Cardiovascular Anesthesiology

綫述：圍術期心臟舒張功能不全的評估
(陸秉瑋譯 陳傑校)

Review Article: Perioperative Assessment of Diastolic Dysfunction
- Robina Matyal,
- Nikolaos J. Skubas,
- Stanton K. Shernan,
- and Feroze Mahmood


Ambulatory Anesthesiology

簡報：術中小劑量氯胺酮可預防瑞芬太尼引起的麻醉後寒戰
(范羽譯 薛張綱校)

Brief Report: An Intraoperative Small Dose of Ketamine Prevents Remifentanil-Induced Postanesthetic Shivering
- Masato Nakasuji,
- Mitsuyo Nakamura,
- Norie Imanaka,
- Masuji Tanaka,
- Masataka Nomura,
- and Soon Hak Suh


Anesthetic Pharmacology

一項關於瑞芬太尼--丙泊酚聯合應用引起對食道檢查儀器的反應喪失、應答反應喪失、和/或發生重度呼吸抑制的研究
(張怡譯 馬皓琳 李士通校)

An Exploration of Remifentanil-Propofol Combinations That Lead to a Loss of Response to Esophageal Instrumentation, a Loss of Responsiveness, and/or Onset of Intolerable Ventilatory Depression
Cris D. LaPierre,
Ken B. Johnson,
Benjamin R. Randall,
Julia L. White,
and Talmage D. Egan


前腦特定的γ-氨基丁酸A型受體β3亞基的基因敲除小鼠對異氟醚的遺忘效應有抵抗作用
（孫曉瓊譯 陳傑校）

Gamma-Aminobutyric Acid Type A Receptor β3 Subunit Forebrain-Specific Knockout Mice Are Resistant to the Amnestic Effect of Isoflurane

Vinuta Rau,
Irene Oh,
Mark Liao,
Christina Bodarky,
Michael S. Fanselow,
Gregg E. Homanics,
James M. Sonner,
and Edmond I Eger II


研究氯胺酮和瑞芬太尼與小鼠七氟醚麻醉的最低肺泡有效濃度及小鼠急性阿片耐受的相互影響
（侯文婷譯 薛張綱校）

Ketamine and Remifentanil Interactions on the Sevoflurane Minimum Alveolar Concentration and Acute Opioid Tolerance in the Rat

Delia Aguado,
Mariana Abreu,
Javier Benito,
Javier García–Fernández,
and Ignacio A. Gómez de Segura

Technology, Computing, and Simulation

Evaluation of a New Software Version of the FloTrac/Vigileo (Version 3.02) and a Comparison with Previous Data in Cirrhotic Patients Undergoing Liver Transplant Surgery

- Gianni Biancofio, Gianni Biancofio
- Lester A. H. Critchley, Lester A. H. Critchley
- Anna Lee, Anna Lee
- Xiao-xing Yang, Xiao-xing Yang
- Lucia M. Bindi, Lucia M. Bindi
- Massimo Esposito, Massimo Esposito
- Massimo Bisà, Massimo Bisà
- Luca Meacci, Luca Meacci
- Roberto Mozzo, Roberto Mozzo
- and Franco Filipponi, Franco Filipponi


The Ability of Pulse Pressure Variations Obtained with CNAP™ Device to Predict Fluid Responsiveness in the Operating Room

- Matthieu Biais, Matthieu Biais
- Laurent Stecken, Laurent Stecken
- Laetitia Ottolenghi, Laetitia Ottolenghi
- Stéphanie Roullet, Stéphanie Roullet
- Alice Quinart, Alice Quinart
- Françoise Masson, Françoise Masson
- and François Sztark, François Sztark


Mechanical Ventilator for Pressure-Controlled Ventilation: A Moulard Study

- Young J. K., Young J. K.
- and Zhang M. H., Zhang M. H.

The Effect of Ventilator Performance on Airway Pressure Release Ventilation: A Model Lung Study

- Takeshi Yoshida,
- Akinori Uchiyama,
- Takashi Mashimo,
- and Yuji Fujino

*Anesth Analg* September 2011 113:529–533; published ahead of print April 25, 2011

低流量麻醉工作站有無濕熱交換器對溫度和濕度的影響

(劉伍譯 馬皓琳 李士通校)

The Temperature and Humidity in a Low-Flow Anesthesia Workstation With and Without a Heat and Moisture Exchanger

- Jair de Castro, Jr.,
- Fernanda Bolfi,
- Lidia R. de Carvalho,
- and Jose R. C. Braz


Patient Safety

改變體表降溫的速度對於血管收縮和寒戰閾值的影響

(張婷譯  陳傑校)

The Effect of Altering Skin-Surface Cooling Speeds on Vasoconstriction and Shivering Thresholds

- Yoshie Taniguchi,
- Rainer Lenhardt,
- Daniel I. Sessler,
- and Andrea Kurz


Critical Care, Trauma, and Resuscitation

一項隨機、開放性研究：關於磷異丙酚應用於重症監護病房行機械通氣患者的安全性及有效性研究

(劉玳瑩譯 薛張綱校)
A Randomized, Open-Label Study of the Safety and Tolerability of Fospropofol for Patients Requiring Intubation and Mechanical Ventilation in the Intensive Care Unit

- Keith A. Candiotti,
- Tong J. Gan,
- Christopher Young,
- Alex Bekker,
- S. T. John Sum-Ping,
- Richard Kahn,
- Philip Lebowitz,
- and Jeffrey J. Littman

*Anesth Analg September 2011 113:550–556; published ahead of print May 19, 2011*

**Obstetric Anesthesiology**

超聲評估妊娠期髂脊線的脊椎水準
(劉朝輝譯，馬皓琳，李士通校)

Ultrasound Assessment of the Vertebral Level of the Intercristal Line in Pregnancy

- Allison J. Lee,
- J. Sudharma Ranasinghe,
- Jules Marie Chehade,
- Kris Arheart,
- Bruce S. Saltzman,
- Donald H. Penning,
- and David J. Birnbach

*Anesth Analg September 2011 113:559–564; published ahead of print June 16, 2011*

**Neuroscience in Anesthesiology and Perioperative Medicine**

應用辛伐他丁能減少大鼠的脊髓缺血再灌注損傷
(趙嫣紅譯 陳傑校)

Reduction of Spinal Cord Ischemia/Reperfusion Injury with Simvastatin in Rats

- Takeshi Saito,
Anesth Analg September 2011 113:565–571; published ahead of print
June 16, 2011

Immune Cell Populations Decrease During Craniotomy Under General Anesthesia

Anesth Analg September 2011 113:572–577; published ahead of print
August 3, 2011

Analgesia

Pain Medicine

Anesth Analg September 2011 113:565–571; published ahead of print
June 16, 2011


Anesth Analg September 2011 113:572–577; published ahead of print
August 3, 2011

Analgesia

Pain Medicine
Early Thoracic Sympathetic Block Improves the Treatment Effect for Upper Extremity Neuropathic Pain

Hyung Seok Yoo,
Francis Sahngun Nahm,
Pyung Bok Lee,
and Chul Joong Lee

Application of Pulsed Radiofrequency Currents to Rat Dorsal Root Ganglia Modulates Nerve Injury–Induced Tactile Allodynia

Danielle M. Perret,
Doo-Sik Kim,
Kang-Wu Li,
Karin Sinavsky,
Robert L. Newcomb,
Jason M. Miller,
and Z. David Luo

A Comparison of Different Dosages of a Continuous Preperitoneal Infusion and Systemic Administration of Ropivacaine After Laparotomy in Rats

Toni Kfoury,
Jean-Xavier Mazoit,
Michael Schumacher,
Dan Benhamou, and Helene Beloeil


Hyperbaric Oxygenation Therapy Alleviates Chronic Constrictive Injury–Induced Neuropathic Pain and Reduces Tumor Necrosis Factor-Alpha Production

Fenghua Li, Lili Fang, Shiwei Huang, Zhongjin Yang, Jyotirmoy Nandi, Sebastian Thomas, Chung Chen, and Enrico Camporesi

*Anesth Analg* September 2011 113:626–633; published ahead of print May 19, 2011

The Median Effective Dose of Ketamine and Gabapentin in Opioid-Induced Hyperalgesia in Rats: An Isobolographic Analysis of Their Interaction

Alain C. Van Elstraete, Philippe Sitbon, Dan Benhamou, and Jean-Xavier Mazoit


Enhanced Analgesic Responses After Preferential Delivery of Morphine and Fentanyl to the Olfactory Epithelium in Rats

John D. Hoekman and
Rodney J. Y. Ho


新的三叉神經痛動物模型：大鼠眶下神經注入克痛寧
(黃丹譯 陳傑校)
A New Animal Model of Trigeminal Neuralgia Produced by Administration of Cobra Venom to the Infraorbital Nerve in the Rat

Jian–Xiong An,
Ying He,
Xiao–Yan Qian,
Jian–Ping Wu,
Yi–Kuan Xie,
Qu–Lian Guo,
John P. Williams,
and Doris K. Cope


Regional Anesthesia

簡要報導：超聲的螯合劑與神經接觸：一項動物組織學研究
(張月琪譯 謝張綱校)
Brief Report: Ultrasound Gel-Nerve Contact: An Experimental Animal Histologic Study

Abdelazeem El–Dawlatly,
Khalid Kathiry,
Ammar Al Rikabi,
Waseem Hajjar,
Omar Al Obaid,
and Tariq Alzahrani

An Exploration of Remifentanil-Propofol Combinations That Lead to a Loss of Response to Esophageal Instrumentation, a Loss of Responsiveness, and/or Onset of Intolerable Ventilatory Depression
Cris D. LaPierre, BS, Ken B. Johnson, MD, Benjamin R. Randall, MD, Julia L. White, RN and Talmage D. Egan, MD
From the Departments of Anesthesiology and Biomedical Engineering, University of Utah, Salt Lake City, Utah.
Anesth Analg September 2011 113:490-499

BACKGROUND:
Remifentanil and propofol are increasingly used for short-duration procedures in spontaneously breathing patients. In this setting, it is preferable to block the response to moderate stimuli while avoiding loss of responsiveness (LOR) and intolerable ventilatory depression (IVD). In this study, we explored selected effects of combinations of remifentanil-propofol effect-site concentrations (Ces) that lead to a loss of response to esophageal instrumentation (EI), LOR, and/or onset of IVD. A secondary aim was to use these observations to create response surface models for each effect measure. We hypothesized that (1) in a large percentage of volunteers, selected...
remifentanil and propofol Ces would allow EI but avoid LOR and IVD, and (2) the drug interaction for these effects would be synergistic.

