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圍手術期心肌形變的評估

Perioperative Assessment of Myocardial Deformation

Duncan, Andra E. MD; Alfirevic, Andrej MD; Sessler, Daniel I. MD; Popovic, Zoran B. MD; Thomas, James D. MD

Anesthesia & Analgesia 2014 118 525–544

評價左心室性能提高風險評估和麻醉決策水準。然而，心肌功能最常見的超聲心動圖測量參數是左心室射血分數(LVEF)，有相當的局限性。LVEF 受到主觀判斷的限制，降低其準確性和可重複性，並且 LVEF 評估的是整體功能，不包括局部心肌的異常表現。因此需要另一種客觀評價心肌功能的超聲心動圖參數。心肌形變分析，可對整體和局部的心肌功能進行定量的評估，對於手術患者的圍手術期監護是有用的。心肌形變分析通過定量應變及應變率來評估左室力學參數。應變描述在縱向(從基底部到心尖部)和周向(圍繞著心室短軸)上心肌長度的變化和在徑向上心肌厚度的變化。節段應變描述局部心肌功能。當心室行縱向或周向縮短時應變是一個負值，而發生徑向增厚時其爲正值時。近期一項經胸心超的 Meta 分析顯示正常縱向應變的參考值爲 (平均數±標準差)−19.7%±0.4%,而徑向和周向應變正常值分別爲 47.3%±1.9%和−23.3%±0.7%。心肌應變的速度也很重要，被稱爲應變速率。正常人群的縱向收縮期應變率平均值爲 1.10±0.16s−1。心肌形變的評估需要考慮各應變(形變變化)，這與 LVEF 和應變率(形變速度)相關，也與左室壓力的上升速度(dP / dt)有關。心肌形變分析還評估心室的舒張、扭轉、鬆弛活動，提供一種新穎無創的方法來評估心肌收縮和舒張期組成。心肌形變分析是基於多普勒或非多普勒技術,稱爲斑點追蹤超聲心動圖。心肌形變分析提供整體和局部心肌功能的定量評估，用於手術患者圍手術期的監護。例如,可通過受累冠脈支配區域應變值急劇降低來診斷冠狀動脈旁路移植後移植物閉塞。此外,評估左心室力學參數可在常規心超之前發現潛在的心肌病變。當然，主動脈瓣返流患者在 LVEF 減少發生前表現爲縱向應變減少，它可發現亞臨床的左心室功能障礙並預測修補術後發生心衰和心功能受損的風險增加。此綜述描述了心肌形變分析得原理、技術和臨床應用。

（李峰日 譯 陳傑 校）

Evaluation of left ventricular performance improves risk assessment and guides anesthetic decisions. However, the most common echocardiographic measure of myocardial function, the left ventricular ejection fraction (LVEF), has important limitations. LVEF is limited by subjective interpretation that reduces accuracy and reproducibility, and LVEF assesses global function without characterizing regional myocardial abnormalities. An alternative objective echocardiographic measure of myocardial function is thus needed. Myocardial deformation analysis, which performs quantitative assessment of global and regional myocardial function, may be useful for perioperative care of surgical patients. Myocardial deformation analysis evaluates left ventricular mechanics by quantifying strain and strain rate. Strain describes percent change in myocardial length in the longitudinal (from base to apex) and circumferential (encircling the short-axis of the ventricle) direction and change in thickness in the radial direction. Segmental strain describes regional myocardial function.Strain is a negative number when the ventricle shortens longitudinally or circumferentially and is positive with radial thickening. Reference values for normal longitudinal strain from a recent meta-analysis by using transthoracic echocardiography are (mean ± SD) −19.7% ± 0.4%, while radial and circumferential strain are 47.3% ± 1.9% and −23.3% ± 0.7%, respectively. The speed of myocardial deformation is also important and is characterized by strain rate. Longitudinal systolic strain rate in healthy subjects averages −1.10 ± 0.16 s−1. Assessment of myocardial deformation requires consideration of both strain (change in deformation), which correlates with LVEF, and strain rate (speed of deformation), which correlates with rate of rise of left ventricular pressure (dP/dt). Myocardial deformation analysis also evaluates ventricular relaxation, twist, and untwist, providing new and noninvasive methods to assess components of myocardial systolic and diastolic function. Myocardial deformation analysis is based on either Doppler or a

non-Doppler technique, called speckle-tracking echocardiography. Myocardial deformation analysis provides quantitative measures of global and regional myocardial function for use in the perioperative care of the surgical patient. For example, coronary graft occlusion after coronary artery bypass grafting is detected by an acute reduction in strain in the affected coronary artery territory. In addition, assessment of left ventricular mechanics detects underlying myocardial pathology before abnormalities become apparent on conventional echocardiography. Certainly, patients with aortic regurgitation demonstrate reduced longitudinal strain before reduction in LVEF occurs, which allows detection of subclinical left ventricular dysfunction and predicts increased risk for heart failure and impaired myocardial function after surgical repair. In this review, we describe the principles, techniques, and clinical application of myocardial deformation analysis.

環丙基甲氧基羰醯美托咪酯的藥理學：與異丙酚的比較

The Pharmacology of Cyclopropyl-Methoxycarbonyl Metomidate: A Comparison with Propofol

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Anesthesia & Analgesia 2014 118 563–567

背景：作爲麻醉誘導和維持中異丙酚的替代物，環丙基甲氧基羰醯美托咪酯（CPMM）是一種最近研發作用溫和的依託咪酯類似藥物。

方法：研究通過評估 CPMM 和異丙酚直接激動 α 1(L264T)β3γ2GABAA 型受體和引起蝌蚪翻正反射消失的能力比較了兩種藥物的效能。同時測試大鼠在持續輸注 CPMM 和異丙酚 5 至 120min 後腦電圖恢復的速率。

結果：CPMM 和異丙酚啓動 GABAA 受體以及引起蝌蚪翻正反射消失的 50%有效濃度（EC50S）分別爲 3.8 ± 0.4 和 3.9 ± 0.2 μM（GABAA 受體）以及 2.6 ± 0.19 and 1.3 ± 0.04 μM （蝌蚪）。長時輸注 CPMM 者腦電圖的恢復比輸注異丙酚者快，而缺乏異丙酚的持續靜注即時半衰期。

結論：在啓動 GABAA 受體和引起蝌蚪翻正反射消失方面 CPMM 和異丙酚有相似的效能。然而，尤其是長時輸注後，CPMM 提供了比異丙酚更快速和可預測的恢復。

（邊文玉 譯 陳傑 校）

BACKGROUND: Cyclopropyl-methoxycarbonyl metomidate (CPMM) is a “soft” etomidate analogue currently being developed as a propofol alternative for anesthetic induction and maintenance.

METHODS: We compared the potencies of CPMM and propofol by assessing their abilities to directly activate α1(L264T)β3γ2 gamma-aminobutyric acid type A (GABAA) receptors and induce loss of righting reflexes in tadpoles. We also measured the rates of encephalographic recovery in rats after CPMM and propofol infusions ranging in duration from 5 to 120 minutes.

RESULTS: CPMM and propofol activate GABAA receptors and induce loss of righting reflexes in tadpoles with respective 50% effective concentrations (EC50s) of 3.8 ± 0.4 and 3.9 ± 0.2 μM (GABAA receptor) and 2.6 ± 0.19 and 1.3 ± 0.04 μM (tadpole). Encephalographic recovery after prolonged infusion was faster with CPMM and lacked propofol’s context sensitivity.

CONCLUSION: CPMM and propofol have similar potencies in GABAA receptors and tadpoles; however, CPMM provides more rapid and predictable recovery than propofol, particularly after prolonged infusion.

一項關於產婦使用瑞芬太尼進行自控靜脈鎮痛和硬膜外自控鎮痛的效能及呼吸影響的隨機對照試驗

A Randomized Controlled Trial of the Efficacy and Respiratory Effects of Patient-Controlled Intravenous Remifentanil Analgesia and Patient-Controlled Epidural Analgesia in Laboring Women

Stocki, Daniel MD*†; Matot, Idit MD†; Einav, Sharon MD‡; Eventov-Friedman, Smadar MD§; Ginosar, Yehuda MBBS*; Weiniger, Carolyn F. MB ChB* ||

Anesthesia & Analgesia 2014 118 611–618

背景：當硬膜外鎮痛效果欠佳時需要尋找安全有效的替代方法。本研究假設自控靜脈瑞芬太尼輸注鎮痛效果非劣於自控硬膜外鎮痛。

方法：此項隨機、非盲、對照、非劣性、單中心研究選擇單胎頭位頂先露的健康產婦入選。產婦隨機分爲兩組：接受靜脈自控鎮痛，單次劑量自 20ug 起開始滴定最大至 60ug，間隔 1-2 分鐘給予；或接受硬膜外鎮痛，配方爲 0.1%的布比卡因和芬太尼 2ug/ml（首次推注劑量 15ml，維持單次劑量 10ml，鎖定時間 20min，基礎維持量 5ml/h）。30min 後進行交叉互換。 主要研究結果是效能【每小時使用數值評定量表(NRS)進行疼痛評分(共計 11 分)】和產婦滿意度評分（共計 11 分); 次要研究結果是安全性(產婦呼吸暫停)。在呼吸監測期間進行持續供氧。在鎮痛的第一小時，比較兩組的心率、呼吸頻率，脈搏氧飽和度和作爲呼吸暫停標誌的呼末 CO2 值。若呼吸暫停持續大於 40 秒，麻醉科主治醫生可以通過給予小的刺激來處理。

