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### **酸中毒对凝血酶生成影响机制的模型建立**

#### **Mechanistic Modeling of the Effects of Acidosis on Thrombin Generation**

Mitrophanov, Alexander Y. PhD\*†; Rosendaal, Frits R. MD, PhD‡§; Reifman, Jaques PhD\*†

*Anesthesia & Analgesia 2015 121 278–288*

**背景：**酸中毒是创伤和复杂手术的常见并发症，是由于组织低灌注和静脉复苏后产生酸性体液的结果。虽然已经知道酸中毒是能够对不同的酶促反应产生抑制，但是其对凝血系

统的累积效应还没有能够完全被揭示。在这里，我们使用计算模型来验证酸中毒会延迟并减少人体血浆中的凝血酶的大量生成这一假设。此外我们在个体和人群水平，研究了不同的凝血酶生成参数对酸中毒的敏感性。

**方法：**我们用动力学模型来模拟分析凝血酶和凝血酶-抗凝血酶复合物的生成（TAT），这是本研究的最终目的。大量的凝血酶和TAT轨迹用来模拟和计算定量参数，如凝血时间（CT）、凝血酶峰值时间、凝血酶曲线最大斜率、凝血酶峰值高度、凝血酶轨迹下的面积（AUC）和凝血酶原时间。将所得的样本的参数值在不同的pH值水平进行了比较，以评估酸中毒所导致的影响。我们利用来自472项莱顿易栓症的研究出的凝血因子成分的数据来参数化计算模型，以此研究个体间的差异。通过模式在我们虚拟主体中发生的计数估算出相对变化模式的概率，从而比较酸中毒引起的在个人（“虚拟”）方面的相应参数的变化。采用Bhattacharyya系数量化对凝血酶生成参数在不同pH值水平的分布重叠。

**结果：**酸中毒在pH值6.9~7.3范围内CT、凝血酶峰值时间、AUC和凝血酶原时间逐步增加，而凝血酶曲线最大斜率和凝血酶峰值高度降低（ $P < 10$ ）。酸中毒推迟了TAT生成的开始时间，降低了生成的数量（ $P < 10$ ）。在我们的个体项目中的所有凝血酶生成参数（项目显示模式的单边95%置信下限区间，0.99）作为衡量个体间的差异，凝血酶曲线最大斜率和CT显示最大和第二大酸中毒所引起的相对变化，而AUC显示最小的相对变化。作为衡量个体间变异性，在酸中毒pH值水平的凝血酶曲线最大斜率分布与在生理pH值水平的凝血酶曲线最大斜率分布有重叠，与CT、凝血酶峰值高度和凝血酶原时间的重叠分布非常系统的相似。

**结论：**酸中毒影响所有的凝血酶和TAT生成的定量参数。在个体项目水平中凝血酶曲线最大斜率在酸中毒的时候显示敏感性最高，这可能是优于CT和凝血酶峰值时间，而在项目组水平中凝血酶原时间是酸中毒的指标。

（李婷婷译，李士通 审校）

**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.

### 阿片受体参与布比卡因引起的心脏毒性的脂肪乳剂抢救

#### 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：**脂肪乳剂（LE）已成功地用于局部麻醉的布比卡因过量所引起的心脏复苏。阿片受体在心脏保护中起关键作用。我们探讨一下LE的复苏作用的是否通过阿片受体介导的。

**方法：**给年轻的雄性Sprague-Dawley大鼠注射布比卡因诱导心脏停搏（超过20秒静脉注射10mg/kg），然后立即用LE（脂肪乳20%；推注5ml/kg后以0.5ml/kg/min维持）复苏。大鼠诱导心脏停搏2分钟前给予非选择性阿片受体拮抗剂如纳洛酮和纳洛酮碘化物、高度选择性阿片受体 $\kappa$ 、 $\delta$ 和 $\mu$ 亚型的拮抗剂，以及磷酸盐缓冲液作为对照这些预处理。使用超声心动图测量心率和射血分数。

**结果：**LE复苏布比卡因心脏毒性作用能够被高剂量（1mg/kg）纳洛酮阻止，但不是被低剂量的纳洛酮（1、5和10 $\mu$ g/kg）和纳洛酮甲碘化物（不穿过血脑屏障）阻止，而高选择性 $\delta$ 和 $\kappa$ 阿片受体拮抗剂要在较高（10 mg/kg）剂量下才能阻止。成功的LE复苏不会被高度选择性的 $\mu$ 阿片受体拮抗剂所影响。与使用LE后没有复苏成功的对照组相比，进行 $\delta$ 阿片受体拮抗剂（10mg/kg）预处理的大鼠，会降低心脏糖原合成酶激酶3 $\beta$ 的磷酸化水平。

**结论：**我们的数据显示出了外周 $\delta$ 和 $\kappa$ 型阿片受体参与了LE复苏作用。

（李婷婷译，李士通 审校）

**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  $\kappa$ ,  $\delta$ , and  $\mu$  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  $\mu$ g/kg), by naloxone methiodide (which does not cross the blood-brain barrier), and by a selective  $\delta$ - and  $\kappa$ -opioid receptor antagonists at a higher (10 mg/kg) dose. Successful LE rescue was not affected by highly selective  $\mu$ -opioid receptor antagonists.  $\delta$ -Opioid receptor antagonist (10 mg/kg) pretreatment

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

**CONCLUSIONS:** Our data highlight the involvement of peripheral  $\delta$ - and  $\kappa$ -opioid receptors in the rescue action of LE.

