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酸中毒對凝血酶生成影響機制的模型建立

Mechanistic Modeling of the Effects of Acidosis on Thrombin Generation

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Anesthesia & Analgesia 2015 121 278–288

背景：酸中毒是創傷和複雜手術的常見併發症，是由於組織低灌注和靜脈復蘇後產生酸性體液的結果。雖然已經知道酸中毒是能夠對不同的酶促反應產生抑制，但是其對凝血系

統的累積效應還沒有能夠完全被揭示。在這裡，我們使用計算模型來驗證酸中毒會延遲並減少人體血漿中的凝血酶的大量生成這一假設。此外我們在個體和人群水準，研究了不同的凝血酶生成參數對酸中毒的敏感性。

方法：我們用動力學模型來類比分析凝血酶和凝血酶-抗凝血酶複合物的生成（TAT），這是本研究的最終目的。大量的凝血酶和TAT軌跡用來模擬和計算定量參數，如凝血時間（CT）、凝血酶峰值時間、凝血酶曲線最大斜率、凝血酶峰值高度、凝血酶軌跡下的面積（AUC）和凝血酶原時間。將所得的樣本的參數值在不同的pH值水準進行了比較，以評估酸中毒所導致的影響。我們利用來自472項萊頓易栓症的研究出的凝血因數成分的資料來參數化計算模型，以此研究個體間的差異。通過模式在我們虛擬主體中發生的計數估算出相對變化模式的概率，從而比較酸中毒引起的在個人（“虛擬”）方面的相應參數的變化。採用Bhattacharyya係數量化對凝血酶生成參數在不同pH值水準的分佈重疊。

結果：酸中毒在pH值6.9～7.3範圍內CT、凝血酶峰值時間、AUC和凝血酶原時間逐步增加，而凝血酶曲線最大斜率和凝血酶峰值高度降低（P＜10）。酸中毒推遲了TAT生成的開始時間，降低了生成的數量（P＜10）。在我們的個體項目中的所有凝血酶生成參數（專案顯示模式的單邊95%置信下限區間，0.99）作爲衡量個體間的差異，凝血酶曲線最大斜率和CT顯示最大和第二大酸中毒所引起的相對變化，而AUC顯示最小的相對變化。作爲衡量個體間變異性，在酸中毒pH值水準的凝血酶曲線最大斜率分佈與在生理pH值水準的凝血酶曲線最大斜率分佈有重疊，與CT、凝血酶峰值高度和凝血酶原時間的重疊分佈非常系統的相似。

結論：酸中毒影響所有的凝血酶和TAT生成的定量參數。在個體專案水準中凝血酶曲線最大斜率在酸中毒的時候顯示敏感性最高，這可能是優於CT和凝血酶峰值時間，而在項目組水準中凝血酶原時間是酸中毒的指標。

（李婷婷譯，李士通 審校）

BACKGROUND: Acidosis, a frequent complication of trauma and complex surgery, results from tissue hypoperfusion and IV resuscitation with acidic fluids. While acidosis is known to inhibit the function of distinct enzymatic reactions, its cumulative effect on the blood coagulation system is not fully understood. Here, we use computational modeling to test the hypothesis that acidosis delays and reduces the amount of thrombin generation in human blood plasma. Moreover, we investigate the sensitivity of different thrombin generation parameters to acidosis, both at the individual and population level.

METHODS: We used a kinetic model to simulate and analyze the generation of thrombin and thrombin-antithrombin complexes (TAT), which were the end points of this study. Large groups of temporal thrombin and TAT trajectories were simulated and used to calculate quantitative parameters, such as clotting time (CT), thrombin peak time, maximum slope of the thrombin curve, thrombin peak height, area under the thrombin trajectory (AUC), and prothrombin time. The resulting samples of parameter values at different pH levels were compared to assess the acidosis-induced effects. To investigate intersubject variability, we parameterized the computational model using the data on clotting factor composition for 472 subjects from the Leiden Thrombophilia Study. To compare acidosis-induced relative parameter changes in individual ("virtual") subjects, we estimated the probabilities of relative change patterns by counting the pattern occurrences in our virtual subjects. Distribution overlaps for thrombin generation parameters at distinct pH levels were quantified using the Bhattacharyya coefficient.

RESULTS: Acidosis in the range of pH 6.9 to 7.3 progressively increased CT, thrombin peak time, AUC, and prothrombin time, while decreasing maximum slope of the thrombin curve and thrombin peak height (P < 10). Acidosis delayed the onset and decreased the amount of TAT generation (P < 10). As a measure of intrasubject variability, maximum slope of the thrombin curve and CT displayed the largest and second-largest acidosis-induced relative changes, and AUC displayed the smallest relative changes among all thrombin generation parameters in our virtual subject group (1-sided 95% lower confidence limit on the fraction of subjects displaying the patterns, 0.99). As a measure of intersubject variability, the overlaps between the maximum

slope of the thrombin curve distributions at acidotic pH levels with the maximum slope of the thrombin curve distribution at physiological pH level systematically exceeded analogous distribution overlaps for CT, thrombin peak time, and prothrombin time.

CONCLUSIONS: Acidosis affected all quantitative parameters of thrombin and TAT generation. While maximum slope of the thrombin curve showed the highest sensitivity to acidosis at the individual-subject level, it may be outperformed by CT, thrombin peak time, and prothrombin time as an indicator of acidosis at the subject-group level.

阿片受體參與布比卡因引起的心臟毒性的脂肪乳劑搶救

Involvement of Opioid Receptors in the Lipid Rescue of Bupivacaine-Induced Cardiotoxicity

Partownavid, Parisa MD; Sharma, Salil PhD; Li, Jignyuan MD, PhD; Umar, Soban MD, PhD; Rahman, Siamak MD; Eghbali, Mansoureh PhD

Anesthesia & Analgesia 2015 121 340–347

背景：脂肪乳劑（LE）已成功地用於局部麻醉的布比卡因過量所引起的心臟復蘇。阿片受體在心臟保護中起關鍵作用。我們探討一下LE的復蘇作用的是否通過阿片受體介導的。

方法：給年輕的雄性Sprague-Dawley大鼠注射布比卡因誘導心臟停搏（超過20秒靜脈注射10mg/kg），然後立即用LE（脂肪乳20%；推注5ml/kg後以0.5ml/kg/min維持）復蘇。大鼠誘導心臟停搏2分鐘前給予非選擇性阿片受體拮抗劑如納絡酮和納洛酮碘化物、高度選擇性阿片受體κ、δ和μ亞型的拮抗劑，以及磷酸鹽緩衝液作爲對照這些預處理。使用超聲心動圖測量心率和射血分數。

結果：LE復蘇布比卡因心臟毒性作用能夠被高劑量（1mg/kg）納洛酮阻止，但不是被低劑量的納洛酮（1、5 和10μg/kg）和納洛酮甲碘化物（不穿過血腦屏障）阻止，而高選擇性δ和κ阿片受體拮抗劑要在較高（10 mg/kg）劑量下才能阻止。成功的LE復蘇不會被高度選擇性的μ阿片受體拮抗劑所影響。與使用LE後沒有復蘇成功的對照組相比，進行δ阿片受體拮抗劑（10mg/kg）預處理的大鼠，會降低心臟糖原合成酶激酶3β的磷酸化水準。

結論：我們的資料顯示出了外周δ和κ型阿片受體參與了LE復蘇作用。

（李婷婷譯，李士通 審校）

BACKGROUND: Lipid emulsion (LE) has been successfully used for resuscitation of local anesthetic cardiotoxicity caused by bupivacaine overdose. Opioid receptors have been shown to play a key role in cardio protection. We explored whether this rescue action of LE is mediated through opioid receptors.

METHODS: Asystole was induced by bupivacaine (10 mg/kg over 20 seconds, IV) in young male Sprague-Dawley rats, and resuscitation with LE (intralipid 20%; 5 mL/kg bolus and 0.5 mL/kg/min maintenance) was started immediately. The rats were pretreated 2 minutes before inducing asystole with nonselective opioid receptor antagonists such as naloxone and naloxone methiodide, as well as highly selective opioid receptor antagonists for subtype κ, δ, and μ or phosphate buffer solution as a control. Heart rates and ejection fractions were measured using echocardiography.

RESULTS:LE rescue of bupivacaine cardiotoxicity was prevented by high-dose (1 mg/kg) naloxone but not by lower doses of naloxone (1, 5, and 10 μg/kg), by naloxone methiodide (which does not cross the blood-brain barrier), and by a selective δ- and κ-opioid receptor antagonists at a higher (10 mg/kg) dose. Successful LE rescue was not affected by highly selective μ-opioid receptor antagonists. δ-Opioid receptor antagonist (10 mg/kg) pretreatment

also resulted in reduced phosphorylation level of cardiac glycogen synthase kinase-3β in rats that were not resuscitated by LE compared with control.

CONCLUSIONS: Our data highlight the involvement of peripheral δ- and κ-opioid receptors in the rescue action of LE.

殘餘肌松在氣管拔管後的發生率研究：加拿大一項殘留神經肌肉阻滯的發生率和嚴重程度的前瞻性多中心研究

The RECITE Study: A Canadian Prospective, Multicenter Study of the Incidence and Severity of Residual Neuromuscular Blockade

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背景：術後殘餘肌松作用（NMB），定義爲四個成串刺激率（TOF）< 0.9，是一個關係到術後呼吸併發症發生和發病率增加危險因素。目前，很少有關於加拿大殘餘NMB發生。RECITE（殘餘肌松作用在氣管拔管後的發生率）的研究是在加拿大的8家醫院進行調查研究殘餘NMB的發生率和嚴重程度的一項前瞻性觀察研究。

方法：選擇接受開腹或腹腔鏡的腹部手術、預計持續＜4小時成人患者，ASA分級 I-III，擇期全麻至少有一個氣管插管或神經肌肉鬆弛維持的非去極化神經肌肉阻斷劑的劑量進行研究。用TOF-Watch® SX加速度儀進行神經肌肉功能的評估。所有報告的TOF比值歸化爲基準值。主治麻醉師和所有其他觀察員都不知道的TOF比值（T4/T1）結果。首要和次要的目標分別是確定在氣管拔管前和到達麻醉恢復室（PACU）時殘餘NMB的發生率和嚴重程度（TOF比值＜0.9）。

結果：302例參與者被選入。有效的資料分別爲在拔管時有241例和到達PACU時有207例患者。99%的參與者使用羅庫溴銨作爲NMB藥物。新斯的明作爲NMB拮抗，使用情況分別爲TE時73.9%和PACU時72%。在氣管拔管時殘餘NMB的發生率爲63.5%（95%置信區間，57.4% - 69.6%），而在到達PACU時爲 56.5%（95%置信區間，49.8% - 63.3%）。在進一步分析中，觀察到殘餘NMB的發生率在性別、年齡、體質指數、ASA分級、手術類型或合併症這些方面都無統計學差異。（P > 0.13）。

結論：儘管定性的肌松監測和使用新斯的明，但是殘餘肌無力還是經常在氣管拔管和到達PACU時發生。減少殘餘NMB相關風險必須要有更有效NMB的監測和管理。

（李婷婷譯，李士通 審校）

BACKGROUND: Postoperative residual neuromuscular blockade (NMB), defined as a train-of-four (TOF) ratio of <0.9, is an established risk factor for critical postoperative respiratory events and increased morbidity. At present, little is known about the occurrence of residual NMB in Canada. The RECITE (Residual Curarization and its Incidence at Tracheal Extubation) study was a prospective observational study at 8 hospitals in Canada investigating the incidence and severity of residual NMB.

METHODS: Adult patients undergoing open or laparoscopic abdominal surgery expected to last <4 hours, ASA physical status I-III, and scheduled for general anesthesia with at least 1 dose of a nondepolarizing neuromuscular blocking agent for endotracheal intubation or maintenance of neuromuscular relaxation were enrolled in the study. Neuromuscular function was assessed using acceleromyography with the TOF-Watch® SX. All reported TOF ratios were normalized to the baseline values. The attending anesthesiologist and all other observers were blinded to the TOF ratio (T4/T1) results. The primary and secondary objectives were to determine the incidence and

severity of residual NMB (TOF ratio <0.9) just before tracheal extubation and at arrival at the postanesthesia care unit (PACU).

RESULTS: Three hundred and two participants were enrolled. Data were available for 241 patients at tracheal extubation and for 207 patients at PACU arrival. Rocuronium was the NMB agent used in 99% of cases. Neostigmine was used for reversal of NMB in 73.9% and 72.0% of patients with TE and PACU data, respectively. The incidence of residual NMB was 63.5% (95% confidence interval, 57.4%-69.6%) at tracheal extubation and 56.5% (95% confidence interval, 49.8%-63.3%) at arrival at the PACU. In an exploratory analysis, no statistically significant differences were observed in the incidence of residual NMB according to gender, age, body mass index, ASA physical status, type of surgery, or comorbidities (all P > 0.13).

CONCLUSIONS: Residual paralysis is common at tracheal extubation and PACU arrival, despite qualitative neuromuscular monitoring and the use of neostigmine. More effective detection and management of NMB is needed to reduce the risks associated with residual NMB.

一種使用條碼技術管理麻醉藥品的系統：科多尼克安全標籤系統和智慧麻醉管理™

A System for Anesthesia Drug Administration Using Barcode Technology: The Codonics Safe Label System and Smart Anesthesia Manager™

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背景：許多麻醉藥物的錯誤是由於小瓶或注射器交換導致的。在藥物配製前掃描小瓶上的條碼、製作帶有條碼標籤的注射器和給藥前掃描注射器標籤條碼可能有助於防止錯誤。相反，手工製造符合監管機構和標準制定機構建議的注射器標籤是相當繁瑣和耗時的。一個採用小瓶條碼和生成含條碼標籤注射器的電腦系統可以解決安全問題和標籤的建議。

方法：我們在多個手術室（ORs）測試了科多尼克安全標籤系統（SLS）出臺前後，使用符合監管機構和標準制定機構建議的含標籤注射器的相容性。科多尼克SLS結合智慧麻醉管理軟體來創建一個麻醉藥品條碼管理系統，這樣我們就可以在2個心胸手術室測量引入咖啡卡激勵前後給藥時注射器標籤條碼的掃描比例。12位主治心胸麻醉醫生和手術室藥房人員參與。

結果：科多尼克SLS藥品標籤系統的使用導致大於75%相容性的注射器標籤（95%置信區間，75% - 98%）。所有使用科多尼克SLS系統製作的注射器標籤都是相容。在13周後使用智慧麻醉管理系統掃描注射器條碼標籤比例平均爲25%（730/2976），但是引入簡單的（咖啡卡）激勵經過8周後就可增加到58%（956/1645）（P＜0.001）。

結論：麻醉藥品條碼管理系統能使得用藥人在給藥時有中等的掃描注射器標籤條碼比例。此外，該系統的適應將需要更高的利用率。

（李婷婷譯，李士通 審校）

BACKGROUND: Many anesthetic drug errors result from vial or syringe swaps. Scanning the barcodes on vials before drug preparation, creating syringe labels that include barcodes, and scanning the syringe label barcodes before drug administration may help to prevent errors. In contrast, making syringe labels by hand that comply with the recommendations of regulatory agencies and standards-setting bodies is tedious and time consuming. A computerized system that uses vial barcodes and generates barcoded syringe labels could address both safety issues and labeling recommendations.

