Table of Contents
May 2012

Cardiovascular Anesthesiology

造影劑增強超聲應用於心肌灌注顯像
(鄧利兵譯 薛張綱校)

Medical Intelligence Article: Contrast-Enhanced Ultrasound for Myocardial Perfusion Imaging

- Carolien S. E. Bulte,
- Jeroen Slikkerveer,
- Rick I. Meijer,
- Dennis Gort,
- Otto Kamp,
- Stephan A. Loer,
- Stefano F. de Marchi,
- Rolf Vogel,
- Christa Boer,
- and R. Arthur Bouwman


Anesthetic Pharmacology

利用分子對接技術對全身麻醉藥與蛋白靶點的連接位點及親和力預測
(夏蘇雲譯 陳傑校)

Binding Site and Affinity Prediction of General Anesthetics to Protein Targets Using Docking

- Renyu Liu,
- Jose Manuel Perez-Aguilar,
- David Liang,
- and Jeffery G. Saven

*Anesth Analg* May 2012 114:947-955; published ahead of print March 5, 2012

幼豬氰化物毒性和它被一種新的前體藥物 Sulfanegen Sodium 逆轉
Cyanide Toxicity in Juvenile Pigs and Its Reversal by a New Prodrug, Sulfanegen Sodium

Kumar G. Belani,
Harpreet Singh,
David S. Beebe,
Preeta George,
Steven E. Patterson,
Herbert T. Nagasawa,
and Robert Vince

Anesth Analg May 2012 114:956-961; published ahead of print March 5, 2012

Technology, Computing, and Simulation

技術及計算機及仿真的發展

Technical Communication: Design and In Vitro Testing of a Pressure-Sensing Syringe for Endotracheal Tube Cuffs

Alexander H. Slocum, Jr.,
Alexander H. Slocum, Sr.,
and Joan E. Spiegel


綜述：連續無創性總體、碳氧和高鐵血紅蛋白濃度檢測現狀

Review Article: The Current Status of Continuous Noninvasive Measurement of Total, Carboxy, and Methemoglobin Concentration

Micha Y. Shamir,
Aharon Avramovich,
and Todd Smaka

Hemoglobin Desaturation After Propofol/Remifentanil-Induced Apnea: A Study of the Recovery of Spontaneous Ventilation in Healthy Volunteers

Tiscia Bernadette Stefanutto, John Feiner, Jens Krombach, Ronald Brown, and James E. Caldwell


Accuracy of Identification of the Cricothyroid Membrane in Female Subjects Using Palpation: An Observational Study

Anastasia Aslani, Su-Cheen Ng, Michael Hurley, Kevin F. McCarthy, Michelle McNicholas, and Conan Liam McCaul


Oxygen Desaturation Index from Nocturnal Oximetry: A Sensitive and Specific Tool to Detect Sleep-Disordered Breathing in Surgical Patients

Frances Chung, Pu Liao, Hisham Elsaid, Sazzadul Islam, Colin M Shapiro, and Yuming Sun

Critical Care, Trauma, and Resuscitation

重症監護病房裡的非計劃性氣管拔管：系統綜述、嚴格評估和循證建議
(陳彬彬 翻譯，馬皓琳 李士通審校)
Medical Intelligence Article: Unplanned Endotracheal Extubations in the Intensive Care Unit: Systematic Review, Critical Appraisal, and Evidence-Based Recommendations
  o Paulo Sergio Lucas da Silva and
  o Marcelo Cunio Machado Fonseca

Pediatric Anesthesiology

兩例惡性高熱家族中出現雙倍和單倍諾丁受體 1 變異
(韓旭譯 薛張綱校)
Novel Double and Single Ryanodine Receptor 1 Variants in Two Austrian Malignant Hyperthermia Families
  o Alexius Kaufmann,
  o Birgit Kraft,
  o Andrea Michalek-Sauberer,
  o Marta Weindlmayr,
  o Hans G. Kress,
  o Ferdinand Steinboeck,
  o and Lukas G. Weigl

Neuroscience in Anesthesiology and Perioperative Medicine

入院時 CT 估計比重可預測創傷性腦損傷患者入 ICU 後 6 個月預後
(俞劼晶譯 陳傑校)
Computed Tomography–Estimated Specific Gravity at Hospital Admission Predicts 6-Month Outcome in Mild-to-Moderate Traumatic Brain Injury Patients Admitted to the Intensive Care Unit
  o Vincent Degos,
  o Thomas Lescot,
  o Christian Icke,
Yannick Le Manach,
Katherin Fero,
Paola Sanchez,
Bassem Hadiji,
Abderrezak Zouaoui,
Anne-Laure Boch,
Lamine Abdennour,
Christian C. Apfel,
and Louis Puybasset


尼莫地平引起的低血壓而不是硝酸甘油引起的低血壓保留成年小鼠長期和短期記憶
Nimodipine-Induced Hypotension but Not Nitroglycerin-Induced Hypotension Preserves Long- and Short-Term Memory in Adult Mice
Michael Haile,
Samuel Galoyan,
Yong-Sheng Li,
Barry H. Cohen,
David Quartermain,
Thomas Blanck,
and Alex Bekker


General Articles

一項關於麻醉師對手術室廢物回收的意見的調查
A Survey of Anesthesiologists' Views of Operating Room Recycling
Forbes McGain,
Stuart White,
Simone Mossenson,
Eugenie Kayak,
and David Story

Review Article: A Comparison of Reusable and Disposable Perioperative Textiles: Sustainability State-of-the-Art 2012

- Michael Overcash


Comparative Life Cycle Assessment of Disposable and Reusable Laryngeal Mask Airways

- Matthew Eckelman,
- Margo Mosher,
- Andres Gonzalez,
- and Jodi Sherman


A Life Cycle Assessment of Reusable and Single-Use Central Venous Catheter Insertion Kits

- Forbes McGain,
- Scott McAlister,
- Andrew McGavin,
- and David Story


Medical Intelligence Article: Assessing the Impact on Global Climate from General Anesthetic Gases

- Mads P. Sulbaek Andersen,
- Ole J. Nielsen,
- Timothy J. Wallington,
- Boris Karpichev,
- and Stanley P. Sander

Life Cycle Greenhouse Gas Emissions of Anesthetic Drugs

- Jodi Sherman,
- Cathy Le,
- Vanessa Lamers,
- and Matthew Eckelman


麻醉中的異丙酚浪費

(Brief Report: Propofol Wastage in Anesthesia)

- Russell F. Mankes


特約文章：以減少環境污染的新鮮氣體流量管理

(Special Article: Managing Fresh Gas Flow to Reduce Environmental Contamination)

- Jeffrey M. Feldman


小兒麻醉學會的雨天

(Brief Report: Rainy Days for the Society for Pediatric Anesthesia)

- Robert S. Greenberg,
- Melania Bembea,
- and Eugenie Heitmiller


Analgesia

Pain Mechanisms

啓動中樞大麻素2型受體系統可以預防紫杉醇引起的神經病

(Analgesia Pain Mechanisms)
Prevention of Paclitaxel-Induced Neuropathy Through Activation of the Central Cannabinoid Type 2 Receptor System

- Mohamed Naguib,
- Jijun J. Xu,
- Philippe Diaz,
- David L. Brown,
- David Cogdell,
- Bihua Bie,
- Jianhua Hu,
- Suzanne Craig,
- and Walter N. Hittelman

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**Regional Anesthesia**

超聲引導下坐骨神經分叉處單次注射的胭窩坐骨神經阻滯較傳統的神經刺激技術起效更快

(孫曉瓊譯 陳傑校)

Ultrasound-Guided Popliteal Sciatic Block with a Single Injection at the Sciatic Division Results in Faster Block Onset than the Classical Nerve Stimulator Technique

- Xavier Sala-Blanch,
- Nicolás de Riva,
- Anna Carrera,
- Ana M. López,
- Alberto Prats,
- and Admir Hadzic

*Anesth Analg May 2012 114:1121-1127; published ahead of print February 24, 2012*

用超聲成像和經皮神經刺激來識別耳大神經

(許辛譯 馬皓琳 李士通校)

Brief Report: Identification of the Great Auricular Nerve by Ultrasound Imaging and Transcutaneous Nerve Stimulation