残余肌松在气管拔管后的发生率研究：加拿大一项残留神经肌肉阻滞的发生率和严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：**术后残余肌松作用（NMB），定义为四个成串刺激率（TOF） $< 0.9$ ，是一个关系到术后呼吸并发症发生和发病率增加危险因素。目前，很少有关于加拿大残余NMB发生。RECITE（残余肌松作用在气管拔管后的发生率）的研究是在加拿大的8家医院进行调查研究残余NMB的发生率和严重程度的一项前瞻性观察研究。

**方法：**选择接受开腹或腹腔镜的腹部手术、预计持续 $< 4$ 小时成人患者，ASA分级 I-III，择期全麻至少有一个气管插管或神经肌肉松弛维持的非去极化神经肌肉阻断剂的剂量进行研究。用TOF-Watch® SX加速度仪进行神经肌肉功能的评估。所有报告的TOF比值归化为基准值。主治麻醉师和所有其他观察员都不知道的TOF比值（T4/T1）结果。首要和次要的目标分别是确定在气管拔管前和到达麻醉恢复室（PACU）时残余NMB的发生率和严重程度（TOF比值 $< 0.9$ ）。

**结果：**302例参与者被选入。有效的数据分别为在拔管时有241例和到达PACU时有207例患者。99%的参与者使用罗库溴铵作为NMB药物。新斯的明作为NMB拮抗，使用情况分别为TE时73.9%和PACU时72%。在气管拔管时残余NMB的发生率为63.5%（95%置信区间，57.4% - 69.6%），而在到达PACU时为56.5%（95%置信区间，49.8% - 63.3%）。在进一步分析中，观察到残余NMB的发生率在性别、年龄、体质指数、ASA分级、手术类型或合并症这些方面都无统计学差异。（ $P > 0.13$ ）。

**结论：**尽管定性的肌松监测和使用新斯的明，但是残余肌无力还是经常在气管拔管和到达PACU时发生。减少残余NMB相关风险必须要有更有效NMB的监测和管理。

（李婷婷译，李士通 审校）

**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.

### 一种使用条形码技术管理麻醉药品的系统：科多尼克安全标签系统和智能麻醉管理™

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

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**背景：**许多麻醉药物的错误是由于小瓶或注射器交换导致的。在药物配制前扫描小瓶上的条形码、制作带有条码标签的注射器和给药前扫描注射器标签条形码可能有助于防止错误。相反，手工制造符合监管机构和标准制定机构建议的注射器标签是相当繁琐和耗时的。一个采用小瓶条形码和生成含条形码标签注射器的计算机系统可以解决安全问题和标签的建议。

**方法：**我们在多个手术室（ORs）测试了科多尼克安全标签系统（SLS）出台前后，使用符合监管机构和标准制定机构建议的含标签注射器的兼容性。科多尼克SLS结合智能麻醉管理软件来创建一个麻醉药品条码管理系统，这样我们就可以在2个心胸手术室测量引入咖啡卡激励前后给药时注射器标签条形码的扫描比例。12位主治心胸麻醉医生和手术室药房人员参与。

**结果：**科多尼克SLS药品标签系统的使用导致大于75%兼容性的注射器标签（95%置信区间，75% - 98%）。所有使用科多尼克SLS系统制作的注射器标签都是兼容。在13周后使用智能麻醉管理系统扫描注射器条码标签比例平均为25%（730/2976），但是引入简单的（咖啡卡）激励经过8周后就可增加到58%（956/1645）（ $P < 0.001$ ）。

**结论：**麻醉药品条形码管理系统能使得用药人在给药时有中等的扫描注射器标签条码比例。此外，该系统的适应将需要更高的利用率。

（李婷婷译，李士通 审校）



**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与硬脊膜穿刺后头痛在产妇中发病的关系**

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

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**背景：**在硬膜外或腰硬联合麻醉之后，无意的硬膜外穿刺也有目前已知的风险，在正常体型孕妇分娩时放置硬膜外导管时它的发生率约为1%，但是在肥胖产妇中的发生率却高达4%。轶事经验和有限的文章里显示身体质量指数（BMI）和硬脊膜穿刺后头痛（PDPH）的发生率存在着反比的关系。我们可以假设，在无意的硬脊膜穿刺后，有着更大BMI的产妇发生PDPH的几率比那些具有较小的BMI的产妇的发病率更低。

**方法：**经过IRB批准，我们进行了回顾性的研究医疗记录的审查。我们查找了从2004年1月1日到2013年12月13日机构存档的案件，关于在进行椎管内镇痛时发生无意识的刺破硬膜的情况。最主要的成果就是发生PDPH的几率。我们用二进制逻辑回归的方法对BMI和PDPH之间的关联进行了评估，以魏氏-曼-惠特尼检验和置信区间（CI）为一个随机对，以发生PDPH患者的BMI值与非PDPH患者相比，计算其特性曲线下的面积。分类树分析方法被用来确定发生PDPH的BMI临界值。我们用Fisher精确检验分别对发生PDPH的产妇和未发生者进行计算，研究无意硬脑膜穿刺后鞘内导管的存在与否和分娩的第二产程是否存在关系。以BMI的临界值分为两组（低BMI和高BMI组）。我们在无意刺破硬膜的时候通过控制分娩的产力和置入鞘内导管，并用Fisher精确检验比较了低BMI和高BMI组PDPH的发生率。次要分析评估头痛在疼痛报道的最高数字评分，以及各个BMI组需要的硬膜外血液补充量。