METHODS: Twenty-four volunteers received escalating target-controlled remifentanil and propofol infusions over ranges of 0 to 6.4 ng · mL⁻¹ and 0 to 4.3 μg · mL⁻¹, respectively. At each set of target concentrations, responses to insertion of a blunt end bougie into the midesophagus (40 cm), level of responsiveness, and respiratory rate were recorded. From these data, response surface models of loss of response to EI and IVD were built and characterized as synergistic, additive, or antagonistic. A previously published model of LOR was used.

RESULTS: Of the possible 384 assessments, volunteers were unresponsive to EI at 105 predicted remifentanil-propofol Ces; in 30 of these, volunteers had no IVD; in 30, volunteers had no LOR; and in 9, volunteers had no IVD or LOR. Many other assessments over the same concentration ranges, however, did have LOR and/or IVD. The combinations that allowed EI and avoided IVD and/or LOR primarily clustered around remifentanil-propofol Ces ranging from 0.8 to 1.6 ng · mL⁻¹ and 1.5 to 2.7 μg · mL⁻¹, respectively, and to a lesser extent approximately 3.0 to 4.0 ng · mL⁻¹ and 0.0 to 1.1 μg · mL⁻¹, respectively. Models of loss of response to EI and IVD both demonstrated a synergistic interaction between remifentanil and propofol.

CONCLUSION: Selected remifentanil-propofol concentration pairs, especially higher propofol-lower remifentanil concentration pairs, can block the response to EI while avoiding IVD in spontaneously breathing volunteers. It is, however, difficult to block the response to EI and avoid both LOR and IVD. It may be necessary to accept some discomfort and blunt rather than block the response to EI to consistently avoid LOR and IVD.

評估 Flotrac/vigileo 新的軟體版本（3.02 版）並和以往肝硬化患者肝移植手術中資料比較

Evaluation of a New Software Version of the FloTrac/Vigileo (Version 3.02) and a Comparison with Previous Data in Cirrhotic Patients Undergoing Liver Transplant Surgery

Gianni Biancofiore, MD*, Lester A. H. Critchley, MD†, Anna Lee, PhD†, Xiao-xing Yang, PhD†, Lucia M. Bindi, MD*, Massimo Esposito, MD*, Massimo Bisà, MD*, Luca Meacci, MD*, Roberto Mozzo, MD* and Franco Filipponi, MD*

From *Liver Transplant Anaesthesia and Critical Care Medicine, Azienda Ospedaliera Universitaria Pisana, Ospedale Cisanello, Pisa, Italy; and †Department of Anaesthesia and Intensive Care, Chinese University of Hong Kong, Prince of Wales Hospital, Shatin, New Territories, Hong Kong, China.

Anesth Analg September 2011 113:515-522

背景：在肝硬化患者進行肝移植手術時，可靠的心輸出量監測是非常有用的，因爲肝硬化合併有血管擴張和高心輸出狀態，稱為肝硬化心肌病，這就會挑戰脈搏輪廓線心輸出量監測技術可靠性。儘管射血分數和心輸出量的升高是由於外周血管阻力低，但是長期耐受的肝硬化患者的心室收縮力還是會受損的。然而，肝硬化患者在手術時由於生理變化與手術應激可以代償。最近，我們發現 Flotrac/vigileo™無法在肝硬化患者移植手術中使用。對此，公司升級了他們的軟體。因此，我們需要
在同一環境中評估這一新的第三代（3.02 版）FloTrac/vigileo 計算軟體的準確性及
可靠性。

方法：同時使用肺動脈導管進行快速灌注熱稀釋法和 Flotrac/vigileo(ClV)進行脈搏
輪廓線分析來監測心臟指數。在 21 例肝移植手術中，讀取移植期間和移植後共 10
個時間點的資料。將其與我們 2009 年使用第二代（1.10 版）軟體的結果進行了比較。

結果：我們的新資料表明 3.02 版軟體顯著減少了在低外周阻力狀態時對脈搏輪廓
心輸出讀數偏差的不利影響，從而提高系統的整體精度和趨勢能力。回歸分析表明
ClTD 和 ClV 之間呈現中等相關性（r =0.67，95% 置信區間為 0.40－0.86）。Bland 和
Altman 分析表明，偏差為 0.4 L.min\(^{-1}\).m\(^{-2}\)，百分比誤差為 52%（95% 置信區間為
49%－55%）。新軟體的趨勢能力也得到了改進，但仍遠遠低於目前的基準。

結論：新版軟體（3.02 版）與以前的版本比較有了重大的改進，整體精度和趨勢能
力更好。進一步的計算改進將會增加這一技術的可靠性，使其廣泛應用在高
度複雜環境的肝硬化患者肝移植手術中。

（唐亮 翻 馬皓琳 李士通 校）

BACKGROUND: Reliable cardiac output monitoring is particularly useful in the
cirrhotic patient undergoing liver transplant surgery, because cirrhosis of the liver is
associated with a vasodilated and high output state, known as cirrhotic cardiomyopathy,
that challenges the reliability of pulse contour cardiac output technology. The
contractility of the ventricle in cirrhosis is impaired, which is tolerated even though the
ejection fraction and cardiac output are elevated because of the low peripheral resistance.
However, during surgery the cirrhotic patient can decompensate because of the
physiological changes and stress of surgery. Recently, we showed that the
FloTrac/Vigileo™ failed to perform in cirrhotic patients undergoing transplant surgery.
In response, the company upgraded their software. Therefore, we have assessed the
accuracy and reliability of this new third-generation (version 3.02) FloTrac/Vigileo
algorithm software in the same setting.

METHODS: The cardiac index was measured simultaneously by single-bolus
thermodilution (ClTD), using a pulmonary artery catheter, and pulse contour analysis,
using the FloTrac/Vigileo (ClV). Readings were made at 10 time points during and after
liver transplant surgery in 21 patients. Comparisons with data from our 2009 study,
which used second-generation (version 01.10) software, were also made.

RESULTS: Our new data show that version 3.02 software significantly reduced the
adverse effect on pulse contour cardiac output reading bias in low peripheral resistance
states, and thus improves the overall precision and trending ability of the system.
Regression analysis between ClTD and ClV showed that the correlation was moderate (r
=0.67, 95% confidence interval, 0.40 to 0.86). The Bland and Altman analysis showed
that bias was 0.4 L.min\(^{-1}\).m\(^{-2}\), and the percentage error was 52% (95% confidence
interval, 49% to 55%). Trending ability of the new software also was improved but was
still well below the current benchmarks.

CONCLUSION: The new software (version 3.02) provided substantial improvements
over the previous versions with better overall precision and trending ability. Further
algorithm refinements will increase this technology’s reliability to be extensively used in
the highly complex setting of cirrhotic patients undergoing liver transplantation.
The Temperature and Humidity in a Low-Flow Anesthesia Workstation With and Without a Heat and Moisture Exchanger

Jair de Castro Jr., MD, PhD*, Fernanda Bolfi, MD*, Lídia R. de Carvalho, PhD† and Jose R. C. Braz, MD, PhD*

From *Faculdade de Medicina de Botucatu, UNESP, Univ. Estadual Paulista, Departamento de Anestesiologia, Botucatu, SP Brazil; †Instituto de BioCiências de Botucatu, UNESP, Univ. Estadual Paulista, Departamento de Bioestatística, Botucatu, SP Brazil.

Anesth Analg September 2011 113:534-538

BACKGROUND: Dräger Primus anesthesia workstation has a built-in hotplate to heat the patient’s exhaled gas. The fresh gas flow is mixed with the heated exhaled gas as they pass through the soda lime canister. A heat and moisture exchanger (HME) may also be used to further heat and humidify the inhaled gas. In this study we measured the temperature and humidity of the inhaled gas coming from the Dräger Primus with or without a HME.

METHODS: Thirty female patients were randomly divided into 2 groups and their lungs ventilated by the Primus Dräger anesthesia workstation with or without a HME. The humidity and temperature of the inhaled gas were measured 15, 30, 60, 90, and 120 minutes after connecting the patient to the breathing circuit.

RESULTS: After 120 minutes of ventilation with a low-flow breathing circuit, the temperatures of inhaled gas were 25°C ± 1°C and 30°C ± 2°C without and with HME, respectively, with a statistically significant difference between groups (P < 0.001) with 95% confidence interval (CI) of 3.80°C to 6.40°C; and the absolute humidity values of the inhaled gas were 20.5 ± 3.6 mg H2O · L⁻¹ and 30 ± 2 mg H2O · L⁻¹ without and with HME, respectively, with a statistically significant difference between groups (P < 0.001) with 95% CI of 7.37°C to 13.03°C.
CONCLUSIONS: The Primus anesthesia workstation partially humidifies the inspired gas when a low fresh gas flow is used. Insertion of an HME increases the humidity in inhaled gas, bringing it close to physiological values.

**Ultrasound Assessment of the Vertebral Level of the Intercristal Line in Pregnancy**

Allison J. Lee, MD*, J. Sudharmia Ranasinghe, MD*, Jules Marie Chehade, MD*, Kris Arheart, EdD†, Bruce S. Saltzman, MD*, Donald H. Penning, MD, MS, FRCP* and David J. Birnbach, MD, MPH*

From the *Department of Anesthesiology, University of Miami, Jackson Memorial Hospital; and †Department of Epidemiology and Public Health/Division of Biostatistics, University of Miami Miller School of Medicine, Miami, Florida.