- Saskia Christ,
- Reza Kaviani,
- Franziska Rindfleisch,
- and Patrick Friederich
簡報：臂叢神經中肌皮神經的出現水準：鎖骨下神經阻滯的影響因素
(楊琰譯 薛張綱校)

Brief Report: The Emergence Level of the Musculocutaneous Nerve from the Brachial Plexus: Implications for Infraclavicular Nerve Blocks

Antoine Pianezza, Arnaud Salces y Nedeo, Patrick Chaynes, Philip E. Bickler, and Vincent Minville

利用分子對接技術對全身麻醉藥與蛋白靶點的連接位點及親和力預測
Binding Site and Affinity Prediction of General Anesthetics to Protein Targets Using Docking

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背景 全身麻醉藥的蛋白作用位點仍未明確，因此首先需要一種工具來預測全身麻醉藥的結合位點。此項研究對 AutoDock 這一計算方法能否作此類工具進行了探討。

方法 獲得水溶性蛋白（細胞色素 C，去鐵蛋白，人血清白蛋白）和膜蛋白（從無囊體 藍藻 GLIC 中提取的五聚體配體門控離子通道）的高解析度晶體結構資料。採用等溫滴定量熱 (ITC) 實驗，測定溶液中麻醉藥對去鐵蛋白的親和力。使用拉馬克遺傳演算法及 solis 和 wets 局域搜索方法的分子對接伺服器進行分子對接的計算（http://www.dockingserver.com/web）。發現 20 種全身麻醉藥可與去鐵蛋白對接。將預測的結合常數與從 ITC 實驗獲得的資料進行比較以明確其可能的聯繫。在與去鐵蛋白對接時，將得到的具體結合位點和它們之間的相互作用與最新共晶資料進行了比較。對目前臨床使用的已明確 50% 有效濃度值 (EC50 值) 的六種全身麻醉藥（異氟醚，七氟醚，地氟醚，氟烷，異丙酚，依託咪酯）同樣進行了與所有測試蛋白的對接計算。並將從對接試驗得出的六種全身麻醉藥的結合常數與已知的 EC50 值和辛醇/水分配係數進行比較。

結果 所有 20 種全身麻醉藥都明確地與從去鐵蛋白的晶體結構中發現的麻醉藥結合位點對接。利用對接計算獲得的 20 種麻醉藥的結合常數與從 ITC 實驗獲得的資料相關 (p = 0.04)。GLIC 的晶體結構中鑑定出的結合位點被包含在對接技術預測的位點之內，但並非最佳位點。對接計算表明最有可能的結合位點位於 GLIC 的胞外分子域。在 GLIC 中鑑
BACKGROUND: The protein targets for general anesthetics remain unclear. A tool to predict anesthetic binding for potential binding targets is needed. In this study, we explored whether a computational method, AutoDock, could serve as such a tool.

METHODS: High-resolution crystal data of water-soluble proteins (cytochrome C, apoferritin, and human serum albumin), and a membrane protein (a pentameric ligand-gated ion channel from Gloeobacter violaceus [GLIC]) were used. Isothermal titration calorimetry (ITC) experiments were performed to determine anesthetic affinity in solution conditions for apoferritin. Docking calculations were performed using DockingServer with the Lamarckian genetic algorithm and the Solis and Wets local search method (http://www.dockingserver.com/web). Twenty general anesthetics were docked into apoferritin. The predicted binding constants were compared with those obtained from ITC experiments for potential correlations. In the case of apoferritin, details of the binding site and their interactions were compared with recent co-crystallization data. Docking calculations for 6 general anesthetics currently used in clinical settings (isoflurane, sevoflurane, desflurane, halothane, propofol, and etomidate) with known 50% effective concentration (EC$_{50}$) values were also performed in all tested proteins. The binding constants derived from docking experiments were compared with known EC$_{50}$ values and octanol/water partition coefficients for the 6 general anesthetics.

RESULTS: All 20 general anesthetics docked unambiguously into the anesthetic binding site identified in the crystal structure of apoferritin. The binding constants for 20 anesthetics obtained from the docking calculations correlate significantly with those obtained from ITC experiments ($P = 0.04$). In the case of GLIC, the identified anesthetic binding sites in the crystal structure are among the docking predicted binding sites, but not the top ranked site. Docking calculations suggest a most probable binding site located in the extracellular domain of GLIC. The predicted affinities correlated significantly with the known EC$_{50}$ values for the 6 frequently used anesthetics in GLIC for the site identified in the experimental crystal data ($P = 0.006$). However, predicted affinities in apoferritin, human serum albumin, and cytochrome C did not correlate with these 6 anesthetics' known experimental EC$_{50}$ values. A weak correlation between the predicted affinities and the octanol/water partition coefficients was observed for the sites in GLIC.

CONCLUSION: We demonstrated that anesthetic binding sites and relative affinities can be predicted using docking calculations in an automatic docking server (AutoDock) for both water-soluble and membrane proteins. Correlation of predicted affinity and EC$_{50}$ for 6 frequently used general anesthetics was only observed in GLIC, a member of a protein family relevant to anesthetic mechanism.

综述：连续无创性总体、碳氧和高铁血红蛋白浓度检测现状

Review Article: The Current Status of Continuous Noninvasive Measurement of Total, Carboxy, and Methemoglobin Concentration
Intraoperative early detection of anemia, identifying toxic levels of carboxyhemoglobin after carbon monoxide exposure and titrating drug dosage to prevent toxic levels of methemoglobin are important goals. The pulse oximeter works by illuminating light into the tissue and sensing the amount of light absorbed. The same methodology is used by laboratory hemoglobinometers to measure hemoglobin concentration. Because both devices work in the same way, efforts were made to modify the pulse oximeter to also measure hemoglobin concentration. Currently there are 2 commercial pulse oximeters (Masimo Rainbow SET and OrSense NBM-200MP) that measure total hemoglobin concentration and one (Masimo) that also measures methemoglobin and carboxyhemoglobin. In this review, we describe the peer-reviewed literature addressing the accuracy of these monitors.
每小時內呼吸暫停和低通氣次數的平均值，為 9.1 (2.8–21.4) [中位數（四分位間距）]，且 64% 的病人 AHI>5。氧飽和指數（oxyge
n desaturation index, ODI, 即單位小時內血氧飽和次數的平均值）和夜間脈氧儀顯示的 SpO_2 <90% (CT90) 累計次數百分比與 PSG 記錄的睡眠呼
吸障礙參數之間均有所顯著的相關性。但和 CT90 相比較，ODI 有更顯著的相關性，且是個更好的 AHI 預測指標。ODI 預測 AHI>5、AHI>12 和 AHI>30 的受試者工作特徵曲
線下面積（the area under the receiver operating characteristic curve, AUC）分別是 0.908（可信區間: 0.880–0.936）、0.931（可信區間: 0.909 to 0.952）和 0.958（可信區間: 0.937 to 0.979）。ODI 預測 AHI>5、AHI>15 和 AHI>30 最大準確度的截斷值分別是：ODI>5、ODI>15 和 ODI>30。準確度分別是：86% （可信區間：83%–88%）、86% （可信區間：83%–89%）和 94% （可信區間：92%–96%）。ODI>10 檢測中重度 SDB 的敏感性和特異性分別為 93% 和 75%。

結論：高解析度夜間血氧監測儀來源的 ODI 應用于外科手術病人中，是一項具有敏感性和特異性檢測未經診斷 SDB 的工具。

INTRODUCTION: It is impractical to perform polysomnography (PSG) in all surgical patients suspected of having sleep disordered breathing (SDB). We investigated the role of nocturnal oximetry in diagnosing SDB in surgical patients.

METHOD: All patients 18 years and older who visited the preoperative clinics for scheduled inpatient surgery were approached for study participation. Patients expected to have abnormal electroencephalographic findings were excluded. All patients underwent an overnight PSG at home with a portable device and a pulse oximeter. The PSG recordings were scored by a certified sleep technologist. The oximetry recordings were processed electronically.