METHODS: We measured compliance of syringe labels in multiple operating rooms (ORs) with the recommendations of regulatory agencies and standards-setting bodies before and after the

introduction of the Codonics Safe Label System (SLS). The Codonics SLS was then combined with Smart Anesthesia Manager software to create an anesthesia barcode drug administration system, which allowed us to measure the rate of scanning syringe label barcodes at the time of drug administration in 2 cardiothoracic ORs before and after introducing a coffee card incentive. Twelve attending cardiothoracic anesthesiologists and the OR satellite pharmacy participated.

RESULTS: The use of the Codonics SLS drug labeling system resulted in >75% compliant syringe labels (95% confidence interval, 75%-98%). All syringe labels made using the Codonics SLS system were compliant. The average rate of scanning barcodes on syringe labels using Smart Anesthesia Manager was 25% (730 of 2976) over 13 weeks but increased to 58% (956 of 1645) over 8 weeks after introduction of a simple (coffee card) incentive ($P < 0.001$).

CONCLUSIONS: An anesthesia barcode drug administration system resulted in a moderate rate of scanning syringe label barcodes at the time of drug administration. Further, adaptation of the system will be required to achieve a higher utilization rate.

BMI與硬脊膜穿刺後頭痛在產婦中發病的關係

The Relationship of Body Mass Index with the Incidence of Postdural Puncture Headache in Parturients

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背景：在硬膜外或腰硬聯合麻醉之後，無意的硬膜外穿刺也有目前已知的風險，在正常體型孕婦分娩時放置硬膜外導管時它的發生率約爲1%，但是在肥胖產婦中的發生率卻高達4%。軼事經驗和有限的文章裡顯示身體品質指數（BMI）和硬脊膜穿刺後頭痛（PDPH）的的發生率存在著反比的關係。我們可以假設，在無意的硬脊膜穿刺後，有著更大BMI的產婦發生PDPH的幾率比那些具有較小的BMI的產婦的發病率更低。

方法：經過IRB批准，我們進行了回顧性的研究醫療記錄的審查。我們查找了從2004年1月1日到2013年12月13日機構存檔的案件，關於在進行椎管內鎮痛時發生無意識的刺破硬膜的情況。最主要的成果就是發生PDPH的幾率。我們用二進位邏輯回歸的方法對BMI和PDPH之間的關聯進行了評估，以魏氏-曼 - 惠特尼核對總和置信區間（CI）爲一個隨機對， 以發生PDPH患者的BMI值與非PDPH患者相比，計算其特性曲線下的面積。分類樹分析方法被用來確定發生PDPH的 BMI臨界值。我們用Fisher精確檢驗分別對發生PDPH的產婦和未發生者進行計算，研究無意硬腦膜穿刺後鞘內導管的存在與否和分娩的第二產程是否存在關係。以BMI的臨界值分爲兩組（低BMI和高BMI組）。我們在無意刺破硬膜的時候通過控制分娩的產力和置入鞘內導管，並用Fisher精確檢驗比較了低BMI和高BMI組PDPH的發生率。次要分析評估頭痛在疼痛報導的最高數位評分，以及各個BMI組需要的硬膜外血液補充量。

結果：確定發生無意硬膜穿刺的患者有518人(0.53%) (95% CI,0.48%–0.58%)。在無意硬膜穿刺以後PDPH的發生率總體來說是51% (95% CI,46%–55%)。以隨機的BMI值對PDPH者與非PDPH者相比，用魏氏-曼 - 惠特尼檢驗值爲0.74 (95% CI 0.60–0.90, $P = 0.001$)。在孕婦分娩時與未分娩所導致的PDPH的比值比爲2.4 (95% CI 1.2–3.9, $P = 0.001$)。分類樹分析方法來預測發生PDPH的 BMI臨界值爲31.5 kg/m2。BMI ≥31.5 kg/m2 (39%)的孕婦PDPH的發生率要低於BMI <31.5 kg/m2 的孕婦(56%; difference −17%; 95% CI, −7% to −26%, $P = 0.0004$)。高BMI組合和低BMI組發生PDPH的比值比在孕婦分娩時有產力者爲0.36 (95% CI, 0.14–0.92, $P = 0.04$)，而在孕婦分娩時無產力者爲0.62 (95% CI, 0.41–0.97, $P = 0.04$)。在無意硬膜穿刺以後，112 名(22%)的產婦置入了鞘內導管。置入了鞘內導管的產婦發生PDPH的幾率爲59% (95% CI, 49%–68%)，而置入了硬膜外導管的產婦發生PDPH的幾率爲48% (95% CI, 43%–54%)($P = 0.06$)。頭痛的嚴重程度(0–10 語言評價量表)的中位數爲8 (6–9)，

這一數值在高BMI組和低BMI組的產婦中沒有區別(*P* = 0.61)。在各BMI組中，對於發生PDPH的治療處理時，硬膜外血液的補充速率也是相似的。

結論：這個發現和以前所報導的關於在不斷增長BMI的孕婦中無意硬膜穿刺後降低PDPH的發生率的結論是類似的，甚至控制了分娩產力這一因素。在高BMI和低BMI組中頭痛的嚴重程度和硬膜外血液的補充治療也是相似的。

（李蔚文 譯，李士通 審校）

BACKGROUND: Unintentional dural puncture is a known risk after epidural or combined spinal–epidural procedures, occurring in approximately 1% of labor epidural catheters placed in parturients with normal body habitus but may be as high as 4% in morbidly obese parturients. Anecdotal experience and limited publications suggest that an inverse relationship between body mass index (BMI) and postdural puncture headache (PDPH) may exist. We hypothesized that parturients with increased BMI have a lower incidence of PDPH than those with a lower BMI after unintentional dural puncture.

METHODS: After IRB approval, we performed a retrospective cohort study by medical record review. Case logs from our institution were searched for patients with documented unintentional dural puncture during attempted neuraxial analgesia between January 1, 2004, and December 13, 2013. The primary outcome was the incidence of PDPH. The association between BMI and PDPH was assessed using binary logistic regression, and the Wilcoxon-Mann-Whitney odds and confidence intervals (CIs) for a random pair of BMI values from a PDPH subject compared with a non-PDPH subject were calculated from the area under the receiver operator characteristics curve. Classification tree analysis was used to determine the BMI cutoff value for the risk of developing a PDPH. The presence or absence of second-stage labor pushing and placement of an intrathecal catheter after unintentional dural puncture were compared in parturients with and without PDPH using the Fisher exact test. BMI groups were dichotomized at the cutoff value (low and high BMI groups). We compared the incidence of a PDPH between high and low BMI groups using the Fisher exact test after controlling for pushing during labor and placement of an intrathecal catheter at the time of unintentional dural puncture. Secondary analysis evaluated the highest reported numeric rating of pain scores for headache and the need for an epidural blood patch between BMI groups.

RESULTS: Unintentional dural puncture was identified in 518 (0.53%) patients (95% CI, 0.48%–0.58%). The overall incidence of PDPH after unintentional dural puncture was 51% (95% CI, 46%–55%). The Wilcoxon-Mann-Whitney odds for a random pair of BMI values from a PDPH subject compared with a non-PDPH subject was 0.74 (95% CI, 0.60–0.90, *P* = 0.001). The odds ratio for developing a PDPH in women who pushed during delivery was 2.4 (95% CI, 1.2–3.9, *P* = 0.001) compared with women who did not push. Classification tree analysis identified a BMI cutoff value of 31.5 kg/m2 for prediction of a PDPH. The incidence of PDPH in parturients with a BMI ≥31.5 kg/m2 (39%) was lower than in parturients with a BMI <31.5 kg/m2 (56%; difference −17%; 95% CI, −7% to −26%, *P* = 0.0004). The odds ratio for a PDPH in the high BMI compared with the low BMI group was 0.36 (95% CI, 0.14–0.92, *P* = 0.04) in parturients who pushed during labor and 0.62 (95% CI, 0.41–0.97, *P* = 0. 04) in parturients who did not push. After the unintentional dural puncture, 112 (22%) parturients had an intrathecal catheter placed. The incidence of PDPH in parturients with an intrathecal catheter was 59% (95% CI, 49%–68%) compared with 48% (95% CI, 43%–54%) in women with an epidural catheter (*P* = 0.06). Median (interquartile range) headache severity (0–10 verbal rating scale) was 8 (6–9) and did not differ between parturients in the high versus low BMI groups (*P* = 0.61). The rate of epidural blood patch administration for PDPH treatment was similar in BMI groups (difference −12%; 95% CI, 4 to −27, *P* = 0.13).

CONCLUSIONS: The findings are consistent with previous reports of decreased PDPH incidence after unintentional dural puncture in parturients with an increased BMI, even after controlling for pushing during labor. Severity of headache and need for epidural blood patch treatment were similar in low and high BMI groups.

產科手術中的細胞回收

Cell Salvage in Obstetrics

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術中細胞回收是減少異體輸血的一項戰略。傳統的來說，在產科手術中細胞回收一直被避免，認爲會有羊水栓塞和誘導產婦產生同種免疫的風險。隨著細胞回收技術的不斷進步，產科手術細胞回收的風險降低到和其他手術相似。在胎盤剝離的時候，胎兒鱗狀上皮細胞在血液中被回收的水準可以和孕婦靜脈血液相比較。目前並沒有明確的羊水栓塞病例報告，而且使用現代化設備也不太可能出現。細胞回收技術是符合成本效益的高利率輸血，例如產婦胎盤異常。

（李蔚文 譯，李士通 審校）

BACKGROUND: Intraoperative cell salvage is a strategy to decrease the need for allogeneic blood transfusion. Traditionally, cell salvage has been avoided in the obstetric population because of the perceived risk of amniotic fluid embolism or induction of maternal alloimmunization. With advances in cell salvage technology, the risks of cell salvage in the obstetric population parallel those in the general population. Levels of fetal squamous cells in salvaged blood are **comparable to those** in maternal venous blood at the time of placental separation. No definite cases of amniotic fluid embolism have been reported and appear unlikely with modern equipment. Cell salvage is cost-effective in patients with predictably high rates of transfusion, such as parturients with abnormal placentation.

右美用於兒科影像麻醉時，是否需要預防性使用抗膽鹼能藥物

To Pretreat or Not to Pretreat: Prophylactic Anticholinergic Administration Before Dexmedetomidine in Pediatric Imaging

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背景：高劑量使用右美托咪啶是目前唯一的有效用於兒科影像時的鎮靜藥，但是其造成一過性高血壓，低血壓和心動過緩的風險卻不斷增加。但是目前沒有臨床的證據和指南來指導我們是否需要在麻醉前預使用抗膽鹼藥物。這項實驗的目的就是來研究右美鎮靜前是否需要用抗膽鹼藥預處理，以及其所造成的血流動力學改變，並比較兩者的相同和不同點。我們對唐氏綜合症的患兒進行了一個亞組的分析。

方法：在這項回顧描述性研究中，我們回顧了163名在MRI檢查時接受了右美麻醉的患兒。資料的分析包括了人口統計學、歷史上的唐氏綜合症、右美輸注以後的血流動力學變化（包括心率、收縮壓、舒張壓），以及抗膽鹼能藥物的使用（阿托品或胃長寧）。

結果：小兒的平均年齡在94.5個月，其中52 (32%)名患兒有唐氏綜合症。廣義的線性混合效應模型顯示，與預處理組相比，沒有用抗膽鹼藥物預處理組的所有患兒都出現了心率和收縮壓的顯著降低。但兩組的舒張壓沒有明顯變化。在掃描的過程中，沒有用抗膽鹼藥物預處理組的心率降低了26.6%，然而預處理組的心率只減少了基線的16.7% ($P < 0.01$)。和基線相比，預處理組的最大心率比未預處理組有著明顯的增加(20.2% vs 10.4%,

respectively; $P = 0.02$)。在唐氏綜合症組，在掃描期間最大心率有著更誇張的變化，預處理組的最大心率比未預處理組增加了36倍(22% vs 0.6%, respectively; $P < 0.01$)。

結論：在使用右美前預防性的使用抗膽鹼能藥物沒有任何優點，除了能產生明顯的一過性的心率和收縮壓的增加，而且和沒有用抗膽鹼能藥物預處理者相比，它在更多的患者中會造成一過性誇張的收縮壓。

（李蔚文 譯，李士通 審校）

BACKGROUND: Dexmedetomidine (Dex) appears to be very effective as a sole sedative for pediatric imaging when used at high doses, but at an increased risk of transient hypertension, hypotension, and bradycardia. There are no clinical evidence/guidelines to guide anesthesia providers as to whether patients should be pretreated with an anticholinergic. The aim of this study was to demonstrate the changes in hemodynamic parameters after Dex sedation attributed to receiving or not receiving an anticholinergic pretreatment and compare for any differences or similarities. A subgroups analysis was performed in children with Down syndrome (DS).

METHODS: In this retrospective descriptive study, we reviewed the records of 163 children receiving Dex anesthesia during MRI studies. Data analyzed included demographics, history of DS, and hemodynamics (heart rate [HR], systolic blood pressure [SBP], and diastolic blood pressure [DBP]) following Dex loading and infusion and the administration of an anticholinergic (atropine or glycopyrrolate).