結果：40 例產婦入選：瑞芬太尼組 19 例(排除 1 例)，硬膜外組 20 例，其中 4 例進行了交叉(3 例是從瑞芬太尼組到硬膜外組；1 例從硬膜外組到瑞芬太尼組)。兩組基線的 NRS 疼痛評分均值（±標準差）相似（瑞芬太尼組 8.4±1.5，硬膜外組 8.7±1.2，P 值=0.52； 30min 時兩組疼痛評分分別爲：瑞芬太尼組 3.7±2.8，硬膜外組 1.5±2.2，P 值=0.009）。 由於觀察評分差異大於預期的−1.5 個單位，瑞芬太尼組在各個時間點的 NRS 評分均低於硬膜外鎮痛組。兩組的產婦滿意度分別爲：瑞芬太尼組 8.6±1.4,硬膜外鎮痛組 9.1±1.5, P 值=0.26；瑞芬太尼組平均呼吸次數要低於硬膜外組（18±4VS21±4 次/min,p=0.03）。瑞芬太尼組的平均 SpO2 值低於硬膜外組（96.8% ± 1.4 vs 98.4 ± 1.2 , P < 0.0001）。期間有 9 次呼吸暫停事件，所有的均發生在接受瑞芬太尼鎮痛者。新生兒 Apgar 評分和新生兒呼吸預後相同。

結論：靜脈給予瑞芬太尼優於硬膜外鎮痛。瑞芬太尼可以爲產婦提供一個滿意的鎮痛水準。但是使用瑞芬太尼鎮痛的產婦需要接受足夠的監測和警惕呼吸暫停的發生。

（梁玉丹 譯 陳傑 校）

BACKGROUND: Safe and effective alternatives are required in labor when epidural analgesia is not appropriate. We hypothesized that patient-controlled IV remifentanil labor analgesia would not be inferior to patient-controlled epidural labor analgesia.

METHODS: This randomized nonblinded controlled noninferiority study in healthy women with a singleton fetus and vertex presentation was performed at 1 site. Women were randomized to receive patient-controlled IV analgesia titrated from 20 mcg up to a maximum bolus dose of 60 mcg with a lockout interval of 1 to 2 minutes, or patient-controlled epidural analgesia 0.1% bupivacaine with 2 mcg/mL fentanyl (initiation bolus 15 mL; maintenance bolus 10 mL, lockout interval 20 minutes, basal infusion 5 mL/h). Crossover was permitted after 30 minutes. The primary study outcome was efficacy (assessed as hourly numerical rating scale [NRS] pain score [11-point NRS] and maternal satisfaction [11-point NRS]); the secondary outcome was safety (maternal apnea). Supplementary oxygen was administered continuously during the respiratory monitoring period. During the first hour of analgesia, the heart rate, respiratory rate, pulse oximetry (SpO2), and end-tidal CO2, as an indication of apnea, were compared. Apnea lasting >40 seconds was managed by light stimulation by the attending anesthesiologist.

RESULTS: Forty women were recruited to the following groups: remifentanil n = 19 (1 exclusion), epidural n = 20. Four crossed over: 3 from the remifentanil to epidural group and 1 from the epidural to remifentanil group. Mean (± SD) baseline NRS pain scores were similar, 8.4 ± 1.5 for remifentanil and 8.7 ± 1.2 for epidural analgesia, P = 0.52. Baseline adjusted mean NRS reduction at 30 minutes for remifentanil was −4.5 (± 0.6) vs −7.1(± 0.6) for epidural analgesia, P < 0.0001 for both. Pain score at 30 minutes was 3.7 ± 2.8 for remifentanil and 1.5 ± 2.2 for epidural analgesia, P = 0.009. Remifentanil was inferior to epidural analgesia with respect to the NRS at all time points, because the observed difference in NRS was greater than the expected −1.5 units. Maternal satisfaction was 8.6 ± 1.4 for the remifentanil group and 9.1 ± 1.5 for epidural group, P = 0.26. Mean respiratory rate was lower in the remifentanil group, 18 ± 4 vs 21 ± 4 breaths/min in the epidural group, P = 0.03. Mean SpO2 was lower in the remifentanil group 96.8% ± 1.4 vs 98.4 ± 1.2 for epidural group, P < 0.0001. There were 9 apnea events; all occurred in 5 women receiving remifentanil (5/19 [26.3%], P = 0.046). Apgar scores and neonatal respiratory outcomes were similar.

CONCLUSION: IV remifentanil is inferior to epidural analgesia for provision of labor analgesia; however, remifentanil does provide a satisfactory level of labor analgesia. Laboring women receiving remifentanil require suitable monitoring to detect and alert for apnea.

脊麻下行擇期剖腹產期間解救性推注新福林複合不同速率輸注與單純解救性推注新福林的隨機對照試驗

A Randomized Controlled Trial of Variable Rate Phenylephrine Infusion With Rescue Phenylephrine Boluses Versus Rescue Boluses Alone on Physician Interventions During Spinal Anesthesia for Elective Cesarean Delivery

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背景：新福林注射常用于緩解脊麻下剖腹產手術中產生的低血壓。預防性的固定速率注射無法明顯改善血流動力學的控制，根據動脈血壓和心率進行變化的速率注射可以更加精確地維持血壓的基礎值。本研究認爲，晶體液的輸注合併變化速率注射加單獨搶救性快速注射新福林，相比之於僅僅晶體液輸注合併單獨搶救性快速注射新福林，可以減少醫生介入處理維持母體收縮壓變化在基線的 20%內，而且血流動力學方面更穩定。

方法：本次前瞻性、雙盲試驗中，80 名患者在脊麻後立刻使用 15ml/kg 的乳酸林格氏液。各患者隨機使用預防性的變化速率注射新福林（起始爲 0.75 μg/kg/min）（P 組）或輸注生理鹽水（S 組）。使用預設的方法搶救性快速輸注新福林，使母體收縮壓維持在基線值的上下 20%之內。對比在胎兒產出前，兩組之間的內科介入次數（主要結果）、血流動力學表現、噁心/嘔吐、以及臍動靜脈血氣值。

結果：S 組有 1 人因違反實驗規則而被排除， P 組有 40 例而 S 組有 39 人。需要醫生處理以維持血流動力學在指定範圍內的中位數（範圍：0 [0–6] 對 3 [0–9]，中值差異：3，95%可信區間的差異：2-4），以及低血壓的發生率（8/40 [20%] 對 35/39 [90%]），P 組均低於 S 組（P＜0.001）。P 組相對 S 組有更高的高血壓發生率（6/40 [15%] 對 0/39 [0%], P = 0.026）。P 組相對 S 組執行誤差中位數更接近於基線（P＜0.001），且執行誤差絕對值的中位數較小（P=0.001）。P 組中，4/40 (10%)的病人發生了噁心/嘔吐，而 S 組中有 17/39 (44%)（P=0.001）。需要處理的次數方面，1.4 位女性中有 1 例需預防低血壓，3 位女性中有 1 例需預防噁心/嘔吐，高血壓的處理率爲 6.7 位女性中有 1 例。兩組的母嬰預後沒有差異。

結論：變化速率輸注新福林附加搶救性快速注射大劑量新福林，與僅僅依靠單獨搶救性快速注射大劑量新福林相比，在減少臨床工作量、緩解母體于脊麻剖腹產中的症狀方面更有效果。

（賀加貝 譯 陳傑 校）

BACKGROUND: Phenylephrine infusion is used to reduce hypotension during spinal anesthesia for cesarean delivery. A prophylactic fixed rate infusion regimen may not improve hemodynamic control; a variable rate regimen adjusted in response to changes in arterial blood pressure and heart rate may allow more accurate maintenance of baseline blood pressure. We hypothesized that a combination of crystalloid solution coload with a variable rate phenylephrine infusion and phenylephrine rescue boluses may be associated with fewer physician interventions needed to maintain maternal systolic blood pressure within 20% of baseline and greater hemodynamic stability than crystalloid solution coload with phenylephrine rescue boluses alone.

METHODS: In this prospective, double-blind study, 80 patients received a coload with 15 mL/kg lactated Ringer's solution immediately after the initiation of spinal anesthesia. Patients were randomized to receive a prophylactic variable rate phenylephrine infusion starting at 0.75 μg/kg/min (group P) or infusion of normal saline (group S). Maternal systolic blood pressure was maintained within 20% of baseline with rescue phenylephrine boluses using a preset algorithm. During the predelivery period, the number of physician interventions (primary outcome), hemodynamic performance, nausea/vomiting, and umbilical cord blood gas values were compared between the groups.

RESULTS: One patient from group S was excluded due to protocol violation. Therefore, group P included 40 patients and group S 39 patients. The median (range) number of physician interventions needed to maintain maternal hemodynamics within the target range (0 [0–6] vs 3 [0–9], difference in median: 3, 95% confidence interval of difference: 2–4) and incidence of hypotension (8/40 [20%] vs 35/39 [90%]) were lower in group P compared with group S ($P < 0.001$). Group P had a higher incidence of hypertension compared with group S (6/40 [15%] vs 0/39 [0%], $P = 0.026$). The median performance error was closer to baseline ($P < 0.001$) with a smaller median absolute performance error ($P = 0.001$) in group P versus group S. In group P, 4/40 (10%) patients had nausea/vomiting compared with 17/39 (44%) in group S ($P = 0.001$). The number needed to treat was 1.4 women to prevent 1 case of hypotension, and 3 women to prevent 1 case of nausea/vomiting; the rate of hypertension was 1 case per 6.7 women treated. Neonatal outcomes were not different between the 2 groups.

