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## Regional Anesthesia

在連續股神經阻滯中，導管尖端相對於股神經位置（前或後）對股四頭肌運動和皮膚感覺阻滯效果的影響

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*Anesth Analg September 2012 115:721-727; published ahead of print June 28, 2012*

正中神經阻滯時使用或不使用超聲引導下 5%葡萄糖溶液繞神經水分離技術：一項前瞻隨機雙盲非劣效性檢驗試驗

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腹橫肌平面阻滯用於腹腔鏡膽囊切除日間手術術後的有效性：一項隨機臨床研究

**The Beneficial Effect of Transversus Abdominis Plane Block After Laparoscopic Cholecystectomy in Day-Case Surgery: A Randomized Clinical Trial**

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**背景：**腹腔鏡膽囊切除術的術後早期常伴有中度疼痛。最近隨機試驗顯示腹橫肌平面（TAP）阻滯對腹部手術術後鎮痛的有效性。本研究假設腹橫肌平面阻滯可以減輕腹腔鏡膽囊切除日間手術病人術後 24 小時內咳嗽及靜息時的疼痛，阿片類鎮痛藥需要量及其副反應。

**方法：**此項隨機雙盲研究中，擬在日間手術室接受腹腔鏡膽囊切除術的 80 名患者隨機分爲兩組：術後行超聲引導下雙側腹橫肌平面（TAP）阻滯（注射 0.5%羅呱卡因 20mL）或行安慰劑注射。術後疼痛治療包括口服對乙醯氨基酚 1000mg 共 4 次，口服布洛芬 400mg

共 3 次，術後 0-2 小時內靜脈注射嗎啡和術後 2-24 小時內口服酚呱丙酮。主要終點指標爲術後咳嗽時疼痛評分，後者通過術後 24 小時內曲線下面積(AUC/24 h)計算得到。次要終點指標包括靜息時疼痛評分(AUC/24 h)，阿片類鎮痛藥的需要量及副作用。分別在術後 0,2,4,6,8 和 24 小時對患者進行評估。對視覺類比評分（VAS）疼痛（AUC/24 h）指標的組間比較採用配對 t 檢驗。對嗎啡和酚呱丙酮需要量的不匹配資料採用秩和檢驗。對分類資料分析採用卡方檢驗。

**結果：**主要終點指標結果爲：與安慰劑組相比，腹橫肌平面(TAP)阻滯極大的減少了咳嗽時 VAS 疼痛評分(AUC/24 h) (P = 0.04)[TAP 組：26mm(標準差 13)(加權平均後）；安慰劑組：34（18）（95%可信區間：: 0.5–15 mm）]。兩組在靜息狀態下 VAS 疼痛評分（AUV/24h）差異無統計學意義。兩組的嗎啡需要量（術後 0-2 小時）有顯著差異(P < 0.001) [安慰劑組：中位數 7.5mg（四分位差爲 5-10mg）vs TAP 組 中位數 5mg（四分位差爲 0-5mg）]。TAP 組隨機患者比安慰劑組需要更少嗎啡劑量的比值比爲 P（TAP 組<安慰劑組）= 0.26（可信區間爲 0.15-0.37），P=0.5 代表無統計學意義。在酚呱丙酮總需要量，噁心和鎮靜程度，嘔吐病人數量及昂丹司瓊需要量方面，兩組間無明顯差異。

**結論：**腹橫肌平面阻滯用於腹腔鏡膽囊切除術後，減少咳嗽時疼痛及阿片類藥物的需要量有一定效果，但其效果有限。

（諸琳婕　譯　陳傑　校）

**BACKGROUND:** Laparoscopic cholecystectomy is associated with postoperative pain of moderate intensity in the early postoperative period. Recent randomized trials have demonstrated the efficacy of transversus abdominis plane (TAP) block in providing postoperative analgesia after abdominal surgery. We hypothesized that a TAP block may reduce pain while coughing and at rest for the first 24 postoperative hours, opioid consumption, and opioid side effects in patients undergoing laparoscopic cholecystectomy in day-case surgery.

**METHODS:** In this randomized, double-blind study, 80 patients undergoing laparoscopic cholecystectomy in our day-case surgery unit were allocated to receive either bilateral ultrasound-guided posterior TAP blocks (20 mL 0.5% ropivacaine) or placebo blocks. Postoperative pain treatment consisted of oral acetaminophen 1000 mg × 4, oral ibuprofen 400 mg × 3, IV morphine (0–2 hours postoperatively), and oral ketobemidone (2–24 hours postoperatively). The primary outcome was postoperative pain scores while coughing calculated as area under the curve for the first 24 postoperative hours (AUC/24 h). Secondary outcomes were pain scores at rest (AUC/24 h), opioid consumption, and side effects. Patients were assessed 0, 2, 4, 6, 8, and 24 hours postoperatively. Group-wise comparisons of visual analog scale (VAS) pain (AUC/24 h) were performed with the 2-sample t test. Morphine and ketobemidone consumption were compared with the Mann-Whitney test for unpaired data. Categorical data were analyzed using the $\chi 2$ test.

**RESULTS:** The primary outcome variable, VAS pain scores while coughing (AUC/24 h), was significantly reduced in the TAP versus the placebo group (P = 0.04); group TAP: 26 mm (SD 13) (weighted average level) versus group placebo: 34 (18) (95% confidence interval): 0.5–15 mm). VAS pain scores at rest (AUC/24 h) showed no significant difference between groups. Median morphine consumption (0–2 hours postoperatively) was 7.5 mg (interquartile range: 5–10 mg) in the placebo group compared with 5 mg (interquartile range: 0–5 mg) in the TAP group (P < 0.001). The odds ratio of a random patient in group TAP having less morphine consumption than a random patient in group placebo was P (group TAP < group placebo) = 0.26 (confidence interval: 0.15, 0.37) where 0.5 represents no difference between groups. There were no between-

group differences in total ketobemidone consumption, levels of nausea and sedation, number of patients vomiting, or consumption of ondansetron.
**CONCLUSIONS:** TAP block after laparoscopic cholecystectomy may have some beneficial effect in reducing pain while coughing and on opioid requirements, but this effect is probably rather small.

## 一項關於舌下給予芬太尼膜片劑在健康志願者體內的藥代動力學和生物利用度的臨床 I 期研究

**A Phase I Pharmacokinetic and Bioavailability Study of a Sublingual Fentanyl Wafer in Healthy Volunteers**

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Anesth Analg September 2012 115:554-559

**背景：**舌下給予阿片類藥物是一種快速鎮痛的簡單無創方法，本 I 期臨床研究調查一種芬太尼膜片劑在健康志願者體內的藥代動力學和生物利用度參數。目的是調查一種新的舌下給予型芬太尼膜片劑的藥代動力學特徵並確定其絕對生物利用度。
**方法：**共 24 名健康志願者，平均年齡 23 歲，隨機分組接受舌下或靜脈給予芬太尼 100ug。在芬太尼給藥 24 個小時後，採集血標本並放於無菌聚丙烯試管中。藥代動力學參數取決於對芬太尼血漿濃度—時間關係的模型非依賴性藥代動力學分析。
**結果：**舌下給予芬太尼膜片劑的平均絕對生物利用度是 78.9%（90%可信區間 51.1%—121.7%）。所有志願者芬太尼血漿濃度首次可測時間的區間爲 2-10 分鐘，平均血漿濃度達峰時間是給藥後的 0.91（±0.73）小時。
**結論：**舌下給予芬太尼膜片劑可迅速檢測出芬太尼血漿濃度。78.9%的絕對生物利用度表明芬太尼很高的系統可利用性，證實了此種膜片劑型有長遠發展前景。
（詹凱誕　譯　陳傑　校）

**BACKGROUND:** The sublingual administration of opioids is a simple and noninvasive method that provides rapid analgesia. In this phase I study we investigated the pharmacokinetics and bioavailability of a fentanyl wafer in healthy volunteers. The principal study objective was to investigate the pharmacokinetic profile of a new sublingual fentanyl wafer and to establish its absolute bioavailability.
**METHODS:** Twenty-four healthy volunteers, mean age 23 years, were randomly assigned to receive the equivalent of fentanyl 100 μg by both the sublingual and IV routes. Blood samples were collected in sterile polypropylene tubes for 24 hours after each fentanyl administration. The pharmacokinetic parameters were determined by model-independent pharmacokinetic analyses of the plasma fentanyl concentration–time profiles.
**RESULTS:** The mean absolute bioavailability of the sublingual fentanyl wafer was 78.9% (90% confidence interval [CI] 51.1% to 121.7%). The first detectable plasma fentanyl concentration

time ranged from 2 to 10 minutes in all volunteers, and the mean (±SD) time to peak plasma concentration at 0.91 (±0.73) hours after administration.
**CONCLUSION:** Sublingual administration of fentanyl as a wafer product resulted in rapidly detectable plasma fentanyl concentrations. The absolute bioavailability of 78.9% indicated a high systemic availability of fentanyl and suggests that further development of this wafer is justified.

## 對於離線困難的氣管插管患者的雙模式撤機策略：一項可行性研究

## Dual-Mode Weaning Strategy for Difficult-Weaning Tracheotomy Patients: A Feasibility Study

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**背景**：離線困難的氣管切開患者佔用大量 ICU 資源。這些患者通常會接受漫長的機械通氣同樣有很高的死亡率。雙模式撤機策略（有創和無創機械通氣交替）對離線困難的氣管切開病人的療效是未知的。
**方法**：於 2009 年 7 月至 2011 年 10 月，在一個 17 張床位的呼吸科 ICU 進行此項前瞻隨機對照試驗。氣管切開後，連續三天自主呼吸試驗失敗的患者（人數=32），隨機分配到雙模式組（人數=15）或傳統撤機組（人數=17）。
**結果**：在整個研究過程中及隨機化後，雙模式組患者較傳統撤機組機械通氣時間更少（分別爲-中位數 38 天，四分位間距[IQR]：28-53 vs 59，IQR：39-88，P 值=0.03; 中位數 10 天，IQR: 4–21 vs 37, IQR: 16–51, P 值< 0.01）。雙模式組患者 ICU 停留時間更短(中位數 44 天, IQR: 32–54 vs 72, IQR: 52–102, P 值 = 0.01)，離線時死亡率更低(1/15 vs 7/17 , P 值 = 0.04), 且在隨機化後擁有較低的肺部感染率 (3/15 vs 12/17, P 值< 0.01).
**結論**：雙模式撤機對治療離線困難的氣管切開患者是個有效的策略。本項小樣本佇列研究證明雙模式撤機減少了氣管切開患者的機械通氣時間和 ICU 停留時間，建議進一步研究以評估其對肺部感染和死亡率的影響。
（孫莉荔　譯　陳傑　校）
**BACKGROUND:** Tracheotomy patients who are difficult to wean from ventilation consume a substantial portion of intensive care unit (ICU) resources. These patients also typically undergo a long period of mechanical ventilation (MV) and have a high mortality rate. The efficacy of a dual-mode weaning strategy (alternation of invasive and noninvasive MV) in tracheotomy patients who are difficult to wean is unknown.
**METHODS:** We performed this prospective, randomized, controlled trial in a 17-bed respiratory ICU from July 2009 to October 2011. After tracheotomy, patients who failed for 3 consecutive days in a spontaneous breathing trial were enrolled (n = 32) and randomly allocated to either the dual-mode (n = 15) or conventional (n = 17) weaning group.
**RESULTS:** Compared with the conventional group, patients in the dual-mode group had a shorter duration of MV during the entire study (median 38 days, interquartile range [IQR]: 28–53 vs 59, IQR: 39–88, P = 0.03) and after randomization (median 10 days, IQR: 4–21 vs 37, IQR: 16–51, P < 0.01). They also had a shorter ICU stay (median 44 days, IQR: 32–54 vs 72, IQR:

52–102, P = 0.01), a lower mortality rate during weaning (1 of 15 vs 7 of 17, P = 0.04), and a lower rate of pulmonary infection after randomization (3 of 15 vs 12 of 17, P < 0.01).
**CONCLUSIONS:** Dual-mode weaning is a promising strategy for treating tracheotomy patients who are difficult to wean. In a small cohort of patients with tracheotomies, we demonstrated that dual-mode weaning reduced the total duration of MV and ICU stay; we recommend additional studies to assess its effect on pulmonary infections and mortality.