RESULTS: The mean age was 94.5 months, and 52 (32%) patients had DS. The generalized linear mixed-effects regression model showed a significant reduction in HR and SBP in all patients when no anticholinergic was administered compared with when it was administered. There was no significant change with DBP. During the scan period, the HR of the no-anticholinergic group decreased 26.6%, whereas that of the anticholinergic group decreased by only 16.7% from baseline ($P < 0.01$). The maximal SBP increased by a significantly greater percentage, compared with baseline, in the anticholinergic group in comparison with the no-anticholinergic group (20.2% vs 10.4%, respectively; $P = 0.02$). In the DS group, the difference in the maximal SBP change during the scan period was exaggerated, with a percentage increase that was 36 times larger in the anticholinergic group compared with the no-anticholinergic group (22% vs 0.6%, respectively; $P < 0.01$).

CONCLUSIONS: Administration of a prophylactic anticholinergic with Dex shows no advantage other than a transient clinically insignificant increase in HR and SBP, and it may precipitate transient exaggerated SBP in more patients compared with not using a prophylactic anticholinergic.、

血糖濃度對家兔寒戰閾值的影響

The Effects of Blood Glucose Concentration on the Shivering Threshold in Rabbits

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背景：高血糖在危重病和手術患者中很常見，因爲身體的核心溫度受到了干擾。但是高血糖對體溫調節功能的影響仍是未知的。我們研究了血糖濃度對家兔寒戰閾值的影響。

方法：對27只家兔用異氟烷進行了淺麻醉，然後隨機分配到(1)鹽水輸液組、(2)胰島素滴定使血糖濃度維持在60 -100 mg/dL組和(3) 50%的葡萄糖滴定使血糖維持在200 -300 mg/dL組。在結腸放置一個塑膠管，用10℃的水灌注，使中心爲溫度以2 -3℃/h的速度降低。繼

續冷卻，直到採用盲法的研究員發現家兔寒戰產生或食管（核心）的溫度達到34℃。發生寒戰時的核心溫度被設爲閾值。所有分析均採用SAS9.3版進行（SAS公司，Cary，NC）。

結果：鹽水輸液組的家兔寒戰時的核心溫度在37.2 ± 0.5℃（平均值±標準差）。給予胰島素組的核心溫度在36.3 ± 1.1℃。給予葡萄糖組的核心溫度在38.0 ± 0.6℃。寒戰閾值的增加受血糖濃度的影響：寒顫閾值(℃) =0.009 [血糖濃度 (mg/dL)] + 35.6, $r2$ = 0.53。血糖濃度每增加100 mg/dL，寒顫閾值因此增加大約1℃。

結論：高血糖會增加家兔的寒顫閾值，而低血糖則相反。

（李蔚文 譯，李士通 審校）

BACKGROUND: Hyperglycemia is common in critically ill and surgical patients, as are core temperature disturbances. The effect of hyperglycemia on thermoregulatory defenses remains unknown. We determined the effect of blood glucose concentration on the shivering threshold in rabbits.

METHODS: Twenty-seven rabbits lightly anesthetized with isoflurane were randomly assigned to infusions of (1) saline, (2) insulin titrated to produce blood glucose concentrations 60 to 100 mg/dL, or (3) 50% dextrose titrated to produce blood glucose concentrations 200 to 300 mg/dL. Core temperature was reduced at a rate of 2 to 3°C/h by perfusing water at 10°C through a plastic tube positioned in the colon. Cooling continued until shivering was observed by an investigator blinded to treatment or until esophageal (core) temperature reached 34°C. Core temperatures at the onset of shivering defined the threshold. All analyses were conducted using SAS version 9.3 (SAS Institute Inc., Cary, NC).

RESULTS: Rabbits given saline shivered at 37.2 ± 0.5°C (mean ± SD). Rabbits given insulin shivered at 36.3 ± 1.1°C. Rabbits given dextrose shivered at 38.0 ± 0.6°C. The shivering threshold increased as a function of blood glucose concentration: shivering threshold (°C) = 0.009 [blood glucose concentration (mg/dL)] + 35.6, $r2$ = 0.53. The shivering threshold thus increased approximately 1°C for each 100 mg/dL increase in blood glucose concentration.

CONCLUSIONS: Hyperglycemia increases the threshold for shivering, whereas hypoglycemia lowers the threshold on rabbits.

椎旁阻滯用於腹股溝疝修補術：一項系統回顧和隨機對照試驗的Meta分析

Paravertebral Block for Inguinal Herniorrhaphy: A Systematic Review and Meta-Analysis of Randomized Controlled Trials

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背景：椎旁神經阻滯是一項安全有效的麻醉方法用於開胸和乳房切除術。然而，對於椎旁阻滯用於腹股溝疝修補術卻沒有系統的回顧和Meta分析。我們來研究比較一下椎旁阻滯和全身麻醉、椎管內麻醉和其他的周圍神經阻滯的區別和優缺點。

方法：我們分析了來自PubMed,、MEDLINE,、CENTRAL,、EMBASE、CINAHL ，直到2015年2月的14例隨機對照實驗，排除了語言的限制，比較了鎮靜下進行椎旁阻滯和全身麻醉(135 vs 133 名患者)，椎旁阻滯和椎管內麻醉(191 vs 186 名患者)，椎旁阻滯和其他周圍神經阻滯(119 vs 117 名患者)。研究了疼痛評分、術後鎮痛的要求、術後噁心嘔吐的發生率(PONV)、住院時間、麻醉後監護室通過率、進行阻滯所需要的時間、術中血流動力學變化和尿儲留的發生率這些因素。疼痛和鎮痛、PONV以及血流動力學指標都採用聯合

假設檢驗。所有的分析都採用RevMan 5.2.11版進行 (Cochrane Collaboration, Copenhagen)。Hartung-Knapp-Sidik-Jonkman法用於事後檢驗。

結果：和全身麻醉(證據品質 [QoE]: 高)相比，PVB 減少了PONV的發生率(噁心: 風險比 [RR] = 0.22; 95% 置信區間[CI], 0.05–0.93; 需要治療者 [NNT] = 4.5; $I2$ = 15% ；嘔吐: RR = 0.15; 95% CI, 0.03–0.76; NNT = 8.3; $I2$ = 0%)。和椎管內阻滯(QoE: 高)相比，PVB降低了術後噁心 (RR = 0.34 [95% CI, 0.13–0.91], NNT = 8.3, $I2$ = 0%)和尿儲留(RR = 0.14 [95% CI, 0.05–0.42], NNT = 7.4, $I2$ = 0%)的發生率。但是進行 PVB 比椎管內麻醉需要更多的時間(標準化平均差 = 1.90 [95% CI, 0.02–3.77], $I2$ = 92%; 平均差 = 5.33分鐘(QoE: 中等)。然而，在疼痛評分和鎮痛要求方面，在現有的資料中，PVB和全麻、 PVB 和椎管內阻滯(QoE: 低)、PVB 和椎管內阻滯造成的血流動力學改變(QoE:中等)，均不能排除非劣效性假設。我們的系統綜述表明，在腹股溝腫塊和腹橫肌平面腫塊切除時，PVB可以減少術後疼痛評分和鎮痛的要求。

結論：這項Meta分析顯示，在腹股溝疝修補術時，PVB是造成較少的不良影響的一種麻醉方法。對於全身麻醉、椎管內麻醉、PVB和其它周圍神經阻滯等不同麻醉方法的選擇時，我們要參考進行阻滯所需要的時間和阻滯以後相關結構的完全阻滯範圍。

（李蔚文 譯，李士通 審校）

BACKGROUND: Paravertebral block (PVB) is a safe and effective anesthetic technique for thoracotomy and mastectomy. However, no systematic review or meta-analysis has focused on PVB for inguinal herniorrhaphy. Our study compares PVB with general anesthesia/systemic analgesia, neuraxial blocks, and other peripheral nerve blocks.

METHODS: We analyzed 14 randomized controlled trials from PubMed, MEDLINE, CENTRAL, EMBASE, and CINAHL up to February 2015, without language restriction, comparing PVB under sedation with general anesthesia/systematic analgesia (135 vs 133 patients), neuraxial blocks (191 vs 186 patients), and other peripheral nerve blocks (119 vs 117 patients). We investigated pain scores, consumption of postoperative analgesia, incidence of postoperative nausea and vomiting (PONV), length of hospital stay, postanesthesia care unit bypassing rate, time to perform blocks, intraoperative hemodynamics, and incidence of urinary retention. Joint hypothesis testing was adopted for pain and analgesics, PONV, and hemodynamic variables. All analyses were performed with RevMan 5.2.11 (Cochrane Collaboration, Copenhagen). Hartung-Knapp-Sidik-Jonkman method was used for post hoc testing.

RESULTS: PVB reduced PONV (nausea: risk ratio [RR] = 0.22; 95% confidence interval [CI], 0.05–0.93; numbers needed to treat [NNT] = 4.5; $I2$ = 15% and vomiting: RR = 0.15; 95% CI, 0.03–0.76; NNT = 8.3; $I2$ = 0%) compared with general anesthesia/systematic analgesia (quality of evidence [QoE]: high). Compared with neuraxial blocks, PVB resulted in less postoperative nausea (RR = 0.34 [95% CI, 0.13–0.91], NNT = 8.3, $I2$ = 0%) and urinary retention (RR = 0.14 [95% CI, 0.05–0.42], NNT = 7.4, $I2$ = 0%) than neuraxial blocks (QoE: high). More time was needed to perform PVB than neuraxial blocks (standardized mean difference = 1.90 [95% CI, 0.02–3.77], $I2$ = 92%; mean difference = 5.33 minutes; QoE: moderate). However, the available data could not reject the null hypothesis of noninferiority on all pain scores and analgesic requirements for both PVB versus general anesthesia/systematic analgesia and PVB versus neuraxial blocks (QoE: low), as well as on hemodynamic outcomes for PVB versus neuraxial blocks (QoE: moderate). Our systematic review showed that PVB decreased postoperative pain scores and analgesic requirement as compared with ilioinguinal block and transversus abdominis plane block.

CONCLUSIONS: This meta-analysis shows that PVB provides an anesthesia with fewer undesirable effects for inguinal herniorrhaphy. The choice between general anesthesia/systematic analgesia, neuraxial blocks, PVB, and other peripheral nerve blocks should be based on time available to perform the block and a complete coverage over the relevant structures by the blocks.

主動脈瓣置換術前服用阿司匹林與術後肺損傷：一項回顧性佇列研究

Preoperative Aspirin Use and Lung Injury After Aortic Valve Replacement Surgery: A Retrospective Cohort Study

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背景：急性呼吸窘迫綜合征（ARDS）並不是心臟手術術後的常見併發症，但其死亡率卻高達 80%。阿司匹林對高危病人有肺損傷保護作用，其機制是通過減少肺內血小板-中性粒細胞聚集。我們假設在主動脈瓣置換術前使用阿司匹林能降低術後 ARDS 的風險。

方法：我們進行了一項回顧性的單中心佇列研究，研究物件包括 5 年內接受了主動脈瓣置換術的所有成年患者。主要結果變數是術後 ARDS 的發生。次要結果變數是術後最初的 72 小時內最低 PaO2/FiO2 比值。通過粗略的和傾向性分數調整的邏輯回歸分析來預測服用阿司匹林患者發生 ARDS 的相對危險度。亞組分析研究術前使用阿司匹林是否能提高具有明確肺損傷危險因素患者的氧合。

結果： 在研究期間的 375 例進行主動脈瓣置換術的患者中，181 名患者（48.3%）術前服用了阿司匹林，最大劑量是 81mg（72%）。佇列中有 22 例發生了 ARDS(5.5%)。在服用和不服用阿司匹林的患者中，ARDS 的發生率沒有顯著差異（5.0% vs 6.7%, P = 0.52）。而兩者間的最低 PaO2/FiO2 比值也沒有顯著差異（P = 0.12）。服用阿司匹林的患者發生 ARDS 的粗略相對危險度是 0.725（99%置信區間 0.229-2.289；P = 0.47），而傾向性分數調整的相對危險度是 0.457（99%置信區間 0.120-1.730；P = 0.13）。

結論：在僅有 22 例患者出現 ARDS 的條件限制下，我們的研究中術前服用阿司匹林不會降低主動脈瓣置換術後 ARDS 的發生，也不會提高患者的氧合。

（施芸岑 譯 薛張綱 校）

BACKGROUND: Acute respiratory distress syndrome (ARDS) occurs uncommonly after cardiac surgery but has a mortality rate as high as 80%. Aspirin may prevent lung injury in at-risk patients by reducing platelet-neutrophil aggregates in the lung. We hypothesized that preoperative aspirin use would be associated with a decreased risk of ARDS after aortic valve replacement surgery.

METHODS: We performed a retrospective single-center cohort study that included all adult patients who had aortic valve replacement surgery during a 5-year period. The primary outcome variable was postoperative ARDS. The secondary outcome variable was nadir PaO2/FIO2 ratio during the first 72 hours after surgery. Both crude and propensity score-adjusted logistic regression analyses were performed to estimate the odds ratio for developing ARDS in aspirin users. Subgroups were analyzed to determine whether preoperative aspirin use might be associated with improved oxygenation in patients with specific risk factors for lung injury.

RESULTS: Of the 375 patients who had aortic valve replacement surgery during the study period, 181 patients took aspirin preoperatively (48.3%) with most taking a dose of 81 mg (72.0%). There were 22 cases of ARDS in the cohort (5.5%). There was no significant difference in the rate of ARDS between aspirin users and nonusers (5.0% vs 6.7%, P = 0.52). There was also no significant difference in the nadir PaO2/FIO2 ratio between aspirin users and nonusers (P = 0.12). The crude odds ratio for ARDS in aspirin users was 0.725 (99% confidence interval, 0.229-2.289; P = 0.47), and the propensity score-adjusted odds ratio was 0.457 (99% confidence interval, 0.120-1.730; P = 0.13).

CONCLUSIONS: Within the constraints of this analysis that included only 22 affected patients, preoperative aspirin use was not associated with a decreased incidence of ARDS after aortic valve replacement surgery or improved oxygenation.

