesia and Intensive Care Unit of Emergency Department, Careggi Teaching Hospital, Florence, Italy, and the †Department of Preclinical and Clinical Pharmacology, University of Florence, and the Regional Agency for Health Care Services of Tuscany, Epidemiology Unit, Florence, Italy.

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**BACKGROUND:** Despite evidence demonstrating improved safety with ultrasound-guided placement of central venous catheters (CVC) in comparison with the use of anatomical landmarks, ultrasound guidance is still not routinely used by all physicians when obtaining central venous access.

**METHODS:** We report data pertaining to the placement of long-term CVCs in a 7-year period before and after ultrasound guidance was introduced. We included 3951 procedures (total of 1,642,402 catheter days) in our study: 1584 using the anatomical landmark method (landmark group, January 2000 to May 2003), and 2367 with ultrasound guidance (ultrasound group, June 2003 to May 2007). All procedures were performed by the same team of intensivists. Comparison criteria included procedural data, complications, patient's comfort, and perceptions. Variables were analyzed with Student's
t test and χ² test. Multivariate analysis was performed according to the Cox proportional hazards regression model.

RESULTS: Using ultrasound guidance, we noted a significant reduction in procedure time in both port (mean difference 4.9 ± 0.4 minutes, confidence interval [CI] 4.1 to 5.7) and tunneled catheter (mean difference 2.4 ± 0.8 minutes, CI 0.9 to 3.8) placement. The landmark method was associated with an increased risk of overall perioperative complications (4.5, CI 3.6 to 5.6). Among disease entities, acute leukemia patients had a significantly higher risk of CVC-related infections (2.6, CI 2.1 to 3.8). On the basis of questionnaires submitted to patients from both groups, ultrasound guidance was associated with improved patient comfort and satisfaction.

CONCLUSIONS: Ultrasound guidance reduces complications and improves patient comfort. Further studies are needed to define whether acute leukemia patients should be considered a separate category with regard to the higher incidence of infections.
BACKGROUND: The administration of prophylactic phenylephrine infusions in combination with fluid cohydration significantly reduces the incidence of hypotension in women having cesarean delivery under spinal anesthesia. The ideal dosing regimen for this purpose is not known. In this study, we investigated the dose of phenylephrine that, when administered as a prophylactic fixed rate infusion, is associated with the least interventions needed to maintain maternal systolic blood pressure (SBP) within 20% of baseline.

METHODS: Women undergoing elective cesarean delivery were randomly allocated to receive placebo or prophylactic phenylephrine infusion at 25, 50, 75, or 100 μg/min immediately after spinal anesthesia in combination with a 2-L fluid coload. Maternal SBP was maintained within the target range using a predetermined algorithm. The number of physician interventions, hemodynamic performance, intraoperative nausea and vomiting, and umbilical cord blood gases were compared among the groups.

RESULTS: One hundred one patients were included in the analysis. There were no differences between the placebo and phenylephrine groups in the number of interventions needed to maintain maternal SBP within the target range. Doses of phenylephrine of 25 and 50 μg/min were associated with significantly fewer interventions when compared with 100 μg/min (P = 0.004 vs 50 μg/min, P = 0.02 vs 25 μg/min). Predelivery hypotension was more frequent in the control group compared with all phenylephrine groups. Phenylephrine 75 and 100 μg/min groups were associated with a significantly higher incidence of predelivery hypertension compared with control (P < 0.001 vs 75 μg/min and 100 μg/min). There was a trend toward an increase in median magnitude of deviations of SBP above or below baseline (P = 0.006), and the bias of SBP to be above baseline (P < 0.001) with increasing rates of phenylephrine infusion. There were no differences in the incidence and severity of intraoperative nausea and vomiting and umbilical cord blood gases among the groups.

CONCLUSIONS: The use of prophylactic fixed rate phenylephrine infusions did not significantly reduce the number of physician interventions needed to maintain maternal predelivery SBP within 20% of baseline compared with placebo. However, prophylactic phenylephrine infusions reduced the incidence and severity of maternal predelivery hypotension. Phenylephrine 25 and 50 μg/min administered as a prophylactic fixed rate infusion provided greater maternal hemodynamic stability than phenylephrine 75 and 100 μg/min. Prophylactic fixed rate infusions may have limited application in clinical practice, and future studies assessing the accuracy of hemodynamic control with variable rate phenylephrine infusions are needed.

The Relationship Between Inflammatory Activation and Clinical Outcome After Infant Cardiopulmonary Bypass
BACKGROUND: Cardiopulmonary bypass (CPB) induces a systemic inflammatory response. The magnitude and consequences in infants remain unclear. We assessed the relationship between inflammatory state and clinical outcomes in infants undergoing CPB.

METHODS: Plasma concentrations of interleukin (IL)-6, IL-8, IL-10, tumor necrosis factor α, IL-1β, and C-reactive protein (CRP) were measured pre-CPB and immediately post-CPB, and at 6, 12, and 24 hours post-CPB in infants ≤9 months old. Perioperative clinical data were collected prospectively.

RESULTS: Diagnoses of 93 patients included transposition of the great arteries (40), tetralogy of Fallot (28), ventricular septal defect (21), truncus arteriosus (2), and complete atrioventricular canal (2). The median age was 37 days (range = 2 to 264). Pre-CPB IL-6 and CRP were higher in younger infants but were not associated with postoperative inflammatory mediator concentrations or measured clinical outcomes. IL-6 increased post-CPB (median 3.2 pg/mL pre-CPB, 24.2 post-CPB, 95.4 at 6 hours, and 90.3 at 24 hours; all P < 0.001). CRP increased post-CPB, peaking at 24 hours (median 27.5 at 24 hours, 0.3 pre-CPB; P < 0.001). IL-10 and IL-8 increased immediately post-CPB. After adjusting for age and diagnosis, postoperative IL-6 and IL-8 correlated with
CONCLUSIONS: Greater preoperative cytokine and CRP production in younger infants did not correlate with postoperative outcomes; correlation between postoperative inflammatory mediator production and clinical course was statistically significant but clinically modest. We conclude that in infants undergoing low-to-moderate-complexity cardiac surgery in a single high-volume center, the contribution of inflammatory mediator production to postoperative morbidity is relatively limited.