Anesth Analg September 2011 113:559-564

**BACKGROUND:** The intercristal line is known to most frequently cross the L4 spinous process or L4-5 interspace; however, it is speculated to be positioned higher during pregnancy because of the exaggerated lumbar lordosis. Clinical estimation of vertebral levels relying on the use of the intercristal line has been shown to often be inaccurate. We hypothesized that the vertebral level of the intercristal line determined by palpation would be higher than the level determined by ultrasound in pregnant women.

**METHODS:** Fifty-one term pregnant patients were recruited. Two experienced anesthesiologists performed estimates of the position of the intercristal line by palpation. Using ultrasound, another anesthesiologist who was blinded to the clinical estimates, determined the position of the superior border of the iliac crest in the transverse and
longitudinal planes and then identified the lumbar vertebral levels. The vertebral level at which the clinical estimates of the intercristal line crossed the spine was recorded and compared with the ultrasound-determined level of the superior border of the iliac crest. 

**RESULTS:** The clinical estimates of the spinal level of the intercristal line agreed with the ultrasound measurement 14% of the time (14 of 101; 95% confidence interval [CI]: 8%, 22%). The clinical estimates were 1 level higher than the ultrasound measurement 23% of the time (23 of 101; 95% CI: 16%, 32%) and >1 level higher 25% of the time (25 of 101; 1-tailed 95% CI: >18%). The distribution of the clinical estimates found clinicians locating the intercristal line at L3 or L3-4 54% of the time (54 of 101; 95% CI: 44%, 63%) and at L2-3 or higher 27% of the time (27 of 101; 1-tailed 95% CI: >20%).

**CONCLUSION:** The anatomical position of the intercristal line was at L3 or higher in at least 6% of term pregnant patients using ultrasound. Clinical estimates were found to be ≥1 vertebral level higher than the anatomical position determined by ultrasound at least 40% of the time. This disparity may contribute to misidentification of lumbar interspaces and increased risk of neurologic injury during neuraxial anesthesia.


Stephen Choi, MD, FRCPC* and Richard Brull, MD, FRCPC†

From the *Department of Anesthesia, Sunnybrook Health Sciences Centre, University of Toronto; and †Department of Anesthesia and Pain Management, Toronto Western Hospital, University Health Network, University of Toronto, Toronto, Ontario, Canada.

Anesth Analg September 2011 113:596-604

**背景:** 超聲（US）引導下周圍神經阻滯已在全球範圍內得到廣泛應用。關於即時超聲視覺化技術較傳統的神經定位技術的優勢的報導大多是關於操作和技術阻滯相關的結果，而關於急性疼痛治療的相關結果則明顯較少報導。在本綜述中，我們比較了 US 引導與傳統神經定位技術對於急性疼痛干預管理和急性疼痛相關結果的作用。

**方法:** 我們對 1990 年 1 月至 2011 年 1 月期間的 MEDLINE、EMBASE、循證醫學中心登記的對照臨床試驗做了系統檢索，檢索出關於比較評估 US 引導和傳統神經定位技術對急性疼痛及其相關結果的作用的隨機對照試驗。排除標準包括：納入實驗未報告以下至少一項急性疼痛的結果——疼痛程度、阿片類藥物使用量、感覺阻滯持續時間、首次需要止痛藥的時間。相關結果分類如下：患者相關結果（阿片類藥物相關副作用、患者滿意度、術後認知功能障礙）、麻醉相關結果（不必要的運動阻滯、周圍神經管失敗、患病率、慢性疼痛的發生）、手術相關結果（再次入院、行走的能力）、住院相關結果（住院時間、花費）。我們對於 US 引導治療急性疼痛的有前景的新穎應用也予以了討論。

**結果:** 我們納入了比較 US 引導與或不與外周神經刺激器聯用、單用外周神經刺激器和應用解剖標誌技術的 23 項隨機對照試驗，共 1674 名患者。在 16 項評估了疼痛程度的研究中，8 項報導了 US 引導帶來的改善，但是僅1項研究報導了 US 引導與對照組有大於1個區間的數值分級疼痛評分的差異性。8 項研究評估了感覺阻滯的持續時間，其中 3 項報導了 US 引導的阻滯持續時間延長。7 項研究評估了阿
片類藥物的使用量，其中3項報導了US引導組的使用量減少。3項研究評估了首次需用鎮痛藥的時間，其中2項支援US引導技術。我們未發現US引導和傳統神經定位技術在其他相關結果上的差異性。我們未發現在任何結果上顯示US引導次於傳統的神經定位技術。非隨機的資料顯示US引導的腹橫肌平面的阻滯可能提供多於標準鎮痛治療的益處，但未與解剖學標誌定位阻滯技術相比。

結論：目前根據同時期的文獻報導沒有足夠的證據可用於定義US引導用於急性疼痛干預管理時與傳統神經定位技術比較對於急性疼痛及其相關結果的作用。

（毛祖旻譯馬皓琳李士通校）

BACKGROUND: Ultrasound (US) guidance for peripheral nerve blockade has gained popularity worldwide. The reported benefits of real-time sonographic visualization compared with traditional nerve localization techniques generally apply to procedural and technical block-related outcomes whereas acute pain–related outcomes are featured less prominently. In this review, we evaluated the effect of US guidance compared with traditional nerve localization techniques for interventional management of acute pain and acute pain–related outcomes.

METHODS: We performed a systematic search of MEDLINE, EMBASE, and the Cochrane Central Register of Controlled Clinical Trials (from January 1990 to January 2011) to identify randomized controlled trials evaluating the effects of US guidance on acute pain and related outcomes compared with traditional nerve localization techniques. Studies were excluded if they did not report at least one of the following acute pain outcomes: pain severity, opioid consumption, sensory block duration, and time to first analgesic request. Related outcomes were classified as follows: patient related (opioid-related adverse effects, patient satisfaction, postoperative cognitive deficit); anesthesia related (unwanted motor block, perineural catheter failure, morbidity, development of chronic pain); surgery related (hospital readmission, ability to ambulate); and hospital related (length of stay, cost). Promising novel applications of US guidance for acute pain management were also sought for discussion purposes.

RESULTS: We identified 23 randomized controlled trials, including 1674 patients, that compared US guidance with and without peripheral nerve stimulation with peripheral nerve stimulation alone or anatomical landmark techniques. Of the 16 studies that evaluated pain severity, 8 reported improvement with US guidance; however, only 1 study reported a difference between US guidance and the comparator of >1 interval on the numeric rating pain scale. Eight studies evaluated sensory block duration and 3 of these reported prolonged block duration with US guidance. Seven studies evaluated opioid consumption, of which 3 reported a reduction with US guidance. Three studies evaluated time to first analgesic request, of which 2 favored US guidance. We uncovered no significant differences between US guidance and traditional nerve localization techniques for any other related outcome. US guidance was not found to be inferior compared with traditional nerve localization techniques for any outcome. Nonrandomized data suggest that US-guided transversus abdominis plane blocks may offer analgesic benefit over standard analgesic therapy, but has not been compared with an anatomical landmark technique.

CONCLUSIONS: At present, there is insufficient evidence in the contemporary literature to define the effect of US guidance on acute pain and related outcomes.
compared with traditional nerve localization techniques for interventional acute pain management.

**A Comparison of Different Dosages of a Continuous Preperitoneal Infusion and Systemic Administration of Ropivacaine After Laparotomy in Rats**

Toni Kfoury, MD*, Jean-Xavier Mazoit, MD, PhD*, Michael Schumacher, PhD†, Dan Benhamou, MD* and Helene Beloeil, MD, PhD*

From the *Université Paris—Sud, Laboratoire d'Anesthesie, INSERM U788, Le Kremlin Bicêtre, France; and †UMR 788, INSERM, and Université Paris—Sud 11, Le Kremlin Bicêtre Cedex, France.

Anesth Analg September 2011 113:617-625

**INTRODUCTION:** To further explain the mechanisms of action involved in the analgesic effect of a local anesthetic wound infusion, we evaluated parietal and visceral sensitivity as well as indices of inflammation after laparotomy and administration of a local anesthetic. Ropivacaine was administered at different dosages by a continuous infusion using a multiholed catheter in the preperitoneal position or systemically in rats.

**METHODS:** Nine groups of rats received 2 injections after laparotomy or sham surgery: (1) a bolus injection (ropivacaine or saline) via a preperitoneal catheter and (2) an IM injection (ropivacaine or saline). These injections were followed by a continuous infusion (ropivacaine or saline) in the preperitoneal catheter for 24 hours and 1 IM injection every 8 hours. Mechanical and visceral thresholds after stimulation were evaluated 3 times during the 48 hours after surgery. Stimulated production of tumor necrosis factor α, and interleukin 1β in whole-blood cultures were measured by enzyme-
RESULTS: Preperitoneal infusion of high doses of ropivacaine and systemic ropivacaine similarly prevented mechanical and visceral sensitivity alterations and led to a better functional recovery. The analgesic effect of systemic administration was associated with an anti-inflammatory effect.

CONCLUSION: In the current study, high-dose ropivacaine administered via a preperitoneal infusion or systemic boluses had the same effect on mechanical and visceral sensitivity after laparotomy. Moreover, systemic administration was associated with an anti-inflammatory effect. The merits of the comparable benefit of systemic and high-dose preperitoneal infusion of ropivacaine need to be confirmed with further studies.
facilitating this direct nose-to-CNS transfer. If the fraction of opioid administered to the olfactory region could be improved, there could be a larger fraction of drug directly delivered to the CNS, mediating greater therapeutic benefit.

**METHODS:** We have developed a pressurized olfactory delivery (POD) device to consistently and noninvasively deposit a majority of drug on the olfactory region of the nasal cavity in Sprague-Dawley rats. Using the tail-flick latency test and analysis of plasma and CNS tissue drug exposure, we compared distribution and efficacy of the opioids morphine and fentanyl administered to the nasal olfactory region with the POD device or the nasal respiratory region with nose drops or systemically via intraperitoneal injection.