單肺通氣後的肺損傷：一篇機械通氣對通氣側肺和萎陷側肺病理生理影響的綜述

Lung Injury After One-Lung Ventilation: A Review of the Pathophysiologic Mechanisms Affecting the Ventilated and the Collapsed Lung

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肺損傷是胸外科手術後主要的死亡原因。最初意識到肺損傷是在全肺切除術後，它已經被描述在任何時期的單肺通氣後，即使沒有進行肺切除。儘管，現在認爲單肺通氣對病理生理的影響更複雜更多樣，但仍然認爲體內水分過多和高潮氣量在不同時間點占主要因素。所有已知通氣導致肺損傷的因果機制被認爲與單肺通氣設置有關。通氣側肺暴露於大的非生理潮氣量帶來的高壓力並失去正常功能殘氣量。另外，通氣側肺處於氧化應激狀態，如同過度灌注造成的毛細血管剪切應力。外科手術操作和/或萎陷側肺的切除可能導致肺損傷。一貫的單肺通氣後，萎陷側肺重新膨脹時會產生時間依賴性缺血再灌注損傷。保護性通氣策略和易揮發的吸入麻醉藥可降低肺損傷程度。然而，肺損傷的生化和組織學指標的升高是不可避免的。內皮多糖蛋白質複合物可能代表單肺通氣肺損傷的普遍通路，因爲它可以被大多數認可的肺損傷機制所破壞。在未來，穩定內皮多糖蛋白質複合物的試驗性治療可能緩解肺損傷。目前，單肺通氣時按照 4-5ml/kg 的潮氣量保護性通氣、5-10cm 水柱的呼氣末正壓通氣及常規的肺複張等保護性策略，以把肺應激壓力損傷減到最低。其他減少肺損傷的策略包括常規的吸入麻醉及儘量使單肺通氣時間最小化。

（張雪 譯 薛張綱 校）

Lung injury is the leading cause of death after thoracic surgery. Initially recognized after pneumonectomy, it has since been described after any period of 1-lung ventilation (OLV), even in the absence of lung resection. Overhydration and high tidal volumes were thought to be responsible at various points; however, it is now recognized that the pathophysiology is more complex and multifactorial. All causative mechanisms known to trigger ventilator-induced lung injury have been described in the OLV setting. The ventilated lung is exposed to high strain secondary to large, nonphysiologic tidal volumes and loss of the normal functional residual capacity. In addition, the ventilated lung experiences oxidative stress, as well as capillary shear stress because of hyperperfusion. Surgical manipulation and/or resection of the collapsed lung may induce lung injury. Re-expansion of the collapsed lung at the conclusion of OLV invariably induces duration- dependent, ischemia-reperfusion injury. Inflammatory cytokines are released in response to localized injury and may promote local and contralateral lung injury. Protective ventilation and volatile anesthesia lessen the degree of injury; however, increases in biochemical and histologic markers of lung injury appear unavoidable. The endothelial glycocalyx may represent a common pathway for lung injury creation during OLV, because it is damaged by most of the recognized lung injurious mechanisms. Experimental therapies to stabilize the endothelial glycocalyx may afford the ability to reduce lung injury in the future. In the interim, protective ventilation with tidal volumes of 4 to 5 mL/kg predicted body weight, positive end-expiratory pressure of 5 to 10 cm H2O, and routine lung recruitment should be used during OLV in an attempt to minimize harmful lung stress and strain. Additional strategies to reduce lung injury include routine volatile anesthesia and efforts to minimize OLV duration and hyperoxia. (Anesth Analg 2015;121:302–18)

平衡麻醉研究的原理和設計：一項前瞻性隨機臨床試驗——大手術中兩種不同麻醉深度對患者預後的影響。

Rationale and Design of the Balanced Anesthesia Study: A Prospective Randomized Clinical Trial of Two Levels of Anesthetic Depth on Patient Outcome After Major Surgery

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背景：已發表的 8 篇觀察性研究中有 6 篇顯示較深的麻醉深度和術後死亡率增加之間有關聯，麻醉深度由腦電雙頻指數（BIS）監測。但這種關聯並不一定意味著因果關係。有關麻醉深度的小規模臨床試驗已經證明麻醉較深的患者譫妄和術後認知功能障礙增加，但在研究死亡率方面缺乏足夠的檢驗力。要明確這種因果關係是否存在需要大規模隨機研究。

方法：本研究的主要假設是，在年齡≥60 歲全麻下行大手術的人群中，淺麻醉（定義爲 BIS 目標值 50，）和深麻醉（定義爲 BIS 目標值 35）相較可以減少術後 1 年內全因死亡率。該試驗是一項國際多中心、隨機、平行、雙盲（患者和研究者）的前瞻性、意向性治療、安全性和有效性研究。淺麻醉組的死亡率預期相對減少 20%，絕對風險從 10%減少至 8%。效能檢驗 α= 0.049 和 β=0.2 計算樣本量，每個組需要 3250 個病人。

結果：這項研究正在進行中，在 5 個國家的 40 個中心招募了 1325 名患者。預計這項研究將在 3 年內完成。

結論：這項隨機對照試驗可以明確回答在易感患者中滴定調節麻醉深度是否影響患者預後的問題。

（鄔其瑋 譯 薛張綱 校）

BACKGROUND: An association between relatively deep anesthesia, as guided by the bispectral index (BIS), and increased postoperative mortality has been demonstrated in 6 of 8 published observational studies, but association does not necessarily mean causality. Small clinical trials of anesthetic depth have demonstrated increased delirium and postoperative cognitive dysfunction in patients who were relatively deeply anesthetized, but have been inadequately powered to study mortality. A large-scale randomized study is required to determine whether causality exists.

METHODS: The primary hypothesis of our study is that "light" anesthesia, defined as a BIS target of 50, will reduce all-cause mortality within 1 year of surgery in comparison with "deep" anesthesia, defined as a BIS target of 35, in patients aged ≥60 years presenting for major surgery under general anesthesia. The trial is an international multicenter, randomized, parallel-group, double-blind (patients and investigators) prospective, intention-to-treat, safety and efficacy study. The relative reduction in mortality in the light anesthesia group is expected to be 20%, giving an absolute risk reduction from 10% to 8%. Power analysis using a = 0.049 and b = 0.2 indicates that 3250 patients are required in each group.

RESULTS: The study is underway, and 1325 patients have been recruited in 40 centers in 5 countries. It is anticipated that the study will be completed in 3 years.

CONCLUSIONS: This randomized controlled trial should definitively answer the question of whether titrating anesthetic depth makes a difference to patient outcome in a vulnerable patient group.

對比肺動脈導管熱稀釋法，esCCO™和 ECOM™監護儀在心臟手術術後患者行肺複張手法時測定心輸出量的性能比較

The Ability of esCCO™ and ECOM™ Monitors to Measure Trends in Cardiac Output During Alveolar Recruitment Maneuver After Cardiac Surgery: A Comparison with the Pulmonary Thermodilution Method

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背景：肺複張手法(ARMs)能夠減少圍術期肺部併發症的發生，同時也會對心輸出量(CO)造成短暫影響。這項干擾血流動力學的可重複性操作可用來檢驗多種監護設備對 CO 急性變化的測定能力。本研究旨在評估 esCCO™（氣管內心輸出監護儀） 和 ECOM™（連續評估心輸出監護儀）兩種微創 CO 監護儀用於心臟手術術後患者接受 ARMs 治療時 CO 變化趨勢的測定能力。

方法：研究納入了 27 名術後於監護室接受機械通氣治療的患者。分別在 3 個不同時間點行血流動力學測定：（1）ARM 前，呼氣末正壓爲零時；（2）ARM 過程中維持呼氣末正壓爲 15cmH2O 時；（3）ARM 後，呼氣末正壓爲零時。經肺動脈導管間斷熱稀釋法(TDco)測量獲得心輸出量參照值。在上述各個時間點，記錄 3 種方法所測 CO 的平均值以及相應動脈壓變化，並以 3 種方法所測 CO 值的變異係數計算各儀器間的精度誤差。採用 Bland-Altman 圖分析兩種試驗方法與熱稀釋法測得的 CO 絕對值的差異。此外，分別以一致性相關係數 4 象限圖及極座標圖評價 CO（ΔTDco、ΔESco、ΔECco 分別表示 TDco、esCCO、ECOM 測量值的變化）和平均動脈壓（MAP）變化的一致性和反應性。極性一致率高於 80%被認爲是臨床上可接受的。

結果：研究共分析了 81 組，每組包括 3 個 CO 測量值。TDco 的精度誤差約爲 5.1%（四分位間距：2.8-7.1）。esCCO 與 TDco 間均值偏差爲+0.7L/min，一致性範圍爲-2.1~+3.5L/min；ECOM 與 TDco 均值偏差爲+0.2L/min，一致性範圍爲-2.0~+2.4L/min。ΔECco 與 ΔTDco 的一致性相關係數（0.82 [95%可信區間(CI), 0.72-0.89]）顯著高於(P=0.0053)ΔESco 與 ΔTDco 的一致性相關係數(0.42 [95%CI, 0.20-0.59])，但和 ΔMAP 與 ΔTDco 的一致性相關係數(0.69 [95% CI, 0.54-0.80])間並無顯著性差異（P=0.16）。極座標圖分析表明 ΔESco 與 ΔTDco 角度偏移爲-29° ± 38°，ΔECco 與 ΔTDco 爲-15° ± 29°。4 象限圖分析表明 ΔESco 與 ΔTDco 的一致率爲 81%(95% CI, 74-88)，ΔECco 與 ΔTDco 的一致率爲 100%。ΔESco 與 ΔTDco 的極性一致率爲 41% (95% CI, 34-48)，ΔESco 與 ΔTDco 爲 85% (95% CI, 79-90)。

結論：在心臟手術術後的患者中，相較於肺動脈導管溫度稀釋法，ECOM 與 esCCO 均低估了 ARM 時 CO 的變化。然而 ΔECco 的角度限制在臨床可接受範圍內，在監測 CO 變化方面可能與有創動脈血壓效果相仿。相比之下，esCCO 則無法很好地反映 CO 變化。

（俞穎 譯 薛張綱 校）

BACKGROUND: Alveolar recruitment maneuvers (ARMs) are known to improve perioperative morbidity but can transiently impact cardiac output (CO). This reproducible hemodynamic perturbation creates a clinical opportunity to test multiple devices during acute changes in CO. The objective of this study was to evaluate the ability of 2 minimally invasive CO monitors, the ECOM™ (Endotracheal Cardiac Output Monitor) and the esCCO™ (estimated Continuous Cardiac Output), to measure trends in CO during an ARM in postoperative cardiac surgical patients.

METHODS: Twenty-seven mechanically ventilated patients were studied in the postoperative intensive care unit setting. Hemodynamic measurements were made at 3 distinct time points: (1) before an ARM at zero end-expiratory pressure; (2) during an ARM at 15 cm H2O positive end-expiratory pressure; and (3) after the ARM again at zero end-expiratory pressure. Reference CO was obtained from intermittent bolus thermodilution (TDco) using a pulmonary artery catheter. At each of the 3 time points, mean values of 3 CO measurements from each device were collected simultaneously, as well as the corresponding changes in arterial pressure. The

coefficient of variation of the 3 sets for each patient at each time point allowed for the calculation of the precision error for each device. Differences between absolute values of CO using the 2 tested methods and TDco were assessed using a Bland-Altman plot. Additionally, the agreement and responsiveness of the changes in CO (ΔTDco, ΔESco, and ΔECco for changes in TDco, esCCO, and ECOM, respectively) and mean arterial pressure (MAP) were assessed using both a 4-quadrant plot with the coefficient of correlation concordance (CCC) and a polar plot diagram. A polar concordance rate above 80% was considered clinically acceptable.

RESULTS: Eighty-one sets of 3 CO values were analyzed. Precision error of TDco was approximately 5.1% (interquartile range: 2.8-7.1). Between esCCO and TDco, the mean bias was +0.7 L/min with limits of agreement of -2.1 L/min and +3.5 L/min. Between ECOM and TDco, the mean bias was +0.2 L/min with limits of agreement of -2.0 L/min and +2.4 L/min. The CCC between ΔECco and ΔTDco (0.82 [95% confidence interval (CI), 0.72-0.89]) was significantly higher (P = 0.0053) than the CCC between ΔESco and ΔTDco (0.42 [95% CI, 0.20-0.59]), but not statistically different (P = 0.16) than the CCC between ΔMAP and ΔTDco (0.69 [95% CI, 0.54-0.80]). Polar plot analysis showed an angular bias with radial agreement limits of -29° ± 38° between ΔESco and ΔTDco and -15° ± 29° between ΔECco and ΔTDco. Four-quadrant concordance rate was 81% (95% CI, 74-88) between ΔESco and ΔTDco and 100% between ΔECco and ΔTDco. Polar concordance rates were 41% (95% CI, 34-48) between ΔESco and ΔTDco and 85% (95% CI, 79-90) between ΔECco and ΔTDco.

CONCLUSIONS: Compared to pulmonary artery catheter thermodilution, both ECOM and esCCO underestimate changes in CO during an ARM in postoperative cardiac surgical patients. However, ΔECco is within the angular limits of acceptable agreement and may be as efficient as invasive arterial pressure monitoring to track CO changes. In contrast, esCCO is not able to adequately track CO in these specific conditions.

藥房準備注射器麻黃堿的短缺對術中藥物使用的影響

The Impact of a Shortage of Pharmacy-Prepared Ephedrine Syringes on Intraoperative Medication Use

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背景：在美國與麻醉有關的用藥短缺已經越來越普遍。我們測試用供應商準備的麻黃堿取代藥房準備的注射器麻黃堿，麻黃素和去氧腎上腺素術中使用的血流動力學和患者水準的變化與提供商級別的變化有關。

方法：在藥房準備的注射器麻黃堿短缺開始的前後 1 個月，在三級醫療中心進行一般和骨科手術患者被列入範圍。最低平均動脈血壓和最慢的心率作爲評估血流動力學的措施。調整後的分組採用混合效應回歸與重複測量進行測試。

結果：麻黃堿短缺前有 304 名患者，短缺後有 298 名患者。在麻黃堿短缺期間，相對於之前，至少 1 次麻黃堿的管理是更常見的(148/304 [48.7]% vs 117/298 [39.3]%; P = 0.0199)。在調整了年齡，性別，ASA 評分，手術類型，麻醉提供商，以及手術時間後，在短缺期間患者不太可能得到麻黃素([RR] = 0.78 [95% {CI}, 0.61-0.96]; P = 0.0198)，更容易獲得去氧腎上腺素(RR = 1.27 [95% CI, 1.02-1.51]; P = 0.0357)。在短缺期間，用最慢心率或最低平均動脈血壓評估患者的血流動力學沒有顯著不同。

結論：在藥店準備的注射器短缺期間，用藥管理模式有了一些改變。麻黃素和去氧腎上腺素的作用是明顯的;然而對患者血流動力學影響是相當的。如本研究中觀察到的，在相對或非絕對的藥物短缺期間，供應商的使用模式是敏感的。

（侯君誼 譯 薛張綱 校）

BACKGROUND: Anesthesia-related medication shortages have become increasingly common in the United States. We tested whether a local shortage of pharmacy-prepared ephedrine syringes, replaced by provider-prepared ephedrine, was associated with provider-level changes in ephedrine and phenylephrine use and patient-level changes in intraoperative hemodynamics.