CONCLUSION: Prophylactic variable rate phenylephrine infusion and rescue phenylephrine bolus dosing is more effective than relying on rescue phenylephrine bolus dosing with respect to limiting clinician workload and maternal symptoms during spinal anesthesia for cesarean delivery.

在血液稀釋過程中腦和脊髓血流量增加的機制

The Mechanism of Increased Blood Flow in the Brain and Spinal Cord During Hemodilution

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背景:血液稀釋常伴隨腦血流量增加，但這是否由於動脈氧含量降低、血粘度降低或兩種機制的共同作用所導致的代償性血管擴張，仍然存在爭議。此項研究以深入瞭解這個問題，通過評估血液稀釋對（1）血管擴張儲備（2）在大腦和脊髓的區域高碳酸血症引起血管舒張時的血流水平。

方法：用 0.9%氟烷麻醉（1MAC）16 只雜種犬並進行機械通氣。放射性微球（15um）用來在大腦皮層，小腦，腦橋，延髓，脊髓（頸，胸，和腰段）測量區域的血流量（RBF）。通過動脈導管測量動脈壓。血管擴張儲備是由高碳酸血症時的 RBF（PaCO2 大約是 65mmHg）與高碳酸血症前的 RBF 的比值來評估。PaCO2 的增高是通過增加通氣死腔而不改變通氣設置。用血細胞比容來評估高碳酸血症對中樞神經系統的擴張作用，正常組（組 1，n=8），用 5%右旋糖酐介導等容稀釋使血細胞比容達 19 ± 4 (SD)（組 2，n=8）。

結果：血液稀釋增加了 RBF（$P < 0.0001$），減少了腦內所有區域和脊髓的血管擴張儲備比值($P < 0.05$)。血液稀釋組的比值（組 2）爲 48%，而未血液稀釋組的比值則爲 68%（組 1）。高碳酸血症時的 RBF 程度在血液稀釋和不稀釋時無顯著差別(大腦皮層: 平均值, 122 mL/min/100 g vs 平均值, 108 mL/min/100 g; 95% 可信區間(95% CID), −53 to 26; P = 0.46; 小腦: 平均值, 117 mL/min/100 g vs 平均值, 100 mL/min/100 g; 95% CID, −52 to 18; P = 0.32; 腦橋: 平均值, 83 mL/min/100 g vs 平均值, 73 mL/min/100 g; 95% CID, −12 to 31; P = 0.35; 髓質: 平均值, 96 mL/min/100 g vs 平均值, 82 mL/min/100 g; 95% CID, −11 to 40; P = 0.25; 頸髓: 平均值, 61 mL/min/100 g vs 平均值, 52 mL/min/100 g; 95% CID, −18 to 34; P = 0.51; 胸髓: 平均值, 35 mL/min/100 g vs 平均值, 46 mL/min/100 g; 95% CID, −30 to 8; P = 0.24; 腰髓: 平均值, 54 mL/min/100 g vs 平均值, 58 mL/min/100 g ; 95% CID, −25 to 15; P = 0.61)。僅高碳酸血症或者高碳酸血症和血液稀釋同時存在對平均動脈壓沒有影響（分別爲 P = 0.78 and P = 0.81）。

結論：血液稀釋引起血管擴張儲備的增加，這表明在血管舒張對於整個中樞神經系統 RBF 的增加發揮了作用。儘管在高碳酸血症時血液稀釋和不稀釋的 RBF 平均值類似，反應存在較大變化，排除了一個決定性的問題：降低血粘度與否也促進了血液稀釋引起 RBF 的增加。在血液稀釋過程中，對血管擴張的依賴將限制整個中樞神經系統自動調節能力，這將會增加低血壓性缺血的風險。

（談婧華 譯 陳傑 校）

BACKGROUND: Hemodilution is accompanied by an increase in cerebral blood flow, but whether this is due to vasodilation in response to reduced arterial oxygen content, reduced blood viscosity, or a combination of these mechanisms is a matter of debate. We performed the current study to gain insight into this question by evaluating the effect of hemodilution on (1) vasodilator reserve and (2) the level of blood flow during hypercapnia-induced vasodilation in regions of the brain and spinal cord.

METHODS: Sixteen mongrel dogs were anesthetized with halothane 0.9% (1 minimum alveolar concentration) while their lungs were mechanically ventilated. Radioactive microspheres (15 μm) were used to measure regional blood flow (RBF) in the cerebral cortex, cerebellum, pons, medulla, and spinal cord (cervical, thoracic, and lumbar segments). Arterial blood pressure was measured via an aortic catheter. Vasodilator reserve was assessed from the ratio of RBF during hypercapnia (PaCO2 approximately 65 mm Hg) to RBF before hypercapnia. PaCO2 was increased by the addition of dead-space tubing without changing the ventilator settings. The dilating effects of hypercapnia within the central nervous system (CNS) were assessed with hematocrit normal (group 1; n = 8) and after induction of isovolemic hemodilution to a hematocrit of 19 ± 4 (SD) with 5% dextran (group 2; n = 8).

RESULTS: Hemodilution increased RBF ($P < 0.0001$) and decreased the vasodilator reserve ratio ($P < 0.05$) in all regions of the brain and spinal cord; the ratios during hemodilution (group 2) were only 48% to 68% of those without hemodilution (group 1). The level of RBF during hypercapnia was not significantly different in the absence and presence of hemodilution (cerebral cortex: mean, 122 mL/min−1/100 g−1 vs mean, 108 mL/min−1/100 g−1; 95% confidence interval of the difference (95% CID), −53 to 26; P = 0.46; cerebellum: mean, 117 mL/min−1/100 g−1 vs mean, 100 mL/min−1/100 g−1; 95% CID, −52 to 18; P = 0.32; pons: mean, 83 mL/min−1/100 g−1 vs mean, 73 mL/min−1/100 g−1; 95% CID, −12 to 31; P = 0.35; medulla: mean, 96 mL/min−1/100 g−1 vs mean, 82 mL/min−1/100 g−1; 95% CID, −11 to 40; P = 0.25; cervical spinal cord: mean, 61 mL/min−1/100 g−1 vs mean, 52 mL/min−1/100 g−1; 95% CID,

−18 to 34; P = 0.51; thoracic spinal cord: mean, 35 mL/min−1/100 g−1 vs mean, 46 mL/min−1/100 g−1; 95% CID, −30 to 8; P = 0.24; lumbar spinal cord: mean, 54 mL/min−1/100 g−1 vs mean, 58 mL/min−1/100 g−1; 95% CID, −25 to 15; P = 0.61). Neither hypercapnia alone nor combined with hemodilution affected mean arterial blood pressure (P = 0.78 and P = 0.81, respectively).

CONCLUSIONS: Hemodilution caused recruitment of the vasodilator reserve, suggesting that vasodilation played a role in the increase in RBF throughout the CNS. Although the mean values for RBF during hypercapnia were similar with and without hemodilution, a large variation in the responses precluded a conclusive determination of whether or not reduced blood viscosity also contributed to the hemodilution-induced increases in RBF. A dependence on vasodilation would limit autoregulatory capability throughout the CNS during hemodilution, which would enhance the risk for ischemia if hypotension was superimposed.

大鼠核苷逆轉錄酶抑制劑誘導的機械性痛覺過敏被 p55TNFSR 抑制，p55TNFSR 是單純皰疹病毒載體通過 SDF1 alpha/CXCR4 系統所介導

Mechanical Allodynia Induced by Nucleoside Reverse Transcriptase Inhibitor Is Suppressed by p55TNFSR Mediated by Herpes Simplex Virus Vector Through the SDF1 alpha/CXCR4 System in Rats

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背景：在人類免疫缺陷病毒（HIV）相關的感覺神經病變，使用核苷類逆轉錄酶抑制劑（NRTI 類藥物）的愛滋病毒/獲得性免疫缺陷綜合症患者發生神經病理性疼痛在臨床上較爲常見。儘管有證據表明，神經病理性疼痛是由神經炎症相關的，包括促炎分子，腫瘤壞死因數-α（TNF-α），基質細胞衍生因數 1-α（SDF1-α）和 CXC 趨化因數受體類型 4（CXCR4），其中 NRTI 類藥物在神經病理性疼痛發展的詳細機制尚不清楚。在這項研究中，作者調查在背根神經節（DRG）和脊髓背角的促炎分子在 NRTI 類藥物介導的神經病理性疼痛的作用。

方法：神經病理性疼痛由 2'，3'-二去氧胞苷（核苷類逆轉錄酶抑制劑類藥物之一）介導產生。機械痛閾用 von Frey 絲纖維進行測定。非複製性的單純皰疹病毒（HSV）載體表達的 p55 腫瘤壞死因數可溶性受體（p55TNFSR）接種於大鼠後爪。用 Western 印跡技術測定在兩腰段脊髓和 L4 /5 背根神經節 TNF-α，SDF1-α 和 CXCR4 的表達。鞘內注射 CXCR4 拮抗劑。

結果：本研究表明（1）全身性的 ddC 給藥誘導上調腰段脊髓和 L4 /5 背根神經節 TNF-α，SDF1-α 和 CXCR4 的表達；（2）由非複製性 HSV 載體介導的 p55TNFSR 能逆轉全身性 ddC 給藥引起的機械性痛覺過敏；(3) 鞘內注射 CXCR4 拮抗劑 AMD3100 增加機械痛閾；（4）單純皰疹病毒載體表達 p55TNFSR 能逆轉 ddC 給藥所引起的腰段脊髓背角和背根神經節 TNF-α，SDF1-α 和 CXCR4 的上調。

結論：研究表明，TNF-α 通過 SDF1/CXCR4 系統在 NRTI 類藥物相關的神經病理性疼痛發揮作用並且阻斷這些促炎分子的信號傳導能夠減少 NRTI 類藥物相關的神經病理性疼痛。這些結果提供了一種新的以（基因治療）機制爲基礎的方法治療 HIV 相關神經病理性疼痛。

（林甲票 譯 陳傑 校）

BACKGROUND: In the human immunodeficiency virus (HIV)–associated sensory neuropathy, neuropathic pain associated with the use of nucleoside reverse transcriptase inhibitors (NRTIs) in

patients with HIV/acquired immunodeficiency syndrome is clinically common. While evidence demonstrates that neuropathic pain is influenced by neuroinflammatory events that include the proinflammatory molecules, tumor necrosis factor-α (TNF-α), stromal cell–derived factor 1-α (SDF1-α), and C-X-C chemokine receptor type 4 (CXCR4), the detailed mechanisms by which NRTIs contribute to the development of neuropathic pain are not known. In this study, we investigated the role of these proinflammatory molecules in the dorsal root ganglion (DRG) and the spinal dorsal horn in NRTIs-mediated neuropathic pain state.