**RESULTS:** Compared with nose drop administration, POD administration of morphine resulted in a significantly higher overall therapeutic effect (area under the curve [over the time course] \([AUC]_{\text{effect}}\)) without a significant increase in plasma drug exposure \((AUC_{\text{plasma}})\). POD of morphine resulted in a nose-to-CNS direct transport percentage of 38% to 55%. POD of fentanyl led to a faster (5 vs 10 minutes) and more intense analgesic effect compared with nasal respiratory administration. Unlike intraperitoneal injection or nose drop administration, both morphine and fentanyl given by the POD device to olfactory nasal epithelium exhibited clockwise (plasma) versus effect hysteresis after nasal POD administration, consistent with a direct nose-to-CNS drug transport mechanism.

**CONCLUSIONS:** Deposition of opioids to the olfactory region within the nasal cavity could have a significant impact on drug distribution and pharmacodynamic effect, and thus should be considered in future nasally administered opioid studies.
Assessment of diastolic function should be a component of a comprehensive perioperative transesophageal echocardiographic examination. Abnormal diastolic function exists in >50% of patients presenting for cardiac and high-risk noncardiac surgery, and has been shown to be an independent predictor of adverse postoperative outcome. Normalcy of systolic function in 50% of patients with congestive heart failure implicates diastolic dysfunction as the probable etiology. Comprehensive evaluation of diastolic function requires the use of various, load-dependent Doppler techniques This is further complicated by the additional effects of dehydration and anesthetic drugs on myocardial relaxation and compliance as assessed by these Doppler measures. The availability of more sophisticated Doppler techniques, e.g., Doppler tissue imaging and flow propagation velocity, makes it possible to interrogate left ventricular diastolic function with greater precision, analyze specific stages of diastole, and to differentiate abnormalities of relaxation from compliance. Additionally, various Doppler-derived ratios can be used to estimate left ventricular filling pressures. The varying hemodynamic environment of the operating room mandates modification of the diagnostic algorithms used for ambulatory cardiac patients when left ventricular diastolic function is evaluated with transesophageal echocardiography in anesthetized surgical patients.

Gamma-Aminobutyric Acid Type A Receptor β3 Subunit Forebrain-Specific Knockout Mice Are Resistant to the Amnestic Effect of Isoflurane
Vinuta Rau, PhD*, Irene Oh, BA†, Mark Liao, BS‡, Christina Bodarky, BS*, Michael S. Fanselow, PhD‡, Gregg E. Homanics, PhD§, James M. Sonner, MD* and Edmond I Eger II, MD*
From the *Department of Anesthesia, University of California, San Francisco; †University of California, San Francisco; ‡University of California, Los Angeles; §Department of Anesthesiology, University of Pittsburgh, Pittsburgh, Pennsylvania; and ‡El Camino Hospital, Mountain View, California.
Anesth Analg September 2011 113:500-504;

背景：包括γ-氨基丁酸 A 型受体（GABA_A-Rs）的 β3 介導靜脈麻醉藥的作用，如制動和催眠。前腦目標區域敲除了 GABA_A-Rs 的 β3 亞基的實驗鼠對依託咪酯的催眠效果敏感性降低，表現出測量時翻正反射消失。在這種條件性敲除下，由吸入麻酔藥產生的遺忘和制動作用尚未評估。

方法：作者通過對前腦選擇性 β3 條件敲除的實驗鼠及作爲對照的同窩出生鼠條件性恐懼的測試，來評估組間吸入性麻醉藥對傷害性刺激產生不動性的遺忘和最小肺泡濃度的差異，即不動性方面的差異。評估依託咪酯和異氟醚對條件恐懼的抑制，評估異氟醚的 MAC。
結果: 依託咪酯對兩種基因型產生同樣的條件恐懼抑制。相對於同窩出生鼠，被敲除的實驗鼠表現出了對由異氟醚產生的條件恐懼抑制的抵抗力。在異氟醚 MAC 值方面，對照組和試驗組沒有不同。

結論: 這些結果表明異氟醚而不是依託咪酯能抑制前腦與記憶相關的海馬區包含 GABAₐ-Rs 的 β3 作用。

背景: β3 含有 γ-氨基丁酸酸型 A 受體 (GABAₐ-Rs) 介導行為終點的 IV 安靜剝如不動和催眠。一齣基因型小鼠中靶點前腦剔除的 β3 子單位的 GABAₐ-Rs 表現了對異氟醚的催眠抑制的抗性，這在與同窩出生的對照組相比有統計學意義。小鼠在 GB₂ₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐ$_{\text{ART}}$ 和 ΔPₚ₀₄₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀¢ₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐ$_{\text{ART}}$ 和 ΔPₚ₀₄₄₀₄₀₄₀₄₀₄₀₄₀₄₀₄₀¢ₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐ$_{\text{ART}}$ 一樣，能預測全麻機械通氣患者的液體治療反應性。

方法: 35 例行血管手術全身麻醉誘導後的患者使用 6% 經乙基澱粉 130/0.4（500 毫升）進行擴容 (VE)。擴容前後記錄由 Vigileo™/ FloTrac™（Edwards Lifesciences, Irvine, CA）測量每搏輸出量 (SV)、ΔPₚ₀₄₄₀₄₀₄₀₄₀¢ₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐₐ$_{\text{ART}}$ 和 ΔPₚ₀₄₄₀₄₀¢ₐₐₐₐₐₐ$_{\text{ART}}$ 資料。如 SV 擴容後增加 ≥15%，則受試者被認定為有反應。
結果：20例患者有擴容反應，15例無擴容反應。擴容前ΔPP_{ART} and ΔPP_{CNAP}之間的相關係數為 R = 0.90 (95%可信區間[CI] = 0.84-0.96, P <0.0001)。有擴容反應者的ΔPP_{ART}和ΔPP_{CNAP}數值在擴容之前顯著高於無反應患者(P < 0.0001)。擴容前ΔPP_{ART}和ΔPP_{CNAP}數值與擴容後SV增加百分比之間有顯著關係（分別為，r² = 0.50; P < 0.0001和r² = 0.57; P < 0.0001）。擴容前，ΔPP_{ART}數值>10%區分有擴容反應者與無擴容反應者，靈敏度為90%（95%CI = 69%-99%），特異性為87%（95%CI = 60%-98%）。ΔPP_{ART}受試者特徵（ROC）曲線下面積為0.957 ± 0.035。擴容前，ΔPP_{CNAP}數值>11%區分有擴容反應者與無擴容反應者，靈敏度為85%（95%CI = 62%-97%），特異性為100%（95%CI = 78%-100%）。ΔPP_{CNAP}ROC曲線下面積為0.942 ± 0.040。ΔPP_{ART}和ΔPP_{CNAP}ROC曲線面積間無顯著差異。

結論：用ΔPP_{CNAP} > 11%預測全麻下前負荷依賴的機械通氣患者有無擴容反應，其敏感性至少有62%。（陳毓雯譯 陳傑校）

BACKGROUND: Respiratory-induced pulse pressure variations obtained with an arterial line (ΔPP_{ART}) indicate fluid responsiveness in mechanically ventilated patients. The Infinity® CNAP™ SmartPod® (Dräger Medical AG & Co. KG, Lübeck, Germany) provides noninvasive continuous beat-to-beat arterial blood pressure measurements and a near real-time pressure waveform. We hypothesized that respiratory-induced pulse pressure variations obtained with the CNAP system (ΔPP_{CNAP}) predict fluid responsiveness as well as ΔPP_{ART} predicts fluid responsiveness in mechanically ventilated patients during general anesthesia.

METHODS: Thirty-five patients undergoing vascular surgery were studied after induction of general anesthesia. Stroke volume (SV) measured with the Vigileo™/FloTrac™ (Edwards Lifesciences, Irvine, CA), ΔPP_{ART}, and ΔPP_{CNAP} were recorded before and after intravascular volume expansion (VE) (500 mL of 6% hydroxyethyl starch 130/0.4). Subjects were defined as responders if SV increased by ≥15% after VE.

RESULTS: Twenty patients responded to VE and 15 did not. The correlation coefficient between ΔPP_{ART} and ΔPP_{CNAP} before VE was r = 0.90 (95% confidence interval [CI] = 0.84–0.96; P < 0.0001). Before VE, ΔPP_{ART} and ΔPP_{CNAP} were significantly higher in responders than in nonresponders (P < 0.0001). The values of ΔPP_{ART} and ΔPP_{CNAP} before VE were significantly correlated with the percent increase in SV induced by VE (respectively, r² = 0.50; P < 0.0001 and r² = 0.57; P < 0.0001). Before VE, a ΔPP_{ART} >10% discriminated between responders and nonresponders with a sensitivity of 90% (95% CI = 69%-99%) and a specificity of 87% (95% CI = 60%-98%). The area under the receiver operating characteristic (ROC) curve was 0.957 ± 0.035 for ΔPP_{ART}. Before VE, a ΔPP_{CNAP} >11% discriminated between responders and nonresponders with a sensitivity of 85% (95% CI = 62%-97%) and a specificity of 100% (95% CI = 78%-100%). The area under the ROC curve was 0.942 ± 0.040 for ΔPP_{CNAP}. There was no significant difference between the area under the ROC curve for ΔPP_{ART} and ΔPP_{CNAP}.

CONCLUSIONS: A value of ΔPP_{CNAP} >11% has a sensitivity of at least 62% in predicting preload-dependent responders to VE in mechanically ventilated patients during general anesthesia.
The Effect of Altering Skin-Surface Cooling Speeds on Vasoconstriction and Shivering Thresholds
Yoshie Taniguchi, MD†, Rainer Lenhardt, MD‡, Daniel I. Sessler, MD* and Andrea Kurz, MD*
From the *Department of Outcomes Research, Cleveland Clinic, Cleveland, Ohio; †Department of Anesthesia, University of Bern, Bern, Switzerland; and ‡Department of Anesthesiology and Perioperative Medicine, University of Louisville, Louisville, Kentucky.
Anesth Analg September 2011 113:540-544;

BACKGROUND: Both core and skin temperatures contribute to steady-state thermoregulatory control. Dynamic thermoregulatory responses trigger aggressive defenses against rapid thermal perturbations. These responses potentially complicate interpretation of thermoregulatory studies and could slow induction of therapeutic hypothermia. We thus tested the hypothesis that rapid external skin-cooling triggers vasoconstriction and shivering at higher mean skin temperatures than slow or moderate rates of skin cooling.