**结果：**确定发生无意硬膜穿刺的患者有518人(0.53%) (95% CI,0.48%-0.58%)。在无意硬膜穿刺以后PDPH的发生率总体来说是51% (95% CI,46%-55%)。以随机的BMI值对PDPH者

与非PDPH者相比，用魏氏-曼-惠特尼检验值为0.74 (95% CI 0.60–0.90,  $P = 0.001$ )。在孕妇分娩时与未分娩所导致的PDPH的比值比为2.4 (95% CI 1.2–3.9,  $P = 0.001$ )。分类树分析方法来预测发生PDPH的BMI临界值为31.5 kg/m<sup>2</sup>。BMI ≥31.5 kg/m<sup>2</sup> (39%)的孕妇PDPH的发生率要低于BMI <31.5 kg/m<sup>2</sup>的孕妇(56%; difference -17%; 95% CI, -7% to -26%,  $P = 0.0004$ )。高BMI组合和低BMI组发生PDPH的比值比在孕妇分娩时有产力者为0.36 (95% CI, 0.14–0.92,  $P = 0.04$ )，而在孕妇分娩时无产力者为0.62 (95% CI, 0.41–0.97,  $P = 0.04$ )。在无意硬膜穿刺以后，112名(22%)的产妇置入了鞘内导管。置入了鞘内导管的产妇发生PDPH的几率为59% (95% CI, 49%–68%)，而置入了硬膜外导管的产妇发生PDPH的几率为48% (95% CI, 43%–54%) ( $P = 0.06$ )。头痛的严重程度(0–10语言评价量表)的中位数为8 (6–9)，这一数值在高BMI组和低BMI组的产妇中没有区别( $P = 0.61$ )。在各BMI组中，对于发生PDPH的治疗处理时，硬膜外血液的补充速率也是相似的。

**结论：**这个发现和以前所报道的关于在不断增长BMI的孕妇中无意硬膜穿刺后降低PDPH的发生率的结论是类似的，甚至控制了分娩产力这一因素。在高BMI和低BMI组中头痛的严重程度和硬膜外血液的补充治疗也是相似的。

(李蔚文译，李士通 审校)

**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/m<sup>2</sup> for prediction of a PDPH. The incidence of PDPH in parturients with a BMI ≥31.5 kg/m<sup>2</sup> (39%) was lower than in parturients with a BMI <31.5 kg/m<sup>2</sup> (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.

## 产科手术中的细胞回收

### Cell Salvage in Obstetrics

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术中细胞回收是减少异体输血的一项战略。传统的来说，在产科手术中细胞回收一直被避免，认为会有羊水栓塞和诱导产妇产生同种免疫的风险。随着细胞回收技术的不断进步，产科手术细胞回收的风险降低到和其他手术相似。在胎盘剥离的时候，胎儿鳞状上皮细胞在血液中被回收的水平可以和孕妇静脉血液相比较。目前并没有明确的羊水栓塞病例报告，而且使用现代化设备也不太可能出现。细胞回收技术是符合成本效益的高利率输血，例如产妇胎盘异常。

(李蔚文 译，李士通 审校)

**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.

## 右美用于儿科影像麻醉时，是否需要预防性使用抗胆碱能药物

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

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**背景：**高剂量使用右美托咪啶是目前唯一的有效用于儿科影像时的镇静药，但是其造成一过性高血压，低血压和心动过缓的风险却不断增加。但是目前没有临床的证据和指南来指导我们是否需要在麻醉前预使用抗胆碱药物。这项实验的目的就是来研究右美镇静前是否需要用抗胆碱药预处理，以及其所造成的血流动力学改变，并比较两者的相同和不同点。我们对唐氏综合症的患儿进行了一个亚组的分析。

**方法：**在这项回顾描述性研究中，我们回顾了163名在MRI检查时接受了右美麻醉的患儿。数据的分析包括了人口统计学、历史上的唐氏综合症、右美输注以后的血流动力学变化（包括心率、收缩压、舒张压），以及抗胆碱能药物的使用（阿托品或胃长宁）。

**结果：**小儿的平均年龄在94.5个月，其中52 (32%)名患儿有唐氏综合症。广义的线性混合效应模型显示，与预处理组相比，没有用抗胆碱药物预处理组的所有患儿都出现了心率和收缩压的显著降低。但两组的舒张压没有明显变化。在扫描的过程中，没有用抗胆碱药物预处理组的心率降低了26.6%，然而预处理组的心率只减少了基线的16.7% ( $P < 0.01$ )。和基线相比，预处理组的最大心率比未预处理组有着明显的增加(20.2% vs 10.4%, respectively;  $P = 0.02$ )。在唐氏综合症组，在扫描期间最大心率有着更夸张的变化，预处理组的最大心率比未预处理组增加了36倍(22% vs 0.6%, respectively;  $P < 0.01$ )。