METHODS: Neuropathic pain was induced by intraperitoneal administration of 2´,3´-dideoxycytidine (ddC, one of the NRTIs). Mechanical threshold was tested using von Frey filament fibers. Nonreplicating herpes simplex virus (HSV) vectors expressing p55 TNF soluble receptor (p55TNFSR) were inoculated into hindpaw of rats. The expression of TNF-α, SDF1-α, and CXCR4 in both the lumbar spinal cord and the L4/5 DRG was examined using Western blots. Intrathecal CXCR4 antagonist was administered.

RESULTS: The present study demonstrated that (1) systemic ddC induced upregulation of TNF-α, SDF1-α, and CXCR4 in both the lumbar spinal cord and the L4/5 DRG; (2) p55TNFSR mediated by a nonreplicating HSV vector reversed mechanical allodynia induced by systemic ddC; (3) intrathecal administration of the CXCR4 antagonist AMD3100 increased mechanical threshold; and (4) HSV vector expressing p55TNFSR reversed upregulation of TNF-α, SDF1-α, and CXCR4 induced by ddC in the lumbar spinal dorsal horn and the DRG.

CONCLUSIONS: Our studies demonstrate that TNF-α through the SDF1/CXCR4 system is involved in the NRTIs-related neuropathic pain state and that blocking the signaling of these proinflammatory molecules is able to reduce NRTIs-related neuropathic pain. These results provide a novel mechanism-based approach (gene therapy) to treating HIV-associated neuropathic pain.

喚醒時間在脊柱側彎手術中回應面模型預測

Response surface model predictions of wake-up time during scoliosis surgery

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背景：在已發表資料的基礎上，研究者建立了新的不同鎮靜程度的七氟醚-瑞芬太尼交互模型。這個新模型根據最小肺泡濃度(MAC 值)和阿片類藥物等效劑量與地氟醚-芬太尼等效。這些模型用來預測脊柱側彎手術患者在喚醒實驗中應答時間。我們的假設是某種交互模型可以精確地預估喚醒試驗中患者的應答時間。

方法：前期已有觀察者警覺/鎮靜評分法（OAA/S3）評估志願者的資料。基於這些資料建立了 3 個新的七氟醚-瑞芬太尼交互模型。這些模型包括 OAA/S<2（無反應）的預測，OAA/S< 3 和 OAA/S<4（鎮靜狀態）。23 個擇期行脊柱側彎手術的患者接受了地氟醚-芬太尼麻醉。根據已發表的藥代動力學模型，記錄了整個手術過程中芬太尼和地氟醚效應室濃度的預測值。當關閉地氟醚揮發罐後，每 10 秒記錄一次資料，直至患者有移動手足的反應後 10 分鐘。模型預測與圖形和時間分析觀察進行比較。

結果：實際患者第一次反應的時間和模型所預測 50%患者反應的時間的平均差爲：OAA / S < 2 模型中-2.6 ± 3.6 分鐘（均數±標準差），OAA / S < 3 模型中 2.8 ± 5.6 分鐘，OAA / S < 4 模型中 52.6 ± 32.3 分鐘。

結論：實驗結果證實了我們的研究假設；基於對志願者觀察資料建立的七氟醚-瑞芬太尼交互模型，以及相對應的地氟醚-芬太尼模型在喚醒實驗中精確地預測了患者的反應時間。這些研究與我們前期研究的結論相似，都是比較了七氟醚-瑞芬太尼/芬太尼麻醉下模型預測時間和實際觀察到患者的反應時間。OAA / S < 2 模型最爲精確地預測了患者移動手足的時間。這個模型或許可以說明麻醉醫生更好地在脊柱側彎手術需要術中喚醒時預測患者。

（陳實玉譯 薛張綱校）

BACKGROUND: With the use of previously published data, new sevoflurane-remifentanil interaction models of various degrees of sedation were created and adapted to desflurane-fentanyl by using minimal alveolar concentration and opioid equivalencies. These models were used to predict return of responsiveness in patients undergoing scoliosis surgery during a wake-up test. Our hypothesis was that one of the interaction models would accurately predict return of responsiveness during a wake-up test.

METHODS: Three new sevoflurane-remifentanil interaction models were constructed from previous observations in volunteers by using the Observer's Assessment of Alertness/Sedation (OAA/S) scores. These models included predictions of OAA/S<2 (unresponsive), OAA/S< 3, and OAA/S<4 (sedation). Twenty-three patients scheduled for scoliosis surgery received a fentanyl-desflurane anesthetic. With the use of published pharmacokinetic models, predictions of fentanyl and desflurane effect-site concentrations were recorded throughout surgery and converted to equivalent remifentanil and sevoflurane effect-site concentrations. Data were recorded every 10 seconds from the time when desflurane was turned off until 10 minutes after the patients responded by moving their hands and toes. Model predictions were compared with observations with graphical and temporal analyses.

RESULTS: The average difference between the time when a patient first responded and the time when the model predicted that there was a 50% probability that the patient would respond were -2.6 ± 3.6 minutes (mean ± SD) for the OAA/S<2 model, 2.8 ± 5.6 minutes for the OAA/S<3 model and 52.6 ± 32.3 minutes for the OAA/S<4 model.

CONCLUSIONS: The results confirmed our study hypothesis; a sevoflurane-remifentanil interaction model built from observations in volunteers and adapted to desflurane and fentanyl accurately predicted patient response during a wake-up test. These results were similar to our previous study comparing model predictions and patient observations after a sevoflurane-remifentanil/fentanyl anesthetic. The OAA/S <2 model most accurately predicted the time patients would respond by moving their fingers and toes. This model may help anesthesiologists better predict return of responsiveness during a wake-up test in patients undergoing spine surgery.

在麻醉的癱瘓患者通過實施環狀軟骨按壓來堵塞食管開口的有效性：一項針對 Glidescope 喉鏡的實驗和觀察性研究

The effectiveness of cricoid pressure for occluding the esophageal entrance in anesthetized and paralyzed patients: an experimental and observational glidescope study.

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背景：在過去的 20 年裡，環狀軟骨按壓（CP）對堵塞食管開口的有效性受到了質疑。最近的磁共振成像研究取得了相互矛盾的結論。我們在麻醉和癱瘓的成年患者上，使用即時視覺及機械手段，評估了有或無環狀軟骨按壓時食管開口的開放情況。

方法：研究納入了 107 名非肥胖、ASA 分級 I-II 的患者。使用 30N 的力量環狀加壓。在對每一例患者實施環狀軟骨按壓前，通過使用重量秤來標準化力量大小。在給氧、麻醉誘導、神經肌肉阻滯及實施純氧手控通氣後，暴露聲門和食管開口的視野，錄影通過 Glidescope 視頻喉鏡獲得。在給予或不給予環狀軟骨按壓的情況下，由一位元對研究不知情的操作者嘗試向食管插入 2 根規格分別爲 12F 和 20F 的胃管（GTs），但插入的時間是隨機的。存在 CP 的情況下成功置入胃管被認爲是食管入口開放的證據（無效 CP），而未成功插入胃管則被認爲是一個食管入口堵塞的證據（有效 CP ）。經過放置胃管的嘗試後，在使用 CP 的情況下進行氣管插管。從視頻錄影來評估使用或不使用 CP 時食管開口與聲門的位置關係（中線或橫向）。

結果：我們在收集了 79 名合格患者（41 例男性，38 例女性）資料後停止並完成了研究（95％-100％的雙側 Clopper-Pearson 可信區間（CI），N =72）。在實施 CP 的所有患者中，兩種規格的胃管均不能插入食管，但在所有未行 CP 的患者中很容易置入胃管。不管食管開口是在中線位置或相對於聲門的左側或右側，上述結果都相同。在無 CP 的情況下，能觀察到到食管入口開放，而在所有實施 CP 患者中都觀察到食道開口的閉塞。沒有進行 CP 時，觀察到 57％的患者食管開口位於聲門左側（95％CI，45％-68％），32％的患者爲中線位置（CI，22％-43％），11％的患者（CI，5％-21％）食管開口位於聲門右側。該位置關係不會隨環狀軟骨按壓而發生變化。

結論：目前的研究提供了額外的視覺和機械證據支援在麻醉和癱瘓的正常成年患者中，使用 30N 的環狀力來阻塞食道開口至少有 95％的成功率。該手法的效果與食管開口相對於聲門的位置無關，無論處於中線或側位關係。

（淩曉敏譯 薛張綱校）

BACKGROUND: In the last 2 decades, the effectiveness of cricoid pressure (CP) in occluding the esophageal entrance has been questioned. Recent magnetic resonance imaging studies yielded conflicting conclusions. We used real-time visual and mechanical means to assess the patency of the esophageal entrance with and without CP in anesthetized and paralyzed adult patients.