Review Article: Genetics for the Pediatric Anesthesiologist: A Primer on Congenital Malformations, Pharmacogenetics, and Proteomics
Jeffrey L. Galinkin, MD, FAAP*, Laurie Demmer, MD† and Myron Yaster, MD‡
From the *Department of Anesthesiology and Pediatrics, The Children's Hospital, University of Colorado Denver, Aurora, Colorado; †Tufts Medical Center and the Floating Hospital for Children, Tufts University School of Medicine, Boston, Massachusetts; and ‡Departments of Anesthesiology, Critical Care Medicine, and Pediatrics, The Johns Hopkins University, Baltimore, Maryland.
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Molecular genetics is the study, at the molecular level, of how genetic information is stored, inherited, and expressed and of how it influences the structure and function of cells in health and in disease. Although molecular approaches have been used for decades in the laboratory and are at the core of modern medical education, they are only now beginning to influence clinical practice. A variety of sophisticated techniques permit rapid and affordable DNA sequencing, gene expression profiling, gene cloning, gene manipulation, gene transfer, recombinant protein production, and other technologies of enormous biomedical importance. Success in genomics has spawned additional ambitious endeavors, including proteomics, pharmacogenomics, and bioinformatics. These techniques are providing new diagnostic, prognostic, and therapeutic opportunities in all areas of medicine, including anesthesiology. With the use of molecular criteria and the diminishing cost of analytic technologies, anesthetic practice will become more individualized, and greater emphasis will be placed on the patient's genetic makeup. Both
surgical and nonsurgical decisions will increasingly accommodate molecular data crucial to perioperative anesthetic management. In this article we have summarized three lectures on congenital malformations, pharmacogenetics, and proteomics presented at the 22nd Annual Meeting of the Society for Pediatric Anesthesia.

The Analgesic and Antihyperalgesic Effects of Transcranial Electrostimulation with Combined Direct and Alternating Current in Healthy Volunteers

V. Nekhendzy, MD*, H. J. Lemmens*, M. Tingle*, M. Nekhendzy* and M. S. Angst*

From the *Department of Anesthesiology, Stanford University, Stanford University, Stanford, California.

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BACKGROUND: Transcranial electrostimulation (TES) has been reported to produce clinically significant analgesia, but randomized and double-blind studies are lacking. We investigated the analgesic and antihyperalgesic effects of TES in validated human experimental pain models.

METHODS: In 20 healthy male subjects we evaluated the analgesic and antihyperalgesic effects of TES_{60Hz} and TES_{100Hz} to heat and mechanical pain in experimentally induced ultraviolet B skin sunburns and in normal skin. Previous animal studies in our laboratory predicted that TES_{60Hz} would provide significant analgesia, and TES_{100Hz} was a suitable active control. The study was conducted in a double-blind, randomized, 2-way cross-over fashion. TES was administered for 35 minutes. Quantitative sensory testing evaluating heat and mechanical pain thresholds was conducted before TES, during TES, and 45 minutes after TES.

RESULTS: TES (TES_{60Hz} > TES_{100Hz}) evoked rapidly developing, significant thermal and mechanical antihyperalgesic effects in the ultraviolet B lesion, and attenuated thermal pain in unimpaired skin. No long-lasting analgesic and antihyperalgesic effects of a single TES treatment were demonstrated in this study.
CONCLUSIONS: TES produces significant, frequency-dependent antihyperalgesic and analgesic effects in humans. The characteristics of the TES effects indicate a high likelihood of its ability to modulate both peripheral sensitization of nociceptors and central hyperexcitability.

簡要報告：椎管內阻滯後硬膜外血腫：來自中國的回顧性報告

Brief Reports: Epidural Hematoma After Neuraxial Blockade: A Retrospective Report from China

Shuang-Ling Li, MD, PhD*, Dong-Xin Wang, MD, PhD* and Daqing Ma, MD, PhD†
From the *Department of Anesthesiology and Surgical Intensive Care, Peking University First Hospital, Beijing, China; and the †Department of Anaesthetics, Pain Medicine and Intensive Care, Imperial College London, London, United Kingdom.

Abstract
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We conducted a detailed 54-year retrospective review of patients who developed epidural hematoma after neuraxial blockade in a university hospital and throughout Mainland China. Incidence, risk factors, and outcomes in the Chinese population were identified. The incidence of epidural hematoma after neuraxial blockade was 2.14 of 100,000 (95% confidence interval: 0.44–6.25 of 100,000). Patients who had a bacterial infection and required emergency surgery were at increased risk of developing epidural hematoma. There is a significant correlation between good neurologic recovery and short interval to decompressive surgery.

Heart-Type Fatty Acid Binding Protein Is an Independent Predictor of Death and Ventricular Dysfunction After Coronary Artery Bypass Graft Surgery

Jochen D. Muehlschlegel, MD*, Tjörvi E. Perry, MD*, Kuang-Yu Liu, PhD*, Amanda A. Fox, MD*, Charles D. Collard, MD†, Stanton K. Sherman, MD* and Simon C. Body, MD*
From the *Department of Anesthesiology, Perioperative and Pain Medicine, Brigham and Women's Hospital, Boston, Massachusetts; and †Division of Cardiovascular Anesthesia, Baylor College of Medicine, Texas Heart Institute, Saint Luke's Episcopal Hospital, Houston, Texas.
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背景：心型脂肪酸結合蛋白（hFABP）是冠脈搭橋手術後發生死亡和心室功能障礙的獨立預示因數。
METHODS: A prospective cohort study of 1298 patients undergoing primary CABG with cardiopulmonary bypass (CPB) was performed at 2 institutions. Four plasma myocardial injury biomarkers (hFABP; cardiac troponin I [cTnI]; creatine kinase, MB [CK-MB] fraction; and myoglobin) were measured at 7 perioperative time points. The association among perioperative cardiac biomarkers and ventricular dysfunction, hospital length of stay (HLOS), and up to 5-year postoperative mortality (median 3.3 years) was assessed using Cox proportional hazard models. We defined in-hospital ventricular dysfunction as a new requirement for 2 or more inotropes, or new placement of an intraaortic balloon pump, or ventricular assist device either during the intraoperative period after the patient separated from CPB or postoperatively in the intensive care unit.

RESULTS: The positive and negative predictive values of mortality for hFABP are 13% (95% confidence interval [CI], 9%–19%) and 95% (95% CI, 94%–96%), respectively, which is higher than for cTnI and CK-MB. After adjusting for clinical predictors, both postoperative day (POD) 1 and peak hFABP levels were independent predictors of ventricular dysfunction (P < 0.0001), HLOS (P < 0.05), and 5-year mortality (P < 0.0001) after CABG surgery. Furthermore, POD1 and peak hFABP levels were significantly superior to other evaluated biomarkers for predicting mortality. In a repeated-measures analysis, hFABP outperformed all other models of fit for HLOS. Patients with POD2 hFABP levels higher than post-CPB hFABP levels had an increased mortality compared
with those patients whose POD2 hFABP levels decreased from their post-CPB level (hazard ratio, 10.9; 95% CI, 5.0–23.7; P = 7.2 × 10^{-10}). Mortality in the 120 patients (10%) with a later hFABP peak was 18.3%, compared with 4.7% in those who did not peak later. Alternatively, for cTnI or CK-MB, no difference in mortality was detected.

CONCLUSION: Compared with traditional markers of myocardial injury after CABG surgery, hFABP peaks earlier and is a superior independent predictor of postoperative mortality and ventricular dysfunction.

**Correlations Between Controlled Endotracheal Tube Cuff Pressure and Postprocedural Complications: A Multicenter Study**

Jianhui Liu, MD*, Xiaoqing Zhang, MD*, Wei Gong, MD†, Shitong Li, PhD†, Fen Wang, MD‡, Shukun Fu, MD‡, Mazhong Zhang, PhD§ and Yannan Hang, MD§

From the *Department of Anesthesiology, Tongji Hospital, Tongji University School of Medicine; †Department of Anesthesiology, First People's Hospital, Jiaotong University School of Medicine; ‡Department of Anesthesiology, Shanghai 10th People's Hospital, Tongji University School of Medicine; and §Department of Anesthesiology, Renji Hospital, Jiaotong University School of Medicine, Shanghai China.