## 中心靜脈乳酸與動脈乳酸是否相同？一項人體回顧性研究

**Are Central Venous Lactate and Arterial Lactate Interchangeable? A Human Retrospective Study**

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**背景**：危重病人的動脈血乳酸濃度(Lacta)和 Lacta 清除率可用於診斷休克，評估預後及指導治療。近年來，代表混合靜脈血氧飽和度的中心靜脈血氧飽和度(Scvo2)，可通過中心靜脈纖維導管或從中心靜脈采血測得，被用於評估休克病人的整體氧供需平衡。當抽取中心靜脈血測量 Scvo2 時，可同時檢測中心靜脈血乳酸濃度(Lactcv)。此項研究分別評估危重病人的 Lactcv 和 Lactcv 清除率對於預測 Lacta 和 Lacta 清除率的作用。
**方法**：此項回顧性研究在一所地區和教學醫院的重症監護室進行，通過查詢從 2007 年 3 月到 2009 年 12 月血氣分析儀中的電子記錄，確定發生迴圈衰竭及呼吸衰竭患者，且其血氣標本的 Lactcv 和 Lacta 的檢測間隔小於 30min。爲了評估 Lactcv 在 Lacta 分別大於 2 和 4 mmol/L 時是否可作爲其預測值，計算這兩個閾值的 ROC 曲線下面積(AUCs)。同時計算 Lactcv 清除率的 AUCs 來辨別 Lacta 清除率<10%或>10%。
**結果**：分析 188 例病人共 673 組 Lactcv/Lacta。預測 Lacta 大於 2 和 4mmol/L 的 Lactcv AUC 分別是 0.98(95%可信區間: 0.97–0.99)和 0.98(95%可信區間: 0.96–0.99)。Lactcv 以 2 mmol/L 爲截斷值，對於預測 Lacta 大於 2 mmol/L 的敏感度>92%，特異度>90%。判斷 Lacta 清除率<10% 或 >10% 的 Lactcv AUC 分別爲 0.93 或 0.94。
**結論**：在 30 分鐘內測得的 Lactcv 和 Lacta 在臨床操作中是等同的。
（瞿亦楓　譯　陳傑　校）
**BACKGROUND:** In critically ill patients, arterial blood lactate concentration (Lacta) and Lacta clearance are used for the diagnosis of shock, for prognosis assessment, and to guide therapy. In recent years, central venous oxygen saturation (Scvo2), a surrogate for mixed venous blood saturation, either measured by fiberoptic catheters or from central venous blood samples, was used in shock to estimate the global balance between oxygen delivery and consumption. When central venous blood is drawn for Scvo2 measurement, it also could be used to measure central venous lactate concentration (Lactcv). In this study, we evaluated the utility of Lactcv and Lactcv clearance as predictors of Lacta and Lacta clearance, respectively, in critically ill patients.
**METHODS:** This retrospective study was performed in an intensive care unit of a regional and teaching hospital. Using the electronic registry of our blood gas analyzer from March 2007 to December 2009, we identified patients with circulatory or respiratory failure who had pairs of Lactcv and Lacta obtained within a 30-minute interval. To assess the utility of Lactcv as a predictor of Lacta above 2 and 4 mmol/L, we calculated the area under receiver operating

characteristic curves (AUCs) for these thresholds. We also calculated AUC of Lactcv clearance to detect a Lacta clearance <10% or >10%.
**RESULTS:** Six hundred seventy-three Lactcv/Lacta pairs in 188 patients were analyzed. AUC of Lactcv to predict a Lacta above 2 and 4 mmol/L was 0.98 (95% confidence interval: 0.97–0.99) and 0.98 (95% confidence interval: 0.96–0.99), respectively. Lactcv with the cutoff value of 2 mmol/L can predict a Lacta above 2 mmol/L with sensitivity >92% and specificity >90%. AUC for Lactcv clearance to detect a Lacta clearance <10% or >10% was 0.93 or 0.94, respectively.
**CONCLUSION:** Lactcv and Lacta collected within a 30-minute range are interchangeable for clinical practice.

## 綜述：新生兒和嬰兒椎管內鎮痛：關於建立安全和有效性資料的臨床及臨床前期策略回顧

**Review Article: Neuraxial Analgesia in Neonates and Infants: A Review of Clinical and Preclinical Strategies for the Development of Safety and Efficacy Data**

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作用于椎管內的藥物可以提供穩定的鎮痛效果，能改善預後，並且是兒童圍術期監護的重要組成部分。圍術期硬膜外輸注阿片類藥物或可樂定可增強鎮痛。在單次注射局麻藥物的骶管麻醉中，加入可樂定，氯胺酮，新斯的明或曲馬多可顯著延長鎮痛效果。且新生兒鞘內麻醉/鎮痛在某些中心逐漸增多。但由於缺乏有關鎮痛需求、副作用和隨訪的詳實資料，很難確定不同技術和藥物的相對風險/收益。總結了當前關於新生兒和嬰兒的椎管內麻醉/鎮痛的收益和併發症，但目前椎管內用藥的多樣性反映此領域高品質證據的缺乏。最近臨床前期研究報導了全麻藥對大腦的發育有不良影響，這個發現使椎管內麻醉/鎮痛能避免或減少全麻藥用量的優點得到重視。發育中的脊髓同樣對藥物劑量相關毒性作用較敏感，儘管臨床前期實驗已用成熟的模型和相關指標來評估期對成年動物脊髓毒性，但是對於幼年生命來說還沒有系統性的評估。因此，此綜述第二部分列出不同椎管內鎮痛藥的年齡相關性的藥效變化，以及現今基於特定模型的脊髓毒性評估研究。最後因其注射安全範圍廣，本文提倡使用椎管內麻醉，並建議新的鎮痛藥和製劑在納入臨床實踐之前，採用臨床前期實驗評估的最小劑量標準。
（王苑　譯　陳傑　校）

Neuraxial drugs provide robust pain control, have the potential to improve outcomes, and are an important component of the perioperative care of children. Opioids or clonidine improves analgesia when added to perioperative epidural infusions; analgesia is significantly prolonged by the addition of clonidine, ketamine, neostigmine, or tramadol to single-shot caudal injections of local anesthetic; and neonatal intrathecal anesthesia/analgesia is increasing in some centers. However, it is difficult to determine the relative risk-benefit of different techniques and drugs without detailed and sensitive data related to analgesia requirements, side effects, and follow-up. Current data related to benefits and complications in neonates and infants are summarized, but variability in current neuraxial drug use reflects the relative lack of high-quality evidence. Recent

preclinical reports of adverse effects of general anesthetics on the developing brain have increased awareness of the potential benefit of neuraxial anesthesia/analgesia to avoid or reduce general anesthetic dose requirements. However, the developing spinal cord is also vulnerable to drug-related toxicity, and although there are well-established preclinical models and criteria for assessing spinal cord toxicity in adult animals, until recently there had been no systematic evaluation during early life. Therefore, in the second half of this review, we present preclinical data evaluating age-dependent changes in the pharmacodynamic response to different spinal analgesics, and recent studies evaluating spinal toxicity in specific developmental models. Finally, we advocate use of neuraxial drugs with the widest demonstrable safety margin and suggest minimum standards for preclinical evaluation before adoption of new analgesics or preparations into routine clinical practice.

## 手術室管理工具成功減少了手術室首台手術延遲：來自德國醫院證據

**Success of Commonly Used Operating Room Management Tools in Reducing Tardiness of First Case of the Day Starts: Evidence from German Hospitals**

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**背景**：德國手術室管理宣稱目標之一是通過減少首台手術的工作拖拉來增加手術室的工作效率。本文分析了德國醫院由於增加的經濟壓力而引進的手術室管理工具是否能夠說明成功達到這一目標。手術室管理工具被定義爲手術室管理者的任命和手術室管理公文（即手術室憲章）的發展和引進。假設引進這些管理工具的之一或全部能較少首台手術的工作拖拉情況。

**方法**：在控制了醫院的規模和手術室複雜性的前提下，利用來自 107 家德國麻醉學系的具有代表性的 2005 例調查資料，使用托比模型來評估手術室管理者或手術室憲章的引進對首台手術的工作拖拉的影響。

**結果**：引進手術室管理工具至少能減少首台手術七分鐘的延遲（平均減少 15 分鐘，95％的可信區間：7-22 分鐘，$p<0.01$）

**結論**：首台手術延遲的減少顯著體現了德國手術室管理的目標。結果顯示手術室管理者的任命或手術室憲章的引進對這一目標是有積極作用的。對於根據當天的手術來作出短期決策，由於它減少了總體手術室使用時間，故這種減少是有經濟學意義的。

（鄭華容　譯　陳傑　校）

**BACKGROUND:** One of the declared objectives of surgical suite management in Germany is to increase operating room (OR) efficiency by reducing tardiness of first case of the day starts. We analyzed whether the introduction of OR management tools by German hospitals in response to increasing economic pressure was successful in achieving this objective. The OR management tools we considered were the appointment of an OR manager and the development and adoption

of a surgical suite governance document (OR charter). We hypothesized that tardiness of first case starts was less in ORs that have adopted one or both of these tools.
**METHODS:** Using representative 2005 survey data from 107 German anesthesiology departments, we used a Tobit model to estimate the effect of the introduction of an OR manager or OR charter on tardiness of first case starts, while controlling for hospital size and surgical suite complexity.
**RESULTS:** Adoption reduced tardiness of first case starts by at least 7 minutes (mean reduction 15 minutes, 95% confidence interval (CI): 7–22 minutes, $P < 0.001$).
**CONCLUSION:** Reductions in tardiness of first case starts figure prominently the objectives of surgical suite management in Germany. Our results suggest that the appointment of an OR manager or the adoption of an OR charter support this objective. For short-term decision making on the day of surgery, this reduction in tardiness may have economic implications, because it reduced overutilized OR time.

## 術後阿片類藥物服用的決定因素的縱向佇列研究

**A Pilot Cohort Study of the Determinants of Longitudinal Opioid Use After Surgery**

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**背景：**對術後阿片類藥物的服用時長的決定因素尚未報導。假設術前心理壓力和濫用藥物都將延長術後阿片類藥物的服用時長。
**方法：**2007 年 1 至 2009.4，一項前瞻性縱向佇列研究納入 134 例患者，有 109 例患者完成全程隨訪。手術類型包括乳房切除術、乳房腫瘤切除、胸廓切開術、全膝關節置換術或全髖關節置換術。術前測試心理壓力、瞭解藥物濫用情況，並且記錄患者日常阿片類藥物服用情況，直至患者報告停藥和疼痛停止。研究的主要終點是阿片類藥物停用的時刻。所有分析都有相應手術類型的對照組。
**結果：**總體，6%患者持續服用新的阿片類藥物至術後 150 天。術前服用阿片類藥物、抑鬱症狀、成癮風險自我評價增加是延長服用阿片類藥物的獨立因素。術前服用阿片類藥物與 73%術後服用時間延長的發生有關（95%置信區間（CI）18 %-58%）(P = 0.0009)。另外，成癮風險自我評價每增加 1 分（4 分制），服用時間延長的發生增加 53%（95% CI 23%-71%）(P = 0.003)。獨立于術前阿片類藥物服用和成癮風險自我評價，術前貝克抑鬱量表 II 每增加 10 分，服用時間延長的發生增加 42％（95% CI 18 %-58%）（P =