METHODS: Eleven healthy volunteers were cooled at 3 skin-cooling rates using forced air or/and conductive cooling in random order. One day volunteers received slow (~2°C/h) skin cooling, and on another day, they received both medium (~4°C/h) and fast (~6°C/h) skin cooling. An endovascular heat-exchanging catheter maintained core temperature. Fingertip blood flow ≤0.25 ml/min defined onset of vasoconstriction; sustained ≥25% increase in oxygen consumption defined onset of shivering. Results were evaluated with repeated-measures analysis of variance, with P < 0.05 representing statistical significance.

結論：對於3種不同的降溫速度，開始發生血管收縮或寒戰時，其體表溫度相似。積極地體表降溫可以用於體溫調節研究以及指導治療性低體溫而沒有引起令人難以接受的體溫調節的防禦反應。
(張婷譯 陳傑校)
RESULTS: Volunteers were 25 ± 5 years of age (mean ± SD), 175 ± 7 cm tall, and weighed 63 ± 10 kg. Core temperature remained constant (~37°C) throughout each study day. At vasoconstriction, mean skin temperatures were 33.2°C (95% confidence interval [CI]: 32.0°C, 34.4°C), 33.5°C (95% CI: 32.3°C, 34.7°C), and 33.0°C (95% CI: 31.4°C, 34.6°C) at slow, medium, and fast skin-cooling rates, respectively. Mean skin temperatures at shivering were also comparable: 31.4°C (95% CI: 30.3°C, 32.5°C), 31.5°C (95% CI: 30.2°C, 32.8°C), and 30.7°C (95% CI: 28.9°C, 32.5°C), respectively.

CONCLUSIONS: Onset of vasoconstriction and shivering occurred at similar mean skin temperatures with all 3 cooling rates. Aggressive surface cooling can thus be used in thermoregulatory studies and for induction of therapeutic hypothermia without provoking dynamic thermoregulatory defenses.
be neuroprotective against brain ischemia/reperfusion, would be neuroprotective in a rat spinal cord ischemia/reperfusion model.

**METHODS:** Rats were randomly assigned to simvastatin, vehicle, or sham-surgery (sham) groups (n = 6 per group). Simvastatin (10 mg/kg) or vehicle was administered subcutaneously once daily for 7 days before aortic balloon occlusion, and once at 24 hours after reperfusion. Spinal cord ischemia was induced by balloon inflation of a 2F Fogarty catheter in the thoracic aorta, and the proximal mean arterial blood pressure was maintained at 40 mm Hg for 12 minutes. The sham group received the same operation without inflation of the balloon. Ischemic injury was assessed by hindlimb motor function using the Motor Deficit Index score at 6 to 48 hours after ischemic reperfusion, and histological assessment of the spinal cord was performed 48 hours after reperfusion.

**RESULTS:** The Motor Deficit Index scores at 24 and 48 hours after reperfusion were significantly improved in the simvastatin group compared with the vehicle group (P = 0.021 and P = 0.023, respectively). Furthermore, there were significantly more normal motor neurons in the simvastatin group than in the vehicle group (P = 0.037). The percentage area of white matter vacuolation was significantly smaller in the simvastatin group than in the vehicle group (P = 0.030).

**CONCLUSIONS:** Simvastatin treatment can attenuate hindlimb motor dysfunction and histopathological changes in spinal cord ischemia/reperfusion injury in rats.

**早期胸交感神經阻滯提高上肢神經病理性疼痛的療效**
Early Thoracic Sympathetic Block Improves the Treatment Effect for Upper Extremity Neuropathic Pain

Hyung Seok Yoo, MD*, Francis Sahngun Nahm, MD†, Pyung Bok Lee, MD† and Chul Joong Lee, MD‡

From the *Department of Anesthesiology and Pain Medicine, School of Medicine, Kyung Hee University, Seoul; †Department of Anesthesiology and Pain Medicine, Seoul National University Bundang Hospital, Seongnam; and ‡Samsung Seoul Hospital, Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul, Korea. Hyung Seok Yoo, MD, is currently affiliated with Bumin Hospital, Seoul, Korea. Chul Joong Lee, MD, is currently affiliated with ZEIN (zeropain) Pain Treatment Clinic, Seoul, Korea.

Anesth Analg September 2011 113:605-609

**背景：** 交感神經系統在介導多種神經病理性疼痛中發揮重要的作用。胸交感神經阻滯（thoracic sympathetic block，TSB）對上肢和胸部的神經病理性疼痛具有良好的治療作用。然而，未有研究評估過促進 TSB 治療作用的相關因素。本次研究評估了 TSB 產生良好預後作用的影響因素，並確定臨床上重要的影響預後的因素。

**方法：** 對 51 位患者在 X 線引導下實施經皮 TSB，並採集每位患者的年齡、性別、體重指數、診斷、疼痛強度和症狀的持續時間。用 logistic 回歸計算每個變數的調整後的比值比和 95%置信區間。

**結果：** 相比於症狀持續時間長於 1 年的患者，TSB 對持續時間小於或等於 1 年的患者的效果更好（P=0.006，比值比，8.037，95%置信區間為 1.808-35.729）。患者的年齡、性別、體重指數、診斷和 TSB 前患者的疼痛強度與 TSB 療效不相關。
BACKGROUND: The sympathetic nervous system has important roles in mediating many neuropathic pain conditions. A thoracic sympathetic block (TSB) is a useful therapeutic procedure for neuropathic pain in the upper extremities and thorax. However, no studies have examined the factors related to an improved therapeutic effect of TSB. In this study, we evaluated the influence of potential prognostic factors for a better TSB effect and identified clinically important prognostic factors.

METHODS: Percutaneous TSB was performed in 51 patients, under fluoroscopic guidance. Data collected for each patient included age, gender, body mass index, diagnosis, pain intensity, and symptom duration. The adjusted odds ratios and 95% confidence intervals for each variable were calculated by logistic regression.

RESULTS: TSB was more effective in patients with symptom durations of ≤1 year compared with >1 year (P = 0.006; odds ratio, 8.037; 95% confidence interval, 1.808–35.729). Patient age, gender, body mass index, diagnosis, and intensity of pre-TSB pain were not associated with TSB effectiveness.

CONCLUSION: The results showed that an earlier TSB produced a better outcome for patients with chronic pain syndrome. Thus, early TSB should be performed in patients with chronic pain in the upper extremities.

高壓氧療緩解慢性壓迫性損傷所致神經性疼痛，並減少腫瘤壞死因數α產生

Hyperbaric Oxygenation Therapy Alleviates Chronic Constrictive Injury–Induced Neuropathic Pain and Reduces Tumor Necrosis Factor–Alpha Production
Fenghua Li, MD*, Lili Fang, MD*, Shiwei Huang, MD*, Zhongjin Yang, MD*, Jyotirmoy Nandi, PhD*, Sebastian Thomas, MD†, Chung Chen, PhD‡ and Enrico Camporesi, MD§
From the *Department of Anesthesiology, Upstate Medical University; †Pain Treatment Center, Department of Anesthesiology, Upstate Medical University, Syracuse; ‡Department of Finance, Whitman School of Management, Syracuse University, Syracuse, New York; and §Department of Anesthesiology and Critical Care Medicine, University of South Florida, Tampa, Florida.
Anesth Analg September 2011 113:626-633;

背景：慢性壓迫性損傷（CCI）後的痛覺過敏和痛覺異常的發展與腫瘤壞死因子α（TNF-α）和白細胞介素（IL）-1β顯著增加有關。從理論上講，如果可以減少TNF-α和/或IL-1β的產生，就可以緩解神經性疼痛綜合征。最近，有建議表明高壓氧治療(HBOT)對於疼痛疾病中有治療作用。本研究旨在探討以下假說：（1）CCI誘導的神經性疼痛可能與TNF-α和IL-1β產生增加有關，（2）高壓氧治療可能能夠緩解CCI引起的神經性疼痛，以及（3）神經性疼痛的緩解可能與TNF-α和/或IL-1β產生無明顯相關。

方法：對男性大鼠（體重250-300克）用氯胺酮和甲苯噻嗪行麻醉誘導。從股二頭肌暴露坐骨神經。手術組，在坐骨神經三個分支部近端，4根結紮線鬆散地系在神經周圍。在假手術組，同樣暴露坐骨神經但不進行結紮。通過von Frey細絲刺激
和丙酮傳播分別測試機械性痛覺異常和冷痛覺異常。HBO的大鼠（N = 18）每天一次暴露於2.4個大氣壓的純氧1小時。非HBO（N = 18）和假手術大鼠（N = 6）被放置在高壓氧治療室呼吸空氣。用ELISA法檢測坐骨神經中的TNF-α和IL-1β。用Western blot分析組織勻漿中腫瘤壞死因子-α蛋白的存在。

結果：CCI後第4和第7天測量CCI誘發的顯著冷和機械性痛覺異常。HBO大鼠中冷痛覺異常出現頻率顯著低於非HBO組。第4天和第7天的比值分別為20%±1.6%比50%±4.5%；和40%±4.6%比70%±4.5%（F = 87.42，置信區間[HBO和非HBO的差異]= 29.612±8.781，第4和第7天的P<0.05）。與非HBO的大鼠相比，HBO大鼠機械性痛覺異常的閾值顯著增加。第4天和第7天的比值分別為6.20±0.9 VS 4.1±0.9 g和4.2±0.5 VS 2.3±0.4 g（F = 18.8，置信區間[HBO和非HBO的差異]= 1.806±1.171，第4和第7天的P<0.05）。非HBO組大鼠TNF-α含量顯著高於假手術組大鼠，第4天（17.89±0.83比10.66±1.1 pg/mg蛋白，P<0.05）和第7天（18.97±1.57比9.09±1.5 pg/mg蛋白，P<0.05）。高壓氧治療後TNF-α含量顯著降低到的假手術大鼠組水準左右，第4天和第7天分別為10.94±2.78和11.32±2.98 pg/mg蛋白水準（與非HBO組相比P<0.05）。Western blot分析證實大鼠坐骨神經勻漿中存在分子量為51 kDa的蛋白質。於假手術組相比，非HBO的大鼠中IL-1β含量也顯著增高，第4天和第7天分別為（636±74 VS 256±31 pg/mg蛋白，P<0.05）（687±89 VS 288±35 pg/mg蛋白，P<0.05）。在HBO大鼠中，高壓氧治療對IL-1β含量沒有影響，第4天和第7天分別為671±85 pg/mg蛋白和672±75 pg/mg蛋白（與非HBO的大鼠相比P不顯著）。