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**BACKGROUND:** Postoperative respiratory complications related to endotracheal intubation usually present as cough, sore throat, hoarseness, and blood-streaked expectorant. In this study, we investigated the short-term (hours) impact of measuring and controlling endotracheal tube cuff (ETTc) pressure on postprocedural complications.

**METHODS:** Five hundred nine patients from 4 tertiary care university hospitals in Shanghai, China scheduled for elective surgery under general anesthesia were assigned to a control group without measuring ETTc pressure, and a study group with ETTc pressure measured and adjusted. The duration of the procedure and duration of endotracheal intubation were recorded. Twenty patients whose duration of endotracheal intubation was between 120 and 180 minutes were selected from each group and examined by fiberoptic bronchoscopy immediately after removing the endotracheal tube. Endotracheal intubation–related complications including cough, sore throat, hoarseness, and blood-streaked expectorant were recorded at 24 hours postextubation.

**RESULTS:** There was no significant difference in sex, age, height, weight, procedure duration, and duration of endotracheal intubation between the 2 groups. The mean ETTc pressure measured after estimation by palpation of the pilot balloon of the study group was 43 ± 23.3 mm Hg before adjustment (the highest was 210 mm Hg), and 20 ± 3.1 mm Hg after adjustment (P < 0.001). The incidence of postprocedural sore throat, hoarseness, and blood-streaked expectoration in the control group was significantly higher than in the study group. As the duration of endotracheal intubation increased, the incidence of sore throat and blood-streaked expectoration in the control group increased. The incidence of sore throat in the study group also increased with increasing duration of endotracheal intubation. Fiberoptic bronchoscopy in the 20 patients showed that the tracheal mucosa was injured in varying degrees in both groups, but the injury was more severe in the control group than in the study group.

**CONCLUSIONS:** ETTc pressure estimated by palpation with personal experience is often much higher than measured or what may be optimal. Proper control of ETTc pressure by a manometer helped reduce ETT-related postprocedural respiratory complications such as cough, sore throat, hoarseness, and blood-streaked expectoration even in procedures of short duration (1–3 hours).

**缺氧時利用脈搏 CO-血氧測量儀提高高鐵血紅蛋白測量的精確性**

*Improved Accuracy of Methemoglobin Detection by Pulse CO-Oximetry During Hypoxia*

John R. Feiner, MD and Philip E. Bickler, MD, PhD
From the Department of Anesthesia and Perioperative Care, University of California at San Francisco, San Francisco, California.
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**背景:** 血液中的高鐵血紅蛋白無法用傳統血氧測定法檢測，並可能使血氧測量儀對真實的動脈功能血氧含量（SaO2）的估計值（SpO2）產生偏倚。最近引進的“脈搏 CO-血氧測量儀”(Masimo Rainbow SET® Radical-7)可測量 SpMet，是一種無創的測量動脈血中高鐵血紅蛋白比率(％MetHb)的方法，研究顯示這種方法在缺氧時測量值呈假性升高。我們通過本實驗試圖確定製造商的修正是否改善了設備同時發現並精確測量高鐵血紅蛋白及去氧血紅蛋白的能力。
METHODS: Twelve healthy adult volunteer subjects were fitted with sensors on the middle finger of each hand, and a radial arterial catheter was placed for blood sampling. Intravenous administration of ~300 mg of sodium nitrite elevated subjects' methemoglobin levels to a 7% to 11% target level, and hypoxia was induced to different levels of SaO₂ (70% to 100%) by varying fractional inspired oxygen. Pulse CO-oximeter readings were compared with arterial blood values measured with a Radiometer ABL800 FLEX multi-wavelength oximeter. Pulse CO-oximeter methemoglobin reading performance was analyzed by the bias (SpMet-%MetHb), and by observing the incidence of meaningful reading errors and predictive value at the various hypoxia levels. SpO₂ bias (SpO₂ – SaO₂), precision, and root-mean-square error were evaluated during conditions of elevated methemoglobin.

RESULTS: Observations spanned 74% to 100% SaO₂ and 0.4% to 14.4% methemoglobin with 307 blood draws and 602 values from the 2 oximeters. Masimo methemoglobin reading bias and precision over the full SaO₂ span was 0.16% and 0.83%, respectively, and was similar across the span. Masimo SpO₂ readings were biased –1.93% across the 70% to 100% SaO₂ range.

CONCLUSIONS: The Rainbow's methemoglobin readings are acceptably accurate over an oxygen saturation range of 74%–100% and a methemoglobin range of 0%–14%.

BACKGROUND: Methemoglobin in the blood cannot be detected by conventional pulse oximetry and may bias the oximeter's estimate (SpO₂) of the true arterial functional oxygen saturation (SaO₂). A recently introduced “pulse CO-oximeter” (Masimo Rainbow SET® Radical-7) that measures SpMet, a noninvasive measurement of the percentage of methemoglobin in arterial blood (%MetHb), was shown to read spuriously high values during hypoxia. In this study we sought to determine whether the manufacturer's modifications have improved the device's ability to detect and accurately measure methemoglobin and deoxyhemoglobin simultaneously.
A Critical Review of the Ability of Continuous Cardiac Output Monitors to Measure Trends in Cardiac Output
Lester A. Critchley, MD, FFARCSI, FHKAM, Anna Lee, PhD, MPH and Anthony M.-H. Ho, MD, FCCP, FHKAM
From the Department of Anaesthesia & Intensive Care, The Chinese University of Hong Kong, Prince of Wales Hospital, Hong Kong, China.
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Numerous cardiac output (CO) monitors have been produced that provide continuous rather than intermittent readings. Bland and Altman has become the standard method for validating their performance against older standards. However, the Bland and Altman method only assesses precision and does not assess how well a device detects serial changes in CO (trending ability). Currently, there is no consensus on how trending ability, or trend analysis, should be performed. Therefore, we performed a literature review to identify articles published between 1997 and 2009 that compared methods of continuous CO measurement. Identified articles were grouped according to measurement technique and statistical methodology. Articles that analyzed trending ability were reviewed with the aim of finding an acceptable statistical method. Two hundred two articles were identified. The most popular methods were pulse contour (69 articles), Doppler (54), bioimpedance (38), and transpulmonary or continuous thermodilution (27). Forty-one articles addressed trending, and of these only 23 provided an in-depth analysis. Several common statistical themes were identified: time plots, regression analysis, Bland and Altman using change in CO (ΔCO), and the 4-quadrant plot, which used direction of change of ΔCO to determine the concordance. This plot was further refined by exclusion of data when values were small. Receiver operating characteristic curves were used to
define the exclusion zone. In animal studies, a reliable reference standard such as an aortic flowprobe was frequently used, and regression or time plots could be used to show trending. Clinical studies were more problematic because data collection points were fewer (8–10 per subject). The consensus was to use the 4-quadrant plot with exclusion zones and apply concordance analysis. A concordance rate of >92% when using a 15% zone indicated good trending. A new method of presenting trend data (ΔCO) on a polar plot is proposed. Agreement was shown by the angle with the horizontal axis and ΔCO by the distance from the center. Trending can be assessed by the vertical limits of the data, similar to the Bland and Altman method.