0.002）。術前服用阿片類藥物、成癮風險自我評價和抑鬱症狀，較術後疼痛持續時間或嚴重程度，更能預測術後阿片類藥物使用時長的變化。
**結論：**術前因素，包括合法醫囑的阿片類藥物服用，成癮風險自我評價，抑鬱狀態都是預測術後阿片類藥物延長服用的獨立因素。比起術後疼痛時間或嚴重程度，這些因素均能更好預測延長阿片類藥物的服用。
（黃萍　譯　陳傑　校）
**BACKGROUND:** Determinants of the duration of opioid use after surgery have not been reported. We hypothesized that both preoperative psychological distress and substance abuse would predict more prolonged opioid use after surgery.
**METHODS:** Between January 2007 and April 2009, a prospective, longitudinal inception cohort study enrolled 109 of 134 consecutively approached patients undergoing mastectomy, lumpectomy, thoracotomy, total knee replacement, or total hip replacement. We measured preoperative psychological distress and substance use, and then measured the daily use of opioids until patients reported the cessation of both opioid consumption and pain. The primary end point was time to opioid cessation. All analyses were controlled for the type of surgery done.
**RESULTS:** Overall, 6% of patients continued on new opioids 150 days after surgery. Preoperative prescribed opioid use, depressive symptoms, and increased self-perceived risk of addiction were each independently associated with more prolonged opioid use. Preoperative prescribed opioid use was associated with a 73% (95% confidence interval [CI] 0.51%–87%) reduction in the rate of opioid cessation after surgery (P = 0.0009). Additionally, each 1-point increase (on a 4-point scale) of self-perceived risk of addiction was associated with a 53% (95% CI 23%–71%) reduction in the rate of opioid cessation (P = 0.003). Independent of preoperative opioid use and self-perceived risk of addiction, each 10-point increase on a preoperative Beck Depression Inventory II was associated with a 42% (95% CI 18%–58%) reduction in the rate of opioid cessation (P = 0.002). The variance in the duration of postoperative opioid use was better predicted by preoperative prescribed opioid use, self-perceived risk of addiction, and depressive symptoms than postoperative pain duration or severity.
**CONCLUSIONS:** Preoperative factors, including legitimate prescribed opioid use, self-perceived risk of addiction, and depressive symptoms each independently predicted more prolonged opioid use after surgery. Each of these factors was a better predictor of prolonged opioid use than postoperative pain duration or severity.

## 在連續股神經阻滯中，導管尖端相對於股神經位置（前或後）對股四頭肌運動和皮膚感覺阻滯效果的影響

**Continuous Femoral Nerve Blocks: The Impact of Catheter Tip Location Relative to the Femoral Nerve (Anterior Versus Posterior) on Quadriceps Weakness and Cutaneous Sensory Block**

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**背景:**連續股神經阻滯過程中，導管尖端相對於股神經的不同放置，其對輸注特點的影響仍然未知。
**方法:**分別將兩根導管置於志願者雙側股神經周圍（B 超引導下平面內進針）。如在患者優勢側將導管尖端隨機置於股神經的前方或後方。則在對側肢體將導管尖端放置到另一側。通過兩個導管同時輸注 0.1%的羅呱卡因持續 6 個小時（4ml/h）。測量的指標包括股四頭肌的最大隨意等長收縮（MVIC）和股四頭肌腱遠端的經皮電流耐受程度。分別在 0 小時（基線值），第 9 小時，還有第 22 小時進行測量。研究的主要終點是股四頭肌在 6 個小時候的 MVIC 值。
**結果：**在第 6 個小時或者其他時間段，導管尖端放置在股神經前、後的兩組（n=16）的股四頭肌 MVIC 值並沒有顯著的統計學差異(均數 [標準差] 分別爲 29% [26] vs 30% [28]; 95% 可信區間: −22% 至 20%; P = 0.931)。不但在第 6 小時(分別爲 20 [23] mA vs 6 [4] mA; 95% 可信區間: 1–27 mA; P = 0.035)，同樣在第 1、7、8、9 小時 (P < 0.04)前端組較後側組對表層電流的最大耐受度要更高。
**結論：**此研究證實通過放置在股神經前面和後面的神經導管，注射低劑量的羅呱卡因（4mg/h）進行持續的股神經阻滯，都產生明顯股四頭肌的肌力下降(70%–80%)。與導管放置在後面組相比，導管放置在前面組增加了感覺神經的阻滯，而不伴相應的運動神經阻滯。
（馬霄雯　譯　陳傑　校）
**BACKGROUND:** During a continuous femoral nerve block, the influence of catheter tip position relative to the femoral nerve on infusion characteristics remains unknown.
**METHODS:** We inserted bilateral femoral perineural catheters in volunteers (ultrasound-guided, needle in-plane). Subjects' dominant side was randomized to have the catheter tip placed either anterior or posterior to the femoral nerve. The contralateral limb received the alternative position. Ropivacaine 0.1% was administered through both catheters concurrently for 6 hours (4 mL/h). Outcome measures included the maximum voluntary isometric contraction (MVIC) of the quadriceps femoris muscle and tolerance to cutaneous electrical current over to the distal quadriceps tendon. Measurements were performed at hour 0 (baseline), and on the hour until hour 9, as well as hour 22. The primary end point was the MVIC of the quadriceps at hour 6.
**RESULTS:** As a percentage of the baseline measurement, quadriceps MVIC for limbs with anterior (n = 16) and posterior (n = 16) catheter tip placement did not differ to a statistically significant degree at hour 6 (mean [SD] 29% [26] vs 30% [28], respectively; 95% confidence interval: −22% to 20%; P = 0.931), or at any other time point. However, the maximum tolerance to cutaneous electrical current was higher in limbs with anterior compared with posterior catheter tip placement at hour 6 (20 [23] mA vs 6 [4] mA, respectively; 95% confidence interval: 1–27 mA; P = 0.035), as well as at hours 1, 7, 8, and 9 (P < 0.04).
**CONCLUSIONS:** This study documents the significant (70%–80%) quadriceps femoris weakness induced by a continuous femoral nerve block infusion at a relatively low dose of ropivacaine (4 mg/h) delivered through a perineural catheter located both anterior and posterior to the femoral nerve. In contrast, an anterior placement increases cutaneous sensory block compared with a posterior insertion, without a concurrent relative increase in motor block.

## 關於右旋氯胺酮對健康志願者和複雜性區域疼痛綜合症 1 型慢性疼痛患者心輸出量的劑量依賴效應

**The Dose-Dependent Effect of S(+)-Ketamine on Cardiac Output in Healthy Volunteers and Complex Regional Pain Syndrome Type 1 Chronic Pain Patients**

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**背景**：氯胺酮作爲鎮痛劑用於急性和慢性疼痛的治療。氯胺酮對心血管系統有刺激作用，然而對其濃度 - 效應關係知之不多。 爲此，我們利用藥代動力學及藥效學模型來驗證了右旋氯胺酮在健康志願者和慢性疼痛患者對心輸出量的影響。
**方法**：在 10 例慢性疼痛患者（診斷出患有複雜區域疼痛綜合征 1 型[CRPS1，平均年齡 43.2±13 歲，病程 8.4 年，範圍爲 1.1 至 21.7 歲）和 12 名健康志願者（21.3±1.6 歲），給予首劑 1.5mg 的右旋氯胺酮後，以後每次增加近 1.5 毫克，共 7 次，每次給藥時間超過 5min，每次間隔近 20 分鐘通過植入橈動脈的動脈導管的動脈壓力曲線計算出心輸出量。並對血漿中氯胺酮和去甲氯胺酮進行濃度測定。構建一個基於藥動學，藥效學新型模型，用於量化氯胺酮對心輸出量的影響及後續適應/抑制效應。
**結論**：通過藥代動力學的評估，相比 CRPS1 患者，我們在健康志願者中觀察到其增加了 15% 的右旋氯胺酮及增加了 40%去甲氯胺酮。在病人和志願者中，輸注右旋氯胺酮對於 CO 的刺激作用呈劑量依賴性。在輸注後觀察到 CO 的抑制作用。在 CRPS1 患者和健康志願者中，藥效學模型參數沒有顯著差異。引起心輸出量增加 1L/min 的右旋氯胺酮濃度是 243 ± 54 ng/mL，消除半衰期是 1.3 ± 0.21 分鐘。抑制過程是緩慢的（時間常數爲 67.2±17.0 分鐘）。
**結論**：在研究人群中，不管在疾病狀態（CRPS1 與否）或年齡的差異，右旋氯胺酮的區別是其藥效學而非藥代動力學。 右旋氯胺酮對心輸出量的的劑量依賴性的效果可通過雙相的動態模型做出很好的描述。
（鄧利兵譯 薛張綱校）

**BACKGROUND:** Ketamine is used as an analgesic for treatment of acute and chronic pain. While ketamine has a stimulatory effect on the cardiovascular system, little is known about the concentration–effect relationship. We examined the effect of S(+)-ketamine on cardiac output in healthy volunteers and chronic pain patients using a pharmacokinetic–pharmacodynamic modeling approach.
**METHODS:** In 10 chronic pain patients (diagnosed with complex regional pain syndrome type 1 [CRPS1] with a mean age 43.2 ± 13 years, disease duration 8.4 years, range 1.1 to 21.7 years) and 12 healthy volunteers (21.3 ± 1.6 years), 7 increasing IV doses of S(+)-ketamine were given over 5 minutes at 20-minute intervals starting with 1.5 mg with 1.5-mg increments. Cardiac output (CO) was calculated from the arterial pressure curve obtained from an arterial catheter in the radial artery. Ketamine and norketamine plasma concentrations were measured. A novel pharmacokinetic–pharmacodynamic model was constructed to quantify the direct stimulatory effect of ketamine on CO and the following adaptation/inhibition.
**RESULTS:** Significant differences in pharmacokinetic estimates were observed between study groups with 15% and 40% larger S(+)-ketamine S(+)-norketamine concentrations in healthy volunteers compared to CRPS1 patients. S(+)-ketamine had a dose-dependent stimulatory effect

on CO in patients and volunteers. After infusion an inhibitory effect on CO was observed. Pharmacodynamic model parameters did not differ between CRPS1 patients and healthy volunteers. The concentration of S(+)-ketamine causing a 1 L/min increase in CO was 243 ± 54 ng/mL with an onset/offset half-life of 1.3 ± 0.21 minutes. The inhibitory component was slow (time constant of 67.2 ± 17.0 minutes).
**CONCLUSIONS:** S(+)-ketamine pharmacokinetics but not pharmacodynamics differed between study populations, related to differences in disease state (CRPS1 or not) or age. The dose-dependent effect of S(+)-ketamine on CO was well described by the biphasic dynamic model. The effect of S(+)-ketamine on CO was similar between study groups with respect to its stimulatory and inhibitory components, despite group differences in age and health.