**结论：**在使用右美前预防性的使用抗胆碱能药物没有任何优点，除了能产生明显的一过性的心率和收缩压的增加，而且和没有用抗胆碱能药物预处理者相比，它在更多的患者中会造成一过性夸张的收缩压。

(李蔚文 译，李士通 审校)

**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.

## 血糖浓度对家兔寒战阈值的影响

### 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术患者中很常见，因为身体的核心温度受到了干扰。但是高血糖对体温调节功能的影响仍是未知的。我们研究了血糖浓度对家兔寒战阈值的影响。

**方法：**对27只家兔用异氟烷进行了浅麻醉，然后随机分配到(1)盐水输液组、(2)胰岛素滴定使血糖浓度维持在60 -100 mg/dL组和(3) 50%的葡萄糖滴定使血糖维持在200 -300 mg/dL组。在结肠放置一个塑料管，用10°C的水灌注，使中心为温度以2 -3°C/h的速度降低。继续冷却，直到采用盲法的研究员发现家兔寒战产生或食管（核心）的温度达到34°C。发生寒战时的核心温度被设为阈值。所有分析均采用SAS9.3版进行（SAS公司，Cary，NC）。

**结果：**盐水输液组的家兔寒战时的核心温度在 $37.2 \pm 0.5^\circ\text{C}$ （平均值±标准差）。给予胰岛素组的核心温度在 $36.3 \pm 1.1^\circ\text{C}$ 。给予葡萄糖组的核心温度在 $38.0 \pm 0.6^\circ\text{C}$ 。寒战阈值的增加受血糖浓度的影响：寒颤阈值( $^\circ\text{C}$ ) =  $0.009$  [血糖浓度 (mg/dL)] +  $35.6$ ,  $r^2 = 0.53$ 。血糖浓度每增加100 mg/dL，寒颤阈值因此增加大约1°C。

**结论：**高血糖会增加家兔的寒颤阈值，而低血糖则相反。

（李蔚文 译，李士通 审校）

**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  $37.2 \pm 0.5^\circ\text{C}$  (mean  $\pm$  SD). Rabbits given insulin shivered at  $36.3 \pm 1.1^\circ\text{C}$ . Rabbits given dextrose shivered at  $38.0 \pm 0.6^\circ\text{C}$ . The shivering threshold increased as a function of blood glucose concentration: shivering threshold ( $^\circ\text{C}$ ) =  $0.009$  [blood glucose concentration (mg/dL)] +  $35.6$ ,  $r^2 = 0.53$ . 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.

### 椎旁阻滞用于腹股沟疝修补术：一项系统回顾和随机对照试验的Meta分析

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

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**背景：**椎旁神经阻滞是一项安全有效的麻醉方法用于开胸和乳房切除术。然而，对于椎旁阻滞用于腹股沟疝修补术却没有系统的回顾和Meta分析。我们来研究比较一下椎旁阻滞和全身麻醉、椎管内麻醉和其他的周围神经阻滞的区别和优缺点。

**方法：**我们分析了来自PubMed、MEDLINE、CENTRAL、EMBASE、CINAHL，直到2015年2月的14例随机对照实验，排除了语言的限制，比较了镇静下进行椎旁阻滞和全身麻醉(135 vs 133 名患者)，椎旁阻滞和椎管内麻醉(191 vs 186 名患者)，椎旁阻滞和其他周围神经阻滞(119 vs 117 名患者)。研究了疼痛评分、术后镇痛的要求、术后恶心呕吐的发生率(PONV)、住院时间、麻醉后监护室通过率、进行阻滞所需要的时间、术中血流动力学变化和尿储留的发生率这些因素。疼痛和镇痛、PONV以及血流动力学指标都采用联合假设检验。所有的分析都采用RevMan 5.2.11版进行 (Cochrane Collaboration, Copenhagen)。Hartung-Knapp-Sidik-Jonkman法用于事后检验。

**结果：**和全身麻醉(证据质量 [QoE]: 高)相比，PVB 减少了PONV的发生率(恶心: 风险比 [RR] = 0.22; 95% 置信区间[CI], 0.05–0.93; 需要治疗者 [NNT] = 4.5; *I*<sup>2</sup> = 15% ; 呕吐: RR = 0.15; 95% CI, 0.03–0.76; NNT = 8.3; *I*<sup>2</sup> = 0%)。和椎管内阻滞(QoE: 高)相比，PVB降低了术后恶心 (RR = 0.34 [95% CI, 0.13–0.91], NNT = 8.3, *I*<sup>2</sup> = 0%)和尿储留(RR = 0.14 [95% CI, 0.05–0.42], NNT = 7.4, *I*<sup>2</sup> = 0%)的发生率。但是进行 PVB 比椎管内麻醉需要更多的时间(标准化平均差 = 1.90 [95% CI, 0.02–3.77], *I*<sup>2</sup> = 92%; 平均差 = 5.33分钟( QoE: 中等)。然而，在疼痛评分和镇痛要求方面，在现有的数据中，PVB和全麻、PVB 和椎管内阻滞(QoE: 低)、PVB 和椎管内阻滞造成的血流动力学改变(QoE:中等)，均不能排除非劣效性假设。我们的系统综述表明，在腹股沟肿块和腹横肌平面肿块切除时，PVB可以减少术后疼痛评分和镇痛的要求。