METHODS: Consecutive patients undergoing general and orthopedic surgery at a tertiary care center were included 1 month before and 1 month after the start of the pharmacy-prepared ephedrine syringe shortage. Lowest mean arterial blood pressure and slowest heart rate were obtained as measures of hemodynamics. Adjusted associations were tested using mixed-effects regression with repeated measures.

RESULTS: Three hundred four patients before the shortage and 298 patients after the shortage began were included. The administration of at least 1 bolus of ephedrine was significantly more common before versus during the shortage (148/304 [48.7]% vs 117/298 [39.3]%; P = 0.0199). After adjusting for age, sex, ASA physical status, surgery type, anesthesia provider, and operative duration, patients were significantly less likely to receive ephedrine during the shortage (relative risk [RR] = 0.78 [95% confidence interval {CI}, 0.61-0.96]; P = 0.0198) and more likely to receive a phenylephrine bolus (RR = 1.27 [95% CI, 1.02-1.51]; P = 0.0357). Patient hemodynamics assessed by slowest heart rate or lowest mean arterial blood pressure did not differ significantly during the shortage.

CONCLUSIONS: There was an alteration in medication administration patterns during a shortage of pharmacy-prepared syringes. Changes in ephedrine and phenylephrine use were noted; however, patient hemodynamics remained comparable. Provider use patterns were sensitive even to a relative and not absolute medication shortage as observed in this study.

I-gel™ 與 LMA-Fastrach™聲門上氣道裝置在纖維支氣管鏡引導下使用 Parker (GlideRite™)氣管插管對比：一項隨機對照試驗

I-gel™ Versus LMA-Fastrach™ Supraglottic Airway for Flexible Bronchoscope-Guided Tracheal Intubation Using a Parker (GlideRite™) Endotracheal Tube: A Randomized Controlled Trial

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背景：I-gel™ (IG)聲門上氣道裝置是一種能夠建立可靠氣道的方式。其大通氣腔使氣管插管很容易就能通過。IG 裝置可以在麻醉醫生使用柔性支氣管鏡時提供喉入口良好的視野。本前瞻性隨機對照研究的目的是比較同樣在靈活的纖維支氣管鏡引導下氣管插管，IG 和 LMA-Fastrach™（FT）喉罩的成功率。

方法：120 例需要進行全身麻醉的患者被隨機分爲 2 組：IG 組和 FT 組。麻醉誘導後，以當組分配的喉罩插入，以建立氣道使患者獲得足夠的通氣。隨後我們通過聲門上裝置進行纖維支氣管鏡引導下氣管插管。氣管插管和喉罩插入成功率以及完成這些操作所需的時間被記錄下來。每次插管嘗試中看到的喉入口景象均被分級。

結果：每組分配 60 例病人。IG 組和 FT 組的插管成功率類似（首次嘗試成功率分別爲 100%與 95%，P=0.12）。與 FT 相比，IG 組的插管所需時間則顯著降低（30±11 秒相對 50±21 秒；P<0.0001）。IG 組聲門視野情況更好，1 級有著更高的百分比（63.3%對 3.3%；P<0.0001），而 3 級有較低的百分比（1.7%對 60.0%，P<0.0001）。

結論：使用 IG 聲門上氣道裝置作爲柔性支氣管鏡引導下氣管插管的的成功率與 FT 喉罩類似。然而，與 FT 喉罩相比，IG 裝置可以爲插管提供更好的聲門口視野以及縮短插管時間。

（楊曉迪 譯 薛張綱 校）

BACKGROUND: The I-gel™ (IG) supraglottic airway device is a reliable way to establish an airway. Its large ventilation lumen allows for easy passage of an endotracheal tube. With the use of a flexible bronchoscope, the IG offers a good visualization of the laryngeal inlet. This prospective randomized study aims to compare the success rate of flexible bronchoscope-guided tracheal intubation using either the IG or the LMA-Fastrach™ (FT) laryngeal masks.

METHODS: One hundred twenty patients requiring general anesthesia were randomized to 1 of the 2 study groups: IG or FT. After anesthesia induction, the assigned laryngeal mask was inserted to obtain adequate ventilation. We then proceeded to a flexible bronchoscope-guided intubation through the supraglottic device. Tracheal intubation and laryngeal mask insertion success rates were noted, as well as the time required for these manipulations. The view of the laryngeal inlet was graded for each intubation attempt.

RESULTS: Sixty patients were assigned to each study group. The intubation success rates were similar between the IG and the FT groups (100 % vs 95.0 % at first attempt; P = 0.12). The times required for tracheal intubation were significantly lower in the IG group (30 ± 11 seconds vs 50 ± 21 seconds; P < 0.0001). Glottic visualization was better in the IG group, with a significantly higher percentage of grade 1 visualization (63.3% vs 3.3%; P < 0.0001) and a lower percentage of grade 3 visualization (1.7% vs 60.0%; P < 0.0001), than that in the FT group.

CONCLUSIONS: The use of the IG supraglottic airway device as a conduit for flexible bronchoscope-guided tracheal intubation results in a success rate equivalent to the use of the LMA-FT™. However, the IG allows for shorter intubation times and a better visualization of the glottic opening compared with the LMA-FT™.

普通喉鏡與可視喉鏡用於氣管導管交換的對比：高風險呼吸道障礙病人的聲門視覺化，成功率，併發症以及救援方案

Conventional Versus Video Laryngoscopy for Tracheal Tube Exchange: Glottic Visualization, Success Rates, Complications, and Rescue Alternatives in the High-Risk Difficult Airway Patient

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背景：氣管導管交換是一項簡單的概念然而並不是一種簡單的過程，因爲低氧血症，導管誤入食道，以及失去氣道都有致命的影響。將喉鏡與呼吸道交換導管（AEC）結合用於氣管導管交換可能能夠減少風險。喉鏡可用於交換前檢查和開出一條氣管內導管通道（ETT）。直接喉鏡（DL）因爲“視線”而受到限制；因此，會造成氣道評估和氣管導管交換的盲操作，這樣也造成了交換導管的難度以及併發症。我們假設曾經用過直接喉鏡用於氣管導管交換的氣道高風險患者，當用可視喉鏡（VL）時，相對於直接喉鏡（DL），可爲氣道評估提供更好地聲門暴露，以及用視覺化氣道交換導管方法交換氣管內導管可減少導致氣道和血流動力學併發症的風險。

方法：危重病人在氣管導管交換前需要在直接喉鏡的輔助下進行氣道評估。假如在直接喉鏡輔助下交換前氣道評估爲“暴露差”，這些患者在用可視喉鏡氣道評估後可用可視喉鏡進行氣管導管交換。我們將直接喉鏡下的氣道評估與可視喉鏡下的氣道評估進行比較。我們分析了用於氣管內導管交換所做的嘗試，併發症及救援設備。然後，這些交換結果將與一組歷史對照組病人作對比，這些病人在直接喉鏡（DL）輔助預交換呼吸道評估中被評

定爲暴露不佳，並採用了直接喉鏡（DL）+呼吸道交換導管（AEC）輔助交換。這種呼吸道評估方法及氣管內導管通道（ETT）由一個來自麻醉部門的或有麻醉援助能力的職業麻醉醫生執行。

結果：328 個在原先的採用直接喉鏡（DL）評估中被認定爲暴露不佳的病人與在歷史對照組（DL+AEC）中視線清晰的 337 個病人對比，之後做了可視喉鏡（VL）。大部分（88%）的病人可以在可視喉鏡檢查中可以做到完全或者接近完全的暴露。氣管內導管通道（ETT）交換的初步成功率在 VL 組中更大（跟 DL 對比爲 91.5%對 67.7%，P=0.0001）需要嘗試 3 次以上的病人的數量更低（與 DL 對比爲 1.2%對 6.8%，P=0.0003）。在與歷史對照 DL+AEC 組病人對比時，中度及重度低氧血症的發病率的相對差異，氣管導管誤入食道，心動過緩以及呼吸道援救設備干預需求將在 VL 交換過程中被監測。

結論：這些發現支持了這樣的假設：可視喉鏡在呼吸道評估中可以更好的暴露聲門，並能減少氣管內導管（ETT）交換過程中的呼吸道及血流動力學的併發症。通過提高聲門視覺化得到更高效及時的氣管內導管通道，此法已在利用呼吸道交換導管完成氣管內導管交換中得到驗證。更多的搶救呼吸道的嘗試將會增加交換所帶來的併發症的數量。由此得出結論，採用 VL+AEC 交換導管將會減少嘗試次數和併發症，並且這個嘗試次數是與美國社會麻醉呼吸道困難任務組織限制喉鏡嘗試的推薦次數是一致的。基於可視喉鏡的預交換氣道評估，不僅對於計畫內的交換，對於發現無法識別的呼吸道疾病，如部分或者完全的自拔管，也將是一種有效的評估方法。

（王潔 譯 薛張綱 校）

BACKGROUND: Tracheal tube exchange is a simple concept but not a simple procedure because hypoxemia, esophageal intubation, and loss of airway may occur with life-threatening ramifications. Combining laryngoscopy with an airway exchange catheter (AEC) may lessen the exchange risk. Laryngoscopy is useful for a pre-exchange examination and to open a pathway for endotracheal tube (ETT) passage. Direct laryngoscopy (DL) is hampered by a restricted "line of sight"; thus, airway assessment and exchange may proceed blindly and contribute to difficulty and complications. We hypothesized that video laryngoscopy (VL), when compared with DL, will improve glottic viewing for airway assessment, and the VL-AEC method of ETT exchange will result in a reduction in airway and hemodynamic complications in high-risk patients when compared with a historical group of patients who underwent DL + AEC-assisted exchange.

METHODS: Critically ill patients requiring an ETT exchange underwent DL-assisted pre-exchange airway assessment. If the DL-assisted pre-exchange assessment rendered a "poor view," these patients underwent a VL-based airway assessment followed by a VL-assisted ETT exchange procedure. The DL and VL pre-exchange assessments were compared. The attempts, complications, and rescue devices required for ETT exchange were analyzed. These exchange results were then compared with a historical control group of patients who (1) were classified as a poor view on DL-assisted pre-exchange airway assessment; and (2) underwent a DL + AEC-assisted exchange. The airway assessment and ETT exchange were performed by a board-certified anesthesiologist from the Department of Anesthesiology alone or with anesthesia resident assistance.

RESULTS: Three hundred twenty-eight patients with a poor view on initial DL examination underwent a subsequent VL with comparison of views with the 337 patients in the historical control group (DL + AEC). A majority (88%) had a "full or near-full view" on VL examination. The first-pass success rate for ETT exchange was greater in the VL group (91.5% vs 67.7% with DL; P = 0.0001) and the number of patients requiring 3+ attempts was lower (1.2% vs 6.8% with DL; P = 0.0003). A commensurate difference in the incidence of mild and severe hypoxemia, esophageal intubation, bradycardia, and the need for rescue airway device intervention was also observed with VL exchange procedures when compared with the historical DL + AEC group.

CONCLUSIONS: These findings support the hypothesis that VL may result in better glottic viewing for airway assessment and may permit the ETT exchange procedure to be performed with fewer airway and hemodynamic complications. Execution of the ETT exchange over an

AEC was augmented by improved glottic visualization to allow more efficient and timely ETT passage. Multiple attempts to resecure the airway increased the number of exchange complications. VL + AEC exchange led to fewer attempts and is consistent with the recommendation of the American Society of Anesthesiologists Difficult Airway Task Force to limit laryngoscopic attempts and, as a consequence, decrease complications. A VL-based pre-exchange airway assessment may be a valuable procedure for both planning the exchange and uncovering unrecognized airway maladies, for example, partial or complete self-extubation.

右美托咪啶在脊柱手術中對腦誘發電位無影響

Dexmedetomidine Does Not Affect Evoked Potentials During Spine Surgery

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背景：右美托咪啶對腦誘發電位（EPs）的影響尚未闡明，本研究旨在證明右美托咪定對軀體感覺，運動和視覺腦誘發電位的影響。

方法：經機構委員審查會批准，40 位成年病人納入研究，進行選擇性脊柱手術，使用異丙酚和瑞芬太尼進行全靜脈麻醉，隨機分配兩組使用右美托咪定或安慰劑，以達成一個雙盲安慰劑對照試驗。在進行知情同意，分配入組，基線腦誘發電位記錄後，患者隨機接受超過 10 分鐘的右美托咪定 0.6μg/kg/h 靜脈注射或相同劑量普通鹽水靜脈注射。在研究開始後 30-90 分鐘之間檢測 EP 記錄爲 T1，在 120-180 分鐘之間檢測 EP 記錄爲 T2。兩組 EP 潛伏期（ms）及振幅（μV）從基線到 T1（初級終點）和從基線到 T2（二級終點）的改變進行比較。資料用均數+標準差表示（95%可信區間）。

結果：對 40 位元病人的資料進行分析（右美托咪定組：n=20；年齡 54+3 歲；10 名男性，對照組：n=20；年齡 52+2 歲，5 名男性）。初級終點兩組無統計學差異：T1 軀體感覺 EPs 改變，潛伏期：0.01 ± 1.3 (-0.64, 0.65) vs 0.01 ± 1.3 (-0.64, 0.65), P = 0.43 (-1.24, 0.45)；振幅：0.03 ± 0.14 (-0.06, 0.02) vs -0.01 ± 0.13 (-0.07, 0.05), P = 0.76 (-0.074, 0.1)；T1 運動 EPs 振幅：65.1 ± 194.8 (-35, 165; n = 18) vs 109.2 ± 241.4 (-24, 243; n = 16), P = 0.57 (-113.5, 241.57)；T1 視覺 EPs（右眼），振幅：2.3 ± 3.6 (-0.4, 5.1; n = 11) vs 0.3 ± 6.0 (-3.3, 3.9; n = 16), P = 0.38 (-6.7, 2.6)；潛伏期 N1：2.3 ± 3.6 (-0.4, 5.1) vs 0.3 ± 6.0 (-3.3, 3.9), P = 0.38 (-6.7, 2.6)；潛伏期 P1：-1.6 ± 13.4 (-11.9, 8.7) vs -1.4 ± 8.1 (-6.3, 3.5), P = 0.97 (-9.3, 9.7)。二級終點兩組各資料之間比較也無統計學差異。無論 T1 還是 T2 在左右眼的視覺 EPs 均無差異。

結論：臨床相關劑量下，將右美托咪定作爲靜脈麻醉輔助用藥並不會改變 EPs，因此其可以在 EPs 監測下安全用於外科手術。

（儀修文 譯 薛張綱 校）

BACKGROUND: The effect of dexmedetomidine on evoked potentials (EPs) has not been elucidated. We aimed to investigate the effect of dexmedetomidine on somatosensory, motor, and visual EPs.