## 兩種鈉離子通道調節劑對活體豬皮內 C 類纖維導電性能的不同影響

**The Differential Effects of Two Sodium Channel Modulators on the Conductive Properties of C-Fibers in Pig Skin In Vivo**

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**背景：**針對慢性疼痛治療來說，軸突的鈉通道是一個有吸引力的目標，而且最近的證據顯示對於特殊的目標，慢性失活的鈉通道（NaV）可以發揮鎮痛作用。使用類人類動物模型——豬，我們快速給予利多卡因（非選擇性鈉通道阻斷劑）和拉科醯胺（鈉通道慢性失活選擇性增強劑）來比較不同 C 類纖維等級的傳導性能的變化。
**方法：**單纖維細胞外記錄從隱神經進行。我們根據機械回應和傳導速度的功能性依賴放緩的數量來給 C 類纖維分類。在刺激的部位皮內注入利多卡因(4 mM; 100 μL)，拉科醯胺(4 mM; 100 μL)或者生理鹽水，然後對纖維傳導性能的變化進行評估。
**結果：**被利多卡因誘發的傳導延遲在機械敏感的疼痛感應器(5.5%± 2.1%)中比機械遲鈍的(2.5% ± 1%)要明顯的多。然而使用拉科醯胺的 C 類疼痛感應器，機械遲鈍的(3% ± 1%)比機械敏感的(2% ± 0.9%)增加到了更大的一個程度。利多卡因，而不是拉科醯胺，增加了所有機械敏感的 C 類纖維的電閾值，而不是機械遲鈍的 C 類纖維。拉科醯胺阻礙了傳導，此外，相比較機械敏感的疼痛感應器(ΔADS: 2.4% ± 0.5% vs 1.6% ± 0.5%)，在機械遲鈍的疼痛感應器中功能性依賴放緩要減少的顯著的多，利多卡因卻恰恰是相反的結果。生理鹽水在 C 類纖維的傳導性上沒有明顯的效果。
**結論：**在豬皮上的混合測試的局部應用，要考慮到有疼痛反應的和無疼痛反應的 C 類纖維的穩定性和功能依賴性調整的功能評估。增加的鎮痛特異性可能來自鈉通道緩慢失活的選擇性增強。
(方昕譯 薛張綱校)

**BACKGROUND:** Axonal sodium channels are attractive targets for chronic pain treatment, and recent evidence suggests that specific targeting of the slow inactivation of sodium channels (NaV) might exert analgesic effects. Using a human-like animal model, the pig, we compared changes

in the conductive properties of different C-fiber classes on acute administration of lidocaine (nonselective NaV blocker) and lacosamide (selective enhancer of NaV slow inactivation).
**METHODS:** Single-fiber extracellular recordings from saphenous nerves were performed. We classified C-fibers according to mechanical responsiveness and amount of activity-dependent slowing (ADS) of conduction velocity. Lidocaine (4 mM; 100 μL), lacosamide (4 mM; 100 μL), or saline was injected intradermally at the stimulation site, and changes of fibers' conductive properties were assessed.
**RESULTS:** Conduction latencies evoked by lidocaine were more prominent in mechanosensitive (5.5%± 2.1%) than in mechano-insensitive nociceptors (2.5% ± 1%), whereas lacosamide increased conduction latencies to a greater extent in the mechano-insensitive (3% ± 1%) than in mechanosensitive C-nociceptors (2% ± 0.9%). Lidocaine, but not lacosamide, increased electrical thresholds in all mechanosensitive, but not in the mechano-insensitive, C-fibers. Lacosamide blocked conduction and, in addition, reduced ADS in mechano-insensitive nociceptors significantly more than in mechanosensitive nociceptors (ΔADS: 2.4% ± 0.5% vs 1.6% ± 0.5%), whereas lidocaine had opposite effects. Saline had no significant effect on the conductive properties of C-fibers.
**CONCLUSION:** Local application of test compounds in pig skin allows for functional assessment of steady-state and use-dependent modulation of sodium channels in nociceptive and nonnociceptive C-fibers. Increased analgesic specificity might derive from selective enhancement of slow inactivation of sodium channels.

## 一項關於外科術後血糖控制的新型電腦化記憶褪色演算法

**A novel computerized fading memory algorithm for glycemic control in postoperative surgical patients.**

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**背景：**高血糖常見於危重病人，並且其與患者發病率和死亡率的增加相關。爲了更好的控制血糖水準，我們最近開發了一種新型電腦化記憶褪色（FM）演算法。在本項研究中，我們在外科重症監護室（SICU）患者中評估了這項演算法的安全性和有效性，並且將之與在我們機構中使用的現有的胰島素輸注演算法（佛吉尼亞（VA）演算法）相比較。
**方法：**我們開發了一項電腦程式來演算 FM 演算法和 VA 演算法。48 位擇期手術患者被隨機分配，接受按照 FM 演算法或是 VA 演算法得出的胰島素泵輸注。在 SICU 中，胰島素泵的使用是將手術室中帶入的繼續輸注，或是當患者血糖水準超過目標水準（140mg/dL）時啓動胰島素泵。每小時對患者進行血糖監測並將資料登錄電腦程式中，然後得出出下一次的胰島素劑量。在 SICU 的第一個 8 小時使用隨機分配兩種演算法，在這之後統一使用 VA 演算法。低血糖（血糖<60mg/dL）和高血糖（血糖>300mg/dL）事件會予以記錄。此外，我們將使血糖回歸目標範圍（140±20mg/dL）所需的時間、在目標範

圍內血糖測量的數量、血糖變異性以及胰島素的使用情況在 2 種演算法間進行了分析和比較。
**結果**：兩組患者在人口統計學和初始血糖值上相似。在使用現有的 VA 演算法下，觀察到一起嚴重的低血糖事件；3 位患者的血糖在 8 小時內沒有到達目標範圍。FM 演算法下，沒有出現過低血糖事件；所有的患者均在 8 小時內血糖達到目標範圍。血糖變異性測量通過計算平均血糖的標準差得出。變異性爲 28%（95%可信區間：14%-39%），FM 演算法較低（P<0.001）。FM 演算法使用的胰島素劑量比 VA 演算法少 1.1U/h（P=0.043）。
**結論**：使用新型的電腦化 FM 演算法類比生理雙向胰島素分泌進行血糖控制，血糖管理優於現有演算法，沒有任何低血糖發作。FM 演算法相比常規臨床演算法減少了血糖變異性以及胰島素的使用量。
(郭晨躍譯 薛張綱校)

**BACKGROUND:** Hyperglycemia is commonly encountered in critically ill patients and is associated with increased mortality and morbidity. To better control blood glucose levels, we previously developed a new computerized fading memory (FM) algorithm.(1) In this study we evaluated the safety and efficacy of this algorithm in surgical intensive care unit (SICU) patients and compared its performance against the existing insulin-infusion algorithm (named VA algorithm) used in our institution.
**METHODS:** A computer program was developed to run the FM and VA algorithms. Forty eight patients, who were scheduled to have elective surgery, were randomly assigned to receive insulin infusion on the basis of either the FM or VA algorithm. On SICU admission, an insulin infusion was either continued from the operating room or initiated when the glucose level exceeded the target level of 140 mg/dL. Hourly blood glucose measurements were performed and entered into the computer program, which then prescribed the next insulin dose. The randomly assigned algorithm was applied for the first 8 hours of SICU stay, after which the VA algorithm was used. The number of episodes of hypoglycemia (glucose <60 mg/dL) and excessive hyperglycemia (>300 mg/dL) were noted. Additionally, the time required to bring the glucose level within target range (140 ± 20 mg/dL), the number of glucose measurements within the target range, glycemic variability, and insulin usage were analyzed and compared between the 2 algorithms.
**RESULTS:** Patient demographics and starting glucose levels were similar between the groups. With the existing VA algorithm, 1 episode of severe hypoglycemia was observed. Three patients did not reach the target range within 8 hours. With the FM algorithm no hypoglycemia occurred, and all patients achieved the target range within 8 hours. Glycemic variability measured by the SD of mean glucose levels was 28% (95% confidence interval, 14% to 39%) lower for the FM algorithm (P < 0.001). The FM algorithm used 1.1 U/h less insulin than did the VA algorithm (P = 0.043).
**CONCLUSION:** The novel computerized FM algorithm for glycemic control, which emulates physiologic biphasic insulin secretion, managed glucose better than the existing algorithm without any episodes of hypoglycemia. The FM algorithm had less glycemic variability and used less insulin when compared to the conventional clinical algorithm.

## 對於左心發育不全綜合征的雙心室修補過渡血液迴圈的數學模型

**A mathematical model of transitional circulation toward biventricular repair in hypoplastic left heart syndrome.**

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**背景：**雖然對於單一心室損傷左心臟發育不全綜合征的傳統手術方法是執行階段性，姑息性的手術,但是對於雙心室修復病人無論是作爲一個主要的或作爲一個分階段的手術過程一定解剖亞型是作爲候選的。對於那些單一心室損傷--左側心室對於體循環輸出沒有任何貢獻的 、施行傳統干預措施的病人能夠優化全身組織氧供(DO(2))和靜脈氧飽和度的肺循環（Q（P））/體循環（Q（S））血流量比值範圍已經被描繪出。然而，在從階段性修復到兩心室修復期間創建的過渡環流，左心室確實對心輸出量作出了貢獻。系統性的氧供和系統性的靜脈氧飽和度被最佳化的 Q(P)/Q(S) ，在後者的環流優化尚未評價。利用電腦模型，我們研究了優化全身氧輸送參數。
**方法：**在改良的第一階段操作和用 Sano 分流改良的雙向 Glenn 分流後我們設計了模型血液迴圈，這是從階段性到雙心室修復而創造的過渡性迴圈。在兩個模型中衍生的數理方程用來描述 全身組織氧供。利用電腦和試算表我們用這些方程去檢驗全身氧供 DO(2)與動脈血氧飽和(Sao(2))度，靜脈血氧飽和度(Svo(2))，動脈血氧飽和度與靜脈血氧飽和度差值 Sao(2) - Svo(2)，肺循環與體循環比值 Q(P)/Q(S)，及氧過剩因數 Sa o(2)/(Sao(2) - Svo(2))之間的相互關係。
**結果：**在這兩個迴圈中，Sao(2)或者 Svo(2)本身不能準確地預期 DO(2) 或 Q(P)/Q(S)。這些變數間的相互關係被左心室提供的體循環輸出量的程度進一步改變了。相反地，DO（2）與氧過剩因數表現出了與左心室體循環心輸出量的程度無關的線性關係。
**結論：**通常臨床使用的評估指標，如單獨使用 Sao(2)或 Svo(2)不能準確地評估 DO(2)或 Q(P)/Q(S)。因此，這些不能被單獨用來指導手術期間的治療。
(李麗紅譯 薛張綱校)
**BACKGROUND:**Although the traditional surgical approach or left hypoplastic heart syndrome is to perform staged, palliative procedures as a single ventricle lesion, certain anatomical subsets of patients are candidates for a 2-ventricle repair either as a primary or as a staged procedure. The pulmonary blood flow (Q(P))/systemic blood flow (Q(S)) range necessary to optimize systemic oxygen delivery (DO(2)) and systemic venous oxygen saturation has been delineated for patients undergoing conventional interventions as a single ventricle physiology where the left ventricle is assumed to make no contribution to systemic cardiac output. However, in the transitional circulations created during staging to a 2-ventricle repair, the left ventricle does contribute to cardiac output. The Q(P)/Q(S) at which systemic DO(2) and systemic venous oxygen saturation are optimized in the latter circulations has not yet been evaluated. Using computer modeling, we investigated parameters to optimize systemic oxygen delivery.
**METHODS:**We designed model circulations after both modified stage I operation and modified bidirectional Glenn shunt with Sano shunt, which are transitional circulations created during staging to a 2-ventricle repair. Mathematical equations were derived to describe DO(2) in both models. Using a computer and an Excel spreadsheet, we used the equations to examine the relationships between DO(2) and arterial oxygen saturation (Sao(2)), venous oxygen saturation (Svo(2)), Sao(2) - Svo(2), Q(P)/Q(S), and the oxygen excess factor Sao(2)/(Sao(2) - Svo(2)).
**RESULTS:**In both circulations, Sao(2) or Svo(2) alone does not accurately predict DO(2) or Q(P)/Q(S). The relationships between these variables are further altered by the degree of

systemic cardiac output supplied by the left ventricle. To the contrary, DO(2) demonstrates the linear relationship with the oxygen excess factor Sao(2)/(Sao(2) - Svo(2)) irrespective of the degree of systemic cardiac output supplied by the left ventricle.
**CONCLUSIONS:**Commonly obtained clinical values such as Sao(2) and Svo(2) alone are not accurate assessments of DO(2) or Q(P)/Q(S). Therefore, these cannot be used in isolation to guide perioperative therapy.