RESULT: Four hundred seventy-five patients completed the study: 217 males and 258 females, aged 60 ± 11 years, and body mass index 31 ± 7 kg/m^2. The apnea-hypopnea index (AHI), the average number of episodes of apnea and hypopnea per hour of sleep, was 9.1 (2.8 to 21.4) [median (interquartile range)] and 64% patients had AHI>5. There was a significant correlation between oxygen desaturation index (ODI, hourly average number of desaturation episodes) and cumulative time percentage with SpO_2 <90% (CT90) from nocturnal oximetry, with the parameters measuring sleep breathing disorders from PSG. Compared to CT90, ODI had a stronger correlation and was a better predictor for AHI. The area under receiver operator characteristics curve for ODI to predict AHI>5, AHI>15, and AHI>30 was 0.908 (CI: 0.880 to 0.936), 0.931 (CI: 0.909 to 0.952), and 0.958 (CI: 0.937 to 0.979), respectively. The cutoff value based on the maximal accuracy for ODI to predict AHI>5, AHI>15, and AHI>30 was ODI>5, ODI>15, and ODI>30. The accuracy was 86% (CI: 83%–88%), 86% (CI: 83%–89%), and 94% (CI: 92%–96%), respectively. The ODI>10 demonstrated a sensitivity of 93% and a specificity of 75% to detect moderate and severe SDB.

CONCLUSIONS: ODI from a high-resolution nocturnal oximeter is a sensitive and specific tool to detect undiagnosed SDB in surgical patients.
BACKGROUND: It is clear that patients with a severe traumatic brain injury (TBI) develop secondary, potentially lethal neurological deterioration. However, it is difficult to predict which patients with mild-to-moderate TBI (MM-TBI), even after intensive care unit (ICU) admission, will experience poor outcome at 6 months. Standard computed tomography (CT) imaging scans provide information that can be used to estimate specific gravity (eSG). We have previously demonstrated that higher eSG measurements in the standard CT reading were associated with poor outcomes after severe TBI. The aim of this study was to determine whether eSG of the intracranial content predicts 6-month outcome in MM-TBI. METHODS: We analyzed admission clinical and CT scan data (including eSG) of 66 patients with MM-TBI subsequently admitted to our neurosurgical ICU. Primary outcome was defined as a Glasgow Outcome Scale score of 1 to 3 after 6 months. Discriminating power (area under the receiver operating characteristic curve [ROC-AUC], 95% confidence interval) of eSG to predict 6-month poor outcome was calculated. The correlation of eSG with the main ICU characteristics was then compared.

RESULTS: Univariate and stepwise multivariate analyses showed an independent association between eSG and 6-month poor outcome ($P = 0.001$). ROC-AUC of eSG for the prediction of 6-month outcomes was 0.87 (confidence interval: 0.77–0.96). Admission eSG values were
correlated with the main ICU characteristics, specifically 14-day mortality ($P = 0.004$), length of mechanical ventilation ($P = 0.01$), length of ICU stay ($P = 0.045$), and ICU procedures such as intracranial pressure monitoring ($P < 0.001$).

CONCLUSIONS: In this MM-TBI cohort admitted to the ICU, eSG of routine CT scans was correlated with mortality, ICU severity, and predicted 6-month poor outcome. An external validation with studies that include the spectrum of TBI severities is warranted to confirm our results.

綜述：可重複使用和一次性手術紡織品比較：2012 現代可持續發展技術

Review Article: A Comparison of Reusable and Disposable Perioperative Textiles: Sustainability State-of-the-Art 2012
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現代可再利用和一次性使用手術紡織品（手術衣和鋪巾等）的比較反映出生產和再利用此類產品技術的重大變革。可重複使用和一次性使用手術衣和鋪巾由人工合成的輕薄面料製造，不僅滿足醫務工作者和患者保護的新標準，同時價格也具有競爭力。在基於多元科學的生命週期環境研究中，可重複使用手術衣與鋪巾相對於同類一次性產品，顯示了極大的可持續收益，具體在自然資源能源（200%–300%），水（250%–330%），碳元素（200%–300%），揮發性有機物，固體廢物（750%）和儀器回收方面。因爲所有其他因素（成本，保護和舒適）是相似的，作爲衛生保健可持續發展專案的一部分，可重複使用手術衣和鋪巾所帶來的環境收益對於此工業是重要的。因此，不再認為可重複使用對某些環境下更有利而一次性使用在其他情況下更好。同樣重要的是我們認識到，在過去的五至十年，對舒適、保護和經濟大規模研究未能得到積極推行，因此對提高可重複使用和一次性使用系統的因素難以評估。此外，職業相關比較研究較少，但可能會進一步支持可重複使用。總之，現有的圍術期紡織品舒適、安全，成本相似，但可重複使用而非一次性使用的紡織品為護士、醫生和醫院提供了減少對環境影響的機會。對環境因素比較的循證醫學支持這個結論：可重複使用的手術衣和鋪巾對可持續發展提供了極大的支援。可重複使用系統的益處與麻醉領域中其他的再利用方面類似，如喉罩通氣道或吸引器，但需要生命週期研究來證實這些益處。

Contemporary comparisons of reusable and single-use perioperative textiles (surgical gowns and drapes) reflect major changes in the technologies to produce and reuse these products. Reusable and disposable gowns and drapes meet new standards for medical workers and patient protection, use synthetic lightweight fabrics, and are competitively priced. In multiple science-based life cycle environmental studies, reusable surgical gowns and drapes demonstrate substantial sustainability benefits over the same disposable product in natural resource energy (200%–300%), water (250%–330%), carbon footprint (200%–300%), volatile organics, solid wastes (750%), and instrument recovery. Because all other factors (cost, protection, and comfort) are reasonably similar, the environmental benefits of reusable surgical gowns and drapes to health care sustainability programs are important for this industry. Thus, it is no longer valid to indicate that reusables are better in some environmental impacts and disposables are better in other
environmental impacts. It is also important to recognize that large-scale studies of comfort, protection, or economics have not been actively pursued in the last 5 to 10 years, and thus the factors to improve both reusables and disposable systems are difficult to assess. In addition, the comparison related to jobs is not well studied, but may further support reusables. In summary, currently available perioperative textiles are similar in comfort, safety, and cost, but reusable textiles offer substantial opportunities for nurses, physicians, and hospitals to reduce environmental footprints when selected over disposable alternatives. Evidenced-based comparison of environmental factors supports the conclusion that reusable gowns and drapes offer important sustainability improvements. The benefit of reusable systems may be similar for other reusables in anesthesia, such as laryngeal mask airways or suction canisters, but life cycle studies are needed to substantiate these benefits.

Medical Intelligence Article: Assessing the Impact on Global Climate from General Anesthetic Gases
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Although present in the atmosphere with a combined concentration approximately 100,000 times lower than carbon dioxide (i.e., the principal anthropogenic driver of climate change), halogenated organic compounds are responsible for a warming effect of approximately 10% to 15% of the total anthropogenic radiative forcing of climate, as measured relative to the start of the industrial era (approximately 1750). The family of anesthetic gases includes several halogenated organic compounds that are strong greenhouse gases. In this short report, we provide an overview of the state of knowledge regarding the impact of anesthetic gas release on the environment, with particular focus on its contribution to the radiative forcing of climate change.

Special Article: Managing Fresh Gas Flow to Reduce Environmental Contamination
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Anesthetic drugs have the potential to contribute to global warming. There is some debate about the overall impact of anesthetic drugs relative to carbon dioxide, but there is no question that practice patterns can limit the degree of environmental contamination. In particular, careful attention to managing fresh gas flow can use anesthetic drugs more efficiently—reducing waste while achieving the same effect on the patient. The environmental impact of a single case may be minimal, but when compounded over an entire career, the manner in which fresh gas flow is managed by each individual practitioner can make a significant difference in the volume of anesthetic gases released into the atmosphere. The maintenance phase of anesthesia is the best opportunity to reduce fresh gas flow because circuit gas concentrations are relatively stable and it is often the longest phase of the procedure. There are, however, methods for managing fresh gas flow during induction and emergence that can reduce the amount of wasted anesthetic vapor. This article provides background information and discusses strategies for managing fresh gas flow during each phase of anesthesia with the goal of reducing waste when using a circle anesthesia system. Monitoring oxygen and anesthetic gas concentrations is essential to implementing these strategies safely and effectively. Future technological advances in anesthetic delivery systems are needed to make it less challenging to manage fresh gas flow.
BACKGROUND: For successful, fast-onset sciatic popliteal block (SPB), either a single injection above the division of the sciatic nerve, or 2 injections to block the tibial nerve (TN) and common peroneal nerve (CPN) separately have been recommended. In this study, we compared the traditional nerve stimulator (NS)-guided SPB above the division of the sciatic nerve with the ultrasound (US)-guided block with single injection of local anesthetic (LA) between the TN and CPN at the level of their division. We hypothesized that US-SPB with a single injection between TN and CPN would result in faster block onset than a single-injection NS-SPB.