結論：這些資料表明，高壓氧治療能夠緩解CCI引起的神經性疼痛，並且抑制期間內源性腫瘤壞死因子-α的產生，但對IL-1β的產生沒有影響。腫瘤壞死因子-α產生的減少，可能至少部分對於高壓氧治療的治療作用有一定作用。

(懷曉蓉譯 陳傑校)

BACKGROUND: The development of hyperalgesia and allodynia after chronic constrictive injury (CCI) is associated with significantly increased tumor necrosis factor (TNF)-α and interleukin (IL)-1β. Theoretically, if the production of TNF-α and/or IL-1β could be reduced, neuropathic pain syndrome may be alleviated. Recently, a beneficial effect of hyperbaric oxygenation therapy (HBOT) in the treatment of pain disorders has been suggested. Our present study was designed to examine the hypotheses that (1) CCI-induced neuropathic pain may be associated with increased production of TNF-α and IL-1β, (2) HBOT may alleviate CCI-induced neuropathic pain, and (3) the alleviated neuropathic pain may be associated with reduced production of TNF-α and/or IL-1β.

METHODS: Male rats (weighing 250–300 g) were anesthetized with ketamine and xylazine. The common sciatic nerve was exposed through the biceps femoris. Proximal to the sciatic’s trifurcation, 4 ligatures were loosely tied around the nerve. In the sham group, an identical dissection was performed without ligation of the sciatic nerve. Mechanical allodynia and cold allodynia were tested by von Frey filament stimulation and the spread of acetone, respectively. HBO rats (n =18) were exposed to pure oxygen for 1 hour at 2.4 atm once a day. Non-HBO (n =18) and sham rats (n =6) were placed in the HBOT chamber breathing air. TNF-α and IL-1β in the sciatic nerve were assayed with ELISA. The presence of TNF-α protein in homogenates was verified by Western blot analysis.
RESULTS: CCI induced significant cold and mechanical allodynia as measured after CCI on days 4 and 7. The cold allodynia response frequency was significantly lower in HBO rats than in non-HBO rats. The values were 20% ± 1.6% vs 50% ± 4.5% on day 4 and 40% ± 4.6% vs 70% ± 4.5% on day 7 ($F = 87.42$, confidence interval [for the difference between HBO and non-HBO]= $29.612 ± 8.781$, $P < 0.05$ for day 4 and day 7). The threshold of mechanical allodynia significantly increased in HBO rats compared with non-HBO rats. The values were 6.20 ± 0.9 vs 4.1 ± 1.0 g on day 4 and 3.82 ± 0.5 vs 2.3 ± 0.4 g on day 7 ($F = 18.8$, confidence interval [for the difference between HBO and non-HBO]= $1.806 ± 1.171$, $P < 0.05$ for day 4 and day 7). TNF-α content was significantly higher in non-HBO rats than in sham rats on day 4 (17.89 ± 0.83 vs 10.66 ± 1.1 pg/mg protein, $P < 0.05$) and day 7 (18.97 ± 1.57 vs 9.09 ± 1.5 pg/mg protein, $P < 0.05$). HBOT significantly reduced TNF-α content to near the level in sham rats, which was 10.94 ± 2.78 and 11.32 ± 2.98 pg/mg protein on day 4 ($P < 0.05$ versus non-HBO) and 7 ($P < 0.05$ versus non-HBO), respectively. Western blot analysis confirmed the presence of proteins with molecular weights of 51 kDa in the rat sciatic nerve homogenates. IL-1β content was also significantly higher in non-HBO rats than in sham rats on day 4 (636 ± 74 vs 256 ± 31 pg/mg protein, $P < 0.05$) and on day 7 (687 ± 89 vs 288 ± 35 pg/mg protein, $P < 0.05$). HBOT had no effect on IL-1β content, which was 671 ± 85 pg/mg protein on day 4 and 672 ± 75 pg/mg protein on day 7 in HBO rats ($P =$ not significant versus non-HBO rats).

CONCLUSION: These data show that HBOT alleviates CCI-induced neuropathic pain and inhibits endoneuronal TNF-α production, but not IL-1β in CCI-induced neuropathic pain. Reduced TNF-α production may, at least in part, contribute to the beneficial effect of HBOT.

A New Animal Model of Trigeminal Neuralgia Produced by Administration of Cobra Venom to the Infraorbital Nerve in the Rat

Jian-Xiong An, MD*, Ying He, MD*, Xiao-Yan Qian, CRNA, BSN§, Jian-Ping Wu, MD§, Yi-Kuan Xie, BS†, Qu-Lian Guo, MD, PhD*, John P. Williams, MD‡, and Doris K. Cope, MD‡

From the Department of Anesthesiology, Central South University Xiangya Hospital, Changsha, China; †Institute of Basic Medical Sciences, Chinese Academy of Medical Sciences, Beijing, China; ‡Department of Anesthesiology, University of Pittsburgh School of Medicine, Pittsburgh, PA; and §Department of Anesthesiology, Pain Medicine & Critical Care Medicine, China Medical University Hangkong General Hospital, Beijing, China.

Anesth Analg September 2011 113:652-656

背景：建立嚴格類比三叉神經痛的特定類型特徵的實驗室動物模型可闡明三叉神經痛的機制。作者已經建立了注射克痛寧至眶下神經（ION）主幹的三叉神經痛實驗動物模型。

方法：選擇雄性 SD 大鼠，在眶下神經主幹注射克痛寧或者生理鹽水。手術後連續幾天都在眶下神經主幹區域進行機械性刺激。在雙側面部區域測量 90 天得到機械閾值。用伊文思藍染料測定眶下神經區域的血管通透性。
BACKGROUND: Understanding the mechanism of trigeminal neuralgia may be elucidated by developing laboratory animal models that closely mimic the features of this specific type of neuropathic pain. We have developed an experimental animal model for trigeminal neuralgia using a technique of injecting cobra venom into the infraorbital nerve (ION) trunk.

METHODS: Male Sprague-Dawley rats were subjected to the administration of cobra venom or saline into the ION trunk. Mechanical stimuli were applied to the ION territory in consecutive days after surgery. Mechanical thresholds were measured over a 90-day period on the bilateral facial region. Vascular permeability in the ION territory was measured using Evans blue dye.

RESULTS: The cobra venom–treated rats developed mechanical allodynia 3 days after surgery that lasted for 60 days postoperatively at the ipsilateral side. The mechanical thresholds of the contralateral ION territory also showed a profound decrease but were sustained for only approximately 30 days. There was no change of mechanical thresholds in the control groups. The extravasation of Evans blue increased significantly in the skin after administration of cobra venom to the ION compared with control rats (P < 0.05).

CONCLUSION: The cobra venom model may provide a reasonable model for investigating the mechanism of trigeminal neuropathic pain.

簡報：術中小劑量氯胺酮可預防瑞芬太尼引起的麻醉後寒戰

Brief report: an intraoperative small dose of ketamine prevents remifentanil-induced postanesthetic shivering.

Masato Nakasuji, MD, Mitsuyo Nakamura, MD, Norie Imanaka, MD, Masuji Tanaka, MD, Masatako Nomura, MD and Soon Hak Suh, MD
From the Department of Anesthesiology, Kansai Denryoku Hospital, Osaka, Japan.

將接受婦科開腹手術的患者隨機分成兩組，一组于麻醉誘導時給予 0.5mg/kg 氯胺酮，並以 0.3mg/kg/h 的速率持續輸注氯胺酮至手術結末（氯胺酮組，n=32），另一組則接受同等容量的生理鹽水（對照組，n=32）。通過靜脈注射異丙酚、恆速輸注瑞芬太尼（0.25ug/kg/min）及硬膜外給予羅呱卡因維持麻醉。對蘇醒後 30 分鐘內的麻醉後寒戰（PAS）進行評估。研究顯示，兩組患者的術中體溫較為接近。但較對照組（n=12.38%，P=0.005）而言，氯胺酮組患者發生麻醉後寒戰的幾率明顯減少（n=2.6%）。故本研究推論，在術後恢復早期，術中使用氯胺酮可預防瑞芬太尼引起的麻醉後寒戰

（范羽譯 薛張綱校）
Patients undergoing gynecological laparotomy were randomized to receive either 0.5 mg/kg ketamine at induction of anesthesia followed by an infusion of 0.3 mg/kg/h until
the end of surgery (ketamine group, n = 32), or an equivalent volume of normal saline (control group, n = 32). Anesthesia was maintained with IV propofol, a fixed infusion rate of remifentanil (0.25 μg/kg/min), and epidural ropivacaine. Postanesthetic shivering (PAS) was evaluated for 30 minutes after emergence. Intraoperative temperatures were similar between the 2 groups. The incidence of PAS was less frequent in the ketamine group (n = 2, 6%) compared with the control group (n = 12, 38%, P = 0.005). We conclude that, during the early recovery phase, intraoperative ketamine reduces remifentanil-induced PAS.

Ketamine and remifentanil interactions on the sevoflurane minimum alveolar concentration and acute opioid tolerance in the rat.

Delia Aguado, DVM*, Mariana Abreu, DVM*, Javier Benito, DVM†, Javier García-Fernández, MD, PhD‡ and Ignacio A. Gómez de Segura, DVM, PhD, DECLAM, DECVA*

From the *Department of Animal Medicine and Surgery, Veterinary Faculty, Complutense University of Madrid, Madrid, Spain; †Comparative Pain Research Laboratory, Department of Clinical Sciences, College of Veterinary Medicine, North Carolina State University, Raleigh; ‡Department of Pediatric Anesthesiology, La Paz University Hospital, Madrid, Spain.