## 螯傷經顱大腦皮層激發電位監測的發生率

**The Incidence of Bite Injuries Associated with Transcranial Motor-Evoked Potential Monitoring**

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**背景**：螯傷在經顱大腦皮層激發點位監測中是複雜的干擾。我們試圖去確定其發生率，類型和嚴重的咬傷，分析與經顱大腦皮層激發點位監測可能相關的方面。
**方法**：我們從 17273 件相關的外科手術中複習了與經顱大腦皮層相關的螯傷的事件報告。將事件按咬傷的數量和類型，定位，麻木和刺激變數分類。
**結果**：在 109 名病人中有 111 傷害包括 88 例舌頭損傷，22 例唇部損傷和 1 例門牙損傷。一名病人既損傷了舌頭有損傷了唇部；另一名病人損傷了唇部和牙齒。嚴重的螯傷包括從輕微的擦傷到需要縫合修補的深撕裂傷。需要修復的嚴重損傷共有 25 名患者。有兩名患者需要用牙墊。對於不嚴中的損傷前路修復的方法比後路更普遍。與 Xltek Protektor 相比在 Axon NIM-Eclipse 系統中咬傷的發生率更高。刺激強度在 77 例中最大化。
**結論**：與螯傷相關的經顱的點刺激是不尋常的但是經顱大腦皮層激發點位監測複雜的干擾，最嚴重的是要求縫合的發生率是 0.14%。舌頭的損傷發生大約是唇部損傷的 4 倍。除去螯傷的刺激，改變咬傷的刺激和位置是可能的故障。高強度的經顱刺激可能會增加咬傷的危險。我們提議一直用合適的尺寸的咬傷刺激和定期修復以達到使螯傷的危險最小化。未來的學習需要選擇最理想的刺激結構。
（孫莉萍譯 薛張綱校）

**BACKGROUND:** Bite injuries are a disturbing complication of transcranial motor-evoked potential (TcMEP) monitoring. We sought to determine the incidence, type, and severity of bite injuries, and to analyze possible related factors to determine methods of minimizing injury during TcMEP monitoring.
**METHODS:** We reviewed the incident reports of TcMEP-associated bite injuries from 17,273 consecutive surgical procedures. Cases were reviewed for type and number of bite blocks, positioning, anesthesia, and stimulus variables.
**RESULTS:** There were 111 bite injuries in 109 patients for a total incidence of 0.63% including 88 (79.3%) tongue injuries, 22 (19.8%) lip injuries, and 1 (0.9%) broken incisor. One patient had both tongue and lip injured; another had a lip injury and a broken tooth. Severity of bite injuries ranged from minor bruising to deep lacerations requiring suture repair. The total incidence of injury severe enough to require sutures was 25 patients (0.14%). All but 2 patients had some form of bite block used. Anterior approaches were more prevalent than posterior in the injured group although not significantly. The incidence of bite injuries was higher when the Axon NIM-

Eclipse system was used (1.37%) compared with the Xltek Protektor (0.6%). Stimulus intensity was maximized in 77 cases (70.6%). In 22 cases, displacement of bite block or of the tongue was documented.
**CONCLUSIONS:** Bite injuries associated with transcranial electric stimulation are an uncommon but disturbing complication of TcMEP monitoring occurring with an incidence of 0.63% (95% confidence interval: 0.52%-0.76%), the most severe of which requiring sutures at an incidence of 0.14% (95% confidence interval: 0.09%-0.21%). Injuries of the tongue occur approximately 4 times as frequently as injuries of the lip. Despite placement of bite blocks, shifting of the bite block during stimulation or positioning is a possible cause of failure. High-intensity transcranial stimulation may increase the risk of bite injuries. We suggest consistent use of properly sized and secured bite blocks with periodic inspection to minimize risk of bite injuries. Future study is needed to determine optimal bite block configuration.

## 上肢移植的麻醉處理：匹茲堡經驗

**Anesthetic Management in Upper Extremity Transplantation: The Pittsburgh Experience**
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**背景：**與實質器官不同，手、前臂、上臂移植是聯合血管移植，由皮膚、肌肉、肌腱、血管、神經、淋巴結、骨和骨髓等多種組織構成。在過去的十年中，有 26 例上肢移植在美國實施。2008 年 1 月至 2010 年 9 月間，匹茲堡大學醫學中心在 5 位受體身上完成 8 例手/前臂移植，具有最多的單中心經驗。在上肢移植這新興鄰域中，麻醉實施必須具有相匹配的方案和程式，有關區域阻滯的作用、移植手術中免疫抑制藥物的療效、在顯微手術中液體和血流動力學的管理、嚴格的術中監測等在長時間的手術過程中需要著重注意。
**方法：**基於 5 位患者的麻醉經驗，我們首次列出上肢移植手術麻醉的關鍵點。我們強調減少術中使用血管升壓藥，加強液體管理和使用血液製品的重要性。
**結果：**我們的方法降低了因圍術期出血需要再次探查或止血的機率，縮短了住院和住重症監護室的時間。所有患者移植物的功能、免疫以及存活率等結果都非常令人鼓舞。
**結論：**具體麻醉方案的確定和標準化需要進一步的實踐。同時，我們提供建議的目地是爲了實施這種新手術的中心有相關的準則。
（郁玲玲譯 薛張綱校）
**BACKGROUND:** Hand/forearm/arm transplants are vascularized composite allografts, which, unlike solid organs, are composed of multiple tissues including skin, muscle, tendons, vessels, nerves, lymph nodes, bone, and bone marrow. Over the past decade, 26 upper extremity transplantations were performed in the United States. The University of Pittsburgh Medical

Center has the largest single center experience with 8 hand/forearm transplantations performed in 5 recipients between January 2008 and September 2010. Anesthetic management in the emerging field of upper extremity transplants must address protocol and procedure-specific considerations related to the role of regional blocks, effects of immunosuppressive drugs during transplant surgery, fluid and hemodynamic management in the microsurgical setting, and rigorous intraoperative monitoring during these often protracted procedures.
**METHODS:** For the first time, we outline salient aspects of upper extremity transplant anesthesia based on our experience with 5 patients. We highlight the importance of minimizing intraoperative vasopressors and improving fluid management and blood product use.
**RESULTS:** Our approach reduced the incidence of perioperative bleeding requiring re-exploration or hemostasis and shortened in-hospital and intensive care unit stay. Functional, immunologic and graft survival outcomes have been highly encouraging in all patients.
**CONCLUSIONS:** Further experience is required for validation or standardization of specific anesthetic protocols. Meanwhile, our recommendations are intended as pertinent guidelines for centers performing these novel procedures.

**mu 阿片受體調節大鼠脊髓腹角的神經傳遞。**

**The mu opioid receptor modulates neurotransmission in the rat spinal ventral horn.**
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**背景**：阿片類藥物通過μ阿片受體（MORs）抑制興奮性神經傳遞並產生鎮痛。MORs 表達在脊髓腹角，其功能和效應在很大程度上是未知的。因此，我們在細胞水準上研究脊髓 IX 層神經元內μ阿片類藥物的神經調節作用。
**方法**：我們用全細胞膜片鉗技術研究選擇性μ激動劑酪氨酸-D-丙氨醯-甘氨醯-N-甲基-苯丙氨醯-甘氨醯-醇-腦啡肽（DAMGO）對新生大鼠脊髓 IX 層神經元內突觸傳遞的影響。
**結果**：我們記錄到，DAMGO 在其有效濃度 0.1μM 的 50％時，能在 56％的 IX 層神經元產生外向電流。分析電流和電壓的關係後，發現存在一個約-86mV 的逆轉電位。這些電流不能被河豚毒素阻斷，但能被 Ba（2 +）或選擇性μ拮抗劑抑制。而且，在添加 Cs（+）和四乙基銨或鳥苷-5'-[β-硫代]二磷酸三鋰鹽的溶液中此電流被抑制。此外，DAMGO 能降低自發性的興奮性和抑制性突觸後電流的頻率，這些效應是不能被河豚毒素改變的。
**結論**：我們的研究結果表明，DAMGO 在啓動 MORs 後，通過 G 蛋白介導的 K（+）通道使脊髓 IX 層的神經元超極化。而且，啓動突觸前末梢的 MORs 能減少興奮性和抑制性遞質的釋放。雖然傳統上認爲阿片類藥物並不影響運動功能，但目前的研究表明μ阿片類藥物對脊髓 IX 層神經元的神經調節效應，說明 MORs 能夠影響運動神經的活動。
（周玲譯 薛張綱校）

**BACKGROUND:** Opioids inhibit excitatory neurotransmission and produce antinociception through μ opioid receptors (MORs). Although MORs are expressed in the spinal ventral horn, their functions and effects are largely unknown. Therefore, we examined the neuromodulatory effects of μ opioids in spinal lamina IX neurons at the cellular level.

**METHODS:** The effects of the selective μ agonist [d-Ala(2),-N-Me-Phe(4), Gly(5)-ol]enkephalin (DAMGO) on synaptic transmission were examined in spinal lamina IX neurons of neonatal rats using the whole-cell patch-clamp technique.
**RESULTS:** DAMGO produced outward currents in 56% of the lamina IX neurons recorded, with a 50% effective concentration of 0.1 μM. Analysis of the current-voltage relationship revealed a reversal potential of approximately -86 mV. These currents were not blocked by tetrodotoxin but were inhibited by Ba(2+) or a selective μ antagonist. Moreover, the currents were suppressed by the addition of Cs(+) and tetraethylammonium or guanosine 5'-[β-thio]diphosphate trilithium salt to the pipette solution. In addition, DAMGO decreased the frequency of spontaneous excitatory and inhibitory postsynaptic currents, and these effects were unaltered by treatment with tetrodotoxin.
**CONCLUSION:** Our results suggest that DAMGO hyperpolarizes spinal lamina IX neurons by G protein-mediated activation of K(+) channels after activation of MORs. Furthermore, activation of MORs on presynaptic terminals reduces both excitatory and inhibitory transmitter release. Although traditionally opioids are not thought to affect motor function, the present study documents neuromodulatory effects of μ opioids in spinal lamina IX neurons, suggesting that MORs can influence motor activity.

**正中神經阻滯時使用或不使用超聲引導下 5%葡萄糖溶液繞神經水分離技術：一項前瞻隨機雙盲非劣效性檢驗試驗**

**Ultrasound-guided perineural circumferential median nerve block with and without prior dextrose 5% hydrodissection: a prospective randomized double-blinded noninferiority trial.**

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**背景：**超聲引導下使用水分離技術行外周神經阻滯可減少局麻藥誤注入血管內的風險。在這項前瞻雙盲試驗中，我們驗證了以下假設，即正中神經的阻滯效果不會因爲在局麻藥注入前使用繞神經一周的水分離技術[5%葡萄糖溶液（D5W）]而減弱
**方法：**將擬施手部手術的患者隨機分配至下列兩組：超聲引導下于肘部行正中神經阻滯前繞外周神經注射 6mlD5W，後注射 6ml 局麻藥（1.5%利多卡因+腎上腺素 1:2000,000）（D5W-LA 組）；單純注射 6ml 局麻藥（LA 組）。成功麻醉的時間爲最終結果，成功麻醉的標準爲輕觸示指時無任何感覺。
**結果：**共有 95 名病人入組：D5W-LA 組 43 名，LA 組 52 名。非劣效性評價呈顯著差異（所有 P < 0.05）：7 分鐘的起效時間爲 D5W-LA 組及 LA 組的評價標準。示指觸覺阻滯時間（平均值± SD，分別爲 23.9 ± 7.4 和 22.0 ± 7.9 分鐘，95%可信區間[CI]，-5.9 至 2.1 分鐘），示指尖溫度覺、魚際處感覺阻滯及運動阻滯。D5W-LA 組及 LA 組 30 分鐘成功率（定義爲示指完全的觸覺及溫度覺的消失）分別爲 100%和 98.1%（95%CI，-6%至 10%）以及 95.2%和 96.2%（95%CI，-13%至 9%）

**結論：**外周神經阻滯時在局麻藥注入前在超聲引導下使用 D5W 繞外周神經行水分離不會影響阻滯效果。這一技術可以減少局麻藥誤注入血管的風險及由此帶來的毒性反應。
(楊琰譯 薛張綱校)

**BACKGROUND:** Ultrasound-guided perineural peripheral nerve block using a hydrodissection technique may reduce the risk of accidental intravascular local anesthetic (LA) injection. In this prospective randomized double-blind study, we tested the hypothesis that median nerve block effectiveness is not reduced when circumferential perineural hydrodissection with dextrose 5% in water (D5W) precedes LA injection.
**METHODS:** Patients scheduled for hand surgery were randomized to receive an ultrasound-guided median nerve block at the elbow to achieve circumferential perineural spread with either 6 mL of D5W followed by 6 mL of LA (lidocaine 1.5% with epinephrine 1:200,000) (D5W-LA group) or with 6 mL of LA alone (LA group). The primary outcome was onset time of successful anesthesia defined by a complete abolition of light touch sensation for the index finger.
**RESULTS:** Data from 95 patients were analyzed: 43 in the D5W-LA group and 52 in the LA group. Noninferiority tests were significant (all $P < 0.05$) for a critical limit of 7 minutes between D5W-LA and LA groups for onset time of the primary criterion, light touch block at index finger (mean ± SD, respectively: 23.9 ± 7.4 and 22.0 ± 7.9 minutes; 95% confidence interval [CI], -5.9 to 2.1 minutes), and for cold block at index fingertip, sensory blocks at thenar eminence, and motor block. Success rate at 30 minutes (defined as complete abolition for cold and light touch at index finger) was noted in 100% and 98.1% (95% CI, -6% to 10%) and 95.2% and 96.2% (95% CI, -13% to 9%) of patients for the D5W-LA and the LA groups.
**CONCLUSION:** Performing an ultrasound-guided perineural circumferential hydrodissection with D5W into which LA is injected leaves nerve block outcome unchanged. The assumption that this procedure may reduce the risk of intravascular injection and systemic toxicity remains to be demonstrated.