**结论：**这项Meta分析显示，在腹股沟疝修补术时，PVB是造成较少的不良影响的一种麻醉方法。对于全身麻醉、椎管内麻醉、PVB和其它周围神经阻滞等不同麻醉方法的选择时，我们要参考进行阻滞所需要的时间和阻滞以后相关结构的完全阻滞范围。

(李蔚文 译, 李士通 审校)

**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/systemic 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; *I*<sup>2</sup> = 15% and vomiting: RR = 0.15; 95% CI, 0.03–0.76; NNT = 8.3; *I*<sup>2</sup> = 0%) compared with general anesthesia/systemic 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, *I*<sup>2</sup> = 0%) and urinary retention (RR = 0.14 [95% CI, 0.05–0.42], NNT = 7.4, *I*<sup>2</sup> = 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], *I*<sup>2</sup> = 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/systemic 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.

### 主动脉瓣置换术前服用阿司匹林与术后肺损伤：一项回顾性队列研究

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

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**背景：**急性呼吸窘迫综合征（ARDS）并不是心脏手术术后的常见并发症，但其死亡率却高达 80%。阿司匹林对高危病人有肺损伤保护作用，其机制是通过减少肺内血小板-中性粒细胞聚集。我们假设在主动脉瓣置换术前使用阿司匹林能降低术后 ARDS 的风险。

**方法：**我们进行了一项回顾性的单中心队列研究，研究对象包括 5 年内接受了主动脉瓣置换术的所有成年患者。主要结果变量是术后 ARDS 的发生。次要结果变量是术后最初的 72 小时内最低 PaO<sub>2</sub>/FiO<sub>2</sub> 比值。通过粗略的和倾向性分数调整的逻辑回归分析来预测服用阿司匹林患者发生 ARDS 的相对危险度。亚组分析研究术前使用阿司匹林是否能提高具有明确肺损伤危险因素患者的氧合。

**结果：**在研究期间的 375 例进行主动脉瓣置换术的患者中，181 名患者（48.3%）术前服用了阿司匹林，最大剂量是 81mg（72%）。队列中有 22 例发生了 ARDS（5.5%）。在服用和不服用阿司匹林的患者中，ARDS 的发生率没有显著差异（5.0% vs 6.7%，P = 0.52）。而两者间的最低 PaO<sub>2</sub>/FiO<sub>2</sub> 比值也没有显著差异（P = 0.12）。服用阿司匹林的患者发生 ARDS 的粗略相对危险度是 0.725（99%置信区间 0.229-2.289；P = 0.47），而倾向性分数调整的相对危险度是 0.457（99%置信区间 0.120-1.730；P = 0.13）。

**结论：**在仅有 22 例患者出现 ARDS 的条件限制下，我们的研究中术前服用阿司匹林不会降低主动脉瓣置换术后 ARDS 的发生，也不会提高患者的氧合。

（施芸岑 译 薛张纲 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 PaO<sub>2</sub>/FIO<sub>2</sub> 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 PaO<sub>2</sub>/FIO<sub>2</sub> 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.

### 单肺通气后的肺损伤：一篇机械通气对通气侧肺和萎陷侧肺病理生理影响的综述

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

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肺损伤是胸外科手术后的主要死亡原因。最初意识到肺损伤是在全肺切除术后，它已经被描述在任何时期的单肺通气后，即使没有进行肺切除。尽管，现在认为单肺通气对病理生理的影响更复杂更多样，但仍然认为体内水分过多和高潮气量在不同时间点占主要因素。所有已知通气导致肺损伤的因果机制被认为与单肺通气设置有关。通气侧肺暴露于大的非生理潮气量带来的高压力并失去正常功能残气量。另外，通气侧肺处于氧化应激状态，如同过度灌注造成的毛细血管剪切应力。外科手术操作和/或萎陷侧肺的切除可能导致肺损伤。一贯的单肺通气后，萎陷侧肺重新膨胀时会产生时间依赖性缺血再灌注损伤。保护性通气策略和易挥发的吸入麻醉药可降低肺损伤程度。然而，肺损伤的生化和组织学指标的升高是不可避免的。内皮多糖蛋白质复合物可能代表单肺通气肺损伤的普遍通路，因为它可以被大多数认可的肺损伤机制所破坏。在未来，稳定内皮多糖蛋白质复合物的试验性治疗可能缓解肺损伤。目前，单肺通气时按照 4-5ml/kg 的潮气量保护性通气、5-10cm 水柱的呼气末正压通气及常规的肺复张等保护性策略，以把肺应激压力损伤减到最低。其他减少肺损伤的策略包括常规的吸入麻醉及尽量使单肺通气时间最小化。

(张雪译 薛张纲校)

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 H<sub>2</sub>O, 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设计：一项前瞻性随机临床试验——大手术中两种不同麻醉深度对患者预后的影响。