METHODS: Fifty-two patients were randomized to receive either an NS-SPB or a US-SPB. For both blocks, a single injection of 20 mL mepivacaine 1.5% was given using an automated injection pump while controlling for injection force. For NS-SPB, a TN response below 0.5 mA was sought 7 cm above the popliteal fossa crease (and proximal to the divergence of the TN and peroneal nerves). For US-SPB, the injection was made after a US-guided needle was inserted between the TN and CPN at the level of their separation. Motor response was not actively sought but registered if present. The location and spread of LA were evaluated by US in both groups. Onset of motor and sensory blocks was serially assessed in 5-minute intervals in the TN and CPN divisions and compared between the groups.

RESULTS: All patients in both groups had successful block at 30 minutes after the injection, defined as sensory block to allow surgery without supplementation. A higher proportion of patients in the US-SPB group had a complete sensory (80% vs 4%, P < 0.001) and motor block (60% vs 8%, P < 0.001), defined as anesthesia and paralysis in all nerve territories, at 15 minutes after injection. US signs of intraepineural injection were present in 19 patients (73%) in the NS-SPB group and 25 patients (100%) in the US-SPB group (P < 0.001).
CONCLUSIONS: A single injection of LA in US-SPB with needle insertion at the separation of the TN and CPN results in a similar success rate at 30 minutes; however, more patients in the US-SPB group than in the NS-SPB group had complete block at 15 minutes.

Medical intelligence article: contrast-enhanced ultrasound for myocardial perfusion imaging
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Ultrasound contrast agents are gas-filled microbubbles that enhance visualization of cardiac structures, function and blood flow during contrast-enhanced ultrasound (CEUS). An interesting cardiovascular application of CEUS is myocardial contrast echocardiography, which allows real-time myocardial perfusion imaging. The intraoperative use of this technically challenging imaging method is limited at present, although several studies have examined its clinical utility during cardiac surgery in the past. In the present review we provide general information on the basic principles of CEUS and discuss the methodology and technical aspects of myocardial perfusion imaging.

Design and In Vitro Testing of a Pressure-Sensing Syringe for Endotracheal Tube Cuffs
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摘要：氣管插管是一項經常用在院前，重症監護室和手術中的操作，氣管導管套囊必須充氣達到一定壓力以防止空氣洩漏而不有損氣管粘膜血流。爲了同步氣管導管套囊的膨脹與測量，我們設計並測試了一個全新的體外壓力感受注射器。它的原型是使用一個標準10ml裝配了一個活塞，一個矽膠波紋管和一個壓感元件的聚碳酸酯注射器。波紋管的可
Abstract: Endotracheal intubation is a frequently performed procedure in the prehospital setting, intensive care unit, and for patients undergoing surgery. The endotracheal tube cuff must be inflated to a pressure that prevents air leaks without compromising tracheal mucosal blood flow. For simultaneous endotracheal tube cuff inflation and measurement, we designed and tested a novel pressure-sensing syringe in vitro. The prototype was developed using a standard 10-mL polycarbonate syringe body that houses a plunger and a silicone rubber bellows, the pressure-sensing element. Bellow feasibility was determined and modeled using finite element analysis. Repeatability testing at each pressure measurement for each bellows (pressure versus deflection) was within an average standard deviation of 0.3 cm to 1.61 cm (1%–5% error). Using an aneroid manometer for comparison, there was excellent linear correlation with a Spearman rank of 0.99 (P < 0.001), up to 30 cm H₂O.

簡報：女性患者中使用觸診確認環甲軟骨方式的準確性:一項觀察性研究


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背景:環甲軟骨（CTM）是環甲軟骨切開行緊急氣道供氧的推薦位置。儘管這一技術十分簡便，臨床急救時常常達不到其目標，且併發症多多。氣管切開失敗的原因仍然未知，因此我們想瞭解臨床醫生正確識別女性環甲軟骨的能力。

方法：要求臨床醫生在患者仰臥頸正中位通過使用螢光“隱形”墨水標記環甲軟骨，之後患者改變為頸過伸位元進行標記。我們使用超聲確定環甲軟骨的準確位置，並且測量了準確的位置與醫生標記的位置之間的距離。準確的估計範圍是在環甲軟骨的上下緣之間，且距正中線5mm之內的範圍。研究參與者同時要求用10-cm 視覺類比評分（VAS）評價環甲軟骨觸診。

結果：56位患者參與本研究其中15位為肥胖患者。在仰臥頸正中位時，非肥胖與肥胖患者環甲軟骨確定率分別為10/41和15/0/15（P=0.048）。在46位沒有準確定環甲軟骨的患者中，與標準位置相比24位定位過高（最大3cm），22位過低（最大3cm）。在頭過伸位時我們得到了類似的結果：非肥胖與肥胖分別為12/41和15/1/15。差距範圍也更大：過高最大達2.5cm，過低最大達4cm，偏離正中最大達1.6cm。參與的醫生發現環甲軟骨的觸診在肥胖患者中比非肥胖患者更難以確認：觸診難度的 VAS 評分分別為5.25±2.5和3.3±2.5，P=0.005。應用多元線性回歸，觸診準確率的 VAS 評分與患者身高增長和甲頦間距增加負
BACKGROUND: The cricothyroid membrane (CTM) is the recommended site of access to the airway during cricothyroidotomy to provide emergency oxygenation. Despite the apparent simplicity of the technique, this rescue maneuver frequently fails to achieve its goals and complications are numerous. The reasons for this failure are unclear. We sought to determine the ability of physicians to correctly identify the CTM in female patients.

METHODS: Using fluorescent "invisible" ink, the physician was asked to mark the CTM with the patient in the supine neutral position and then with the head extended. The actual level was identified using ultrasound and the distance between the actual and estimated margin of the CTM was measured. A correct estimation was defined as a mark made between the upper and lower limits of the membrane and within 5 mm of midline. Participants were also asked to assess the ease of CTM palpation using a 10-cm visual analog scoring (VAS) scale.

RESULTS: Fifty-six patients participated of whom 15 were obese. In the supine neutral neck position, the CTM was identified in 10/41 vs 0/15 (P = 0.048) in nonobese versus obese, respectively. Of the 46 incorrectly identified CTMs in this position, 24 were above (maximum 3 cm) and 22 below (maximum 3 cm) the actual level. Similar results were observed when the patients were placed with the neck in the extended position; the CTM was identified correctly in 12/41 vs 1/15 nonobese and obese patients, respectively. The range of values was also extensive; the estimation of the position of the membrane was as high as 2.5 cm above and 4 cm below the actual level, and up to 1.6 cm laterally. Participating doctors found palpation of the CTM subjectively more difficult in the obese than nonobese groups; VAS score for palpation difficulty was 5.25 ± 2.5 vs 3.3 ± 2.5, respectively, P = 0.005. Using multiple linear regression, VAS scores for palpation correlated negatively with increased patient height (P < 0.001) and greater thyromental distance (P = 0.006), and correlated positively with increased sternomental distance (P = 0.011) and neck circumference (P = 0.001).

CONCLUSIONS: Misidentification of the CTM in female patients is common and its localization is less precise in those who are obese. This has implications for the likely success of invasive airway access via the CTM.

Novel double and single ryanodine receptor 1 variants in two austrian malignant hyperthermia families.
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BACKGROUND: Malignant hyperthermia (MH) is a potentially lethal genetic disorder in response to volatile anesthetics and depolarizing muscle relaxants. To support the claim that a novel genetic variant causes MH, it is necessary to demonstrate that it has significant effects on the sensitivity of the ryanodine receptor (RYR1) calcium channel. In this study we focused on 2 Austrian families with strong MH disposition and new RYR1 variants.