METHODS: After IRB approval, 40 adult patients scheduled for elective spine surgery using total IV anesthesia with propofol and remifentanil were randomly assigned to receive either dexmedetomidine (n = 20) or placebo (n = 20) in a double-blind, placebo-controlled trial. After obtaining informed consent, positioning, and baseline EPs recording, patients were randomly assigned to either IV dexmedetomidine 0.6 μg/kg infused over 10 minutes, followed by 0.6 μg/kg/h, or a corresponding volume of IV normal saline (placebo). EP measures at 60 ± 30 minutes after initiation of study drug were defined as T1 and at 150 ± 30 minutes were defined as

T2. Changes from baseline to T1 (primary end point) and from baseline to T2 (secondary end point) in EP latencies (milliseconds) and amplitudes (microvolts) were compared between groups. Data presented as mean ± SD (95% confidence interval).

RESULTS: Data from 40 patients (dexmedetomidine: n = 20; age, 54 ± 3 years; 10 males; placebo: n = 20; age, 52 ± 2 years; 5 males) were analyzed. There was no difference between dexmedetomidine versus placebo groups in primary end points: change of somatosensory EPs at T1, latency: 0.01 ± 1.3 (-0.64, 0.65) vs 0.01 ± 1.3 (-0.64, 0.65), P = 0.43 (-1.24, 0.45); amplitude: 0.03 ± 0.14 (-0.06, 0.02) vs -0.01 ± 0.13 (-0.07, 0.05), P = 0.76 (-0.074, 0.1); motor EPs amplitude at T1: 65.1 ± 194.8 (-35, 165; n = 18) vs 109.2 ± 241.4 (-24, 243; n = 16), P = 0.57 (-113.5, 241.57); visual EPs at T1 (right eye), amplitude: 2.3 ± 3.6 (-0.4, 5.1; n = 11) vs 0.3 ± 6.0 (-3.3, 3.9; n = 16), P = 0.38 (-6.7, 2.6); latency N1: 2.3 ± 3.6 (-0.4, 5.1) vs 0.3 ± 6.0 (-3.3, 3.9), P = 0.38 (-6.7, 2.6); latency P1: -1.6 ± 13.4 (-11.9, 8.7) vs -1.4 ± 8.1 (-6.3, 3.5), P = 0.97 (-9.3, 9.7) or secondary end points. There were no differences between right and left visual EPs either at T1 or at T2.

CONCLUSIONS: In clinically relevant doses, dexmedetomidine as an adjunct to total IV anesthesia does not seem to alter EPs and therefore can be safely used during surgeries requiring monitoring of EPs.

出生早期全身性使用黃體酮改變成年後術後的痛覺過敏反應：一項雌性大鼠研究

Systemic Progesterone Administration in Early Life Alters the Hyperalgesic Responses to Surgery in the Adult: A Study on Female Rats

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背景：目前早產兒的存活率有顯著上升，而進行宮內手術的量也有所增加。新生兒時期受到的有害刺激會引起成年後對疼痛反應的改變。已知孕婦體內含有高濃度的黃體酮，而黃體酮同時是一種有效的抗痛覺過敏藥物。因而，我們研究出生早期使用黃體酮對成年大鼠術後的影響。

方法：選擇雌性新生大鼠在出生後的 1 到 7 天內（P1-P7）分別注射黃體酮或溶劑。第二對照組則不進行注射。每組中一半的大鼠在 P3 時接受後爪切割手術而另一半則沒有。在 P60 時大鼠成年，所有組內的大鼠都受到一次後爪切割手術。我們對大鼠進行觸覺敏感性和熱敏感性的測試，在 P14-P42 每週進行一次（第一階段），在 P60 受到第二次損傷刺激前進行一次以及在 P61-P70 每兩天進行一次（第二階段）。在 P67，將大鼠注射多聚甲醛固定後取出脊髓染色並通過免疫細胞化學方法分析活化 p-p38 絲裂原活化蛋白激酶。

結果：在 P3 時接受手術的大鼠在第一階段的觸覺和熱敏感性都高於非手術大鼠，但在注射黃體酮的大鼠組內則沒有這種差異。P3 時受到的切割刺激也導致在 P60 的切割刺激後（第二階段）持續的觸覺和熱的高敏性，而在早期注射黃體酮的組內，疼痛的程度顯著降低並且疼痛消退的速度更快。即使在第一階段沒有接受手術刺激的大鼠中，出生時注射黃體酮減弱了第二階段中的觸覺高敏性。脊髓細胞染色中，溶劑注射組的大鼠表現出更多的 p-p38 提示出生早期受到損傷刺激，但在黃體酮注射組內則沒有這種表現。

結論：我們的結果提示子宮內的高內源性黃體酮水準可能有相同的保護作用以及新生兒的黃體酮水準能極大地影響傷害性刺激傳導通路的發育。

（施芸岑 譯 薛張綱 校）

BACKGROUND: There has recently been a substantial increase in the survival of prematurely born neonates and an increase of in utero surgeries. Noxious stimulation in the newborn alters the pain response to injury in adult life. Progesterone, an effective antihyperalgesic agent in the

adult, is at high concentration in the pregnant mother. Therefore, we investigated the effects of early-life progesterone on postsurgical outcomes in adult rats.

METHODS: Female rat pups were administered progesterone or vehicle during the first 7 days postpartum (P1-P7). A second control group had no injections. Half of each of these groups received an incision of the hindpaw at P3 and the other half did not. At P60, all groups of these now adult rats received a second paw incision. Tactile sensitivity and thermal sensitivity were measured weekly at P14-P42 (period I), at P60 (just before the second incision), and every 2 days of P61-P70 (period II). At P67, rats were fixed by systemic paraformaldehyde perfusion and their spinal cords taken for staining and immunocytochemical analysis of activated p-p38 mitogen-activated protein kinase.

RESULTS: Rats with surgery at P3 had greater tactile and thermal hyperalgesia in period I than the nonoperated rats, a difference abolished by progesterone treatment. P3 incision also resulted in long-lasting tactile and thermal hyperalgesia after the P60 incision (period II), both of which were markedly smaller in degree and faster to resolve in rats receiving early progesterone. Even in rats that were not operated on in period I, neonatal progesterone lessened the tactile hyperalgesia in period II. More spinal cells showed p-p38 staining in vehicle-treated rats as a result of the early-life incision but not in those treated with progesterone.

CONCLUSIONS: These findings suggest that endogenously high progesterone in utero may have a similarly protective action and that the development of nociceptive circuitry can be strongly influenced by neonatal progesterone.

黏彈性參數 α-角能否鑒別纖維蛋白原和血小板缺乏並指導纖維蛋白原補充?

Can the Viscoelastic Parameter α-Angle Distinguish Fibrinogen from Platelet Deficiency and Guide Fibrinogen Supplementation?

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作爲一項床邊檢驗項目，全血的黏彈性試驗，例如血栓彈力圖 (TEG®, Haemoscope Inc., Niles, IL) 和血栓彈力測定(ROTEM®, Tem International GmbH, Munich, Germany)，正在被越來越多地運用於描述凝血障礙狀態和指導止血治療。TEG® 專利 (發表於 2004 年)提出了基於單一分析（高嶺土活化分析）的一種演算法，其得出的 α-斜率和最大振幅參數分別用來指導纖維蛋白原補充和血小板管理。雖然 TEG® 和 ROTEM® 的儀器都能做到多重分析，但是基於 TEG® 的單一分析演算法仍然在很多機構中使用。最近研究討論了單一分析方法的局限性和不準確性。研究表明 α-角和最大振幅參數都反映了纖維蛋白原和血小板形成血栓強度的綜合作用。因此, 雖然 TEG® 單一分析可用於識別凝血障礙狀態，但無法被用於鑒別纖維蛋白（纖維蛋白原）和（或）血小板的缺陷。反之，兩種黏彈性方法同時進行測定，一項加入而另一項不加血小板抑制劑，能切實辨別特定的凝血障礙狀態，如纖維蛋白形成不足或血小板形成血栓強度不足。這些資訊是選擇適當止血治療的關鍵。

（劉洋　譯　陳傑　校）

Viscoelastic tests such as thrombelastography (TEG®, Haemoscope Inc., Niles, IL) and thromboelastometry (ROTEM®, Tem International GmbH, Munich, Germany), performed in whole blood, are increasingly used at the point-of-care to characterize coagulopathic states and guide hemostatic therapy. An algorithm, based on a mono-analysis (kaolin-activated assay) approach, was proposed in the TEG® patent (issued in 2004) where the α-angle and the maximum amplitude parameters are used to guide fibrinogen supplementation and platelet administration, respectively. Although multiple assays for both the TEG® and ROTEM devices are now available, algorithms based on TEG® mono-analysis are still used in many institutions.

In light of more recent findings, we discuss here the limitations and inaccuracies of the mono-analysis approach. Research shows that both α-angle and maximum amplitude parameters reflect the combined contribution of fibrinogen and platelets to clot strength. Therefore, although TEG® mono-analysis is useful for identifying a coagulopathic state, it cannot be used to discriminate between fibrin/fibrinogen and/or platelet deficits, respectively. Conversely, the use of viscoelastic methods where 2 assays can be run simultaneously, one with platelet inhibitors and one without, can effectively allow for the identification of specific coagulopathic states, such as insufficient fibrin formation or an insufficient contribution of platelets to clot strength. Such information is critical for making the appropriate choice of hemostatic therapy.

持續硬膜外輸注左旋布比卡因和羅哌卡因的靜脈藥代動力學對比研究：一項前瞻、隨機、多中心、雙盲、對照試驗

A Comparison of Differences Between the Systemic Pharmacokinetics of Levobupivacaine and Ropivacaine During Continuous Epidural Infusion: A Prospective, Randomized, Multicenter, Double-Blind Controlled Trial

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背景：與靜脈注射阿片類藥物相比，硬膜外輸注左旋布比卡因和羅哌卡因可以爲患者提供足夠的術後鎮痛同時減少藥物副作用，並提高患者預後。藥代動力學比藥物的客觀副作用能更好地評價不同藥物的安全性。由於左旋布比卡因和羅哌卡因的藥代動力學特性不同，本研究主要目的是研究兩種藥物在同一人群的硬膜外持續輸注過程中是否具有不同藥代動力學特性。此項隨機對照雙盲多中心試驗，比較對接受大型腹部、泌尿外科、婦科手術的成年患者進行 0.125%左旋布比卡因或 0.2%羅哌卡因持續硬膜外輸注作爲術後鎮痛管理的藥代動力學特徵。本研究主要通過變異係數（CV）評估左旋布比卡因和羅哌卡因的系統風險和個體差異的等效值，及預測兩種藥物在持續硬膜外輸注後血漿藥物濃度的可能差異。

方法:181 名接受腹部大手術的成年患者隨機分成兩組，分別接受硬膜外輸注 0.125%左旋布比卡因 +0.75 μg/mL 舒芬太尼或 0.2%羅哌卡因+0.75 μg/mL 舒芬太尼，持續 48 小時。主要終點指標是在 48 小時持續硬膜外輸注期間，通過在 15%變異係數範圍內的曲線下面積分析左旋布比卡因和羅哌卡因的血漿藥物濃度變異性。變異係數反映局麻藥物相對中值濃度的離散情況，從而提示預測血漿藥物濃度的可靠程度。次要終點指標是評價包括平均血漿藥物濃度峰值分析在內的局麻藥藥理學特性，同時評價血漿清除率、副作用、疼痛程度（通過數位化量表評估，比如，靜態數位化量表和動態數位化量表）和需要解救劑量的次數。

結果：兩組 CV 的差異無統計學意義：即曲線下面積的差異在 15%範圍內。左旋布比卡因的變異係數爲 0.54，羅哌卡因爲 0.51（p=0.725）。羅哌卡因的血漿藥物濃度達峰比左旋布比卡因更迅速。羅哌卡因的清除速率隨病人年齡的增長而降低。兩組之間的靜態數位評定量表、動態數位評定量表分數、解救次數以及副作用情況均無統計學意義。

結論：考慮變異係數，成年患者接受持續硬膜外輸注左旋布比卡因和羅哌卡因的血漿藥物濃度個體差異性是相同的。本研究發現羅哌卡因的清除隨著患者年齡增長而減弱，但是這個發現也有一些局限性。48 小時的輸注時間並未達到穩態血藥濃度。由於可能達到中毒水準，左旋布比卡因和羅哌卡因持續輸注 48 小時以上的血漿藥物濃度特性還需進一步研究。總之，兩種藥物局部麻醉在臨床效能和副作用發生率兩方面均無顯著差異。

（楊中偉　譯　陳傑　校）

BACKGROUND: Epidural infusion of levobupivacaine and ropivacaine provides adequate postoperative pain management by minimizing side effects related to IV opioids and improving patient outcome. The safety profile of different drugs can be better estimated by comparing their pharmacokinetic profiles than by considering their objective side effects. Because levobupivacaine and ropivacaine have different pharmacokinetic properties, our aim was to investigate whether there is a difference in the pharmacokinetic variability of the 2 drugs in a homogeneous population undergoing continuous epidural infusion. This double-blind, multicenter, randomized, controlled trial study was designed to compare the pharmacokinetics of continuous thoracic epidural infusion of levobupivacaine 0.125% or ropivacaine 0.2% for postoperative pain management in adult patients who had undergone major abdominal, urological, or gynecological surgery. This study is focused on the evaluation of the coefficient of variation (CV) to assess the equivalence in the systemic exposure and interindividual variability between levobupivacaine and ropivacaine and, therefore, the possible differences in the predictability of the plasmatic concentrations of the 2 drugs during thoracic epidural infusion.