決策樹模型用於預測老年患者自主呼吸試驗成功後拔管的預後
A Decision-Tree Model for Predicting Extubation Outcome in Elderly Patients After a Successful Spontaneous Breathing Trial
Yang Liu, MD*, Lu-Qing Wei, MD, PhD*, Guo-Qiang Li, MD*, Fu-Yun Lv, MD*, Huo Wang, MD†, Yu-Hua Zhang, MD* and Wen-Li Cao, MD*
From the *Department of Intensive Care Medicine and the †Department of Pulmonary Medicine, Affiliated Hospital of the Medical College of the Chinese People's Armed Police Forces, Tianjin, People's Republic of China.

背景：常用的單一測量是基於對某一生理變數的單次測量, 其對於拔管預後的預測很差, 因為它只檢測了影響拔管預後的生理功能的某個單一的方面。我們假設建立一個決策樹模型（它包含了多個變數, 並考慮到這些變數的變化）可以更精確地預測拔管的成功率。

方法：這是一個前瞻性觀察性研究。入選了 2007-2008 年在重症監護室輔助通氣超過 48 小時的 113 例老年患者。所有患者進行持續 60 分鐘的自主呼吸試驗（SBT）【呼氣末正壓為 5cm H\textsubscript{2}O, 自動管路補償, 100%】。能夠耐受該試驗的患者立即拔管。記錄患者自主呼吸試驗 1 分鐘、30 分鐘和 60 分鐘時的口腔阻斷壓（P\textsubscript{0.1}）、淺快呼吸指數（RSBI）及兩者的乘積（P\textsubscript{0.1} × RSBI）。SBT 的 30 分鐘和 60 分鐘時測定的 RSBI 變化（ΔRSBI\textsubscript{30}, ΔRSBI\textsubscript{60}）被評估為 RSBI\textsubscript{30} 或 RSBI\textsubscript{60} 與 SBT 第 1 分鐘時 RSBI 的比率。

結果: 22 例 (19.5%) 患者未通過自主呼吸試驗, 從本研究中剔除; 91 例患者能夠耐受試驗, 予以拔管。48 小時後, 18 例 (19.8%) 患者需要重新插管 (拔管失敗), 73 例 (80.2%) 患者拔管成功, 不需再次插管。雖然拔管失敗的患者 (118% ± 34%) ΔRSBI\textsubscript{30} 較拔管成功的患者 (93% ± 35%, P = 0.01) 高, 但是受試者作用特性 (ROC) 分析顯示, 該指數在閾值<98%時對於拔管成功的預測能力很差, 它在 ROC 曲線以下的面積 (AUC) 只有 0.76。分類回歸樹分析選擇 3 個變數 (P\textsubscript{0.1} × RSBI\textsubscript{30}, RSBI\textsubscript{1}, ΔRSBI\textsubscript{30}), 並從 P\textsubscript{0.1} × RSBI\textsubscript{30} 開始。對於 P\textsubscript{0.1} × RSBI\textsubscript{30} >474 cm H\textsubscript{2}O*次/分/升的患者, ΔRSBI\textsubscript{30} >98% 定義為包含了所有失敗的患者而非成功的患者的一個組, 而 ΔRSBI\textsubscript{30} ≤98% 包含了所有成功的患者而非失敗的患者。對於 P\textsubscript{0.1} × RSBI\textsubscript{30} ≤474 cm H\textsubscript{2}O*次/分/升的患者, P\textsubscript{0.1} × RSBI\textsubscript{30} >328 cm H\textsubscript{2}O*次/分/升和 RSBI\textsubscript{1} >112 次/分/升也合併定義了包含了所有成功的患者而非失敗的患
者的一個組。事實上，當只包括 $P_{0.1} \times \text{RSBI}_{30}$ 時，樹模型的診斷準確性為 89.1%，當包含 $P_{0.1} \times \text{RSBI}_{30}$ 和 $\Delta \text{RSBI}_{30}$ 兩個參數時，其準確性增至 94.5%。最終的樹模型包含了所有這 3 個變數，預測拔管成功的準確率達到 96.7%，AUC 爲 0.94（95% 可信區間 [CI]，0.87-0.98）。

結論：如果通過大樣本量的前瞻性研究能進一步確認現有的樹模型，那麼它將有助於指導醫生為重症監護病房的老年患者做出拔管決策。

（徐妍君譯，馬皓琳 李士通 校）

BACKGROUND: The commonly used single tests, based on a 1-time measurement of a physiologic variable, are often poorly predictive of tracheal extubation outcome because they examine only a single aspect of physiological function that affects the extubation outcome. We hypothesized that the construction of a decision-tree model, which includes multiple variables and considers the changes of these variables, may more accurately predict successful extubation.

METHODS: This was a prospective observational study. From 2007 to 2008, 113 elderly patients in the medical intensive care unit on ventilation for >48 hours were enrolled. All patients underwent a 60-minute spontaneous breathing trial (SBT) [positive end-expiratory pressure of 5 cm H$_2$O; automatic tube compensation, 100%]. Patients tolerating the trial were extubated immediately. The mouth occlusion pressure ($P_{0.1}$), rapid shallow breathing index (RSBI) and their combination ($P_{0.1} \times \text{RSBI}$) were recorded at the first, 30th, and 60th minute of the SBT. The changes in RSBI, which were determined at the 30th and 60th minute of the SBT ($\Delta \text{RSBI}_{30}, \Delta \text{RSBI}_{60}$), were assessed as the ratio (of RSBI$_{30}$ or RSBI$_{60}$) to RSBI at the first minute of the SBT.

RESULTS: Twenty-two patients (19.5%) failed the SBT and were not included in the analysis, and 91 tolerated the trial and were extubated. At 48 hours, 73 (80.2%) remained extubated (successful extubation), and 18 (19.8%) required reintubation (extubation failure). Although the $\Delta \text{RSBI}_{30}$ was significantly higher in the extubation failure patients (118% ± 34%) than that in the successful extubation patients (93% ± 35%, $P = 0.01$), the receiver operating characteristic (ROC) analysis demonstrated that this index, with the threshold of <98%, presented poor performance in predicting successful extubation with area under the ROC curve (AUC) of only 0.76. The classification and regression-tree analysis selected 3 variables ($P_{0.1} \times \text{RSBI}_{30}, \text{RSBI}_{1}, \Delta \text{RSBI}_{30}$) and began with $P_{0.1} \times \text{RSBI}_{30}$. For patients with $P_{0.1} \times \text{RSBI}_{30} > 474$ cmH$_2$O*breaths/min/L, $\Delta \text{RSBI}_{30} > 98\%$ defined a group including all failure patients but no success patients, whereas $\Delta \text{RSBI}_{30} \leq 98\%$ included all success patients with no failure patients. For patients with $P_{0.1} \times \text{RSBI}_{30} \leq 474$ cm H$_2$O*breaths/min/L, the combination of both a $P_{0.1} \times \text{RSBI}_{30} > 328$ cm H$_2$O*breaths/min/L and $\text{RSBI}_{1} > 112$ breaths/min/L also defined a group including all success patients but no failure patients. Indeed, the diagnostic accuracy (DA) of the tree model, which was 89.1% with only the $P_{0.1} \times \text{RSBI}_{30}$ included, increased to 94.5% when both the $P_{0.1} \times \text{RSBI}_{30}$ and $\Delta \text{RSBI}_{30}$ were included. The final tree model with the inclusion of all 3 discriminators could capture the successful extubation with diagnostic accuracy of 96.7%, AUC of 0.94 (95% confidence interval [CI], 0.87 to 0.98).