## 旋轉式血栓彈力檢測器（ROTEM）能夠提高對心臟手術後出血的預測嗎？

## Does Rotational Thromboelastometry (ROTEM) Improve Prediction of Bleeding After Cardiac Surgery?

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**背景：**凝血障礙和大量出血是心臟手術的嚴重併發症，尤其是在需要長期體外迴圈的操作中。在醫院和供應商的橫向研究中，輸血實踐有著巨大的變異性。這種變異性可能預示著非指導性決策制定，也許是歸因於缺乏可靠的、有預測性的凝血障礙的實驗室檢驗來指導輸血實踐。旋轉式血栓彈力檢測器（ROTEM）測量多種凝血參數，提供的應用價值在於操作簡易、結果迅速和測定凝血途徑中多個步驟。然而，ROTEM 的預測價值和實用性仍然不清楚。在本研究中，我們探討了 ROTEM 對心臟手術後胸管引流量的預測價值。
**方法：**選取 321 名行包括 CPB 的心臟手術的病人入組。從醫療記錄中獲得病人資料，包括整個手術 CPB 後頭 8 小時內胸管引流量（CTO）。爲 ROTEM 分析收集圍術期和手術後的血液樣本。使用 CTO 的三種測量方法作爲評估凝血障礙的主要觀察指標：(i) 連續 CTO；(ii) 在 600ml 對分的 CTO（第 75 百分位）；以及(iii)在 910ml 對分的 CTO（第 90

百分位）。在一個逐步回歸模型（模型 1）中，除了 ROTEM 資料以外，臨床和血液學變數都與連續 CTO 顯著相關（P < 0.05）。我們還創建了一個額外的模型（模型 2），它包含 ROTEM 變數和模型 1 中的變數。隨後的分析在解釋這 3 個 CTO 觀察指標 P < 0.0167 時宣告爲有意義。用分類指數評估 ROTEM 資料的總體價值。
**結果：**就連續 CTO 而言，ROTEM 變數提高了模型的預測能力（P < 0.0001）。對於在 600ml 對分的 CTO（第 75 百分位）而言，ROTEM 沒有改善受試者操作特性曲線下面積（AUC）（P = 0.03）。同樣的，對於在 910ml 對分的 CTO（第 90 百分位），ROTEM 也沒有改善 AUC（P = 0.23）。淨重新分類指數同樣表明 ROTEM 結果沒有改善病人的總體分類（CTO ≥600 ml 的 P = 0.12；CTO ≥910 ml 的 P = 0.08）。
**結論：**這些結果表明與常用的臨床和實驗室參數相比較，ROTEM 資料沒有在本質上改善模型預測胸管引流量的能力。雖然有幾個 ROTEM 參數單獨與 CTO 相關，但是當加入到只包含臨床和常規實驗室參數的統計模型中，它們沒有顯著提高擬合優度。儘管 ROTEM 在心臟手術中指導輸血的應用仍需測定，但是 ROTEM 似乎不能夠提高對包括 CPB 的心臟手術後胸管引流量的預測。
（唐瑩 譯 馬皓琳 李士通 校）
**BACKGROUND:** Coagulopathy and massive bleeding are severe complications of cardiac surgery, particularly in procedures requiring prolonged cardiopulmonary bypass (CPB). There is huge variability in transfusion practices across hospitals and providers in cross-sectional studies. This variability may indicate unguided decision-making, perhaps attributable to lack of reliable, predictive laboratory testing of coagulopathy to guide transfusion practice. Rotational thromboelastometry (ROTEM) measures multiple coagulation parameters and may provide value from its ease of use, rapid results, and measurement of several steps in the coagulation pathway. Yet, the predictive value and utility of ROTEM remains unclear. In this study, we investigated ROTEM's predictive value for chest tube drainage after cardiac surgery.
**METHODS:** Three hundred twenty-one patients undergoing cardiac surgery involving CPB were enrolled. Patient data were obtained from medical records, including chest tube output (CTO) from post-CPB through the first 8 postoperative hours. Perioperative and postoperative blood samples were collected for ROTEM analysis. Three measures of CTO were used as the primary end points for assessing coagulopathy: (i) continuous CTO; (ii) CTO dichotomized at 600 mL (75th percentile); and (iii) CTO dichotomized at 910 mL (90th percentile). Clinical and hematological variables, excluding ROTEM data, that were significantly correlated (P < 0.05) with continuous CTO were included in a stepwise regression model (model 1). An additional model that contained ROTEM variables in addition to the variables from model 1 was created (model 2). Significance in subsequent analyses was declared at P < 0.0167 to account for the 3 CTO end points. Net reclassification index was used to assess overall value of ROTEM data.
**RESULTS:** For continuous CTO, ROTEM variables improved the model's predictive ability (P < 0.0001). For CTO dichotomized at 600 mL (75th percentile), ROTEM did not improve the area under the receiver operating characteristic curve (AUC) (P = 0.03). Similarly, for CTO dichotomized at 910 mL (90th percentile), ROTEM did not improve the AUC (P = 0.23). Net reclassification index similarly indicated that ROTEM results did not improve overall classification of patients (P = 0.12 for CTO ≥600 mL; P = 0.08 for CTO ≥910 mL).
**CONCLUSIONS:** These results suggest that ROTEM data do not substantially improve a model's ability to predict chest tube drainage, beyond frequently used clinical and laboratory parameters. Although several ROTEM parameters were individually associated with CTO, they

did not significantly improve goodness of fit when added to statistical models comprising only clinical and routine laboratory parameters. ROTEM does not seem to improve prediction of chest tube drainage after cardiac surgery involving CPB, although its use in guiding transfusion during cardiac surgery remains to be determined.

## 通過神經活動的直接指數來測定麻醉藥起效的動力學

**Kinetics of Anesthetic Onset Measured with a Direct Index of Neural Activity**

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**背景:**先前麻醉藥在作用部位的攝取和消除的動力學模型採用了來自於腦電圖的測定資料。這種測定資料是滯後於當時的腦活動的，因爲需要時間來獲取信號樣本和提取測定數值。通過直接測量麻醉藥物的活動，我們可以更精確地獲得大腦攝取藥物的模型。
**方法：**在志願者中，採取雙盲單週期設計，在使用 30%氧化亞氮洗入和洗出過程中，我們使用一個廣爲著名的神經運動試驗對他們進行重複的測量，即兩目標的指叩測驗。我們還進行了認知功能的測驗，即數位記號替換測試，以評估最大藥物效果。對作用部位的濃度建模來自呼氣末濃度的測量，使用一個簡單的洗入和洗出指數函數，其半衰期在 0.5 到 3 分鐘內。在使用 0 和 5%氧化亞氮的物件中進行比較。
**結果：**我們觀察了 20 個物件。30%濃度氧化亞氮組，在數位記號替換測試中表現始終減低。指叩的頻率也減少了，但是效果卻不太一致，在 20 個受試者中只有 9 個表現出顯著的個別指叩頻率的減少。在這些患者中，在模擬的大腦濃度與藥效之間的關係在將半衰期設定爲 2 分鐘時比 1.5 或者 3 分鐘更佳。
**結論：**當給予亞麻醉濃度時，氧化亞氮具有起效和消除快的特點，與其半衰期爲 2 分鐘一致。此數值低於在麻醉過程中使用腦電圖監測的研究預期，但符合在清醒的受試者觀察到的活躍腦組織的血流監測情況。對有意識的受試者反應的研究可能有助於麻醉藥動力學的進一步研究。
（余亦南 譯 馬皓琳 李士通 校）

**BACKGROUND:** Previous modeling of the kinetics of uptake and elimination of anesthetic drugs from the site of action has used measures derived from the electroencephalogram. Such measures lag the current brain activity because of the time needed to acquire a signal sample and derive the measure. With a direct measure of anesthetic activity, we could model brain uptake more exactly.
**METHODS:** In volunteers, using a double-blind single-session design, we made repeated measurements using a well-known psychomotor test, the 2 target tapping test, during the washin and washout of 30% nitrous oxide. We also assessed maximal drug effect with a test of cognitive function, the digit symbol substitution test. Concentration at the site of action was modeled from end-tidal measurements, using a simple exponential washin and washout function, with half-times between 0.5 and 3 minutes. Comparisons were made within subjects, using 0 and 5% nitrous oxide.

**RESULTS:** We studied 20 subjects. Nitrous oxide, at 30%, consistently reduced performance of the digit symbol substitution test. Tapping frequency was also reduced, but the effect was less consistent, and only 9 of 20 subjects showed a significant individual reduction in tapping frequency. In these subjects, the relationship between the modeled brain concentration and drug effect was better with a half-time set at 2 minutes, compared with 1.5 or 3 minutes.
**CONCLUSIONS:** Given in subanesthetic concentrations, nitrous oxide has rapid onset and offset, consistent with a half-time of 2 minutes. This value is less than the values expected from studies during anesthesia using processed electroencephalogram, but consistent with measures of blood flow to active cerebral tissue in conscious subjects. Studies of performance in conscious subjects may aid further studies of anesthetic kinetics.