METHODS: We sequenced the entire coding region of the RYR1 from 2 Austrian MH individuals. Genotype-phenotype segregation and evolutionary conservation of the variants were considered. On a functional level, Ca(2+) release experiments with fura-2-acetoxymethyl ester were performed in cultured skeletal muscle cells derived from individuals carrying the new variants and compared with control cells from nonsusceptible individuals. Caffeine, 4-chloro-4-m-cresol (4-CmC), and halothane were used as specific Ca(2+) releasing agents.

RESULTS: The variant p.A612P in family A segregated with an MH-susceptible phenotype and cells showed an increased sensitivity for all Ca(2+)-releasing substances tested. In family B, 2 variants (p.R2458H/p.R3348C) were identified. While p.R2458H and p.R2458H/p.R3348C segregated with an MH-susceptible diagnosis, p.R3348C alone showed an MH equivocal diagnosis. Ca(2+)-release experiments showed that exchanges of these highly conserved amino acids increased the sensitivities for the substances tested (except 4-CmC with p.R2458H and p.R3348C) when compared with the MH-negative control group.

CONCLUSIONS: Our results suggest that these variants are new causative MH variants.
BACKGROUND: Operating rooms contribute significantly to the increasing volumes and costs of hospital waste. Little is known, however, about doctors’ views of hospital waste recycling despite their potential influence in improving recycling programs. We surveyed the waste recycling views held by anesthesiologists in Australia, New Zealand, and England in regional or metropolitan and public or private practice. We asked the following: (1) What proportion of anesthesiologists consider recycling operating room waste to be important? (2) What do respondents consider to be identifiable barriers preventing operating room recycling?

METHODS: We performed a Web-based survey of 11 questions of attitudes to operating room waste recycling held by anesthesiologists. After piloting, the survey was e-mailed to 500 randomly selected Fellows of the Australian and New Zealand College of Anesthetists. All anesthetic departments of the National Health Service of England also received the e-mail with a request that English consultant anesthesiologists complete the survey.

RESULTS: We received 780 responses from anesthesiologists, 210 (41% response rate) from Australia and New Zealand and 570 (11% response rate at worst) from England. Regardless of location or type of practice, most (725, 93%; 95% confidence interval [CI]: 91% to 95%) responding anesthesiologists would like to increase recycling of operating room waste and would commit their time, but not their money to doing so. Only 87 (11%; 95% CI: 9% to 14%) respondents agreed/strongly agreed that waste recycling occurred in their operating rooms already. Survey respondents thought that the greatest barriers to recycling waste were (1) inadequate recycling facilities, 381 (49%); (2) negative staff attitudes, 133 (17%); and (3)
inadequate information on how to recycle waste, 121 (16%). Time, safety, inadequate space for recycling receptacles, and cost were each thought by <5% of respondents to be the greatest barrier to recycling.

CONCLUSIONS: Most responding anesthesiologists supported greater operating room waste recycling but thought that there were identifiable barriers. Anesthesiologists could take a leadership role and work with other hospital employees to improve operating room recycling. We suggest studies of the effect of improving operating room recycling facilities, education, and staff attitudes.
BACKGROUND: For most items used in operating rooms, it is unclear whether reusable items are environmentally and financially advantageous in comparison with single-use variants. We examined the life cycles of reusable and single-use central venous catheter kits used to aid the insertion of single-use, central venous catheters in operating rooms. We did not examine the actual disposable catheter sets themselves. We assessed the entire financial and environmental costs for the kits, including the influence of the energy source used for sterilization.

METHODS: For the reusable central venous catheter kit, we performed a “time-in-motion” study to determine the labor costs and measured the energy and water consumption for cleaning and sterilization at Western Health, Melbourne, Australia. For the majority of the inputs for the single-use kit, we relied upon industry and inventory-sourced databases. We modeled the life cycles of the reusable and single-use central venous catheter kits with Monte Carlo analysis.

RESULTS: Inclusive of labor, the reusable central venous catheter insertion kits cost $6.35 Australian ($A) (95% confidence interval [CI], $A5.89 to $A6.86), and the single-use kits cost $A8.65. For the reusable kit, CO$_2$ emissions were 1211 g (95% CI, 1099 to 1323 g) and for the single-use kit 407 g (95% CI, 379 to 442 g). Water use was 27.7 L (95% CI, 27.0 to 28.6 l) for the reusable kit and 2.5 L (95% CI, 2.1 to 2.9 l) for the single-use kit. For the reusable kit, sterilization had the greatest environmental cost, and for the single-use kit, the manufacture of plastic and metal components had the largest environmental costs. Different sources of electricity to make the reusable kits patient-ready again affected the CO$_2$ emissions: electricity from hospital gas cogeneration resulted in 436 g CO$_2$ (95% CI, 410 to 473 g CO$_2$), from the United States electricity grid 764 g CO$_2$ (95% CI, 509 to 1174 g CO$_2$), and from the European electricity grid 572 g (95% CI, 470 to 713 g CO$_2$).

CONCLUSIONS: Inclusive of labor, the reusable central venous catheter insertion kits were less expensive than were the single-use kits. For our hospital, which uses brown coal–sourced electricity, the environmental costs of the reusable kit were considerably more expensive than those of the single-use kit. Efforts to reduce the environmental footprint of reusable items should be directed towards decreasing the water and energy consumed in cleaning and sterilization. The source of hospital electricity significantly alters the relative environmental effects of reusable items.
METHODS: We collected the contents of pharmaceutical waste collection containers in each of 8 operating rooms, sorted them by hand, and tabulated the results. Propofol returned to the pharmacy was not counted as wasted drug.

RESULTS: Wasted or discarded propofol accounted for 45% of all the drug waste.

CONCLUSIONS: Propofol does not degrade in nature, accumulates in body fat, and is toxic to aquatic life. We reduced wastage by removing 50 and 100 mL vials of propofol from the pharmacy, retaining only the smallest size (20 mL).

Background: Peripheral neuropathy is a major dose-limiting toxicity of chemotherapy, especially after multiple courses of paclitaxel. The development of paclitaxel-induced neuropathy is associated with the activation of microglia followed by the activation and proliferation of astrocytes, and the expression and release of proinflammatory cytokines in the spinal dorsal horn. Cannabinoid type 2 (CB(2)) receptors are expressed in the microglia in neurodegenerative disease models.
METHODS: To explore the potential of CB(2) agonists for preventing paclitaxel-induced neuropathy, we designed and synthesized a novel CB(2)-selective agonist, namely, MDA7. The effect of MDA7 in preventing paclitaxel-induced allodynia was assessed in rats and in CB(2)(+/+) and CB(2)(-/-) mice. We hypothesized that the CB(2) receptor functions in a negative-feedback loop and that early MDA7 administration can blunt the neuroinflammatory response to paclitaxel and prevent mechanical allodynia through interference with specific signaling pathways.

RESULTS: We found that MDA7 prevents paclitaxel-induced mechanical allodynia in rats and mice in a dose- and time-dependent manner without compromising paclitaxel's antineoplastic effect. MDA7's neuroprotective effect was absent in CB(2)(-/-) mice and was blocked by CB(2) antagonists, suggesting that MDA7's action directly involves CB(2) receptor activation. MDA7 treatment was found to interfere with early events in the paclitaxel-induced neuroinflammatory response as evidenced by relatively reduced toll-like receptor and CB(2) expression in the lumbar spinal cord, reduced levels of extracellular signal-regulated kinase 1/2 activity, reduced numbers of activated microglia and astrocytes, and reduced secretion of proinflammatory mediators in vivo and in in vitro models.

CONCLUSIONS: Our findings suggest an innovative therapeutic approach to prevent chemotherapy-induced neuropathy and may permit more aggressive use of active chemotherapeutic regimens with reduced long-term sequelae.

BACKGROUND: In this cadaveric study we assessed the level of the emergence of the musculocutaneous nerve (MCN) relative to needle insertion site during infraclavicular block.