METHODS: One hundred eighty-one adults undergoing major abdominal surgery were enrolled in the study. Patients were randomized to receive an epidural infusion of levobupivacaine 0.125% + sufentanil 0.75 μg/mL or of ropivacaine 0.2% + sufentanil 0.75 μg/mL at 5 mL/h for 48 hours. The primary end point of this study was to analyze the variability of plasma concentration of levobupivacaine and ropivacaine via an area under the curve within a range of 15% of the CV during 48 hours of continuous epidural infusion. The CV shows how the concentration values of local anesthetics are scattered around the median concentration value, thus indicating the extent to which plasma concentration is predictable during infusion. Secondary end points were to assess the pharmacologic profile of the local anesthetics used in the study, including an analysis of mean peak plasma concentrations, and also to assess plasma clearance, side effects, pain intensity (measured with a verbal numeric ranging score, i.e., static Numeric Rating Scale [NRS] and dynamic NRS]), and the need for rescue doses.

RESULTS: The comparison between the 2 CVs showed no statistical difference: the difference between area under the curve was within the range of 15%. The CV was 0.54 for levobupivacaine and 0.51 for ropivacaine ($P = 0.725$). The plasma concentrations of ropivacaine approached the Cmax significantly faster than those of levobupivacaine. Clearance of ropivacaine decreases with increasing patient age. There were no significant differences in NRS, dynamic NRS scores, the number of rescue doses, or in side effects between groups.

CONCLUSIONS: Considering the CV, the interindividual variability of plasma concentration for levobupivacaine and ropivacaine is equivalent after thoracic epidural infusion in adults. We found a reduction in clearance of ropivacaine depending on patient age, but this finding could be the result of some limitations of our study. The steady-state concentration was not reached during the 48-hour infusion and the behavior of plasma concentrations of ropivacaine and levobupivacaine during continuous infusions lasting more than 48 hours remains to be investigated, because they could reach toxic levels. Finally, no differences in the clinical efficacy or in the incidence of adverse effects between groups were found for either local anesthetic.

關於七氟烷麻醉下 **Sugammadex** 逆轉呱庫溴銨介導的中度神經肌肉阻滯的一項隨機試驗

Reversal of Pipecuronium-Induced Moderate Neuromuscular Block with Sugammadex in the Presence of a Sevoflurane Anesthetic: A Randomized Trial

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背景：呱庫溴銨是一種甾類神經肌肉阻滯劑。Sugammadex 是一類可與肌松劑結合的 γ-環糊精衍生物，能逆轉羅庫溴銨、維庫溴銨和泮庫溴銨的藥理作用。本研究目的是考察 sugammadex 可否能逆轉呱庫溴銨介導的中度神經肌肉阻滯（NMB），以及其所需要的劑量。

方法：此項單中心、隨機、雙盲、包含 5 個平行實驗組的研究納入 50 名接受異丙酚、七氟烷、芬太尼和呱庫溴銨全麻的患者。根據國際標準使用加速度監測儀（TOF-Watch SX@）進行神經肌肉功能監測。當 NMB 自行恢復到 TOF 值等於 2 時，患者隨機接受 1.0、2.0、3.0、4.0mg/kg 的 sugammadex 或安慰劑。主要終點指標爲從注射 sugammadex 到標準化 TOF 值恢復至 0.9 時所需時間。次要終點指標爲從注射 sugammadex 到最後 T1 所需時間。同時評估術後神經肌肉功能狀況。

結果：所有接受 sugammadex 注射的患者 5 分鐘內標準化 TOF 比值恢復至 0.9（最小劑量的 95%可信區間下限爲 70.1%；所有劑量的則爲 90.8%），其中 79%患者在 2 分鐘內標準化 TOF 比值恢復至 0.9（最小劑量的 95%可信區間下限爲 26.7%；所有劑量的則爲 63.7%）。在 TOF 數分鐘後 T1 也恢復正常。術後未發現殘餘 NMB。

結論：Sugammadex 可充分和迅速逆轉七氟烷麻醉下呱庫溴銨介導的中度 NMB。給予呱庫溴銨後當 TOF 值自發恢復到 2 時，2.0mg/kg 劑量的 sugammadex 即能有效逆轉 NMB。

（宣偉　譯　陳傑　校）

BACKGROUND: Pipecuronium is a steroidal neuromuscular blocking agent. Sugammadex, a relaxant binding γ-cyclodextrin derivative, reverses the effect of rocuronium, vecuronium, and pancuronium. We investigated whether sugammadex reverses moderate pipecuronium-induced neuromuscular blockade (NMB) and the doses required to achieve reversal.

METHODS: This single-center, randomized, double-blind, 5-group parallel-arm study comprised 50 patients undergoing general anesthesia with propofol, sevoflurane, fentanyl, and pipecuronium. Neuromuscular monitoring was performed with acceleromyography (TOF-Watch SX®) according to international standards. When the NMB recovered spontaneously to train-of-four count 2, patients randomly received 1.0, 2.0, 3.0, or 4.0 mg/kg of sugammadex or placebo. Recovery time from sugammadex injection to normalized train-of-four (TOF) ratio 0.9 was the primary outcome variable. The recovery time from the sugammadex injection to final T1 was the secondary end point. Postoperative neuromuscular functions were also assessed.

RESULTS: Each patient who received sugammadex recovered to a normalized TOF ratio of 0.9 within 5.0 minutes (95% lower confidence interval for the lowest dose 70.1%; for all doses 90.8%) and 79% of these patients reached a normalized TOF ratio 0.9 within 2.0 minutes (95% lower confidence interval for the lowest dose 26.7%; for all doses 63.7%). T1 recovered several minutes after the TOF ratio. No residual postoperative NMB was observed.

CONCLUSIONS: Sugammadex adequately and rapidly reverses pipecuronium-induced moderate NMB during sevoflurane anesthesia. Once the train-of-four count has spontaneously returned to 2 responses following pipecuronium administration, a dose of 2.0 mg/kg of sugammadex is sufficient to reverse the NMB

外科監護改進計畫（SCIP）抗生素指南:是否能不流於美好願望？

The Surgical Care Improvement Project Antibiotic Guidelines: Should We Expect More Than Good Intentions?

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從 2006 年起，外科監護改進計畫（SCIP）提出 3 項術前抗生素使用的指導意見，以減少手術部位感染發生。儘管指導意見被證明是有效的，但 SCIP 的努力並沒有使感染率確實下降。本文提出了 3 項 SCIP 沒有達到預期目標的原因。建議重新定位改善治療方案，包括關注減少報導，鼓勵堅持未完成的檢測指標，創建更多的地區性合作完善治療方案指導臨床。最終只有通過提高每一個臨床醫生的積極性，在專業方面不斷的練習，在挑戰性工作中認識到失敗，並且反復訓練直至通向成功。

（馮羽敬 譯 陳傑 校）

Since 2006, the Surgical Care Improvement Project (SCIP) has promoted 3 perioperative antibiotic recommendations designed to reduce the incidence of surgical site infections. Despite good evidence for the efficacy of these recommendations, the efforts of SCIP have not measurably improved the rates of surgical site infections. We offer 3 arguments as to why SCIP has fallen short of expectations. We then suggest a reorientation of quality improvement efforts to focus less on reporting, and incentivizing adherence to imperfect metrics, and more on creating local and regional quality collaboratives to educate clinicians about how to improve practice. Ultimately, successful quality improvement projects are behavioral interventions that will only succeed to the degree that they motivate individual clinicians, practicing within a particular context, to do the difficult work of identifying failures and iteratively working toward excellence.

使用納洛酮來評估遲發性術後呼吸抑制的預測因素

Predictors of Delayed Postoperative Respiratory Depression Assessed from Naloxone Administration

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背景： 本研究目的是確定患者和手術特徵與需要納洛酮干預的術後呼吸抑制或鎮靜之間的關係。

方法： 納入 2008 年 7 月 1 日至 2010 年 6 月 30 日期間，以拮抗麻醉監護（從恢復室轉出或是從手術室轉入術後區域）後 48 小時內阿片類藥物引起的呼吸抑制或鎮靜作用而接受納洛酮治療的患者。每位元患者根據年齡、性別和確切的手術方式與兩個同年的對照者相匹配。製作圖表審查與納洛酮干預風險相關的患者、麻醉和手術因素。另外確認在麻醉恢復第一階段出現呼吸系統不良反應（通氣不足，呼吸暫停，血氧飽和度下降，疼痛/鎮靜不匹配）的所有患者。考慮到 1：2 組匹配的病例對照研究設計，故進行條件 Logistic 回歸來評估與納洛酮使用相關的患者和手術特點。

結果： 確認使用納洛酮 134 例，58%發生在麻醉監護結束後 12 小時內，發生率爲千分之 1.6 的（95%的可信區間，1.3-1.9）。阻塞性睡眠呼吸暫停的發生（比值比 OR=2.45；95%CI，1.27-4.66；P=0.008）和對在恢復室呼吸不良事件的診斷（OR = 5.11; 95% CI, 2.32–11.27; P < 0.001）均與納洛酮使用的風險增加，以治療麻醉監護結束後出現的呼吸抑制或鎮靜相關。麻醉監護結束後，接受納洛酮治療的患者使用了更大中位數劑量的阿片類藥物（10 [四分位間距，0-47.1] VS 5 [0-24.8]嗎啡當量，P = 0.020）和更多與鎮靜副作用相關的藥物（n= 41 [31％] VS 24 [9％]; P <0.001）。

結論：在恢復室出現阻塞性睡眠呼吸暫停和呼吸不良事件預示著使用納洛酮來拮抗麻醉監護結束後出現的呼吸抑制或鎮靜風險增加。此外，接受納洛酮治療的患者往往在麻醉監護結束後使用了更多的阿片類藥物和其他鎮靜藥物。此項研究結果表明對於這些患者，麻醉監護結束後應繼續加強監測可能是有益的。

（馮迪　譯　陳傑　校）

BACKGROUND: The aim of this study was to identify patient and procedural characteristics associated with postoperative respiratory depression or sedation requiring naloxone intervention.

METHODS: We identified patients who received naloxone to reverse opioid-induced respiratory depression or sedation within 48 hours after discharge from anesthetic care (transfer from the postanesthesia care unit or transfer from the operating room to postoperative areas) between July 1, 2008, and June 30, 2010. Patients were matched to 2 control subjects based on age, sex, and exact type of procedure performed during the same year. A chart review was performed to identify patient, anesthetic, and surgical factors that may be associated with risk for intervention requiring naloxone. In addition, we identified all patients who developed adverse respiratory events (hypoventilation, apnea, oxyhemoglobin desaturation, pain/sedation mismatch) during phase 1 anesthesia recovery. We performed conditional logistic regression taking into account the 1:2 matched set case–control study design to assess patient and procedural characteristics associated with naloxone use.

RESULTS: We identified 134 naloxone administrations, 58% within 12 hours of discharge from anesthesia care, with an incidence of 1.6 per 1000 (95% confidence interval [CI], 1.3–1.9) anesthetics. The presence of obstructive sleep apnea (odds ratio [OR] = 2.45; 95% CI, 1.27–4.66; P = 0.008) and diagnosis of an adverse respiratory event in the postanesthesia recovery room (OR = 5.11; 95% CI, 2.32–11.27; P < 0.001) were associated with an increased risk for requiring naloxone to treat respiratory depression or sedation after discharge from anesthesia care. After discharge from anesthesia care, patients administered naloxone used a greater median dose of opioids (10 [interquartile range, 0–47.1] vs 5 [0–24.8] IV morphine equivalents, P = 0.020) and more medications with sedating side effects (n = 41 [31%] vs 24 [9%]; P < 0.001).

CONCLUSIONS: Obstructive sleep apnea and adverse respiratory events in the recovery room are harbingers of increased risk for respiratory depression or sedation requiring naloxone after discharge from anesthesia care. Also, patients administered naloxone received more opioids and other sedating medications after discharge from anesthetic care. Our findings suggest that these patients may benefit from more careful monitoring after being discharged from anesthesia care.

未雨綢繆：對死產和畸形胎兒進行晚期終止妊娠的看法

Expecting the Unexpected: Perspectives on Stillbirth and Late Termination of Pregnancy for Fetal Anomalies

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准媽媽和她們的配偶們準備了幾個月來熱切地歡迎他們期待已久的寶寶來到他們的家庭。而死產或者可能危及胎兒生命的胎兒畸形的診斷結果對受其影響的母親和她們的家庭來說是一個可怕的事故。從診斷到採取干預措施（即引產死胎或對畸形胎兒終止晚期妊娠），患者經常感到無助和被拋棄，會對許多人有長期的心理和情緒的影響。產科知識管理，道德和醫學的挑戰，心理學方面近幾年來有所發展。熟悉相關新興知識使產科麻醉醫生更好地提供有效的移情關懷。考慮到臨產婦的復蘇需要，碰到這類經歷過死胎或致命胎兒畸形的婦女促使麻醉醫生對臨產關懷的現有證據進行總結陳述。

（程鑫宇　譯　陳傑　校）

Expectant mothers and their spouses spend months preparing to eagerly welcome their much-anticipated baby into their family. Stillbirth or a diagnosis of life-limiting fetal anomalies comes as a devastating turn of events for affected women and their families. From the time of diagnosis to intervention (i.e., induction of labor for stillbirth or late termination of pregnancy for fetal

anomalies), affected women often feel vulnerable and abandoned, with many experiencing long-term psychological and emotional effects. Knowledge of obstetric management, ethical and medical challenges, and psychological aspects have evolved in recent years. Familiarity with this emerging knowledge better prepares the obstetric anesthesiologist to deliver effective and empathic care. Encounters with women experiencing stillbirth and life-limiting fetal anomalies prompted this review of current evidence regarding parturient' perspectives on their care as they set out on the road to recovery.