## 氧化亞氮在異氟烷麻醉中對腦電雙相干的影響

**The Impact of Nitrous Oxide on Electroencephalographic Bicoherence During Isoflurane Anesthesia**

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**背景：**我們以前報導腦電雙相干（BIC），一個信號的頻譜成分之間相位耦合程度，在異氟烷麻醉中顯示兩個高峰期。Hayashi 等人（《英國麻醉學雜誌》2007；99：389-95）也揭示了，加用氯胺酮時在 10 Hz 左右的雙相干的峰值頻率增高。因爲氧化亞氮和氯胺酮有一些共同的特點，它們往往被視爲同一類的麻醉劑。在這裡，我們研究了氧化亞氮在異氟烷麻醉中對腦電雙相干和其他腦電波衍生物的影響。
**方法：**20 例（年齡 34-72 歲，ASA 分級 I 和 II）行擇期腹腔鏡手術，不論男女都包括在內。原始 EEG 資料，EEG 衍生參數，用 A-1050 雙頻指數（BIS）顯示器和我們自己創作的用於 BIS 軟體的腦電雙頻譜分析儀記錄原始 EEG 資料和 EEG 衍生參數。我們比較了腦電波雙相干的 2 個峰值（在 4Hz 左右的 BIC 低峰值和在 10Hz 左右的 BIC 高峰值），以及 BIS 和 95%的頻譜邊界頻率（SEF95 95）。使用 3mg/kg 硫噴妥鈉和 3μg/kg 芬太尼麻醉誘導。氣管插管後，用異氟烷（呼出濃度爲 1.0%）、氧氣和氮氣麻醉維持。追加芬太尼並且維持估計效應室濃度> 1.5ng/ml。我們在麻醉誘導後 1 小時獲得基線資料，然後加入 70%氧化亞氮 30 分鐘。
**結果：**在氧化亞氮開啓之前，BIC 低峰值和 BIC 高峰值分別爲 49.3%±8.3%和 42.4%±11.0%。開啓 10 分鐘後，BIC 高峰值降低至 14.9%±5.9%（P <0.001），並且在整個氧化亞氮吸入過程中有統計學意義上的顯著降低。同時，在給予氧化亞氮的早期，BIC 低峰值暫態降低至 37.2%±12.8%（P = 0.01）。在氧化亞氮開啓之前，BIS 和 SEF95 分別爲 43.2±4.9 和 13.1±2.0Hz。在給予氧化亞氮期間，BIS 和 SEF95 都有輕度但在統計學意義上顯著減少。 氧化亞氮開啓 15 分鐘後，BIS 和 SEF95 分別爲 35.7±6.2（P <0.001）和 8.6±1.8Hz（P <0.001），並且在出現大的 δ 波時，二者下降得更多。 氧化亞氮停止後 15 分鐘，BIS、SEF95 以及 BIC 的低峰值和 BIC 高峰值恢復至氧化亞氮開啓之前的水準。

**結論：**與氯胺酮的作用不同，氧化亞氮在異氟烷麻醉中顯著降低 BIC 的高峰值。
（崔曉娜 譯 馬皓琳 李士通 校）

**BACKGROUND:** We previously reported that electroencephalographic (EEG) bicoherence, the degree of phase coupling among the frequency components of a signal, showed 2 peaks during isoflurane anesthesia. Hayashi et al. (Br J Anaesth 2007;99:389–95) also revealed that the peak frequency of bicoherence around 10 Hz increased when ketamine was added. Because nitrous oxide (N2O) and ketamine share several common features, they are often treated as the same category of anesthetic. Here, we investigated the effect of N2O on EEG bicoherence and other EEG derivatives during isoflurane anesthesia.
**METHODS:** Twenty patients (aged 34–72 years, ASA physical status I and II) of either gender who underwent elective laparoscopic surgery were included. Raw EEG data, along with EEG-derived parameters, were recorded using an A-1050 Bispectral Index (BIS) monitor and our self-authored Bispectral Analyzer for BIS software. We compared 2 peaks of EEG bicoherence (pBIC–low, around 4 Hz; and pBIC–high, around 10 Hz), as well as BIS and spectral edge frequency 95% (SEF95). Anesthesia was induced with 3 mg • kg−1 thiopental and 3 μg • kg−1 fentanyl. After tracheal intubation, anesthesia was maintained with isoflurane (expired concentration at 1.0%), oxygen, and nitrogen. Fentanyl was added and maintained at an estimated effect-site concentration of >1.5 ng • mL−1. We obtained baseline data 1 hour after induction of anesthesia, then 70% N2O was added for 30 minutes.
**RESULTS:** Before N2O, pBIC–low and pBIC–high were 49.3% ± 8.3% and 42.4% ± 11.0%. Ten minutes after starting N2O, pBIC–high decreased to 14.9% ± 5.9% ($P < 0.001$), and it was statistically significantly lower throughout the N2O period. Meanwhile, pBIC–low transiently decreased to 37.2% ± 12.8% ($P = 0.01$) during the early phase of N2O administration. Before N2O, BIS and SEF95 were 43.2 ± 4.9 and 13.1 ± 2.0 Hz, respectively. Both BIS and SEF95 slightly but statistically significantly decreased during N2O administration. Fifteen minutes after starting N2O, BIS and SEF95 were 35.7 ± 6.2 ($P < 0.001$) and 8.6 ± 1.8 Hz ($P < 0.001$) and they decreased more when large δ waves emerged. Fifteen minutes after stopping N2O, BIS, SEF95, as well as pBIC–low and pBIC–high returned to pre-N2O values.
**CONCLUSION:** Dissimilar to the effect of ketamine, N2O significantly decreases pBIC–high during isoflurane anesthesia.

## 振動-觸覺顯示器用於臨床監測的即時評估

**A Vibro-Tactile Display for Clinical Monitoring: Real-Time Evaluation**

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**背景：**振動-觸覺顯示器使用人體皮膚爲麻醉醫生傳遞生理監測的參數，提供患者狀態改變的線索。這項研究評估了我們最近所開發出的一種新型振動-觸覺顯示腰帶在即時臨床環境下的實用性和耐磨性，並測定了它在麻醉醫生用的時候鑒別事件的準確性。

**方法：**這是一項前瞻性的觀察性研究。在常規麻醉下，將標準生理監測儀連接到一種軟體工具上，這種軟體使用特定的演算法來自動地識別無創平均動脈壓、每分呼氣量、氣道峰壓、呼氣末二氧化碳分壓的變化趨勢。將這種軟體無線連接到麻醉醫生束的振動-觸覺腰帶上。每項生理參數分別在腰帶上 4 個觸覺定位中的 1 個顯示。方向（增加/減少）和變化的兩種水準（小/大）均編碼到刺激模式上。每一位麻醉醫生均完成了一個培訓期。在麻醉期間常規生理監測時即可即時啓動該系統。當系統檢測到患者的改變時，腰帶會在適當的部位振動，根據改變的幅度和方向相對應不同的振動模式。麻醉醫生使用觸屏顯示器先鑒別參數再鑒別改變的幅度和方向來獲得振動-觸覺的資訊。對每位研究者均進行問卷調查以確定實用性和耐磨性。主要的研究結果爲生理趨勢檢測的準確率、變化方向和變化水準。平均的實用性評分及耐磨性指標爲次要研究結果。本研究假設麻醉醫生根據這種振動-觸覺腰帶來即時鑒別各類事件的準確率爲 90%，且這種腰帶具備實用性和耐磨性。
**結果：**17 位麻醉醫生共評價了 57 例的顯示器結果。每例腰帶的平均使用時程（SD）爲 75（41）分鐘。7 例由於技術錯誤排除在分析之外。81%（可信區間[CI]，77%至 84%）的刺激均進行了解碼。生理趨勢、變化的方向和變化的水準鑒別的準確率分別爲 97.7%（CI 96%-99%）、94.9%（CI 92%-97%）和 93.5%（CI 91%-96%）。14 名麻醉醫生完成了實用性和耐磨性的問卷調查。平均實用性得分爲 4.8，最高得分爲 7。
**結論：**麻醉醫生認爲這種振動-觸覺腰帶具備實用性和耐磨性，能準確解碼即時臨床環境下振動-觸覺的資訊。
（邱鬱薇 譯 馬皓琳 李士通 校）

**BACKGROUND:** Vibro-tactile displays use human skin to convey information from physiological monitors to anesthesiologists, providing cues about changes in the status of the patient. In this investigation, we evaluated, in a real-time clinical environment, the usability and wearability of a novel vibro-tactile display belt recently developed by our group, and determined its accuracy in identifying events when used by anesthesiologists.
**METHODS:** A prospective observational study design was used. During routine anesthesia, a standard physiological monitor was connected to a software tool that used algorithms to automatically identify changing trends in mean noninvasive arterial blood pressure, expired minute ventilation, peak airway pressure, and end-tidal carbon dioxide partial pressure. The software was wirelessly interfaced to a vibro-tactile belt worn by the anesthesiologist. Each physiological variable was mapped to 1 of 4 tactor locations within the belt. The direction (increase/decrease) and 2 levels of change (small/large) were encoded in the stimulation patterns. A training session was completed by each anesthesiologist. The system was activated in real-time during anesthesia alongside routine physiological monitors. When the algorithms detected changes in the patient, the belt vibrated at the appropriate location with the pattern corresponding to the level and direction of change. Using a touch screen monitor the anesthesiologist was to enter the vibro-tactile message by first identifying the variable, then identifying the level and direction of change. Usability and wearability questionnaires were to be completed. The percentage of correct identification of the physiological trend, the direction of change, and the level of change were primary outcome variables. The mean usability score and wearability results were secondary outcome variables. We hypothesized that anesthesiologists would correctly identify the events communicated to them through the vibro-tactile belt 90% of the time, and that anesthesiologists would find the vibro-tactile belt usable and wearable.
**RESULTS:** Seventeen anesthesiologists evaluated the display during 57 cases. The belt was operational for a mean (SD) duration of 75 (41) minutes per case. Seven cases were excluded

from analysis because of technical failures. Eighty-one percent (confidence interval [CI], 77% to 84%) of all stimuli were decoded. The physiological trend, the direction of change, and the level of change were correctly identified for 97.7% (CI 96%–99%), 94.9% (CI 92%–97%), and 93.5% of these stimuli (CI, 91%–96%), respectively. Fourteen anesthesiologists completed the usability and wearability questionnaires. The mean usability score was 4.8 of a maximum usability score of 7.

**CONCLUSIONS:** Anesthesiologists found a vibro-tactile belt to be wearable and usable and could accurately decode vibro-tactile messages in a real-time clinical environment.

## 缺氧再灌注後早期抗氧化治療和後期降低體溫對新生豬沒有神經保護作用

**Early Antioxidant Treatment and Delayed Hypothermia After Hypoxia–Ischemia Have No Additive Neuroprotection in Newborn Pigs**

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**背景：**降低體溫在新生兒缺血缺氧性腦病實施和臨床療效是有限的，部分源于延遲建立低溫和接入設備。在仔豬的缺血缺氧性腦病模型中，恢復後 6 小時殼核中的半數神經元已經顯示出缺血性細胞病理改變。本文驗證了恢復後 30min 時給予超氧化物歧化酶－過氧化氫酶類似物 EUK-134 治療與在復蘇後 4 小時實施的 1 天全身低體溫結合應用提供進一步的神經保護作用這一假設。

**方法：**麻醉後的仔豬接受 40 分鐘低氧（吸入氧濃度 10%），隨後 7 分鐘閉塞氣道並經過復蘇。常溫組體溫維持在 38.5℃，低溫組維持在 34℃。所有組在復蘇後第一天裡機械通氣、鎮靜及注射肌肉鬆弛劑。通過外觀和立體細胞計數評估神經病理學改變。

**結果：**復蘇後 10 天時，用鹽溶液處理的正常體溫組的殼核中神經元活力降低至假操作對照組（100%±15%）的 17%±6%（±95%置信區間）。正常體溫復蘇組靜脈內注射 EUK-134（復蘇後 30 分鐘時 2.5mg/kg+1.25mg/kg/h 至復蘇後 4 小時）導致殼核中的神經元活性爲 40%±12%。鹽溶液治療後進行後續低體溫具有部分保護作用（46%±15%）。早期 EUK-134 處理與後期低溫也產生了部分保護作用（47% ± 18%），但沒有比單獨 EUK-134 處理（差異的可信區間：–15%～29%）或後期低溫（–16%～19%）顯著增強。此外，對神經元缺失並不嚴重的尾核或旁矢狀面的新皮質同樣沒有額外的神經保護作用。

**結論：**本文推斷早期使用這種抗氧化劑治療不能從實質上增加後期低體溫保護缺血缺氧損傷的新生兒中高度易受傷害的神經元的治療學益處，可能由於基底神經節神經元在接受 EUK-134 時已經收到不可逆的細胞死亡信號，或者由於這種物質和低體溫減弱了類似的損傷機制。

（許辛 譯，馬皓琳 李士通 校）

**BACKGROUND:** The implementation and clinical efficacy of hypothermia in neonatal hypoxic–ischemic (HI) encephalopathy are limited, in part, by the delay in instituting hypothermia and access to equipment. In a piglet model of HI, half of the neurons in putamen already showed ischemic cytopathology by 6 hours of recovery. We tested the hypothesis that

treatment with the superoxide dismutase–catalase mimetic EUK-134 at 30 minutes of recovery provides additive neuronal protection when combined with 1 day of whole-body hypothermia implemented 4 hours after resuscitation.
**METHODS:** Anesthetized piglets were subjected to 40 minutes of hypoxia (10% inspired oxygen) followed by 7 minutes of airway occlusion and resuscitation. Body temperature was maintained at 38.5°C in normothermic groups and at 34°C in hypothermic groups. All groups were mechanically ventilated, sedated, and received muscle relaxants during the first day of recovery. Neuropathology was assessed by profile and stereological cell-counting methods.
**RESULTS:** At 10 days of recovery, neuronal viability in putamen of a normothermic group treated with saline vehicle was reduced to 17% ± 6% (±95% confidence interval) of the value in a sham-operated control group (100% ± 15%). Intravenous infusion of EUK-134 (2.5 mg/kg at 30 minutes of recovery + 1.25 mg/kg/h until 4 hours of recovery) with normothermic recovery resulted in 40% ± 12% viable neurons in putamen. Treatment with saline vehicle followed by delayed hypothermia resulted in partial protection (46% ± 15%). Combining early EUK-134 treatment with delayed hypothermia also produced partial protection (47% ± 18%) that was not significantly greater than single treatment with EUK-134 (confidence interval of difference: –15% to 29%) or delayed hypothermia (–16% to 19%). Furthermore, no additive neuroprotection was detected in caudate nucleus or parasagittal neocortex, where neuronal loss was less severe.
**CONCLUSIONS:** We conclude that early treatment with this antioxidant does not substantially enhance the therapeutic benefit of delayed hypothermia in protecting highly vulnerable neurons in HI-insulted newborns, possibly because basal ganglia neurons are already undergoing irreversible cell death signaling by the time EUK-134 is administered or because this compound and hypothermia attenuate similar mechanisms of injury.