METHODS: Forty brachial plexi from 20 embalmed adult cadavers were dissected. The MCN was exposed from its origin on the lateral cord to its penetration into the coracobrachialis muscle.
The point of emergence of the MCN from the lateral cord relative to a line drawn directly caudad from the anteromedial tip of the coracoid process was measured. A needle was placed predissection using our previously described technique, and the distance from the needle tip to the emergence of the MCN was measured.

RESULTS: MCN often emerged distal to the coracoid process. At the needle insertion site, 80% of MCN had already emerged from the lateral cord. The distance of emergence ranged from 8.5 cm proximal to 12 cm distal to the coracoid process.

CONCLUSION: This anatomical study suggests that MCN may be one of the factors explaining MCN block failure for the single-injection technique of infraclavicular block using lateral needle trajectory.

幼豬氰化物毒性和它被一種新的前體藥物 Sulfanegen Sodium 逆轉

Cyanide Toxicity in Juvenile Pigs and Its Reversal by a New Prodrug, Sulfanegen Sodium
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BACKGROUND: Cyanide (CN) toxicity is a serious clinical problem and can occur with sodium nitroprusside (SNP) administration, accidental smoke inhalation, industrial mishaps, and bio-terrorism. In this study, we induced severe CN toxicity independently with SNP or sodium cyanide (NaCN) in a juvenile pig model to demonstrate reversal of severe CN toxicity with a new antidote, sulfanegen sodium, a prodrug of 3-mercaptopuruvate.

METHODS: SNP study: A pilot study in 11 anesthetized, mechanically ventilated juvenile pigs allowed us to determine the dose of SNP to induce CN toxicity. Blood CN, serum lactates, and blood gases were monitored. CN toxicity was defined as the occurrence of severe lactic acidosis accompanied by significant elevation in blood CN levels. Based on this pilot study, 8 anesthetized pigs received a high-dose IV infusion of SNP (100 mg/h) for 2 hours to induce CN toxicity. They were then randomized to receive either sulfanegen sodium or placebo. Four pigs received 3 doses of sulfanegen sodium (2.5 g IV) every hour after induction of severe CN toxicity, and 4 pigs received placebo. NaCN study: A pilot study was conducted in 4 spontaneously ventilating pigs sedated with propofol plus ketamine to demonstrate hemodynamic and metabolic stability for several hours. After this, 6 pigs were similarly sedated and given NaCN in bolus aliquots to produce CN toxicity ultimately resulting in death. Hemodynamics and metabolic variables were followed to define peak CN toxicity. In another group of 6 pigs, severe CN toxicity was induced by this method, and at peak toxicity, the animals were given sulfanegen sodium (2.5 g IV) followed by a repeat dose 60 minutes later in surviving animals.

RESULTS: SNP study: The pilot study demonstrated the occurrence of a significant increase in blood CN levels \((P < 0.05)\) accompanied by severe lactic acidemia \((P < 0.05)\) in all pigs receiving a high dose of SNP. Administration of the sulfanegen antidote resulted in progressive significant reduction in blood lactate and CN levels with 100% survival \((P < 0.05)\), whereas the placebo-treated pigs deteriorated and did not survive \((P < 0.05)\). NaCN study: NaCN injection resulted in CN toxicity accompanied by severe lactic acidosis and mortality in all the pigs. Sulfanegen sodium reversed this toxicity and prevented mortality in all the pigs treated with this antidote.

CONCLUSIONS: CN toxicity can be successfully induced in a juvenile pig model with SNP or NaCN. The prodrug, sulfanegen sodium, is effective in reversing CN toxicity induced by SNP or NaCN.

異丙酚/瑞芬太尼致呼吸暫停後的血紅蛋白氧飽和度下降: 一項健康志願者自主呼吸恢復的研究
Hemoglobin Desaturation After Propofol/Remifentanil-Induced Apnea: A Study of the Recovery of Spontaneous Ventilation in Healthy Volunteers
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背景: 一項較早的調查“不能通氧/不能插管” 的臨床情況的研究表明，應用硫噴妥鈉 5 mg / kg 和琥珀膽鹼 1.0mg/kg 的麻醉誘導引起血紅蛋白飽氧和度下降的顯著風險。琥珀膽鹼導
致的呼吸暂停可能是延长的呼吸暂停的原因。我们假设在气管插管时使用异丙酚和瑞芬太尼也许可以避免由于肌内松弛而导致的长时间呼吸暂停和随后的氧饱和度下降。

方法：有 24 位健康志愿者参加了实验，年龄分布在 18 到 45 岁。在吸氧达到呼气末氧浓度大于 90%后，志愿者们接受了异丙酚 2mg/kg 及分别分别为 2 mcg/kg（组 1；n=12）或 1.5 mcg/kg（组 2；n=12）的瑞芬太尼。测量了手指、耳垂和前额的氧饱和度（SpO2）。如果氧饱和度下降至了 80%，则托起志愿者下颌，如果此情况持续，则进行辅助通气。

结果：5 名志愿者出现了饱和度降低（SpO2 < 80%）：4 名在高剂量（2 mcg/kg）瑞芬太尼组，1 名在低剂量（1.5 mcg/kg）瑞芬太尼组。3 名志愿者需要托下颌和辅助通气。在高剂量瑞芬太尼组中，最低的氧饱和度是 82.4 ± 10.5（均值±标准差），而在低剂量瑞芬太尼组中，最低的氧饱和度是 92.4 ± 8.6（P = 0.019）。低剂量组的呼吸暂停时间（4.7 ± 1.5）比高剂量组的呼吸暂停时间（6.1 ± 1.0）要短（P = 0.0093）。在高剂量组中，有良好或者可接受的插管条件的志愿者为 11 名 （92%；95%可信区间 [CI]，65%–99%）；在低剂量组中，有良好或者可接受的插管条件的志愿者为 8 名（67%；95%可信区间，39%–86%）。

结论：在同时给予异丙酚 2 mg/kg 的情况下，为了产生可接受的插管条件所需的瑞芬太尼剂量 2 mcg/kg，会导致呼吸暂停同时有降低氧饱和的显著风险，然而 1.5 mcg/kg 剂量的瑞芬太尼无法可靠地提供可接受的插管条件，也没有减少氧饱和降低的风险。

（张怡 訳 馬皓琳 李士通校）

BACKGROUND: In an earlier study investigating the “can't ventilate/can't intubate” clinical scenario, induction of anesthesia with thiopental 5 mg/kg and succinylcholine 1.0 mg/kg was associated with a significant risk of hemoglobin desaturation. It appeared that succinylcholine-induced apnea was responsible for the prolonged apnea. Our hypothesis was that using propofol and remifentanil for tracheal intubation might avoid prolonged apnea and subsequent desaturation attributable to muscle relaxation.

METHODS: Twenty-four healthy volunteers ages 18 to 45 years participated. After oxygen administration to end-tidal oxygen >90%, volunteers received 2 mg/kg propofol and remifentanil either 2 mcg/kg (group 1; n = 12) or 1.5 mcg/kg (group 2; n = 12). Oxygen saturation (SpO2) was measured at a finger, an ear lobe, and the forehead. If SpO2 decreased below 80%, volunteers received chin lift and, if persistent, assisted ventilation.

RESULTS: Desaturation (SpO2 < 80%) occurred in 5 volunteers: 4 in the higher remifentanil dose (2 mcg/kg) group and 1 in the lower dose (1.5 mcg/kg) group. Chin lift and assisted ventilation was necessary in 3 volunteers. The lowest SpO2 was 82.4 ± 10.5 (mean ± SD) in the higher-dose group vs. 92.4 ± 8.6 with the lower dose of remifentanil (P = 0.019). Apnea time was shorter (P = 0.0093) with the lower dose (4.7 ± 1.5) than with the higher dose of remifentanil (6.1 ± 1.0). Conditions for intubation were excellent or acceptable in 11 volunteers (92%; 95% confidence interval [CI], 65%–99%) in the higher-dose group, and in 8 (67%; 95% CI, 39%–86%) with the lower dose.