腹橫肌平面阻滯與骶管阻滯在小兒下腹部手術中的應用比較：一項雙盲隨機對照試驗

Transversus Abdominis Plane Block Versus Caudal Epidural for Lower Abdominal Surgery in Children: A Double-Blinded Randomized Controlled Trial

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背景：腹橫肌平面阻滯（TAPB）作爲一種安全而有效的區域阻滯方法,爲術後提供了良好的下腹部鎮痛。腹橫肌平面阻滯的相關併發症較少，與被認爲是小兒下腹部區域阻滯金標準的骶管阻滯相比，其整體風險更低。此項研究假設 TAPB 初期的鎮痛效果與骶管阻滯效果相當，並且鎮痛持續時間更優於骶管阻滯。

方法：本研究是一項雙盲隨機對照試驗。研究物件爲 45 名 1 至 9 歲，需通過低橫切口行雙側輸尿管再植手術的小兒。行阻滯後的 24 小時中，每隔 6 小時在麻醉後監護室（PACU）中記錄每名患者的鎮痛需求、疼痛評分(FLACC/Wong-Baker FACES)、嘔吐發作和解痙需要。本研究方法針對所有患兒採用多模式的疼痛管理方式，包括區域阻滯、酮絡酸、嗎啡以及解痙藥奧昔布林的按需使用。

結果：在前 12 小時中各組患者嗎啡的需求量均無顯著的統計學差異（恢復室中 6 小時和 12 小時，所有 P≥ 0.68）。24 小時後 TAPB 組的患兒所需的嗎啡量少於骶管阻滯組(0.05 mg/kg ± 0.06 vs 0.09 mg/kg ± 0.07, P = 0.03)。TAPB 組在 18 和 24 小時的嘔吐發生率更低（6 vs 1, P = 0.03; 9 vs 2, P = 0.02）。TAPB 組在 PACU 中的疼痛評分（0-10）較高(3.46 ± 2.69 vs 1.71 ± 2.1, P = 0.02)，但在後面的時間點中兩組間沒有統計學差異（P ≥ 0.10）。TAPB 組在 24 小時中所需的膀胱解痙劑奧昔布林的量更大（0.49 ± 0.58 vs 0.28 ± 0.17, P = 0.003）。

結論：正如累積阿片類藥物需求量，即主要研究終點，所顯示出的兩組統計學差異那樣，TAPB 組患者在行阻滯後 6 到 24 小時內的阿片藥物使用量下降，其麻醉效果優於骶管阻滯。而 TAPB 組的嘔吐發生率下降也進一步證實阿片的使用量的減少。TAPB 的 24 小時 PACU 疼痛評分和奧昔布林的使用量均高於骶管阻滯，儘管 TAPB 不如骶管阻滯能更好地抑制術後的膀胱痙攣，但可以通過臨床上實施規範的解痙藥物的使用來彌補這一缺陷。基於 TAPB 較骶管阻滯的整體安全優勢，被認爲是下腹部手術的首選區域阻滯方法。

（楊渝汀　譯　陳傑　校）

BACKGROUND: Transversus abdominis plane block (TAPB) has emerged as a safe and effective regional anesthesia technique for providing postoperative lower abdominal analgesia. Complications associated with TAPB are rare and pose a lower overall risk to the patient receiving a TAPB versus a caudal block, which is considered the gold standard for pediatric lower abdominal regional anesthesia. Our study hypothesis was that TAPB would initially be equivalent to caudal block in providing postoperative pain control but would also show improved pain relief beyond the anticipated caudal duration.

METHODS: This study was a double-blinded randomized controlled trial. Forty-five children between the ages of 1 and 9 undergoing bilateral ureteral reimplantation surgery through a low transverse incision were enrolled. Narcotic requirement, pain scores (FLACC/Wong-Baker FACES), episodes of emesis, and antispasmodic requirement were recorded in the postanesthesia

care unit (PACU) and at 6-hour intervals for 24 hours from the time of block placement. Our protocol used a multimodal approach toward pain management in all children, including randomized regional technique, scheduled ketorolac, morphine as needed, and the antispasmodic, oxybutynin, as needed.

RESULTS: Morphine requirement showed no statistical difference during the initial 12 hours (all P ≥ 0.68 at PACU, 6 and 12 hours). However, at 24 hours those patients randomized to receive the TAPB required less cumulative morphine than the caudal group (0.05 mg/kg ± 0.06 vs 0.09 mg/kg ± 0.07, P = 0.03). There was a trend toward fewer episodes of emesis in the TAPB group which reached statistical significance at 18 and 24 hours (6 vs 1 episodes, P = 0.03; and 9 vs 2 episodes, P = 0.02). Pain scores (0–10) were higher in the TAPB group in the PACU (3.46 ± 2.69 vs 1.71 ± 2.1, P = 0.02), but there were no significant differences at all subsequent time points (all P ≥ 0.10). The TAPB group also had a higher requirement for the bladder antispasmodic oxybutynin at 24 hours (0.49 ± 0.58 vs 0.28 ± 0.17, P = 0.003).

CONCLUSIONS: TAPB provided superior analgesia compared with the caudal block at 6 to 24 hours after block placement, as demonstrated by a statistically significant decrease in cumulative opioid requirement, which was the primary end point. The lower incidence of emesis in the TAPB group likely reflected the decreased opioid consumption. Although TAPB appears to be less effective than the caudal block in preventing viscerally mediated bladder spasms, as evidenced by the higher PACU pain scores and increased oxybutynin requirement at 24 hours, this effect may be counteracted in future clinical practice by scheduled administration of the antispasmodic medications. Considering the overall safety advantages of the TAPB over the caudal block, this should be considered a preferred regional technique for lower abdominal surgeries.

利用血栓彈力計對小兒先心病患者行速率曲線測量以量化纖維蛋白溶解程度

Quantification of Fibrinolysis Using Velocity Curves Measured with Thromboelastometry in Children with Congenital Heart Disease

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背景：本研究假設血栓彈力計(ROTEM® , Tem International GmbH, Munich, Germany)測得的血凝塊振幅（A）和彈性（E）變化擬合得到的速率參數可以更準確地檢測接受先天性心臟病糾治術患兒全血的纖溶風險。

方法：在全身麻醉誘導後獲得患者的全血標本。對以下七種狀態進行了研究：正常對照血（作爲基線）和含不同漸進濃度的組織型纖溶酶原啓動物（t-PA）（102，255，512，1024，1535，2539 個單位/毫升）的樣血。使用 ROTEM 資料，在基於不同時間點間血凝塊振幅和彈性變化來計算速率曲線。分析得出以下參數：基於血栓幅度或彈性變化的血栓形成最大速率，基於血栓幅度變化的血栓裂解最大速率(MTL)，基於血栓彈性變化的血栓裂解最大速率(MTLe)。將這些參數與最大血凝的裂解參數進行比較並一直觀察到凝固時間後的 30 分鐘（LI30，百分率）。

結果：當 t-PA 大於 255 單位濃度/毫升時，LI30（平均差，255 單位/ mL 相較於基線，-31.05%，P <0.0001）和基於血栓振幅的血栓形成最大速率（平均差，255 單位/ mL 對基線，-7.5，P = 0.005）開始減小。當 t-PA 大於 512 單位濃度/毫升時，基於彈性的血栓形成最大速率（平均差，512 單位/ mL 對基線，-10.9，P = 0.010）、MTL（平均差，255 單位/毫升相對於基線，-3.2，p = 0.016）和 MTLE（平均差，255 單位/ mL 相對於基線，-7.8，p = 0.004）發生變化。當 t-PA 濃度≥512 單位/毫升，血栓不再形成。爲了檢測最小的

纖溶活化，LI30、MTL 和 MTLE 之間的受試者特徵曲線下面積沒有顯著差異（102 單位/mL; 分別爲 0.74、0.75 和 0.72， P = 0.708），而靈敏度和特異性的極值： LI30 以 97%爲界值，MTL 以-0.3 爲界值和及 MTLE 以-0.5 爲界值，它們的敏感度和特異度分別爲 52%和 85%、83%和 45%及 83%和 45%。

結論：基於血栓振幅或血栓彈性變化的速率曲線可爲血液中血凝塊形成和溶解提供客觀的動力學量度指標，並能檢測即使是輕微的纖溶。但還需要進一步研究，以評估這些參數的臨床意義。

（袁亞偉　譯　陳傑　校）

BACKGROUND: In this pilot study, we hypothesized that velocity parameters obtained from changes in clot amplitude (A) and clot elasticity (E) measured with thromboelastometry (ROTEM®, Tem International GmbH, Munich, Germany) could improve detection of fibrinolysis in whole blood obtained from children undergoing surgery for congenital heart disease.

METHODS: Whole blood samples were obtained after induction of general anesthesia. Seven conditions were studied: native whole blood (baseline) and samples with progressive tissue-type plasminogen activator (t-PA) concentrations (102, 255, 512, 1024, 1535, and 2539 units/mL). We calculated velocity curves based on changes in clot amplitude and elasticity between different time points using ROTEM data. The analysis allowed for the determination of the following parameters: the maximum rate of thrombus formation based on amplitude or elasticity and the maximum rate of thrombus lysis measured based on amplitude (MTL) or maximum rate of thrombus lysis measured based on elasticity (MTLe). We compared these parameters with the lysis in relation to maximal clotting firmness and measured 30 minutes after the clotting time (LI30, in percent).

RESULTS: Concentrations of t-PA ≥ 255 units/mL resulted in a decrease in LI30 (mean difference, 255 units/mL versus baseline, −31.05%, P < 0.0001) and the maximum rate of thrombus formation based on amplitude (mean difference, 255 units/mL versus baseline, −7.5, P = 0.005). Concentrations of t-PA ≥ 512 units/mL resulted in changes in maximum rate of thrombus formation based on elasticity (mean difference, 512 units/mL versus baseline, −10.9, P = 0.010), MTL (mean difference, 255 units/mL versus baseline, −3.2, P = 0.016), and MTLe (mean difference, 255 units/mL versus baseline, −7.8, P = 0.004). For t-PA concentrations ≥ 512 units/mL, clot formation was abolished. The area under the receiver operating characteristics curves did not differ between LI30, MTL, and MTLe for the detection of minimal fibrinolytic activation (102 units/mL; 0.74, 0.75, and 0.72, respectively, P = 0.708), whereas sensitivity and specificity of the cutoff values 97% for LI30, −0.3 for MTL, and −0.5 for MTLe were 52% and 85%, 83% and 45%, and 83% and 45%, respectively.

CONCLUSIONS: Velocity curves based on the amplitudes or clot elasticity could provide objective measurement of clot growth and clot lysis kinetics, allowing detection of even minor fibrinolysis. Further studies are needed to assess the clinical relevance of these parameters.

運用大鼠皮膚切口模型研究度洛西丁對痛覺異常和痛覺過敏局部和全身的作用

The Local and Systemic Actions of Duloxetine in Allodynia and Hyperalgesia Using a Rat Skin Incision Pain Model

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背景：度洛西丁是一種對重度抑鬱症有效的抗抑鬱劑，同時也是糖尿病性周圍神經病變、慢性骨骼肌疼痛和纖維組織肌痛患者緩解疼痛的良藥。度洛西丁在緩解疼痛方面的作用機制尚不清楚。本次研究提出，度洛西丁是否可通過全身以及局部機制起到鎮痛作用。

方法：在大鼠的皮膚作切口後，對在切口處皮下注射布比卡因和度洛西丁後抑制術後疼痛的療效進行比較。對側和腹膜內的注射是用來評估度洛西丁全身的效果。局麻作用是通過對大鼠坐骨神經功能的阻滯來分析的。度洛西丁對鈉通道的抑制作用主要表現在大鼠的GH3 細胞上。

結果：研究顯示，在皮膚作切口後，皮下注射 2mg 的度洛西丁可以減輕幾天的痛覺異常和痛覺過敏，而皮下注射 2mg 布比卡因並無此作用。在對側注射 10mg 度洛西丁對術後疼痛緩解只有極小的作用。只有用了較高劑量（10 到 20mg），腹膜內注射度洛西丁才可以減輕痛覺異常和痛覺過敏。通過坐骨神經阻滯，度洛西丁（2mg）可以抑制運動和疼痛感覺功能大約 24 小時，同時也可以用 50%的抑制濃度 30.4±1.2μM 和 4.26±0.19μM（n=8）分別使通道靜止和快速滅活來減少鈉電流。此外當受到 5Hz 刺激時，度洛西丁（10μM）產生阻斷近 70%的鈉電流峰值。

結論：此研究顯示度洛西丁可以起到局麻的作用，也是一種可以全身和局部應用的鎮痛劑。由於度洛西丁可以高效地抑制神經元的鈉電流，當它作用於許多中樞神經系統和外周靶點時，可以通過抑制由神經末梢損傷引起的自發神經衝動，發揮其抵抗痛覺過敏的作用。

（李悅　譯　陳傑　校）

BACKGROUND: Duloxetine is an antidepressant effective for major depressive disorder and also the alleviation of pain for patients with diabetic peripheral neuropathy, chronic musculoskeletal pain, and fibromyalgia. How duloxetine works in pain relief remains unknown. In this study, we address whether duloxetine could act as an analgesic via systemic and local applications.

METHODS: Efficacies of bupivacaine and duloxetine applied subcutaneously at the incision site against acute postoperative pain were compared after rat skin incision. Contralateral and intraperitoneal injections were used to assess systemic efficacy of duloxetine. Local anesthetic actions were assayed through functional block of the rat sciatic nerve. Inhibition by duloxetine of neuronal Na+ channels was characterized in rat GH3 cells.

RESULTS: Our studies showed that subcutaneous duloxetine (2 mg) reduced hyperalgesia and allodynia for several days after skin incision, whereas subcutaneous bupivacaine (2 mg) did not. Contralaterally injected duloxetine (10 mg) had minimal effects on postoperative pain. Intraperitoneal duloxetine also reduced both allodynia and hyperalgesia, albeit at higher doses (10–20 mg). Duloxetine (2 mg) inhibited motor and nociceptive functions via sciatic nerve block for approximately 24 hours. It also reduced Na+ currents with 50% inhibitory concentrations of 30.4 ± 1.2 μM and 4.26 ± 0.19 μM (n = 8) for resting and fast-inactivated channels, respectively. Furthermore, duloxetine (10 μM) elicited additional use-dependent block of peak Na+ currents by approximately 70% when stimulated at 5 Hz.

CONCLUSIONS: Our results demonstrate that duloxetine can act as a local anesthetic and an analgesic drug via both local and systemic applications. Because duloxetine inhibits neuronal Na+ currents with high potency, it may exert its antihyperalgesic effects through inhibition of the spontaneous nerve impulses that result from peripheral injury, encompassing its actions on multiple central nervous system and peripheral targets.