METHODS: One hundred seven, nonobese ASA physical status I and II patients were recruited for the study. A cricoid force of 30 N was used. This force was standardized by using a weighing scale before application of CP in each patient. After oxygen administration, anesthetic induction, neuromuscular blockade, and establishment of manual ventilation with FIO2 = 1.0, the view of the glottis and esophageal entrance was visualized, and video recordings were obtained by using a Glidescope video laryngoscope. Attempts to insert 2 gastric tubes (GTs), size 12 and 20 F, into the esophagus were made by a "blinded" operator without and with CP, the timing of which was randomized. A successful insertion of a GT in the presence of CP was considered evidence of a patent esophageal entrance (ineffective CP), whereas an unsuccessful insertion of a GT was considered evidence of an occluded esophageal entrance (effective CP). After the attempts to insert the GTs were completed, tracheal intubation was performed while CP was applied. The position of the esophageal entrance in relation to the glottis (midline versus lateral) was assessed from the video recordings, with and without CP.

RESULTS: We stopped the study when 79 patients (41 men and 38 women) qualified for and completed the study (2-sided Clopper-Pearson confidence interval (CI) 95% to 100%, n = 72). Advancement of either size GT into the esophagus could not be accomplished during CP in any

patient but was easily done in all subjects when CP was not applied. This occurred whether the esophageal entrance was in a midline position or in a left or right lateral position relative to the glottis. Esophageal patency was visually observed in the absence of CP, whereas occlusion of the esophageal entrance was observed during CP in all patients. Without CP, the esophageal entrance was in a left lateral position in relation to the glottis in 57% ([95 % CI, 45%-68%)] of patients, at midline in 32% (CI, 22%-43%), and in a right lateral position in 11% (CI, 5%-21%). The position did not change with CP.

CONCLUSIONS: The current study provides additional visual and mechanical evidence supporting a success rate of at least 95% by using a cricoid force of 30N to occlude the esophageal entrance in anesthetized and paralyzed normal adult patients. The efficacy of the maneuver was independent of the position of the esophageal entrance relative to the glottis, whether midline or lateral.

瑞芬太尼產婦自控靜脈鎮痛與硬膜外鎮痛的比較：隨機對照試驗的元分析

A comparison of remifentanil parturient-controlled intravenous analgesia with epidural analgesia: a meta-analysis of randomized controlled trials.

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背景：硬膜外鎮痛是公認的分娩過程中最有效的鎮痛方式。瑞芬太尼經靜脈患者自控鎮痛法(PCIA)相比於硬膜外鎮痛創傷更少，可能成爲更具吸引力的替代療法。在這篇 meta 分析中，我們將比較這兩種分娩鎮痛技術的有效性和安全性。

方法：兩名調查人員分別搜索 PubMed、EMBASE 和 Cochrane 圖書館的資料庫，以便檢索出符合條件的隨機控制臨床試驗。主要的觀察終點是 1 到 2 小時的疼痛評分，第二個觀察終點是噁心、嘔吐、瘙癢和臍帶動脈的 PH 值。計算 95%置信區間（CIs）下各端點的的平均差（MD）或風險率。分級（GRADE）分析工具被用於評估證據的品質。

結果：通過對五次合格試驗的檢索和分析，我們發現使用瑞芬太尼靜脈自控鎮痛的產婦比接受硬膜外鎮痛的孕婦每小時（MD=1.9 毫米； 95%CI,0.5-3.3；I=94%）或每兩小時（MD=3.0 毫米； 95%CI，0.7-5.2；I=89%）具有更高的視力模擬比例（10-毫米比例）疼痛評分。在使用硬膜外鎮痛和瑞芬太尼靜脈自控鎮痛(PCIA)療法控制噁心，嘔吐，皮膚瘙癢，臍動脈 pH 值方面，兩者沒有統計學上的差異。然而， CIs 非常廣泛，並且具有臨床上的顯著差異。根據 GRADE 分析工具，除了 1 小時處的疼痛評分品質較低之外，大多數觀察終點品質中等。

結論：此次 meta 分析表明，在分娩過程中的鎮痛功效方面，瑞芬太尼 PCIA 不比硬膜外止痛法優越。繼發的孕婦及新生兒結果的綜合結果，還不能得出確定的結論。確認這些結論還需進一步的研究。

（劉毅譯 薛張綱校）

BACKGROUND: Epidural analgesia is generally accepted as the most effective form of pain relief during labor. Remifentanil patient-controlled IV analgesia (PCIA), which is less invasive than epidural analgesia, may be an attractive alternative. In this meta-analysis, we compared the efficacy and safety of the 2 analgesic techniques for labor pain.

METHODS: Databases of PubMed, EMBASE, and Cochrane Library were searched independently by 2 reviewers to retrieve eligible randomized controlled clinical trials. The primary end points were pain scores at 1 and 2 hours, and the secondary end points were nausea,

vomiting, pruritus, and umbilical artery pH values. Mean difference (MD) or risk ratio with 95% confidence intervals (CIs) were calculated for each end point. GRADE profiler was applied to assess the quality of evidence.

RESULTS: Five eligible trials were retrieved and analyzed. We found that parturients with remifentanil PCIA had higher visual analog scale (10-cm scale) pain scores than those who received epidural analgesia at 1 hour (MD = 1.9 cm; 95% CI, 0.5-3.3; I = 94%) and 2 hours (MD = 3.0 cm; 95% CI, 0.7-5.2; I = 89%) after initiation of analgesia. There was no statistical difference between epidural analgesia and remifentanil PCIA in the incidence of nausea, vomiting, pruritus, or umbilical artery pH values. However, the CIs are quite wide and contain clinically significant differences. According to GRADE profiler, most end points had moderate quality except that pain scores at 1 hour were of low quality.

CONCLUSIONS: This meta-analysis suggests that remifentanil PCIA is not superior to epidural analgesia in analgesic efficacy during labor. Given the wide CIs of the pooled results for secondary maternal and neonatal outcomes, definite conclusions cannot be drawn for those outcomes. Further studies are still warranted to validate these conclusions.

門診兒童和青少年進行持續外周神經阻滯：連續 8 年的單中心研究

Ambulatory continuous peripheral nerve blocks in children and adolescents: a longitudinal 8-year single center study.

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背景：雖然近年來區域麻醉在小兒患者中的應用不斷增加，但是在門診患兒給予連續外周神經阻滯（CPNBs）的案例仍較少。在這份報告中，我們記錄了 1285 名患兒門診使用 CPNBs 的資訊。

方法：我們收集了從 2005 年 1 月至 2011 年 12 月間在費城兒童醫院行 CPNBs 患兒的信息。收集的資料包括人口統計學、導管放置的部位和神經阻滯技術、感覺/運動神經阻滯的情況、圍手術期使用阿片類藥物情況以及與 CPNBs 相關併發症。

結果：給予 1285 名門診患兒經導管連續輸注局麻藥。CPNB 的平均持續時間爲 50.7±14.4（平均值±標準差）。在 CPNBs 出院回家的患兒中，969 名（75.4%）患兒不需要額外給予阿片類藥物或僅口服基礎劑量的阿片類藥物（可信區間，73.0%-77.8%）。 2 例患者再次入院的並靜脈給予止痛。隨訪 6 個月後，沒有一例患兒出現 CPNBs 相關的神經功能障礙（置信區間，0%-0.29%）。

結論：通過對 1285 行 CPNBs 患兒的研究表明，CPNBs 可以有效提供術後鎮痛，並可減少需要住院給予靜脈阿片類藥物治療。

（徐升譯 薛張綱校）

BACKGROUND: Although the role of regional anesthesia in pediatric patients has been increasing over the last few years, there are only a few small case series that describe the use of ambulatory continuous peripheral nerve blocks (CPNBs) in this patient population. In this report, we describe our experience with the use of ambulatory CPNBs in 1285 children.

METHODS: Data were collected for consecutive children who had a CPNB placed between January 2005 and December 2011 at The Children's Hospital of Philadelphia from the departmental regional anesthesia database. Data collected included demographics, the site of

catheter placement and technique of nerve block, presence of sensory/motor blockade, use of perioperative opioids, and any complications related to CPNBs.

RESULTS: Continuous infusions of local anesthetics were administered via the catheters in 1285 outpatients. The mean duration of the CPNB was 50.7 ± 14.4 hours (mean ± SD). Among patients discharged home with the CPNBs, 969 (75.4%) of the patients required either no supplemental opioids or oral opioids only on an "as needed" basis in the postoperative period (confidence interval, 73.0%-77.8%). Two patients were readmitted for IV pain management after they were discharged home with the CPNB catheters. No neurological deficit related to the CPNBs was identified in any of the patients at their 6-month follow-up with the orthopedic surgeon (confidence interval, 0%-0.29%).

CONCLUSION: This audit of 1285 children shows ambulatory CPNBs can provide postoperative analgesia and may reduce the need for inpatient parenteral opioid therapy.

設置個體化的呼氣末正壓通氣水準與呼氣末正壓通氣減量試驗後肺複張改善單肺通氣時的氧合和肺動力學。

Setting individualized positive end-expiratory pressure level with a positive end-expiratory pressure decrement trial after a recruitment maneuver improves oxygenation and lung mechanics during one-lung ventilation.