Anesth Analg September 2011 113:505-512

背景：小剂量氯胺酮具有镇痛和抗痛觉过敏的性质，被用来同阿片类药物合用但也可用于治疗阿片类所致的痛觉过敏及阿片类耐受时。我们对氯胺酮与瑞芬太尼联合小鼠七氟醚麻醉的 MAC 值的相互影响，以及氯胺酮是否可以阻断急性阿片类耐受进行了研究。

方法：用七氟醚麻醉大鼠，监测单独给氯胺酮前及后（10, 20, 40及80mg/kg) 或氯胺酮联合瑞芬太尼(120及240 μg/kg)时七氟醚的 MAC 值。另一组在开始瑞芬太尼注射后给予最低剂量氯胺酮。最后，用纳洛酮检测氯胺酮是否在作用于阿片受体。监测气管内气体样本获得 MAC 值，并钳夹老鼠尾部产生超刺激。通过侧流气体制备监测呼气末麻醉气体浓度，并应用方差分析进行统计分析。

结果：氯胺酮及瑞芬太尼呈剂量依赖性降低小鼠七氟醚麻醉的 MAC 值。此外对氯胺酮加用小剂量瑞芬太尼有助于降低 MAC 值的降低。然而大剂量瑞芬太尼通过次加性形式加强氯胺酮降低 MAC 值的作用。然而，任何一种剂量的氯胺酮都不能阻止瑞芬太尼的急性阿片类耐受的作用。最后，纳洛酮阻断了氯胺酮降低 MAC 值的作用。

结论：发现对于降低老鼠七氟醚麻醉的 MAC 值，氯胺酮及瑞芬太尼彼此存在有次加作用。此外，氯胺酮不能阻断阿片类耐受。这个结果的临床意义在于减少未来的麻醉研究。

（侯文婷译 薛张纲校）
BACKGROUND: Ketamine is used at low doses for its analgesic and antihyperalgesic properties when combined with opioids but also when opioid-induced hyperalgesia and tolerance appear. In this study we determined the interaction of ketamine and remifentanil on the minimum alveolar concentration (MAC) of sevoflurane in rats and to determine whether ketamine may block acute opioid tolerance (AOT).

METHODS: Male Wistar rats were anesthetized with sevoflurane, and the MAC was determined before and after ketamine administration (10, 20, 40, and 80 mg kg(-1) or saline) alone or combined with remifentanil (120 and 240 μg kg(-1) h(-1), low and high doses, respectively). One additional group received the lowest ketamine dose after starting a remifentanil infusion. Finally, naloxone was administered to determine the potential action of ketamine on opioid receptors. MAC was determined from intratracheal gas samples, and tail clamping was used as a supramaximal stimulus. End-tidal anesthetic concentrations were assayed using a side stream gas analyzer. Statistical analysis was performed with an analysis of variance.

RESULTS: Ketamine and remifentanil dose-dependently reduced the MAC. Adding the low dose of remifentanil to ketamine did not improve the MAC reduction, whereas the high dose of remifentanil enhanced ketamine reduction in a subadditive fashion. Nevertheless, ketamine was unable to block the development of AOT to remifentanil at either dose. Finally, naloxone blocked the MAC reduction produced by ketamine.

CONCLUSIONS: A subadditive effect between ketamine and remifentanil was found on the sevoflurane MAC reduction rats. In addition, ketamine was unable to block AOT. The clinical relevance of these findings should be elucidated in future studies to reduce anesthetic requirements.
**RESULTS:** In all ventilators, the progressive diminution of the expiratory time caused a significant increase in PEEPi (P<0.001). With a 0.2-second expiratory time, PEEPi ranged from 9.4±0.07 cm H(2)O for the Servo i to 15.7±0.04 cm H(2)O for the Avea. The Servo i had a significantly lower inspiratory PTP than did the other ventilators (P<0.001). When the expiratory flow rate was 0.5 L/s and 1.0 L/s, the expiratory PTP was lower with the Servo i and Evita XL than with the other ventilators (P<0.001).

**CONCLUSIONS:** PEEPi varied significantly among ventilators. Inspiratory and expiratory work of breathing varied between ventilators when spontaneous breathing occurred during the ventilator's inspiratory phase.

**BACKGROUND:** Using a model lung connected to six different ventilators, with each ventilator in the airway pressure release ventilation mode, we measured differences in intrinsic positive end-expiratory pressure (PEEPi) during the expiratory phase and calculated the inspiratory and expiratory pressure time product (PTP) as an index of work of breathing during the inspiratory phase.

**METHODS:** We compared 6 ventilators: Puritan-Bennett 840, Evita XL, Servo i, Avea, Hamilton G5, and Engström. With a constant inspiratory pressure level of 25 cm H(2)O and expiratory pressure level of 0 cm H(2)O, PEEPi was measured as the expiratory time was decremented from 1.0 second to 0.2 second in steps of 0.1 second. The inspiratory and expiratory PTPs were measured during the ventilator's inspiratory phase by simulating spontaneous breathing with a tidal volume of 300 mL, with a respiratory rate of 30 breaths/min and with expiratory flow rates of 0.5 L/s, 1.0 L/s, and 1.5 L/s.

**RESULTS:** In all ventilators, the progressive diminution of the expiratory time caused a significant increase in PEEPi (P<0.001). With a 0.2-second expiratory time, PEEPi ranged from 9.4±0.07 cm H(2)O for the Servo i to 15.7±0.04 cm H(2)O for the Avea. The Servo i had a significantly lower inspiratory PTP than did the other ventilators (P<0.001). When the expiratory flow rate was 0.5 L/s and 1.0 L/s, the expiratory PTP was lower with the Servo i and Evita XL than with the other ventilators (P<0.001).

**CONCLUSIONS:** PEEPi varied significantly among ventilators. Inspiratory and expiratory work of breathing varied between ventilators when spontaneous breathing occurred during the ventilator's inspiratory phase.
Background: Current drugs for induction and maintenance of sedation in mechanically ventilated patients in the intensive care unit have limitations. Fospropofol, a prodrug of propofol, has not been studied as a sedative in the ICU setting.

Methods: In this randomized, open-label pilot study, patients received 1 of 3 regimens with a goal of maintaining a Ramsay Sedation Score of 2 to 5: (1) fospropofol IV infusion with a bolus and increased infusion rate for agitation events (infusion/bolus); (2) fospropofol IV infusion with an increased infusion rate for agitation events (infusion only); or (3) propofol IV infusion with an increased infusion rate for agitation events.

Results: Sixty patients received study drug and were included in the safety and efficacy analyses. Because incidence rates for adverse events were similar between fospropofol groups, and because the study was not powered to determine significant differences between treatment groups for safety variables, adverse events for both fospropofol groups were combined. In the fospropofol groups, 28 out of 38 patients (74%) experienced treatment-emergent adverse events in comparison with 14 out of 22 patients (64%) in the propofol group. The most common treatment-emergent adverse events with fospropofol were procedural pain (21.1%) and nausea (13.2%). Two patients (1 each in the fospropofol infusion/bolus and the propofol groups) experienced hypotension during the study as a potential sedation-related adverse event. Mean plasma formate levels were not significantly different among groups. Patients in all 3 treatment groups maintained Ramsay Sedation Scores of 2 to 5 for >90% of the time they were sedated.

Conclusion: This pilot study suggests that fospropofol, administered in either an infusion/bolus or infusion-only regimen, is tolerable and effective for short-term...
background and maintenance of sedation in mechanically ventilated intensive care unit patients.

全麻下開顱手術期間免疫細胞數量下降

Immune Cell Populations Decrease During Craniotomy Under General Anesthesia

Shujing Liu, MD, Baoguo Wang, PhD, Shuqin Li, MD, Yali Zhou, PhD, Lixin An, MD, Yajie Wang, PhD, Hong Lv, MD, Guojun Zhang, MD, Fang Fang, MD, Zhizhong Liu, PhD, Ruquan Han, PhD, Tao Jiang, PhD and Xixiong Kang, PhD

From Laboratory Diagnosis Center, Beijing Tiantan Hospital, Capital Medical University, Beijing, China.

Anesth Analg September 2011 113:572-577

背景：術後感染是神經外科重症監護醫學中常見和潛在致命的併發症。免疫損害是中樞神經系統手術後的感染和術後併發症的高危因素。我們研究的目的是探討開顱手術的患者在麻醉和手術中的免疫細胞的變化情況。

方法：選取接受吸入全麻的開顱手術患者。收集麻醉前 30min, 45min, 60min, 120min, 血液樣本，測定血液中性粒細胞，單核細胞和淋巴細胞計數，淋巴細胞亞群（T細胞，誘導和輔助性 T細胞，抑制和細胞毒性 T淋巴細胞，自然殺傷細胞，細胞和 B細胞）。隨著腫瘤壞死因數-α和干擾素γ白細胞介素（IL）-2，IL-4，IL-6 和 IL-10 的血漿濃度進行了測定。使用重複測量方差分析，由 Bonferroni 校正用 SPSS 13.0 軟體進行資料分析。

結果：18 例患者，在這項研究中。神經麻醉過程中的免疫細胞計數的比較，我們發現，在麻醉誘導後 30 分鐘，中性粒細胞，單核細胞和淋巴細胞減少 18% (95% 可信區間[CI]：11.0%-24.6%)，34% (95%CI：16.2%-51.1%)，和 39% (95% CI：29.0%-48.9%) 相比，麻醉前的水準。在拔管的中性粒細胞返回到基本水準。它還表明，自然殺傷細胞在麻醉期間顯著下降。外周血細胞因數的濃度沒有顯著改變。

結論：我們的研究結果表明，麻醉和手術，打亂了開顱手術過程中的免疫系統的平衡，免疫細胞數量顯著減少在全身麻醉誘導後出現的。

（陸麗虹譯 薛張綱校）

BACKGROUND: Postoperative infections are common and potentially fatal complications in neurosurgical intensive care medicine. An impairment of immune function after central nervous system surgery is associated with higher risk of infection and postoperative complications. The aim of our study was to investigate how the immune cell population changes during the anesthesia process in patients undergoing craniotomy surgery.