## 關於面部移植圍術期管理的調查

**Perioperative Management of Face Transplantation: A Survey**

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**背景：**自從 2005 年法國報導首例異體面部移植以來，已有 4 個國家完成了 18 例手術，並且這一速度正在增加。
**方法：**我們設計了一項評價面部異體移植中麻醉相關管理和理論基礎的調查。調查發送至全世界完成的前 14 例面部移植術的首席麻醉醫師。

**結果：**本調查共回收 13 例面部移植相應的問卷應答。手術和麻醉持續時間的中位數爲 19 小時（95%可信區間 15-23 小時）。11 例病例中，對受體複雜細微結構的外科準備和解剖最爲費時。失血量相當大。所有患者均輸入濃縮紅細胞（中位數 20 U，95%可信區間 5-28 U）。輸入晶體液的中位數爲 13L（95%可信區間 10-18L）。
**結論：**在面部異體移植過程中，麻醉醫師必須進行長時間的麻醉，並作好移植物再灌注後快速失血的準備。
（陳彬彬譯 馬皓琳 李士通校）

**BACKGROUND:** Since the first facial allograft transplantation was reported in France in 2005, 18 cases have been performed in 4 countries and the rate is increasing.
**METHODS:** We have devised a survey to assess anesthesia-related management and rationale of facial allograft transplantation. It was sent to the lead anesthesiologists of the first 14 face transplants performed worldwide.
**RESULTS:** Responses were received corresponding to 13 face transplants. The median duration of surgery and anesthesia was 19 hours (95% confidence interval 15–23 hours). The surgical preparation and dissection of multiple small anatomical structures of the recipient was time-consuming for 11 cases. Blood loss was considerable. All patients received packed red blood cells (median 20 U, 95% confidence interval 5–28 U). A median of 13 L of crystalloid was administered (95% confidence interval 10–18 L).
**CONCLUSIONS:** During facial allograft transplantation, the anesthesiologist must be prepared for a long anesthetic with rapid blood loss after reperfusion of the graft.

## 肺門高壓對活體肝移植受者術中右心室功能的影響

**The Impact of Portopulmonary Hypertension on Intraoperative Right Ventricular Function of Living Donor Liver Transplant Recipients**

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**背景：**肺門高壓（PPH）加重了在肝移植時已經暴露在生理應激狀態下的右心室（RV）的負擔。PPH 對於右心室功能影響的程度，尤其是再灌注早期，還沒有前瞻性對照試驗對此進行過充分的評估。在這項研究中，我們前瞻性地對 PPH 對於活體肝移植受者的右心室功能的影響進行了量化。
**方法：**20 例接受活體肝臟移植的患者根據平均肺動脈壓（mPAP）水準進行分層，分別分爲對照組（MPAP<25 毫米汞柱）和 PPH 組（MPAP≥25 毫米汞柱）。採用標準麻醉方法和監測。使用能夠測量右心室射血分數（RVEF）的光纖肺動脈導管。記錄麻醉誘導後、肝切除術畢時、門脈開放前、再灌注後 5 分鐘和 30 分鐘及縫皮時的血流動力學資料。
**結果：**與對照組相比，PPH 組門脈開放後 RVEF 和每搏輸出量明顯降低，中心靜脈壓和 RV 舒張末期容積指數顯著較高。整個手術過程中，PPH 組的肺血管阻力指數和平均肺動脈壓均顯著高於對照組，但 RV 每搏作功指數在兩組之間沒有明顯差別。在 PPH 組，再灌注之後的 RVEF 與基線相比明顯下降，而對照組無此下降過程。

**結論：**肝移植術中，輕度至中度 PPH 與 RVEF 降低相關，特別是在再灌注之後，可能是因爲 PPH 病人的 RV 收縮儲備減少了。輕度至中度 PPH 患者對於 RVEF 的這種降低在臨床上能很好地耐受。
（安光惠 譯 馬皓琳 李士通 校）

**BACKGROUND:** Portopulmonary hypertension (PPH) burdens a right ventricle (RV) already exposed to physiologic stress during liver transplantation. The magnitude of the impact of PPH on RV function, especially early reperfusion, has not been evaluated adequately by prospective controlled trials. In this study, we prospectively quantified the impact of PPH on the RV function in living donor liver transplant recipients.
**METHODS:** Twenty patients undergoing living donor liver transplant were stratified based on mean pulmonary artery pressure (mPAP) into a control group (mPAP <25 mm Hg) and a PPH group (mPAP ≥25 mm Hg). Standard anesthetic technique and monitoring were used. Fiberoptic pulmonary artery catheters enabled to measure RV ejection fraction (RVEF) were used. Hemodynamics were recorded after induction of anesthesia, the end of hepatectomy, before portal unclamping, 5 and 30 minutes after reperfusion, and at skin closure.
**RESULTS:** The PPH group had significantly lower RVEF, stroke volume, and higher central venous pressure and RV end-diastolic volume index after portal unclamping versus the controls. Pulmonary vascular resistance index and mPAP were significantly higher throughout the operation in the PPH group, but RV stroke work index did not differ significantly between groups. RVEF was significantly reduced in the PPH group after reperfusion compared with baseline, but the control group did not experience such a reduction.
**CONCLUSIONS:** Mild to moderate PPH was associated with reduced RVEF during liver transplantation, especially after reperfusion, likely because of a reduced RV contractile reserve in PPH patients. This reduction in RVEF was clinically well tolerated by patients with mild to moderate PPH.

## 新型小分子 α9α10 煙鹼受體拮抗劑可以預防並逆轉大鼠化療誘發的神經性疼痛

## Novel Small Molecule α9α10 Nicotinic Receptor Antagonist Prevents and Reverses Chemotherapy-Evoked Neuropathic Pain in Rats

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**背景：**外周神經病變是一種常見的劑量限制性的化療副作用。尚沒有臨床證實有效的鎮痛藥可以治療這種病情。已有研究檢驗了不同種類的藥物並得出了混雜的結果。鑒定鎮痛的新型分子靶向很重要。一般認爲對 α9α10 煙鹼乙醯膽鹼受體（nAChR）亞型（腦內缺乏）的拮抗是產生 α-芋螺毒素肽類的鎮痛效果的基礎。我們發現來自於四價、三價、二價氮雜芳香季銨鹽（α9α10 nAChRs 的高效價選擇性拮抗劑）家族的新型非肽類小分子類似物對於神經損傷引起的神經病變和持續的炎症性疼痛的大鼠模型可以產生與劑量相關的鎮痛。尚無試驗在由應用藥物（例如化療）引起的神經病變模型中進行。

**方法:**這項研究在長春新城誘發神經病變的大鼠模型中研究了一種主要的二價類似物 ZZ1-61c 的特性。給雄性 SD 大鼠重複劑量的這種長春花生物鹼（長春新城）（100 μg/kg/天 IP，第 1 至 5 天和第 8 至 12 天）。在長春新城應用同時或應用完成後（到第 15 天神經損傷作用最大時開始）給予 ZZ1-61c（100 μg/kg/天 IP）。應用 von Frey 毛髮和爪壓試驗來評估反應性。記錄 ZZ1-61c 對小鼠的運動功能（rotarod 方法）和肌肉力量（握力測試）的影響的特點。

**結果：**研究表明隨長春新城重複應用而進展到神經病變（對於機械刺激的痛覺超敏反應）。ZZ1-61c 對於以下情況表現出預防和恢復作用：（1）同時給予 ZZ1-61c 減輕長春新城引起的對壓力的敏感性；（2）在化療停藥後應用 ZZ1-61c 可以減輕已形成的神經病變。ZZ1-61c 不引起運動功能障礙（rotarod 方法）或肌肉無力（握力測試）。

**結論：**這項研究表明 ZZ1-61c（一種對 α9α10 nAChR 有著獨特拮抗機制的新型化合物）可能是一種用於預防和減輕由化療引起的神經疼痛潛在的候選藥物。這項策略或許可以提供有效的治療而避免對 nAChR 有中樞作用的拮抗劑的毒性。

（張怡譯 馬皓琳 李士通校）

**BACKGROUND:** Peripheral neuropathy is a common dose-limiting side effect of chemotherapy. There are no clinically proven analgesics for the treatment of this condition. Drugs from different classes have been tested with mixed results. Identification of novel molecular targets for analgesic(s) is important. Antagonism of the α9α10 nicotinic acetylcholine receptor (nAChR) subtype (absent in brain) is thought to underlie analgesic efficacy of peptide α-conotoxins. We found novel nonpeptide small molecule analogs from a family of tetrakis-, tris-, and bis-azaaromatic quaternary ammonium salts (high potency with selectivity as antagonists at the α9α10 nAChRs) to produce dose-related analgesia in rat models of nerve injury-evoked neuropathy and persistent inflammatory pain. No tests were done in a model of neuropathy induced by drug administration (ie, chemotherapy).

**METHODS:** In this study, a lead bis-analog, ZZ1-61c, was characterized in a rat model of vincristine-evoked neuropathy. Male Sprague-Dawley rats were repeatedly dosed with the vinca-alkaloid, vincristine (100 μg/kg/day IP, days 1 to 5 and 8 to 12). ZZ1-61c (100 μg/kg/day IP) was given either along with or after completion of vincristine (commencing by day 15 when neuropathy was maximum). Responsiveness was assessed with von Frey hairs and the paw-pressure test. The effects of ZZ1-61c on motor function (rotarod) and muscle strength (grip test) were characterized in naïve rats.

**RESULTS:** The development of neuropathy was demonstrated with repeated dosing of vincristine (pain hypersensitivity in response to mechanical stimulation). ZZ1-61c showed both preventive and restorative effects on this condition: (1) vincristine-evoked sensitivity to pressure was reduced by coadministration of ZZ1-61c; (2) established neuropathy was diminished by ZZ1-61c after cessation of chemotherapy. ZZ1-61c did not cause motor dysfunction (rotarod) or muscular weakness (the grip test).

**CONCLUSIONS:** This study suggests that ZZ1-61c, a novel compound with a unique mechanism of antagonistic action at the α9α10 nAChR, may be a potential drug candidate for prevention and attenuation of neuropathic pain resulting from chemotherapy. Such a strategy may provide effective treatment that circumvents toxicity of centrally acting agonists at nAChR.