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我們研究的是單肺通氣時個體化的呼氣末正壓通氣（PEEP）改善氧合，通氣和肺動力學與標準的 PEEP 值進行比較。三十例開胸手術患者隨機分爲研究組和對照組。兩組在開始和結束的單肺通氣後進行肺泡複張。肺泡複張後，對照組以 5 cm•H2O 的 PEEP 進行肺通氣，而研究組對肺通氣進行個體化的 PEEP 水準減量試驗測定。動脈血液樣本，肺動力學，和容量二氧化碳記錄儀記錄了整個過程中多個時間點的資料。在研究組個體化的 PEEP 值均高於標準的 PEEP 值(10 ± 2 vs 5 cm•H2O; P < 0.001)。在兩組中，雙肺通氣轉換到單肺通氣時動脈血氧下降，肺泡複張後增加。在單肺通氣過程中，肺通氣在研究組能保持供應而在對照組則下降。單肺通氣後，研究組的動脈氧合顯著較高(306 vs 231 mm•Hg, P = 0.007)。兩組雙肺通氣轉換到單肺通氣時肺順應性降低。肺順應性只有在研究組顯著增加(P < 0.001)通過肺泡複張和最佳 PEEP 調整後。肺泡複張並沒有減少任何病人的心臟指數。在單肺通氣時，相對於標準的 5 cm•H2O 的 PEEP 值，通過肺複張手法改善氧合和肺動力學時個體化的 PEEP 值以及 PEEP 減量實驗能更好的保護肺通氣。

（徐崢譯 薛張綱校）

Abstract：We investigated whether individualized positive end-expiratory pressure (PEEP) improves oxygenation, ventilation, and lung mechanics during one-lung ventilation compared with standardized PEEP. Thirty patients undergoing thoracic surgery were randomly allocated to the study or control group. Both groups received an alveolar recruitment maneuver at the beginning and end of one-lung ventilation. After the alveolar recruitment maneuver, the control group had their lungs ventilated with a 5 cm•H2O PEEP, while the study group had their lungs ventilated with an individualized PEEP level determined by a PEEP decrement trial. Arterial blood samples, lung mechanics, and volumetric capnography were recorded at multiple timepoints throughout the procedure. The individualized PEEP values in study group were higher than the standardized PEEP values (10 ± 2 vs 5 cm•H2O; P < 0.001). In both groups,

arterial oxygenation decreased when bilateral-lung ventilation was switched to one-lung ventilation and increased after the alveolar recruitment maneuver. During one-lung ventilation, oxygenation was maintained in the study group but decreased in the control group. After one-lung ventilation, arterial oxygenation was significantly higher in the study group (306 vs 231 mm•Hg, P = 0.007). Static compliance decreased in both groups when bilateral-lung ventilation was switched to one-lung ventilation. Static compliance increased significantly only in the study group (P < 0.001) after the alveolar recruitment maneuver and optimal PEEP adjustment. The alveolar recruitment maneuver did not decrease cardiac index in any patient. During one-lung ventilation, the improvements in oxygenation and lung mechanics after an alveolar recruitment maneuver were better preserved by ventilation by using individualized PEEP with a PEEP decrement trial than with a standardized 5 cm•H2O of PEEP.

可誘發運動反應的最小電流強度不能辨別穿刺針-神經接觸和穿刺針神經內插入

Minimal Current Intensity to Elicit an Evoked Motor Response Cannot Discern Between Needle-Nerve Contact and Intraneural Needle Insertion

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背景：近來通過低電流強度刺激是否誘發運動反應(EMR)來判斷神經刺激器穿刺針已置入神經內的可靠性受到了質疑。在這項研究中，我們假設穿刺針-神經接觸的電流強度較穿刺針神經內置入的電流強度更高。

方法：將 6 頭豬麻醉後手術暴露臂叢神經。將絕緣針連接到神經刺激器，並將其尖端分別置於距神經 1mm 處（對照位置），神經外膜旁（穿刺針-神經接觸位置），及神經內（穿刺針神經內置入位置）。將三個脈衝持續時間以隨機方式施加於各置針位置（0.1, 0.3 或 1.0ms）。從 0.0mA 開始逐漸增加電流強度，直到可觀察到產生特定 EMR 的最小閾值電流。對每個置針位置的各脈衝持續時間分別測定 50 個閾值電流。

結果：共測定 50 個周圍神經處閾值電流共計 450 個。穿刺針-神經接觸和穿刺針神經內置入可引出 EMR 的閾值電流強度(mA)之間僅有微小差異，且這一差異不具有臨床相關性和統計學顯著性[中位數（第 25-第 75 百分位數）；穿刺針-神經接觸：0.1ms: 0.12 (0.08–0.18)mA; 0.3ms: 0.10 (0.06–0.12)mA; 1.0ms: 0.06 (0.04–0.10)mA。穿刺針神經內置入：0.1ms 0.12 (0.10–0.16)mA; 0.3ms: 0.08 (0.06–0.10)mA; 1.0ms: 0.06 (0.06–0.08)mA]。不考慮所應用的脈衝持續時間，98.33%可信區間顯示在 0.02mA 差異最大。無論如何，穿刺針-神經接觸位置引出 EMR 的閾值電流強度，低於對照位置的閾值電流強度(0.1ms: 0.28 (0.26–0.32)mA; 0.3 ms: 0.20 (0.16–0.22)mA; 1.0 ms: 0.12 (0.10–0.14)mA)。

結論：對於可信區間的差異表明，可引起運動反應的最小電流強度不能可靠地分辨穿刺針神經內置入和針-神經接觸。此外，閾值電流<0.2mA 仍有 EMR（與所施加的脈衝持續時間無關）提示神經內置針或針-神經接觸。

（朱怡琦譯 薛張綱校）

BACKGROUND: The ability of an evoked motor response (EMR) with nerve stimulation to detect intraneural needle placement reliably at low current intensity has recently been challenged.

In this study, we hypothesized that current intensity is higher in needle-nerve contact than in intraneural needle placement.

METHODS: Brachial plexus nerves were exposed surgically in 6 anesthetized pigs. An insulated needle connected to a nerve stimulator was placed either with 1 mm distance to the nerve (control position), adjacent to nerve epineurium (needle-nerve contact position), or inside the nerve (intraneural position). Three pulse duration settings were applied in random fashion (0.1, 0.3, or 1.0 milliseconds) at each needle position. Starting at 0.0 mA, electrical current was increased until a minimal threshold current resulting in a specific EMR was observed. Fifty threshold current measurements were scheduled for each needle position-pulse duration setting.

RESULTS: Four hundred-fifty threshold currents in 50 peripheral nerves were measured. Threshold current intensities (mA) to elicit EMR showed small differences between the needle-nerve contact position [median (25th–75th percentiles); 0.1 milliseconds: 0.12 (0.08–0.18) mA; 0.3 milliseconds: 0.10 (0.06–0.12) mA; 1.0 milliseconds: 0.06 (0.04–0.10) mA] and the intraneural position (0.1 milliseconds: 0.12 [0.10–0.16] mA; 0.3 milliseconds: 0.08 [0.06–0.10] mA; 1.0 milliseconds: 0.06 [0.06–0.08] mA) that are neither statistically significant nor clinically relevant. Regardless of the pulse duration that was applied, the 98.33% confidence interval revealed a difference of at most 0.02 mA. However, threshold current intensities to elicit EMR were lower for the needle-nerve contact position than for the control position (0.1 milliseconds: 0.28 [0.26–0.32] mA; 0.3 milliseconds: 0.20 [0.16–0.22] mA; 1.0 milliseconds: 0.12 [0.10–0.14] mA).

CONCLUSIONS: The confidence interval for differences suggests minimal current intensity to elicit a motor response that cannot reliably discern between a needle-nerve contact from intraneural needle placement. In addition, an EMR at threshold currents <0.2 mA (irrespective of the applied pulse duration) indicates intraneural needle placement or needle-nerve contact.

支氣管封堵肺萎陷技術：氧化亞氮對單肺通氣條件下支氣管封堵的肺萎陷有利

Bronchial Blocker Lung Collapse Technique: Nitrous Oxide for Facilitating Lung Collapse During One-Lung Ventilation with a Bronchial Blocker

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背景：閉塞肺的有效肺萎陷對胸外科手術有利。之前的研究表明：與使用雙腔氣管內導管相比，使用支氣管封堵能延遲肺萎陷時間。我們假設雙肺通氣中吸入混合氣體氧化亞氮（笑氣）則會在隨後支氣管封堵單肺通氣中改善的臨床相關肺萎陷。

方法：隨機選擇 50 名患者並分成兩組：笑氣組（26 人），氧氣組（24 人）。直到開始單肺通氣，笑氣組接受氧氣和笑氣混合氣體（氧體積分數=0.5），氧氣組接受百分之百氧氣通氣。肺隔離通過一個 Arndt® （Cook® Critical Care, Bloomington, IN）有線制導的支氣管封堵器材實現。將患者翻動並保持側臥位，在纖維支氣管鏡監視下將支氣管封堵的袖帶充氣，然後在兩組單肺通氣時進行功能肺的百分之百純氧通氣。外科醫生通過盲法隨機化評估病人在打開胸膜 5 分鐘後，並採用口述分級評分法方式得出肺萎陷的等級（肺萎陷等級，0 到 10 無萎陷到完全萎陷）。同時，在一分鐘和十分鐘時的肺萎陷作爲第二評估指標。

結果：在打開胸膜 5 分鐘後，笑氣組的肺萎陷評級明顯高於氧氣組（7 比 5，P < 0.001, WMWodds = 7.3，95%置信區間爲 6 到 9）。在打開胸膜 10 分鐘後笑氣組的肺萎陷依然高於氧氣組（10 比 7, P < 0.001, WMWodds = 10.1，95%置信區間爲 1.9–13.3）。在打開胸膜 1 分鐘後兩組沒有顯著性差異（2 比 2，P = 0.76, WMWodds = 1.1, 95% 置信區間爲 0.96–1.2）。在單肺通氣中沒有病人出現低氧（血氧飽和度小於百分之九十二）。

結論：當打開胸膜後 5 分鐘後，與通入百分之百純氧並使用支氣管封堵組相比，在單肺通氣前給肺吸入 50%的笑氣能促進肺萎陷。使用混合氣體—笑氣/氧氣（氧體積分數=0.5）對隨後的單肺通氣中的動脈氧合作用沒有不良影響。

（趙曉 譯 李士通 校 ）

BACKGROUND: Effective lung collapse of the nonventilated lung can facilitate thoracic surgery. Previous studies showed that using a bronchial blocker could delay the time of lung collapse compared with using a double-lumen endotracheal tube. We hypothesized that the use of nitrous oxide (N2O) in the inspired gas mixture during 2-lung ventilation would lead to clinically relevant improvement of lung collapse during subsequent 1-lung ventilation with a bronchial blocker.