#### 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：**已发表的 8 篇观察性研究中有 6 篇显示较深的麻醉深度和术后死亡率增加之间有关联，麻醉深度由脑电双频指数（BIS）监测。但这种关联并不一定意味着因果关系。有关麻醉深度的小规模临床试验已经证明麻醉较深的患者谵妄和术后认知功能障碍增加，但在研究死亡率方面缺乏足够的检验力。要明确这种因果关系是否存在需要大规模随机研究。

**方法：**本研究的主要假设是，在年龄≥60 岁全麻下行大手术的人群中，浅麻醉（定义为 BIS 目标值 50，）和深麻醉（定义为 BIS 目标值 35）相较可以减少术后 1 年内全因死亡率。该试验是一项国际多中心、随机、平行、双盲（患者和研究者）的前瞻性、意向性治疗、安全性和有效性研究。浅麻醉组的死亡率预期相对减少 20%，绝对风险从 10% 减少至 8%。效能检验  $\alpha = 0.049$  和  $\beta = 0.2$  计算样本量，每个组需要 3250 个病人。

**结果：**这项研究正在进行中，在 5 个国家的 40 个中心招募了 1325 名患者。预计这项研究将在 3 年内完成。

**结论：**这项随机对照试验可以明确回答在易感患者中滴定调节麻醉深度是否影响患者预后的问题。

（邬其玮 译 薛张纲 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  $\geq 60$  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  $\alpha = 0.049$  and  $\beta = 0.2$  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.

### 对比肺动脉导管热稀释法，esCCO™和 ECOM™监护仪在心脏手术术后患者行肺复张手法时测定心输出量的性能比较

#### 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：**肺复张手法(ARMs)能够减少围术期肺部并发症的发生，同时也会于心输出量(CO)造成短暂影响。这项干扰血流动力学的可重复性操作可用来检验多种监护设备对 CO 急性变化的测定能力。本研究旨在评估 esCCO™ (气管内心输出监护仪) 和 ECOM™ (连续评估心输出监护仪) 两种微创 CO 监护仪用于心脏手术术后患者接受 ARMs 治疗时 CO 变化趋势的测定能力。

**方法：**研究纳入了 27 名术后于监护室接受机械通气治疗的患者。分别在 3 个不同时间点行血流动力学测定：(1) ARM 前，呼气末正压为零时；(2) ARM 过程中维持呼气末正压为 15cmH<sub>2</sub>O 时；(3) ARM 后，呼气末正压为零时。经肺动脉导管间断热稀释法(TDco)测量获得心输出量参照值。在上述各个时间点，记录 3 种方法所测 CO 的平均值以及相应动脉压变化，并以 3 种方法所测 CO 值的变异系数计算各仪器间的精度误差。采用 Bland-Altman 图分析两种试验方法与热稀释法测得的 CO 绝对值的差异。此外，分别以一致性相关系数 4 象限图及极坐标图评价 CO ( $\Delta$ TDco、 $\Delta$ ESco、 $\Delta$ ECco 分别表示 TDco、esCCO、ECOM 测量值的变化) 和平均动脉压 (MAP) 变化的一致性和反应性。极性一致率高于 80%被认为是临床上可接受的。

**结果：**研究共分析了 81 组，每组包括 3 个 CO 测量值。TDco 的精度误差约为 5.1% (四分位间距：2.8-7.1)。esCCO 与 TDco 间均值偏差为 +0.7L/min，一致性范围为 -2.1~+3.5L/min；ECOM 与 TDco 均值偏差为 +0.2L/min，一致性范围为 -2.0~+2.4L/min。 $\Delta$ ECco 与  $\Delta$ TDco 的一致性相关系数 (0.82 [95% 可信区间(CI), 0.72-0.89]) 显著高于 (P=0.0053) $\Delta$ ESco 与  $\Delta$ TDco 的一致性相关系数(0.42 [95% CI, 0.20-0.59])，但和  $\Delta$ MAP 与  $\Delta$ TDco 的一致性相关系数(0.69 [95% CI, 0.54-0.80])间并无显著性差异 (P=0.16)。极坐标图分析表明  $\Delta$ ESco 与  $\Delta$ TDco 角度偏移为  $-29^\circ \pm 38^\circ$ ， $\Delta$ ECco 与  $\Delta$ TDco 为  $-15^\circ \pm 29^\circ$ 。4 象限图分析表明  $\Delta$ ESco 与  $\Delta$ TDco 的一致率为 81%(95% CI, 74-88)， $\Delta$ ECco 与  $\Delta$ TDco 的一致率为 100%。 $\Delta$ ESco 与  $\Delta$ TDco 的极性一致率为 41% (95% CI, 34-48)， $\Delta$ ESco 与  $\Delta$ TDco 为 85% (95% CI, 79-90)。

**结论：**在心脏手术术后的患者中，相较于肺动脉导管温度稀释法，ECOM 与 esCCO 均低估了 ARM 时 CO 的变化。然而  $\Delta$ ECco 的角度限制在临床可接受范围内，在监测 CO 变化方面可能与有创动脉血压效果相仿。相比之下，esCCO 则无法很好地反映 CO 变化。