CONCLUSIONS: Administered with propofol 2 mg/kg, the remifentanil dose necessary to produce acceptable intubating conditions, 2 mcg/kg, produces apnea that carries a significant risk of desaturation, whereas a remifentanil dose of 1.5 mcg/kg does not reliably produce acceptable intubating conditions and does not eliminate the risk of desaturation.
Unplanned Endotracheal Extubations in the Intensive Care Unit: Systematic Review, Critical Appraisal, and Evidence-Based Recommendations
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BACKGROUND: In this study, we updated the state of knowledge on unplanned tracheal extubations in the intensive care unit. We focused on the following topics: incidence, risk factors, reintubation after unplanned extubation, outcomes, and prevention. Based on this review, recommendations were made for preventing unplanned extubations.

METHODS: Electronic databases were searched for relevant publications from January 1, 1950 through June 30, 2011 on the MEDLINE, EMBASE, CINAHL, SciELO, LILACS, and Cochrane systems. Fifty articles were eligible for data abstraction. Study quality was assessed using the Newcastle-Ottawa Scale. Grades of recommendation were assessed according to the Oxford Centre for Evidence-Based Medicine.

RESULTS: Unplanned extubations occur at a rate of 0.1 to 3.6 events per 100 intubation days. Risk factors associated with unplanned extubations included male gender (odds ratio [OR] 4.8), APACHE score ≥17 (OR 9.0), chronic obstructive pulmonary disease, restlessness/agitation (OR 3.3–30.6), lower sedation level (OR 2.0–5.4), higher consciousness level (OR 1.4–2.0), and use of physical restraints (OR 3.1). Reintubation rates ranged from 1.8% to 88% of unplanned extubations. Thirteen studies assessed preventive measures for avoiding unplanned extubations. These studies focused on data collection tools, standardization of procedures, staff education, staff surveillance, and identification and management of high-risk patients. These studies reported reductions in unplanned extubation rate from 22% to 53%. The best methods of securing the endotracheal tube and use of physical restraints remain controversial issues.
CONCLUSIONS: Despite numerous publications on unplanned extubation, few studies assess preventive strategies for adverse events, and few clinical trials have assessed unplanned extubations. Recommendations are proposed based on the currently available literature.

尼莫地平引起的低血壓而不是硝酸甘油引起的低血壓保留成年小鼠長期和短期記憶

Nimodipine-Induced Hypotension but Not Nitroglycerin-Induced Hypotension Preserves Long- and Short-Term Memory in Adult Mice

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背景：急性低血壓可能引起認知功能障礙。L-型鈣通道阻斷劑在低氧條件下保護學習和記憶。我們驗證尼莫地平(NIMO)和尼卡地平(NICA)誘發的低血壓對比硝酸甘油(NTG)誘發的低血壓將產生保護長期和短期記憶作用。

方法：40只S-W小鼠(30-35g, 6-8周)隨機分為4組，手術當日被動逃避(PA)學習後立即腹膜內注射藥物：(1)硝酸甘油(30 mg/kg); (2)尼卡地平(40 mg/kg); (3)尼莫地平(40 mg/kg); (4)生理鹽水。記錄PA訓練等待時間(s)從懸吊的平臺到進入一個有機玻璃管，在這裡電擊(0.3毫安培，持續時間2秒)自動傳送。在第二天無電擊進行傳輸的複核子試驗過程中記錄等待時間。等待時間大於900s被指定為此數值。更低的測試等待時間顯示出損害長期相關記憶。另外49只小鼠隨機分為類似分組用於物體辨識測試(ORT)，並且在手術當日給予腹膜注射。ORT測量短期記憶通過探索在有熟悉物體的情況下小鼠傾向喜歡新穎物體。在訓練的第5天，2個相同的物體被放置在一個圓形舞臺，並且小鼠進行探索15分鐘。用新穎物體替換熟悉的物體後1小時，進行3分鐘的試驗。具有完整記憶的小鼠花大約65%的時間探索新物體。記憶損害的小鼠花了相同時間探索新老物體。辨識指數(RI)定義為花在探索新物體與花在探索兩個物體的時間比值。在小鼠兩個獨立組進行平均動脈壓(MAP)、腦血流和身體及腦氧合飽和度(PO2)研究，用來確定每次處理生理情況和低血壓程度的對應劑量。

結果：不同情況下中位數PA等待時間如下：NTG，219.5±93.5 s 四分位距(SIQR)；NICA，372.5±75.5 s SIQR；NIMO，540±200s SIQR 和生理鹽水，804±257.5 s SIQR。用等級方法來分析PA等待時間的顯著性差異。NTG等待時間明顯短於NIMO等待時間(P = 0.012)和生理鹽水等待時間(P = 0.006)，但不短於NICA等待時間(P = 0.126)。ORT RI值顯示出類似模式。我們發現NTG RI (47.2±5.9% SEM) 不同於NIMO RI (60.2±4.6% SEM, P = 0.031)，並且不同於生理鹽水 RI (66.9±3.7% SEM, P = 0.006)。生理實驗顯示，在注射10-15分鐘內變得對外界刺激的反應微弱的所有動物中平均動脈壓降至45-50 mm Hg。組間差異在平均動脈壓，體和腦氧合和腦血流沒有統計學意義。

結論：NIMO誘發的急性低血壓保護與臨床後處理階段有關的兩類記憶形成。由PA學習模式測得的瞬間長期相關記憶結構和由ORT模式測得的延遲性短期工作記憶功能與NTG誘發的低血壓相應水準比較，有顯著改善。這些結果顯示對L-型鈣通道阻斷劑作爲低血壓和低流率狀態下保護認知功能的一種潛在方式的進一步研究的實用性。
**BACKGROUND:** Acute hypotension may be implicated in cognitive dysfunction. L-Type calcium channel blockers in the setting of hypoxia are protective of learning and memory. We tested the hypothesis that hypotension induced by nimodipine (NIMO) and nicardipine (NICA) would be protective of long- and short-term memory compared to hypotension induced by nitroglycerin (NTG).

**METHODS:** Forty Swiss-Webster mice (30 to 35 g, 6 to 8 weeks) were randomized into 4 groups for IP injection immediately after passive avoidance (PA) learning on day 0: (1) NTG (30 mg/kg); (2) NICA (40 mg/kg); (3) NIMO (40 mg/kg); and (4) saline. PA training latencies (seconds) were recorded for entry from a suspended platform into a Plexiglas tube where a shock (0.3 mA; 2-second duration) was automatically delivered. On day 2 latencies were recorded during a testing trial during which no shock was delivered. Latencies >900 seconds were assigned this value. Lower testing latency is indicative of an impairment of long-term associative memory. Forty-nine additional mice were randomized into similar groups for object recognition testing (ORT) and given IP injections on day 0. ORT measures short-term memory by exploiting the tendency of mice to prefer novel objects where a familiar object is present. On day 5 during training, 2 identical objects were placed in a circular arena and mice explored both for 15 minutes. A testing trial was conducted 1 hour later for 3 minutes after a novel object replaced a familiar one. Mice with intact memory spend about 65% of the time exploring the novel object. Mice with impaired memory devote equal time to each object. Recognition index (RI) is defined as the ratio of time spent exploring the novel object to time spent exploring both objects was the measure of memory. Mean arterial blood pressure (MAP), cerebral bloodflow, and body and brain oxygenation (PO₂) studies were done in separate groups of mice to determine the dosages for matched degrees of hypotension and the physiological profile of each treatment.

**RESULTS:** The median PA latencies for the different conditions were as follows: NTG (219.5 ± 93.5 second semi-interquartile range [SIQR]), NICA (372.5 ± 75.5 second SIQR), NIMO (540 ± 200 second SIQR) and saline (804 ± 257.5 second SIQR). Rank methods were used to analyze the PA latencies for significant differences. NTG latency was significantly shorter than NIMO latency (P = 0.012) and saline latency (P = 0.006), but not NICA latency (P = 0.126). ORT RI values showed a similar pattern. We found that NTG RI (47.2 ± 5.9% SEM) was different from NIMO RI (60.2 ± 4.6% SEM, P = 0.031) and different from saline RI (66.9 ± 3.7% SEM, P = 0.006). Physiological experiments showed that MAP decreased to 45 to 50 mm Hg in all animals who became minimally responsive to external stimuli within 10 to 15 minutes of injection. Intergroup differences for MAP, body and brain oxygenation, and cerebral bloodflow were not statistically significant.