METHODS: Fifty patients were randomized into 2 groups: N2O (n =26) or O2 (n = 24). The N2O group received a gas mixture of oxygen and N2O (FIO2 = 0.5), and the O2 group received 100% oxygen until the start of 1-lung ventilation. Lung isolation was achieved with an Arndt® wire-guided bronchial blocker (Cook® Critical Care, Bloomington, IN). After turning patients to the lateral decubitus position, the cuff of the bronchial blocker was inflated under fiberoptic bronchoscopy surveillance, and thereafter, the dependent lung was ventilated with 100% oxygen during 1-lung ventilation in both groups. Surgeons blinded to the randomization evaluated the degree of lung collapse by using a verbal rating scale (lung collapse scale, 0 = no collapse to 10 = complete collapse) at 5 minutes after opening the pleura. Also, as secondary outcomes, lung collapse at 1 and 10 minutes were evaluated.

RESULTS: The score on the lung collapse scale in the N2O group was significantly higher compared with the O2 group at 5 minutes after opening the pleura (7 vs 5, P < 0.001, WMWodds = 7.3, 95% confidence interval (CI), 6.0 to 9.0). It was also higher in the N2O group at 10 minutes (10 vs 7, P < 0.001, WMWodds = 10.1, 95% CI, 1.9–13.3). The lung collapse scale between groups was not significant at 1 minute after opening the pleura (2 vs 2, P = 0.76, WMWodds = 1.1, 95% CI, 0.96–1.2). None of the patients developed hypoxia (SpO2 <92%) during 1-lung ventilation.

CONCLUSIONS: Filling the lung with 50% N2O before 1-lung ventilation facilitated lung collapse 5 minutes after opening the chest compared with 100% oxygen when a bronchial blocker was used. The N2O/O2 mixture (FIO2 = 0.5) did not have a harmful effect on subsequent arterial oxygenation during 1-lung ventilation.

抗纖溶藥物應用在小兒非心臟手術中效果：文獻的系統回顧

The Efficacy of Antifibrinolytic Drugs in Children Undergoing Noncardiac Surgery: A Systematic Review of the Literature

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接受大型手術的小兒經常面臨失血的風險並通常需要輸血。儘管近十年來，輸注血製品相關的風險已經大大下降，但輸血仍會導致相關顯著的發病率和死亡率。因此，仍需要做出嚴格的努力來減少外科手術的失血及對血製品的需求。抗纖溶藥物曾被證實在成人及小兒外科病人中都有效。自從 2008 年限制了抑肽酶的使用，最常用的抗纖溶藥物就是賴氨酸類似物、氨甲環酸（TXA）和 ε -氨基己酸，其原理爲抑制纖溶酶原轉換爲纖溶酶從而減少纖溶。本文對有關小兒非心臟手術中抗纖溶藥物使用的效果的文獻進行了系統回顧。在脊柱外科手術中，TXA 和 ε -氨基己酸均可減少失血和輸血的要求，然而此項結果來源於小型回顧性爲主的研究。有兩項前瞻隨機對照試驗檢測了在接受顱頜面外科手術的兒童的 TXA 的療效並且報導了 TXA 可以減少輸血需求。另外最近有兩項相關的藥代動力學試驗結果發表並被總結在此綜述中。沒有關於 TXA 在兒科創傷人群的使用療效的已發表的資料。在該研究領域仍需進一步的資料，本文討論對未來研究的展望。

(王贇譯、李士通校)

Children undergoing major surgery are frequently exposed to a high risk of blood loss often requiring transfusion. Although the risks associated with blood product transfusion have considerably decreased over the last decade, transfusion is still associated with significant morbidity and mortality. Thus, rigorous efforts should be made to decrease surgical bleeding and the need for blood product transfusion. Antifibrinolytic drugs have been shown to be effective when used in both adult and pediatric surgical patients. While there are data in adults to support safety, data remain limited for pediatric patients. Since the restriction of aprotinin use in 2008, the most commonly used antifibrinolytic drugs have been the lysine analogs, tranexamic acid (TXA), and ε-aminocaproic acid, which inhibit the conversion of plasminogen to plasmin and decrease the degree of fibrinolysis. We performed a systematic review of the literature pertaining to the efficacy of antifibrinolytic drugs in children undergoing noncardiac surgery. During spine surgery, both TXA and ε-aminocaproic acid decrease blood loss and transfusion requirements; however, this information comes from small, mainly retrospective trials. Two prospective, randomized, controlled trials have tested the efficacy of TXA in children undergoing craniofacial surgery and have reported that TXA decreases transfusion requirements. Two pharmacokinetic trials were also recently published and are summarized in this review. No data have been published regarding the efficacy of TXA administration in the pediatric trauma population. Further data are still needed in this field of study, and we discuss some perspectives for future research.

高誤吸風險患者中胃管留置和氣道管理的歷史，流行觀點和規程建議

Gastric Tubes and Airway Management in Patients at Risk of Aspiration: History, Current Concepts, and Proposal of an Algorithm

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存在胃食管內容物呼吸道誤吸風險的患者中常用的麻醉技術是快速序貫誘導插管（Rapid sequence induction and intubation, RSII）和清醒狀態氣管插管。有些患者術前可能留置了胃管（gastric tube, GT），目前關於哪部分患者麻醉前應留置胃管尚無指南。而且，臨床醫生對於麻醉誘導前是否需要保留胃管、部分拔出或完全拔除胃管的意見沒有達成統一。在這篇綜述中我們爲存在呼吸道誤吸風險的患者是否應該在麻醉誘導過程中留置胃管進行了歷史回顧。1961 年使用環狀軟骨壓迫（cricoid pressure, CP）技術以前，使用頭高位快速序貫誘導插管技術。Sellick 最早建議麻醉誘導前拔除胃管。他假設留置胃管增加了反流的風險，並且影響了環狀軟骨壓迫時食管上段的壓力。之後 Sellick 修改了他的觀點並且強調了留置胃管時行環狀軟骨壓迫手法的安全性。儘管後續研究證實了環狀軟骨壓迫法可以有效隔斷胃管周圍的食管，Sellick 的早期觀點仍被研究人員引用，他們建議部分或完全拔除胃管。在已有的大量資訊的基礎上，我們爲存在胃食管內容物誤吸風險的患者制定了一項氣道管理規程。個體化的方案根據一下幾點：操作過程；潛在病理類型和嚴重程度；意識狀態；困難氣道評估；胃管留置是否到位；RSII 或 CP 的禁忌症。規程要求麻醉前留置大口徑胃管以排出未消化食物殘塊，對賁門失馳緩症患者實行清醒插管，並且對 Zenker ‘s 憩室患者利用外部壓力排空胃部。它也規定在預計無困難氣道的胃擴張患者中，需通過臨床和影像學特點評估是否有必要留置胃管，在重症患者中應該嘗試留置胃管。後一種情況下，成功留置胃管與否將提示是使用 RSII 或是清醒插管。在誘導過程中，胃管不應拔除，應持續性連接負壓吸引。我們也討論了嬰幼兒幾種胃腸道異常外科矯正術中的氣道管理和胃管留置。

（盛嘉君 譯，李士通 審校）

Rapid sequence induction and intubation (RSII) and awake tracheal intubation are commonly used anesthetic techniques in patients at risk of pulmonary aspiration of gastric or esophageal contents. Some of these patients may have a gastric tube (GT) placed preoperatively. Currently, there are no guidelines regarding which patient should have a GT placed before anesthetic induction. Furthermore, clinicians are not in agreement as to whether to keep a GT in situ, or to partially or completely withdraw it before anesthetic induction. In this review we provide a historical perspective of the use of GTs during anesthetic induction in patients at risk of pulmonary aspiration. Before the introduction of cricoid pressure (CP) in 1961, various techniques were used including RSII combined with a head-up tilt. Sellick initially recommended the withdrawal of the GT before anesthetic induction. He hypothesized that a GT increases the risk of regurgitation and interferes with the compression of the upper esophagus during CP. He later modified his view and emphasized the safety of CP in the presence of a GT. Despite subsequent studies supporting the effectiveness of CP in occluding the esophagus around a GT, Sellick's early view has been perpetuated by investigators who recommend partial or complete withdrawal of the GT. On the basis of available information, we have formulated an algorithm for airway management in patients at risk of aspiration of gastric or esophageal contents. The approach in an individual patient depends on: the procedure; type and severity of the underlying pathology; state of consciousness; likelihood of difficult airway; whether or not the GT is in place; contraindications to the use of RSII or CP. The algorithm calls for the preanesthetic use of a large-bore GT to remove undigested food particles and awake intubation in patients with achalasia, and emptying the pouch by external pressure and avoidance of a GT in patients with Zenker diverticulum. It also stipulates that in patients with gastric distension without predictable airway difficulties, a clinical and imaging assessment will determine the need for a GT and in severe cases an attempt to insert a GT should be made. In the latter cases, the success of placement will indicate whether to use RSII or awake intubation. The GT should not be withdrawn and should be connected to suction during induction. Airway management and the use of GTs in the surgical correction of certain gastrointestinal anomalies in infants and children are discussed.