CONCLUSION: If the current tree model is confirmed by a prospective study with a larger sample size, it would be useful in guiding physicians making extubation decisions in elderly medical intensive care unit patients.
產科病人椎管內嗎啡鎮痛和口腔皰疹病毒復發
Neuraxial Morphine and Oral Herpes Reactivation in the Obstetric Population
Jeanette R. Bauchat, MD
From the Department of Anesthesiology, Northwestern University Feinberg School of Medicine, Chicago, Illinois.
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椎管內注射嗎啡鎮痛是剖宮產後鎮痛的常規策略。嗎啡通過此途徑增加了分娩期婦女的一個常見疾病——唇皰疹（口腔皰疹）的復發。人們最主要關注的問題是病毒再活化後由母體傳染給新生兒的風險。並沒有研究顯示復發性皰疹可導致嚴重的新生兒發病率，因此，母親接受此種方法鎮痛的益處大於母體皰疹復發導致的產後獲得性新生兒皰疹的風險。
（劉伍譯馬皓琳李士通校）
Neuraxial morphine administration is a common strategy for providing postcesarean delivery analgesia. Morphine delivered via this route increases the risk of herpes labialis (oral herpes) reactivation, a disease common in women of childbearing age. A primary concern is risk of transmission to the neonate from maternal reactivation. The benefits to the mother of this form of analgesia outweigh the risk of neonatal herpes acquired postpartum from maternal recurrence because serious neonatal morbidity from recurrent herpes has not been described.

唐氏綜合征患兒使用七氟醚麻醉誘導過程中發生的心動過緩
Brady cardia During Induction of Anesthesia with Sevoflurane in Children with Down Syndrome
F. Wickham Kraemer, MD*, Paul A. Stricker, MD*, Harshad G. Gurnaney, MBBS*, Heather McClung, MD†, Marcie R. Meador, MS, BSN‡, Emily Sussman, BA*, Beverly J. Burgess, BA*, Brian Ciampa, BA*, Jared Mendelsohn, BA*, Mohamed A. Rehan, MD, CBMI* and Mehernoor F. Watcha, MD‡§
From the *Department of Anesthesiology and Critical Care Medicine, The Children's Hospital of Philadelphia, University of Pennsylvania School of Medicine, Philadelphia, Pennsylvania; †St. Christopher's Hospital for Children, Philadelphia, Pennsylvania; ‡Baylor College of Medicine, Houston, Texas; and §Texas Children's Hospital, Houston, Texas.
背景：心動過緩是唐氏綜合征患兒中與使用氟烷吸入麻醉誘導相關的併發症。雖然有報導這些兒童使用七氟醚麻醉誘導後發生了心動過緩，但其發生率是未知的。
目的：在這項研究中我們比較了健康對照兒童和唐氏綜合征患兒使用七氟醚誘導後發生心動過緩的發生率和特徵。
方法：我們回顧了八年間使用七氟醚吸入麻醉誘導的 209 例唐氏綜合征患兒和 268 例健康對照組兒童的電子麻醉記錄。從醫療記錄中提取以下資訊：一般資料、有無先心病史、心率、氧合血紅蛋白濃度、呼氣末七氟醚濃度、動脈血壓和麻醉誘導開始後 360 秒內對心動過緩的所有處理。心動過緩和低血壓被定義為建議啓動兒科快
BACKGROUND: Bradycardia is a complication associated with inhaled induction of anesthesia with halothane in children with Down syndrome. Although bradycardia has been reported after anesthetic induction with sevoflurane in these children, the incidence is unknown.

OBJECTIVES: In this study we compared the incidence and characteristics of bradycardia after induction of anesthesia with sevoflurane in children with Down syndrome to healthy controls.

METHODS: We reviewed electronic anesthetic records of 209 children with Down syndrome and 268 healthy control patients who had inhaled induction of anesthesia with sevoflurane over an 8-year period. Data extracted from the medical record included demographics, history of congenital heart disease, heart rate, oxyhemoglobin saturation, expired sevoflurane concentrations, arterial blood pressure, and any treatment of bradycardia during the first 360 seconds after the start of induction of anesthesia. Bradycardia and hypotension were defined as heart rate and arterial blood pressure below the critical limits recommended for activating a pediatric rapid response team to the bedside of a hospitalized child for quick intervention. Factors associated with bradycardia were identified in a univariate analysis. A step-wise backward multiple logistic regression model was used to identify independent factors. Differences between the 2 groups were computed using Fisher’s exact test or χ² tests for categorical data and t tests for continuous data.

RESULTS: Univariate analysis demonstrated that Down syndrome, low ASA physical status, congenital heart disease, and mean sevoflurane concentrations were factors associated with bradycardia. However, multivariate analysis showed that only Down syndrome and low ASA physical status remained as independent factors associated with bradycardia.

CONCLUSION: Bradycardia during anesthetic induction with sevoflurane was common in children with Down syndrome, with and without a history of congenital heart disease.

Propofol Decreases Neuronal Population Spiking Activity in the Subthalamic Nucleus of Parkinsonian Patients

Aeyal Raz, MD, PhD*, Dan Eimerl, MD†, Adam Zaidel, MSc‡, Hagai Bergman, MD, PhD‡ and Zvi Israel, MD†
背景：在治療帕金森氏症時，通常通過微電極記錄儀（MER）記錄丘腦下核（STN）神經元群峰電位活動來實施在 STN 植入腦深部刺激（DBS）電極。鎮靜藥對 MER 具有何種程度的干擾還未知。我們記錄了丙泊酚鎮靜期間 STN 神經元的群峰電位活動，並檢測其對神經元活動的影響。

方法：在治療帕金森氏症患者的 DBS 手術中實施此操作。在 STN 一個固定的電極部位，我們以丙泊酚 50μg/kg/min 輸注，直到達到穩定的鎮靜深度。我們記錄了在丙泊酚輸注前、中和後的電活動，並計算出其均方根（RMS）。