(俞颖 译 薛张纲 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 H<sub>2</sub>O 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 ( $\Delta$ TDco,  $\Delta$ ESco, and  $\Delta$ ECco 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  $\Delta$ ECco and  $\Delta$ TDco (0.82 [95% confidence interval (CI), 0.72-0.89]) was significantly higher ( $P = 0.0053$ ) than the CCC between  $\Delta$ ESco and  $\Delta$ TDco (0.42 [95% CI, 0.20-0.59]), but not statistically different ( $P = 0.16$ ) than the CCC between  $\Delta$ MAP and  $\Delta$ TDco (0.69 [95% CI, 0.54-0.80]). Polar plot analysis showed an angular bias with radial agreement limits of  $-29^\circ \pm 38^\circ$  between  $\Delta$ ESco and  $\Delta$ TDco and  $-15^\circ \pm 29^\circ$  between  $\Delta$ ECco and  $\Delta$ TDco. Four-quadrant concordance rate was 81% (95% CI, 74-88) between  $\Delta$ ESco and  $\Delta$ TDco and 100% between  $\Delta$ ECco and  $\Delta$ TDco. Polar concordance rates were 41% (95% CI, 34-48) between  $\Delta$ ESco and  $\Delta$ TDco and 85% (95% CI, 79-90) between  $\Delta$ ECco and  $\Delta$ TDco.

**CONCLUSIONS:** Compared to pulmonary artery catheter thermodilution, both ECOM and esCCO underestimate changes in CO during an ARM in postoperative cardiac surgical patients. However,  $\Delta$ ECco 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.

### 药房准备注射器麻黄碱的短缺对术中药物使用的影响

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

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**背景:** 在美国与麻醉有关的用药短缺已经越来越普遍。我们测试用供应商准备的麻黄碱取代药房准备的注射器麻黄碱，麻黄素和去氧肾上腺素术中使用的血流动力学和患者水平的变化与提供商级别的变化有关。

**方法:** 在药房准备的注射器麻黄碱短缺开始的前后 1 个月，在三级医疗中心进行一般和骨科手术患者被列入范围。最低平均动脉血压和最慢的心率作为评估血流动力学的措施。调整后的分组采用混合效应回归与重复测量进行测试。

**结果:** 麻黄碱短缺前有 304 名患者，短缺后有 298 名患者。在麻黄碱短缺期间，相对于之前，至少 1 次麻黄碱的管理是更常见的(148/304 [48.7%] vs 117/298 [39.3%];  $P = 0.0199$ )。在调整了年龄，性别，ASA 评分，手术类型，麻醉提供商，以及手术时间后，在短缺期

间患者不太可能得到麻黄素([RR] = 0.78 [95% {CI}, 0.61-0.96]; P = 0.0198)，更容易获得去氧肾上腺素(RR = 1.27 [95% CI, 1.02-1.51]; P = 0.0357)。在短缺期间，用最慢心率或最低平均动脉血压评估患者的血流动力学没有显著不同。

**结论：**在药店准备的注射器短缺期间，用药管理模式有了一些改变。麻黄素和去氧肾上腺素的作用是明显的;然而对患者血流动力学影响是相当的。如本研究中观察到的，在相对或非绝对的药物短缺期间，供应商的使用模式是敏感的。

(侯君谊 译 薛张纲 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™ 与 LMA-Fastrach™ 声门上气道装置在纤维支气管镜引导下使用 Parker (GlideRite™) 气管插管对比：一项随机对照试验**

### **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)声门上气道装置是一种能够建立可靠气道的方式。其大通气腔使气管插管很容易就能通过。IG 装置可以在麻醉医生使用柔性支气管镜时提供喉入口良好的视野。本前瞻性随机对照研究的目的是比较同样在灵活的纤维支气管镜引导下气管插管，IG 和 LMA-Fastrach™ (FT) 喉罩的成功率。

**方法：**120 例需要进行全身麻醉的患者被随机分为 2 组：IG 组和 FT 组。麻醉诱导后，以当组分配的喉罩插入，以建立气道使患者获得足够的通气。随后我们通过声门上装置进行

纤维支气管镜引导下气管插管。气管插管和喉罩插入成功率以及完成这些操作所需的时间被记录下来。每次插管尝试中看到的喉入口景象均被分级。

**结果：**每组分配 60 例病人。IG 组和 FT 组的插管成功率类似（首次尝试成功率分别为 100% 与 95%， $P=0.12$ ）。与 FT 相比，IG 组的插管所需时间则显著降低（ $30\pm 11$  秒相对  $50\pm 21$  秒； $P<0.0001$ ）。IG 组声门视野情况更好，1 级有着更高的百分比（63.3% 对 3.3%； $P<0.0001$ ），而 3 级有较低的百分比（1.7% 对 60.0%， $P<0.0001$ ）。

**结论：**使用 IG 声门上气道装置作为柔性支气管镜引导下气管插管的的成功率与 FT 喉罩类似。然而，与 FT 喉罩相比，IG 装置可以为插管提供更好的声门口视野以及缩短插管时间。

（杨晓迪 译 薛张纲 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 ( $30 \pm 11$  seconds vs  $50 \pm 21$  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™.