**CONCLUSION:** Acute hypotension induced by NIMO was protective of 2 categories of memory formation relevant to the clinical posttreatment period. Both immediate long-term associative memory consolidation as measured by the PA learning paradigm and delayed short-term working memory function as measured by the ORT paradigm were significantly improved compared to matched levels of hypotension induced by NTG. These results indicate the utility of further investigation of L-type calcium channel blockers as a potential means of preserving cognition in the setting of hypotensive and low flow states.

**Comparative Life Cycle Assessment of Disposable and Reusable Laryngeal Mask Airways**

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BACKGROUND: Growing awareness of the negative impacts from the practice of health care on the environment and public health calls for the routine inclusion of life cycle criteria into the decision-making process of device selection. Here we present a life cycle assessment of 2 laryngeal mask airways (LMAs), a one-time-use disposable Unique™ LMA and a 40-time-use reusable Classic™ LMA.

METHODS: In life cycle assessment, the basis of comparison is called the “functional unit.” For this report, the functional unit of the disposable and reusable LMAs was taken to be maintenance of airway patency by 40 disposable LMAs or 40 uses of 1 reusable LMA. This was a cradle-to-grave study that included inputs and outputs for the manufacture, transport, use, and waste phases of the LMAs. The environmental impacts of the 2 LMAs were estimated using SimaPro life cycle assessment software and the Building for Environmental and Economic Sustainability impact assessment method. Sensitivity and simple life cycle cost analyses were conducted to aid in interpretation of the results.

RESULTS: The reusable LMA was found to have a more favorable environmental profile than the disposable LMA as used at Yale New Haven Hospital. The most important sources of impacts for the disposable LMA were the production of polymers, packaging, and waste management, whereas for the reusable LMA, washing and sterilization dominated for most impact categories.
DISCUSSION: The differences in environmental impacts between these devices strongly favor reusable devices. These benefits must be weighed against concerns regarding transmission of infection. Health care facilities can decrease their environmental impacts by using reusable LMAs, to a lesser extent by selecting disposable LMA models that are not made of certain plastics, and by ordering in bulk from local distributors. Certain practices would further reduce the environmental impacts of reusable LMAs, such as increasing the number of devices autoclaved in a single cycle to 10 (~25% GHG emissions) and improving the energy efficiency of the autoclaving machines by 10% (~8% GHG emissions). For both environmental and cost considerations, management and operating procedures should be put in place to ensure that reusable LMAs are not discarded prematurely.

麻醉藥物溫室氣體排放的生命週期
Life Cycle Greenhouse Gas Emissions of Anesthetic Drugs
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背景：麻醉醫師必須考慮藥物的整個生命週期，以便將其對環境的影響納入臨床決策。在本研究中，我們用生命週期評價來研究以下五種麻醉藥品對氣候變化的影響：七氟醚、地氟醚、異氟醚、笑氣和異丙酚。

方法：本研究採取完整的全程方法，包括原料選取、藥物製造、藥物運輸到健康保健設施、藥物輸送至病人以及藥物清理或排放至環境。生命週期的每個階段，能量、物質的投入和排放以及每種藥物使用的特殊影響均被考慮在內。這 4 種吸入麻醉氣體是溫室氣體（GHGg），所以溫室氣體排放的生命週期包括廢麻醉氣體排放至大氣和起於其他生命週期階段的排放物（主要是二氧化碳）。

結果：當在氧氣/空氣混合氣體中給予時，地氟醚每 MAC-小時麻醉氣體的生命週期溫室氣體影響在這些麻醉藥物中最大，是異氟醚的 15 倍，七氟醚的 20 倍。當混合笑氣/氧氣時，所有藥物的溫室氣體排放量顯著增加。對於所有吸入麻醉藥物，溫室氣體影響主要由於廢麻醉氣體的無節制排放引起。丙泊酚的溫室氣體影響相對較小，比地氟醚和氧化亞氮低了近 4 個數量級。不同於吸入藥物，丙泊酚的溫室氣體影響主要來自注射泵所需的電力而並非源自藥物產生或直接釋放至環境。

討論：本研究結果在提供這些吸入藥物整個生命週期溫室氣體效果的同時重申了先前公佈的資料。對此，有幾個實際的環境影響緩解策略。地氟醚和笑氣應該密封在容器中，這樣可降低發病率和死亡率超過替代藥物。臨床醫生在使用所有吸入藥物時應避免不必要的高新鮮氣體流速。有廢麻醉氣體採集系統，即使在再生麻醉氣體使用前，應充分考慮廢氣採集系統的應用。本研究表明吸入麻醉外的其他麻醉技術，如全憑靜脈麻醉，椎管內，或外周神經阻滯麻醉，可能對環境的影響最小。

（許辛譯 馬皓琳 李士通校）
BACKGROUND: Anesthesiologists must consider the entire life cycle of drugs in order to include environmental impacts into clinical decisions. In the present study we used life cycle assessment to examine the climate change impacts of 5 anesthetic drugs: sevoflurane, desflurane, isoflurane, nitrous oxide, and propofol.

METHODS: A full cradle-to-grave approach was used, encompassing resource extraction, drug manufacturing, transport to health care facilities, drug delivery to the patient, and disposal or emission to the environment. At each stage of the life cycle, energy, material inputs, and emissions were considered, as well as use-specific impacts of each drug. The 4 inhalation anesthetics are greenhouse gases (GHGs), and so life cycle GHG emissions include waste anesthetic gases vented to the atmosphere and emissions (largely carbon dioxide) that arise from other life cycle stages.

RESULTS: Desflurane accounts for the largest life cycle GHG impact among the anesthetic drugs considered here: 15 times that of isoflurane and 20 times that of sevoflurane on a per MAC-hour basis when administered in an O2/air admixture. GHG emissions increase significantly for all drugs when administered in an N2O/O2 admixture. For all of the inhalation anesthetics, GHG impacts are dominated by uncontrolled emissions of waste anesthetic gases. GHG impacts of propofol are comparatively quite small, nearly 4 orders of magnitude lower than those of desflurane or nitrous oxide. Unlike the inhaled drugs, the GHG impacts of propofol primarily stem from the electricity required for the syringe pump and not from drug production or direct release to the environment.

DISCUSSION: Our results reiterate previous published data on the GHG effects of these inhaled drugs, while providing a life cycle context. There are several practical environmental impact mitigation strategies. Desflurane and nitrous oxide should be restricted to cases where they may reduce morbidity and mortality over alternative drugs. Clinicians should avoid unnecessarily high fresh gas flow rates for all inhaled drugs. There are waste anesthetic gas capturing systems, and even in advance of reprocessed gas applications, strong consideration should be given to their use. From our results it appears likely that techniques other than inhalation anesthetics, such as total IV anesthesia, neuraxial, or peripheral nerve blocks, would be least harmful to the environment.
day of each national SPA meeting since 1987 with historical data using the day, month, and location of each meeting. Using a generalized estimating equations model, the odds ratio of rain comparing meeting and nonmeeting days was 2.63 (P value 0.006, 95% confidence interval 1.32–5.22). These results confirm a significantly higher frequency of rain at national SPA meetings than would be anticipated.

Identification of the Great Auricular Nerve by Ultrasound Imaging and Transcutaneous Nerve Stimulation

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約 8% 患者在肌間溝臂叢神經阻滯術後發生頸淺叢神經病變。耳大神經是參與發生頸淺叢神經病變的其中一個神經。本文報告在大多數病例中（95% 置信區間下限 63%）通過超聲和經皮神經電刺激成功識別了耳大神經。女性和肥胖患者的神經識別顯著較難。進一步的研究將考慮確定這些資訊是否將有助於減少頸淺叢神經病變。

(許辛譯 馬皓琳 李土通校)
Superficial cervical plexus neuropathy after interscalene brachial plexus block affects about 8% of patients postoperatively. One of the nerves involved in superficial cervical plexus neuropathy is the great auricular nerve. We report success in identification of the great auricular nerve with ultrasound and transcutaneous nerve stimulation in a clinical setting in the majority of cases (95% lower confidence limit 63%). Identification of the nerve is significantly more difficult in female and in obese patients. Further studies will allow determination of whether this information will help to reduce the incidence of superficial cervical plexus neuropathy.