結果：記錄了 16 名患者的 24 個電極軌跡的活動。在 24 個軌跡中有 18 個 STN 電活動的 RMS 在給予丙泊酚後顯著降低。在丙泊酚輸注期間標準化的 RMS 平均值下降了 23.2%± 9.1%（均值±標準差）（P < 0.001），而在停用後 9.3 ± 4.0 分鐘恢復到基礎值。

結論：使用丙泊酚會導致 STN 神經元活動的明顯減少。因此，這可能干擾了 MER 對 STN 邊界的鑒定。然而，電活動在停用丙泊酚後很快恢復到基礎水準。因此，可以安全地使用丙泊酚直到使用 MER 做 DBS 前即刻。

8-OH-DPAT 阻止嗎啡導致的大鼠背縫神經核的凋亡：減少嗎啡耐受的一個可能機制
8-OH-DPAT Prevents Morphine-Induced Apoptosis in Rat Dorsal Raphe Nucleus: A Possible Mechanism for Attenuating Morphine Tolerance
Mohammad Charkhpour*, Ali Reza Mohajjel Nayebi*, Yousef Doustar† and Kambiz Hassanzadeh‡
From the *Department of Pharmacology and Toxicology, Faculty of Pharmacy, Tabriz University of Medical Sciences, Tabriz, Iran; †Department of Pathobiology, Faculty of Veterinary, Islamic Azad University of Tabriz, Tabriz, Iran; and ‡Department of Physiology and Pharmacology, Faculty of Medicine, Kurdistan University of Medical Sciences, Sanandaj, Iran.
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BACKGROUND: Previously, we found that activation of serotonin 1A (5-HT1A) receptors in the dorsal raphe nucleus (DRN) decreased the development of tolerance to the analgesic effect of morphine. It has been indicated that tolerance to the analgesic effect of morphine is associated with apoptosis in the central nervous system. In this investigation we attempted to evaluate the effect of 8-OH-DPAT (8-hydroxy-2-[di-n-propylamino]tetralin), a specific 5-HT1A receptor agonist, on morphine-induced tolerance and apoptosis in rat DRN.

METHODS: Nociception was assessed using a hotplate apparatus. The terminal deoxynucleotidyl transferase-mediated dUTP nick-end labeling (TUNEL) method was used to analyze apoptosis.

RESULTS: Tolerance to the analgesic effect of morphine was complete by 10 days after morphine administration (5 mg/kg/d, i.p.), whereas a significant analgesic effect was observed through the 10th day in 8-OH-DPAT–treated animals. Furthermore, the results showed that the number of TUNEL positive cells had been increased in morphine-tolerant rats (control group: morphine, i.p. + saline, intra-DRN) in comparison with the saline-treated animals. The results also indicated that 8-OH-DPAT (2, 4, and 8 μg/rat/d) attenuated the number of apoptotic cells in the DRN in comparison with the control group.

背景：以前，我們發現背縫神經核（DRN）中血清素-1A(5-HT1A)受體的活化減少了對嗎啡鎮痛作用耐受的發生。已表明對嗎啡鎮痛作用的耐受與中樞神經系統中的凋亡相關。在本實驗中，我們欲評估8-OH-DPAT（8-羥-2-[di-n-丙胺基]四氫萘，一種特殊的5-HT1A受體激動劑）對嗎啡導致耐受及大鼠DRN中凋亡的影響。

方法：使用熱板儀器評定傷害性感受。使用末梢去氧核轉移酶介導的dUTP缺口末端標記（TUNEL）法分析凋亡。

結果：通過服用嗎啡(5 mg/kg/d, i.p.)十天完成對嗎啡鎮痛作用的耐受，然而，8-OH-DPAT處理的動物在第十天仍有顯著的鎮痛作用。此外，結果顯示與生理鹽水處理組相比，嗎啡耐受組大鼠（對照組：嗎啡i.p. + DRN內生理鹽水）中TUNEL陽性細胞的數量增加。結果還表明：與對照組相比，8-OH-DPAT(2, 4和8 μg/大鼠/d)減少了DRN內凋亡細胞的數量。不過，使用5-HT1A受體拮抗劑NAN-190(6 μg/大鼠/d, DRN內)時，8-OH-DPAT(8 μg/大鼠/d, DRN內)不能減少嗎啡導致的凋亡。

結論：我們發現：背縫神經核內注射一種特異5-HT1A受體激動劑減少了嗎啡導致的大鼠DRN內的凋亡，這可能在嗎啡耐受中起到一個關鍵作用。

（王海濤譯 馬皓琳 李士通校）
However, 8-OH-DPAT (8 μg/rat/d, intra-DRN) failed to reduce morphine-induced apoptosis in the presence of the 5-HT1A receptor antagonist, NAN-190 (6 μg/rat/d, intra-DRN).

**CONCLUSION:** We found that intra-DRN injection of a specific 5-HT1A receptor agonist attenuated morphine-induced apoptosis in rat DRN, which may have a key role in morphine tolerance.

Opioid-Induced Preconditioning Is Dependent on Caveolin-3 Expression.
Tsutsumi YM, Kawaraguchi Y, Niesman IR, Patel HH, Roth DM
Department of Anesthesiology, Institute of Health Biosciences, The University of Tokushima Graduate School, Tokushima, Japan; and Department of Anesthesiology, University of California, San Diego, and VAMC San Diego, San Diego, California.

We tested the hypothesis that caveolin-3 (Cav-3) is essential for opioid-induced preconditioning in vivo. Cav-3 overexpressing mice, Cav-3 knockout mice, and controls were exposed to myocardial ischemia/reperfusion (I/R) in the presence of SNC-121 (SNC), a delta-selective opioid agonist, or naloxone, a nonselective opioid antagonist. Controls were protected from I/R injury by SNC. No protection was produced by SNC in Cav-3 knockout mice. Cav-3 overexpressing mice showed innate protection from I/R compared with controls that was abolished by naloxone. Our results show that opioid-induced preconditioning is dependent on Cav-3 expression and that endogenous protection in Cav-3 overexpressing mice is opioid dependent.
BACKGROUND: Treatment of intense postoperative pain in patients with end-stage renal disease (ESRD) is a recurrent problem for anesthesiologists because of the risk of accumulation of numerous molecules and their metabolites. Nefopam is a potent analgesic metabolized by the liver and weakly eliminated intact in urine that may offer advantages for use in patients with ESRD because it lacks respiratory-depressive effects. However, the effects of renal failure on nefopam disposition have never been investigated.

METHODS: We studied 12 ESRD patients (creatinine clearance < 20 mL/min, mean age 57 ± 13 years) having surgery under general anesthesia to create or repair an arteriovenous fistula. Postoperatively, after complete recovery from anesthesia, each patient received a single 20-mg dose of nefopam IV over 30 minutes. Nefopam and desmethyl-nefopam concentrations in plasma samples obtained over 48 hours were determined by liquid chromatography-tandem mass spectrometry. The pharmacokinetic parameter values obtained were compared with those of 12 healthy 50- to 60-year-old volunteers who also received a single 20-mg nefopam infusion over 30 minutes using a population pharmacokinetic approach.