METHODS: Patients undergoing craniotomy who had an inhaled general anesthetic were studied. Blood samples were collected before anesthesia and 30, 45, 60, 120, and 240 minutes after anesthesia began. Blood counts for neutrophils, monocytes, and lymphocytes were determined along with lymphocyte subpopulations (T cells, inducer and helper T cells, suppressor and cytotoxic T cells, natural killer cells, and B cells). Plasma concentrations of interleukin (IL)-2, IL-4, IL-6, and IL-10 were also measured along with tumor necrosis factor-α and interferon-γ. Data were analyzed by SPSS 13.0
software using repeated-measures analysis of variance followed by a Bonferroni correction.

**RESULTS:** Eighteen patients were enrolled in this study. In the comparison of the immune cell counts during neuroanesthesia, we found that at 30 minutes after anesthesia induction, neutrophils, monocytes, and lymphocytes decreased 18% (95% confidence interval [CI]: 11.0%-24.6%), 34% (95% CI: 16.2%-51.1%), and 39% (95% CI: 29.0%-48.9%) compared with their levels before anesthesia. At extubation the neutrophils returned to the base level. It also showed that natural killer cells decreased significantly during anesthesia. The concentration of cytokines in peripheral blood did not change significantly.

**CONCLUSION:** Our results showed that anesthesia and surgery upset the balance of the immune system during craniotomy, and a significant decrease in immune cell populations emerged after induction under general anesthesia.

**對大鼠背根神經節應用脈衝射頻電流可調節神經損傷導致的觸痛覺過敏**

Application of pulsed radiofrequency currents to rat dorsal root Ganglia modulates nerve injury-induced tactile allodynia.

Danielle M. Perret, MD*†, Doo-Sik Kim, MD, PhD*‡, Kang-Wu Li, MD, PhD*, Karin Sinavsky, MD, MS*, Robert L. Newcomb, PhD§, Jason M. Miller, MD || and Z. David Luo, MD, PhD*#

From the *Department of Anesthesiology & Perioperative Care, #Department of Pharmacology, †Department of Physical Medicine & Rehabilitation, School of Medicine, and §Department of Statistics, University of California, Irvine, Irvine, California; ‡Kosin University School of Medicine, Republic of Korea; and || Pacific Pain Medicine, Oceanside, California.


**背景:** 報道稱對背根神經節(DRG)應用脈衝射頻(PRF)電流對明確的疼痛有緩解作用而不導致熱燒灼。在本實驗中，我們研究了對脊神經損傷相關的背根神經節(DRG)應用脈衝射頻(PRF)和在大鼠神經性疼痛模型中損傷誘導的行行為超敏反應的直接聯繫。

**方法:** 神經損傷透過結紮成年雄性斯普拉格-道利鼠的 L5 左側神經實施。當受傷大鼠發生觸痛覺過敏時，一組被指定對 L5 背根神經節(DRG)進行脈衝射頻(PRF)電流處理，另一組被指定對 L5 背根神經節(DRG)進行偽處理。在術前和指定的天數對試驗組和對照組使用 von Frey 繖毛測試對大鼠進行行行為測試。結果資料由線性混合模型進行分析來評價治療組間的總體差異和實驗天數間的總體差異。對治療後的 14 個實驗天中每天的配對基線差異得分計算出 Cohen’s d 統計值，這些度量出的作用程度被用來描述性對比每組中隨著時間變化的恢復模式。

**結果:** 脊神經損傷導致了左側(損傷側)足對 von Frey 繖毛刺激產生了行行為超敏反應(痛覺過敏)。混合線性模型顯示在處理後組間對照有顯著差異(P = 0.0079)，並且隨著時間過去，所有 12 個動物爪逃避閾值平均值均有顯著改變(P = 0.0006)。Cohen's d 評估顯示了脈衝射頻(PRF)治療後的動物展示了更好的恢復，相對於僞治療組在
BACKGROUND: Application of pulsed radiofrequency (PRF) currents to the dorsal root ganglia (DRG) has been reported to produce relief from certain pain states without causing thermal ablation. In this study, we examined the direct correlation between PRF application to DRG associated with spinal nerve injury and reversal of injury-induced behavioral hypersensitivity in a rat neuropathic pain model.

METHODS: Neuropathic lesioning was performed via left L5 spinal nerve ligation on male adult Sprague-Dawley rats. Once the injured rats had developed tactile allodynia, one group was then assigned to PRF treatment of the L5 DRG and another group was assigned to the sham treatment to the DRG. Behavioral testing was performed on both the control and treated paws using the von Frey filament test before the surgery and at indicated days. The resulting data were analyzed using a linear mixed model to assess the overall difference between the treatment groups and the overall difference among the study days. Cohen's d statistic was computed from paired difference-from-baseline scores for each of the 14 study days after treatment and these measures of effect size were then used to descriptively compare the recovery patterns over time for each study group.

RESULTS: Spinal nerve injury resulted in the development of behavioral hypersensitivity to von Frey filament stimulation (allodynia) in the hindpaw of the left (injury) side. Mixed linear modeling showed a significant difference between the treatment groups (P = 0.0079) and a significant change of paw withdrawal threshold means over time (P = 0.0006) for all 12 animals. Evaluation of Cohen's d (effect size) revealed that the PRF-treated animals exhibited better recovery and recorded larger effect sizes than the sham-treated animals on 10 of the 14 post-PRF treatment days and exhibited moderate-to-strong effects posttreatment at days 8 to 10 and at and beyond day 32.

CONCLUSION: Findings from this study support that PRF of the DRG causes reversal of nerve injury (spinal nerve ligation)-induced tactile allodynia in rats. This allodynia reversal indicates that nonablative PRF acting via modulation of the DRG can speed recovery in nerve injury-induced pain.

The Median Effective Dose of Ketamine and Gabapentin in Opioid-Induced Hyperalgesia in Rats: An Isobolographic Analysis of Their Interaction
Alain C. Van Elstraete, MD, Philippe Sitbon, MD, Dan Benhamou, MD and Jean-Xavier Mazoit, MD, PhD
From the Laboratoire d’Anesthésiologie, Université Paris-Sud, Le Kremlin-Bicêtre; Département d’Anesthésiologie, Institut Gustave Roussy, Villejuif; and Université Paris-Sud, Département d’Anesthésie-Réanimation, Hôpital de Bicêtre, Le Kremlin-Bicêtre, France.
BACKGROUND: Ketamine and gabapentin have been shown to prevent the delayed hyperalgesia induced by short-term use of systemic opioids. The mechanism of this action is believed to be likely at the spinal level, through an antagonism of the N-methyl-d-aspartate receptors for ketamine, and through a specific binding site for gabapentin. In this study, we sought to determine the nature of the interaction of these 2 mechanistically distinct antihyperalgesic drugs in a model of opioid-induced hyperalgesia in rats. The median effective antihyperalgesic doses of each drug and of their combination were first defined, to assess the nature of the interaction using an isobolographic analysis.

METHODS: Long-lasting hyperalgesia was induced in male Sprague Dawley rats with subcutaneous fentanyl (4 injections, 60 μg/kg per injection at 15-minute intervals) resulting in a total dose of 240 μg/kg. Subcutaneous ketamine, or intraperitoneal gabapentin, or their combination was administered 30 minutes before the first subcutaneous fentanyl injection. Sensitivity to nociceptive stimuli (von Frey filaments) was assessed on the day of the experiment and on the day after injections. The dose of ketamine and gabapentin received by a particular animal was determined by the response of the previous animal of the same group, using an up-and-down technique. Initial doses were 10 mg/kg and 300 mg/kg, with dose adjustment intervals of 1 mg/kg and 30 mg/kg, in the ketamine and gabapentin groups, respectively. The initial doses of ketamine and gabapentin were 5 mg/kg and 150 mg/kg, respectively, in the ketamine-gabapentin group, with the same dose adjustment intervals. Antihyperalgesic efficacy was defined as complete prevention of hyperalgesia on the day after drug injections.
RESULTS: The median effective antihyperalgesic doses (median value and 95% confidence interval) of ketamine and gabapentin were 12.4 mg/kg (11.7–13.1 mg/kg) and 296.3 mg/kg (283.5–309.1 mg/kg), respectively. The median effective antihyperalgesic dose of the combination was 4.3 mg/kg (3.7–4.6 mg/kg) for ketamine and 123.9 mg/kg (111.1–136.7 mg/kg) for gabapentin.

CONCLUSION: The isobolographic analysis demonstrated that the combination of the 2 drugs produces effective antihyperalgesia with a supraadditive (synergistic) action.

BACKGROUND: Ultrasound (US) regional nerve block requires the use of gel applied over the skin. With subsequent needle insertion, some of the gel may adhere either on the shaft or within the needle lumen and may be carried to the perineural structures or intraneurally. We performed this experimental animal study to investigate the effects of US gel contact on the nerve histologic structure.

METHODS: Nine male beagle dogs were studied. Dogs 1 to 3 were the control group and dogs 4 to 9 were the study group. Bilateral posterior tibial nerves were dissected and exposed for the control group. Nerve specimens were obtained for histologic examination immediately for the first dog, at 24 hours for the second dog, and at 48 hours for the third...
dog followed by wound closure. For the study group, bilateral posterior tibial nerves were exposed, and 2 mL US gel was applied locally directly on the nerve, followed by wound closure. Nerve specimens were excised at 24 hours from one side and at 48 hours from the other side. Nerve specimens were examined by a neuropathologist for evidence of nerve inflammation.

RESULTS: The control nerve specimens showed no significant pathology. Nerve specimens of the study group at the end of 24 hours of gel-nerve contact showed mild focal perineural inflammatory changes with clusters of polymorph leukocytes. At 48 hours, perineural moderate inflammatory changes with clusters of lymphocytes and macrophages were demonstrated in 2 animals. Long-term neurologic deficit in the form of limping was observed for all dogs.

CONCLUSION: Histologic features after perineural exposure to US gel are rather nonspecific and likely of no clinical significance. However, further studies are needed to determine the effect of US gel injection on intraneural tissues.