內源性大麻素花生四烯酸乙醇胺抑制爪蟾卵母細胞的電壓門控鈉通道 Nav1.2, Nav1.6, Nav1.7 及 Nav1.8

The Endocannabinoid Anandamide Inhibits Voltage-Gated Sodium Channels Nav1.2, Nav1.6, Nav1.7, and Nav1.8 in Xenopus Oocytes

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背景：花生四烯酸是一種內源性大麻素，可通過藥理作用調節多種生理功能，方式類似於大麻。最近，因內源性大麻素的鎮痛效果將其作爲頑固性疼痛治療的新藥物療法備受關注。然而花生四烯酸乙醇胺的鎮痛作用機制仍舊不明了。電壓門控鈉離子通道被認爲在炎症和神經性疼痛中起重要作用。我們研究了大麻素對鈉離子通道的 4 種 α 亞基，Nav1.2、Nav1.6、 Nav1.7 及 Nav1.8 的作用以探討大麻素鎮痛效應的作用機制。

方法：我們通過全細胞雙電極電壓鉗技術，研究了非洲爪蟾卵母細胞內花生四烯酸對 Nav1.2、Nav1.6、Nav1.7 及 Nav1.8 的 α 亞基和 β 1 亞基的作用。

結果：花生四烯酸抑制了所有鈉通道的亞基持續電壓引起的 1/2 最大電流，並呈濃度依賴。 Nav1.2、Nav1.6、Nav1.7 及 Nav1.8 的半數最大抑制濃度值分別爲 17、12、27 及 40μmol/L。對 Nav1.6 抑制作用最大。花生四烯酸乙醇胺在所有 α 亞集中，引起活化曲線向去極化方向移動，及失活曲線向超級化方向移動，表明鈉離子通道的抑制作用是由啓動

減少和失活增加導致的。此外，花生四烯酸乙醇胺呈使用依賴性的阻滯 Nav1.2、Nav1.6 及 Nav1.7 ，不阻滯 Nav1.8。

結論：花生四烯酸乙醇胺抑制神經元鈉離子通道的 α 亞基 Nav1.2、Nav1.6、Nav1.7 及 Nav1.8 的功能。這些結果有助於明確大麻素鎮痛作用的機制。

（邢怡安 譯 李士通 校）

BACKGROUND: Anandamide is an endocannabinoid that regulates multiple physiological functions by pharmacological actions, in a manner similar to marijuana. Recently, much attention has been paid to the analgesic effect of endocannabinoids in terms of identifying new pharmacotherapies for refractory pain management, but the mechanisms of the analgesic effects of anandamide are still obscure. Voltage-gated sodium channels are believed to play important roles in inflammatory and neuropathic pain. We investigated the effects of anandamide on 4 neuronal sodium channel α subunits, Nav1.2, Nav1.6, Nav1.7, and Nav1.8, to explore the mechanisms underlying the antinociceptive effects of anandamide.

METHODS: We studied the effects of anandamide on Nav1.2, Nav1.6, Nav1.7, and Nav1.8 α subunits with β1 subunits by using whole-cell, 2-electrode, voltage-clamp techniques in Xenopus oocytes.

RESULTS: Anandamide inhibited sodium currents of all subunits at a holding potential causing half-maximal current (V1/2) in a concentration-dependent manner. The half-maximal inhibitory concentration values for Nav1.2, Nav1.6, Nav1.7, and Nav1.8 were 17, 12, 27, and 40 μmol/L, respectively, indicating an inhibitory effect on Nav1.6, which showed the highest potency. Anandamide raised the depolarizing shift of the activation curve as well as the hyperpolarizing shift of the inactivation curve in all α subunits, suggesting that sodium current inhibition was due to decreased activation and increased inactivation. Moreover, anandamide showed a use-dependent block in Nav1.2, Nav1.6, and Nav1.7 but not Nav1.8.

CONCLUSION: Anandamide inhibited the function of α subunits in neuronal sodium channels Nav1.2, Nav1.6, Nav1.7, and Nav1.8. These results help clarify the mechanisms of the analgesic effects of anandamide.

預防性抗生素對硬膜外分娩鎮痛引起的產時發熱的有效性:一個隨機試驗

A Randomized Trial of the Effects of Antibiotic Prophylaxis on Epidural-Related Fever in Labor

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背景：據研究表明產婦在硬膜外鎮痛分娩時出現的發熱可能是由於產時感染。我們探討在硬膜外置管前使用預防性抗生素能否降低硬膜外分娩鎮痛引起的產時發熱的發生率。

方法：此次試驗採用雙盲、安慰劑對照。將需硬膜外鎮痛分娩的 400 名初產婦隨機分爲兩組，在即將行硬膜外分娩鎮痛時分別予以頭孢西丁 2g 或安慰劑。每小時測量一次產婦鼓膜溫度，溫度≥38°C 定義爲產時發熱。發熱產婦的新生兒評估是否出現新生兒敗血症，若有胎盤標本則評估是否可有中性粒細胞炎症。主要結果指標就是硬膜外分娩鎮痛時產婦的發熱。

結果：頭孢西丁組 38%的產婦和安慰劑組 40%的產婦出現了發熱 (P = 0.68)。分娩時體溫≥38°C（抗生素對安慰劑）的風險差異（95%的可信區間）是−2.0% (−11.5 —7.5)，而體溫>39°C 的是−1.5% (−4.7—1.7)。每組大約有一半的產婦胎盤出現了中性粒細胞炎症，而且頭孢西丁對任一級的炎症均無明顯預防作用。有胎盤炎症的產婦比沒有炎症的產婦更有可

能出現產時發熱(73/158 vs 33/144, P < 0.001; 風險差異 23% [95%可信區間, 13.0–34.0])。在任何新生兒結局方面，頭孢西丁組和安慰劑組無明顯差異，所有新生兒中無新生兒敗血症，無新生兒死亡。

結論：硬膜外分娩鎮痛時的產時發熱與胎盤炎症有關，但預防性的使用抗生素不能減少發熱與胎盤炎症的發生。此研究表明硬膜外分娩鎮痛相關的產時發熱與胎盤炎症並非感染引起的。

（王慧娟 譯 李士通 校）

BACKGROUND: It has been suggested that the development of maternal fever during epidural analgesia could be due to intrapartum infection. We investigated whether antibiotic prophylaxis before epidural placement decreases the rate of epidural-related fever.

METHODS: In this double-blind, placebo-controlled trial, 400 healthy nulliparous women requesting epidural analgesia were randomly assigned to receive either cefoxitin 2 g or placebo immediately preceding initiation of epidural labor analgesia. Maternal tympanic temperature was measured hourly, and intrapartum fever was defined as a maternal temperature of ≥38°C. Neonates born to women with fever were evaluated for possible sepsis, and available placentas were evaluated for the presence of neutrophilic inflammation. The primary outcome was maternal fever during epidural analgesia.

RESULTS: Thirty-eight percent of women in the cefoxitin group and 40% of women in the placebo group developed fever (P = 0.68). The risk difference (95% confidence interval) for fever ≥38°C during labor (antibiotic versus placebo) was −2.0% (−11.5 to 7.5), and for fever >39°C during labor was −1.5% (−4.7 to 1.7). Approximately half of each study group had placental neutrophilic inflammation, but administration of cefoxitin had no significant effect on any grade of neutrophilic inflammation. Fever developed significantly more often in the women with placental neutrophilic inflammation compared with those without such inflammation (73/158 vs 33/144, P < 0.001; risk difference 23% [95% confidence interval, 13.0–34.0]). There were no significant differences in any neonatal outcomes between the antibiotic and placebo study groups. Sepsis was not diagnosed in any of the infants. There were no neonatal deaths.

CONCLUSION: Fever during labor epidural analgesia is associated with placental inflammation, but fever and placental inflammation were not reduced with antibiotic prophylaxis. This finding suggests that infection is unlikely to be the cause in its development.

局部麻醉注射後外周神經損傷：勘誤表

Peripheral Nerve Injury After Local Anesthetic Injection: Erratum

Anesthesia & Analgesia 2014 118 686

Farber 等 2013 年 9 月發表在《麻醉與鎮痛》雜誌上的論著，“局部麻醉注射後外周神經損傷”在 Figure 4 中濃度有誤。方法部分中的濃度是正確，爲：布比卡因 0.5%，羅呱卡因 0.5%，和利多卡因 1.0%。

（董靜 譯 李士通 校）

In the September 2013 issue of Anesthesia & Analgesia, in the article by Farber et al., “Peripheral Nerve Injury After Local Anesthetic Injection,” the concentrations in Figure 4 were mislabeled.

The correct concentrations are those reported in the Methods section: bupivacaine 0.5%, ropivacaine 0.5%, and lidocaine 1.0%.