RESULTS: Healthy volunteers and ESRD patients had comparable demographic characteristics. In comparison with those volunteers, ESRD patients had a lower volume of central compartment (115 and 53 L vs. 264 L for patients not yet hemodialyzed and on chronic hemodialysis, respectively; P < 0.001) and lower mean nefopam clearance (37.0
and 27.3 L/h vs. 52.9 L/h, P < 0.001), resulting in higher mean nefopam peak concentration (121 and 223 ng/mL vs. 61 ng/mL, P < 0.001).

CONCLUSIONS: Nefopam distribution and elimination are altered in patients with ESRD, resulting in heightened exposure. To avoid too-high concentration peaks, it is suggested that the daily nefopam dose be reduced by 50%.

The Accuracy of the Anesthetic Conserving Device (Anaconda©) as an Alternative to the Classical Vaporizer in Anesthesia
Marina Soro, MD, PhD, DEA, Rafael Badenes, MD, Maria Luisa Garcia-Perez, MD, Lucia Gallego-Ligorit, MD, Francisco J. Martí, MD, PhD, Gerardo Aguilar, MD, PhD, and F. Javier Belda, MD, PhD
From the Department of Anesthesiology and Resuscitation, Hospital Clinico Universitario, Valencia, Spain.
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BACKGROUND: The Anesthetic Conserving Device—AnaConDa_ (ACD)—has been compared with a conventional vaporizer. However, the accuracy of the administered concentration of volatile anesthetics was not examined. In the present study we measured the accuracy of the ACD when used as a portable vaporizer.

METHODS: This prospective study included 30 ASA I–III patients scheduled for elective surgery under general anesthesia. The patients were randomly organized into 3 groups of 10 patients per group. In each group, the sevoflurane infusion rate was adjusted to deliver 1.0 vol%, 1.5 vol%, and 2.0 vol% alveolar concentration. Hemodynamic data, bispectral index, and end-tidal sevoflurane concentrations were recorded every 2 minutes.

RESULTS: We analyzed 801 data points from 30 patients. The mean difference between the end-tidal sevoflurane concentration and the target concentration was –11.0±9.3% of the target when the target was 1.0 vol%, –5.4±6.4% when the target was 1.5 vol%, and –4.0±7.4% when the target was 2.0 vol%. No significant differences were found in the error at the different target concentrations.

CONCLUSIONS: We found that the ACD may be a valid alternative to the conventional vaporizer. The ACD is very simple to use, delivery rate needs to be adjusted only once per
The Effects of Carvedilol Administration on Cardiopulmonary Resuscitation in a Rat Model of Cardiac Arrest Induced by Airway Obstruction

Kurita A, Taniguchi T, Yamamoto K.
Department of Anesthesiology and Intensive Care Medicine, Graduate School of Medical Science, Kanazawa University, Kanazawa, Japan.

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BACKGROUND: Carvedilol is a nonselective β-adrenoceptor and selective α(1)-adrenoceptor blocker and is widely used in the treatment of patients with hypertensive and/or chronic heart failure because, unlike classic β-blockers, this drug has additional endothelium-dependent vasodilatory effects. We evaluated the effects of oral administration of carvedilol on cardiopulmonary resuscitation (CPR) in a rat model of cardiac arrest (CA) induced by airway obstruction.

METHODS: Twenty-four rats were randomly assigned to 2 groups: control group (no medication) and treatment group (oral administration of carvedilol [10 mg/kg/d] for 5 days) (n = 12 per group). All the animals were anesthetized, and CA was induced by obstructing the airway. Three minutes after CA, the animals were revived by administering CPR. The rate of chest compressions (CCs) was 240 to 260 CCs/min and the depth of CCs was adjusted to maintain the diastolic arterial blood pressure between 25 to 30 mm Hg in both groups. Epinephrine (0.02 mg/kg) was administered after 5 minutes of CPR. No other therapy was administered before, during, or after CA.

RESULTS: The time interval between airway obstruction and CA in the treatment group was significantly longer than in the control group (230 ± 27 vs 203 ± 24 seconds; P <
The rate of return of spontaneous circulation in the treatment group was significantly higher than in the control group (92% vs 50%; P < 0.05). Acidosis and increased glucose and tumor necrosis factor-α concentrations in the treatment group were significantly lower than in the control group.

CONCLUSIONS: The results of our study showed that rats that had been administered oral carvedilol for several days were more resistant to CA induced by airway obstruction, and when CA did occur, were more likely to be resuscitated. These findings suggest that carvedilol may prolong the safe ischemic time induced by respiratory failure.

The dose-dependent effects of phenylephrine for elective cesarean delivery under spinal anesthesia.


BACKGROUND: Hypotension is the most common serious side effect of spinal anesthesia for cesarean delivery. There has been a move recently toward the use of...
phenylephrine as a vasopressor infusion to improve maternal cardiovascular stability and fetal outcome. Although it seems safe in the elective setting, there have been concerns about its propensity for causing an increase in afterload and a baroreceptor-mediated bradycardia in the mother, with a consequent reduction in maternal cardiac output (CO). Using a noninvasive measure of CO, our aim was to investigate whether there were any dose-dependent effects of phenylephrine on maternal cardiovascular stability and, if so, any impact on fetal outcome.

METHODS: In this randomized, double-blind study, 75 women scheduled for elective cesarean delivery were allocated to receive a phenylephrine infusion at 25 μg/min, 50 μg/min, or 100 μg/min. This infusion was titrated to maintain maternal baseline systolic blood pressure (SBP), from induction of spinal anesthesia until delivery. The maternal cardiovascular variables recorded included heart rate (HR) and SBP. A suprasternal Doppler monitor measured CO and stroke volume, as well as measures of venous return (corrected flow time) and contractility, at baseline, and then every 5 minutes for 20 minutes after initiation of spinal anesthesia. Apgar scores and umbilical cord blood gases were recorded.

RESULTS: SBP control was satisfactory in all groups; however, the group receiving phenylephrine 100 μg/min required significantly higher doses to achieve arterial blood pressure control compared with the lower infusion rates. There were no significant differences in the number of times SBP decreased below 80% of baseline, or the numbers of boluses of ephedrine or phenylephrine required to maintain SBP above 80% of baseline. There were significant time and dose-dependent reductions in HR and CO with phenylephrine, such that HR and CO were seen to decrease with time in each group, and also with increasing concentrations of phenylephrine. Stroke volume remained stable throughout. Apgar scores and umbilical cord blood gases were similar among groups.

CONCLUSION: By infusing a higher concentration (100 μg/min), we subject the mother and fetus to a much higher dose of phenylephrine, with significant effects on maternal HR and CO (up to a 20% reduction). Future investigation is required to determine whether this reduction in maternal CO has detrimental effects when providing anesthesia for an emergency cesarean delivery for a compromised fetus.
Background: Oral enteric contrast medium (ECM) is frequently administered to achieve visualization of the gastrointestinal tract during abdominal evaluation with computed tomography (CT). Administering oral ECM less than 2 hours before sedation/anesthesia violates the nothing-by-mouth guidelines and in theory may increase the risk of aspiration pneumonia. In this study we measured the residual gastric fluid when using a protocol in which ECM is administered up to 1 hour before anesthesia/sedation. We hypothesized that patients receiving ECM 1 hour before anesthesia/sedation would have residual gastric fluid volume (GFV) > 0.4 mL/kg.

Methods: Anesthesia and radiology reports, CT images, and department incident reports were reviewed between January 2005 and June 2009 for all patients who required sedation/anesthesia for abdominal CT. For each patient, the volume of contrast or stomach fluid was calculated using a region of interest outlining the stomach portion containing high-attenuation fluid and low-attenuation of other gastric contents. Information obtained from anesthesia/sedation reports included demographic characteristics, presenting pathology, drugs used for anesthesia/sedation induction and maintenance, airway interventions, method for securing endotracheal tube, and complications related to ECM administration, including oxygen desaturation, vomiting, coughing, bronchospasm, laryngospasm, and aspiration.

Results: We identified 365 patients (mean age = 32 months; range = 0.66 to 211.10 months) who received oral/IV contrast material before anesthesia/sedation for abdominal CT and 47 patients (mean age = 52 months; range = 0.63 to 215.84 months) who received only IV contrast material and followed the traditional fast. For those who received oral contrast, the mean contrast volume administered was 18.10 mL/kg (range = 1.5 to 82.76 mL/kg). The median GVF 1 hour after completing the oral contrast was significantly
higher than that in patients who received only IV contrast (0.38 mL/kg vs. 0.15 mL/kg, P = 0.0049). GFV exceeded 0.4 mL/kg in 189 patients (178 of 365 [49%] in the oral contrast group vs. 11 of 47 [23%] in the IV contrast group) (χ² = 10.7874, P = 0.0010). Among those who received oral contrast, 207 patients had general anesthesia and 158 patients had deep sedation. Two cases of vomiting were reported in the general anesthesia group with no evidence of pulmonary aspiration identified.

**Conclusion:** For children receiving an abdominal CT, the residual GFV exceeded 0.4 mL/kg in 49% (178/365) of those who received oral ECM up to 1 hour before anesthesia/sedation in comparison with 23% (11/47) of those who received IV-only contrast.

**Background:** Although midazolam and propofol reduce cerebral blood flow (CBF) similarly, they generate different effects on the autonomic nervous system and endothelium-induced relaxation. Midazolam induces sympathetic dominance, whereas propofol induces parasympathetic dominance. Midazolam has no effect on endothelium-dependent relaxation, whereas propofol suppresses endothelium-dependent relaxation. Moreover, midazolam apparently constricts cerebral arterioles. We therefore
hypothesized that midazolam and propofol have different effects on dynamic cerebral autoregulation.

**METHODS:** Ten healthy male subjects received midazolam, propofol, and placebo administrations in a randomized, single-blind, crossover study. The modified Observer's Assessment of Alertness/Sedation scale was used to assess sedation depth. After reaching a target depth of sedation (Observer's Assessment of Alertness/Sedation scale score 3, responds only after name is called loudly and/or repeatedly) or after 15 minutes of normal saline administration as placebo, dynamic cerebral autoregulation was evaluated by spectral and transfer function analyses between mean arterial blood pressure variability in the radial artery measured by tonometry, and CBF velocity variability in the middle cerebral artery measured by transcranial Doppler ultrasonography.

**RESULTS:** Steady-state CBF velocity decreased significantly with midazolam and propofol administration (significant interaction effects, \( P = 0.024 \)). However, transfer function gain in the low-frequency range decreased significantly only with midazolam administration (significant interaction effects, \( P = 0.015 \)), suggesting a reduced magnitude of transfer from mean arterial blood pressure oscillations to CBF fluctuations during midazolam sedation.

**CONCLUSION:** Our results suggest that midazolam and propofol sedation have different effects on dynamic cerebral autoregulation despite causing equivalent decreases in steady-state CBF velocity. Only midazolam sedation is likely to improve dynamic cerebral autoregulation.
BACKGROUND: Phantom limb syndrome (PLS) is common after limb amputations, involving up to 90% of amputees. Although many different therapies have been evaluated, none has been found to be highly effective. Therefore, we evaluated the efficacy of a prolonged perineural infusion of a high concentration of local anesthetic solution in preventing PLS.

METHODS: A perineural catheter was placed immediately before or during surgery in 71 patients undergoing lower extremity amputation. A continuous infusion of 0.5% ropivacaine was started intraoperatively at 5 mL/h using an elastomer (nonelectronic) pump, and continued for 4 to 83 days after surgery. PLS was evaluated on the first postoperative day and then 1, 2, 3, and 4 weeks, and 3, 6, 9, and 12 months after surgery. To evaluate the presence and severity of PLS while the patient was receiving the ropivacaine infusion, it was discontinued for 6 to 12 hours before each assessment period (i.e., until the sensation in the extremity returned). The severity of phantom limb and stump pain was assessed using a 5-point verbal rating scale (VRS), with 0 = no pain to 4 = intolerable pain, and “phantom” sensations were recorded as present or absent. If the VRS score was >1 or significant phantom sensations were present, the ropivacaine infusion was immediately restarted at 5 mL/h. If the VRS score remained at 0 to 1 and the patient had not experienced phantom sensations for 48 hours, the infusion was permanently discontinued and the catheter was removed.

RESULTS: Median duration of the local anesthetic infusion was 30 days (95% confidence interval, 25–30 days). On postoperative day 1, 73% of the patients complained of severe-to-intolerable pain (visual analog scale >2). However, the incidence of severe-to-intolerable phantom limb pain was only 3% at the end of the 12-month evaluation period. At the end of the 12-month period, the percentage of patients with VRS pain scores were 0 = 84%, 1 = 10%, 2 = 3%, 3 = 3%, and 4 = none. However, phantom limb sensations were present in 39% of patients at the end of the 12-month evaluation period. All patients were able to manage the elastomeric catheter infusion system at home.

CONCLUSION: Use of a prolonged postoperative perineural infusion of ropivacaine 0.5% seems to be an effective therapy for the treatment of phantom limb pain and sensations after lower extremity amputation.

Single Versus Triple Injection Ultrasound-Guided Infraclavicular Block: Confirmation of the Effectiveness of the Single Injection Technique
BACKGROUND: The optimal site for local anesthetic placement during ultrasound-guided infraclavicular block remains controversial.

METHODS: Patients were randomized to receive lidocaine 2% 30 mL as a single injection posterior to the axillary artery (n = 51) or a triple injection ideally adjacent to each brachial plexus cord (n = 49). Pinprick sensory and motor block (3 = no block, 0 = complete block) were assessed to 20 minutes in the 4 distal nerve territories.

RESULTS: The single injection group was not significantly inferior (single versus triple injection median [interquartile range] 20-minute aggregate block score: 5 [2–9] vs 7 [3.5–11]) but also demonstrated superiority (2-tailed test, P = 0.043). The single injection technique was associated with a small reduction in procedural time.

CONCLUSIONS: The optimal site for local anesthetic placement during ultrasound-guided infraclavicular block is a single point injection posterior to the axillary artery.