普通喉镜与可视喉镜用于气管导管交换的对比：高风险呼吸道障碍病人的声门可视化，成功率，并发症以及救援方案

### 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：**气管导管交换是一项简单的概念然而并不是一种简单的过程，因为低氧血症，导管误入食道，以及失去气道都有致命的影响。将喉镜与呼吸道交换导管（AEC）结合用于气管导管交换可能能够减少风险。喉镜可用于交换前检查和开出一条气管内导管通道（ETT）。直接喉镜（DL）因为“视线”而受到限制；因此，会造成气道评估和气管导管交换的盲操作，这样也造成了交换导管的难度以及并发症。我们假设曾经用过直接喉镜用于气管导管交换的气道高风险患者，当用可视喉镜（VL）时，相对于直接喉镜（DL），

可为气道评估提供更好地声门暴露，以及用可视化气道交换导管方法交换气管内导管可减少导致气道和血流动力学并发症的风险。

**方法：**危重病人在气管导管交换前需要在直接喉镜的辅助下进行气道评估。假如在直接喉镜辅助下交换前气道评估为“暴露差”，这些患者在用可视喉镜气道评估后可用可视喉镜进行气管导管交换。我们将直接喉镜下的气道评估与可视喉镜下的气道评估进行比较。我们分析了用于气管内导管交换所做的尝试，并发症及救援设备。然后，这些交换结果将与一组历史对照组病人作对比，这些病人在直接喉镜（DL）辅助预交换呼吸道评估中被评定为暴露不佳，并采用了直接喉镜（DL）+呼吸道交换导管（AEC）辅助交换。这种呼吸道评估方法及气管内导管通道（ETT）由一个来自麻醉部门的或有麻醉援助能力的职业麻醉医生执行。

**结果：**328 个在原先的采用直接喉镜（DL）评估中被认定为暴露不佳的病人与在历史对照组（DL+AEC）中视线清晰的 337 个病人对比，之后做了可视喉镜（VL）。大部分（88%）的病人可以在可视喉镜检查中做到完全或者接近完全的暴露。气管内导管通道（ETT）交换的初步成功率在 VL 组中更大（跟 DL 对比为 91.5% 对 67.7%， $P=0.0001$ ）需要尝试 3 次以上的病人的数量更低（与 DL 对比为 1.2% 对 6.8%， $P=0.0003$ ）。在与历史对照 DL+AEC 组病人对比时，中度及重度低氧血症的发病率的相对差异，气管导管误入食道，心动过缓以及呼吸道救援设备干预需求将在 VL 交换过程中被监测。

**结论：**这些发现支持了这样的假设：可视喉镜在呼吸道评估中可以更好的暴露声门，并能减少气管内导管（ETT）交换过程中的呼吸道及血流动力学的并发症。通过提高声门可视化得到更高效及时的气管内导管通道，此法已在利用呼吸道交换导管完成气管内导管交换中得到验证。更多的抢救呼吸道的尝试将会增加交换所带来的并发症的数量。由此得出结论，采用 VL+AEC 交换导管将会减少尝试次数和并发症，并且这个尝试次数是与美国社会麻醉呼吸道困难任务组织限制喉镜尝试的推荐次数是一致的。基于可视喉镜的预交换气道评估，不仅对于计划内的交换，对于发现无法识别的呼吸道疾病，如部分或者完全的自拔管，也将是一种有效的评估方法。

（王洁 译 薛张纲 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术中对脑诱发电位无影响

#### Dexmedetomidine Does Not Affect Evoked Potentials During Spine Surgery

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**背景：**右美托咪啶对脑诱发电位（EPs）的影响尚未阐明，本研究旨在证明右美托咪啶对躯体感觉，运动和视觉脑诱发电位的影响。

**方法：**经机构委员审查会批准，40位成年病人纳入研究，进行选择性的脊柱手术，使用异丙酚和瑞芬太尼进行全静脉麻醉，随机分配两组使用右美托咪啶或安慰剂，以达成一个双盲安慰剂对照试验。在进行知情同意，分配入组，基线脑诱发电位记录后，患者随机接受超过10分钟的右美托咪啶  $0.6\mu\text{g}/\text{kg}/\text{h}$  静脉注射或相同剂量普通盐水静脉注射。在研究开始后30-90分钟之间检测EP记录为T1，在120-180分钟之间检测EP记录为T2。两组EP潜伏期（ms）及振幅（ $\mu\text{V}$ ）从基线到T1（初级终点）和从基线到T2（二级终点）的改变进行比较。数据用均数+标准差表示（95%可信区间）。

**结果：**对40位病人的数据进行分析（右美托咪啶组： $n=20$ ；年龄  $54\pm 3$ 岁；10名男性，对照组： $n=20$ ；年龄  $52\pm 2$ 岁，5名男性）。初级终点两组无统计学差异：T1躯体感觉EPs改变，潜伏期： $0.01\pm 1.3$  (-0.64, 0.65) vs  $0.01\pm 1.3$  (-0.64, 0.65),  $P = 0.43$  (-1.24, 0.45)；振幅： $0.03\pm 0.14$  (-0.06, 0.02) vs  $-0.01\pm 0.13$  (-0.07, 0.05),  $P = 0.76$  (-0.074, 0.1)；T1运动EPs振幅： $65.1\pm 194.8$  (-35, 165;  $n = 18$ ) vs  $109.2\pm 241.4$  (-24, 243;  $n = 16$ ),  $P = 0.57$  (-113.5, 241.57)；T1视觉EPs（右眼），振幅： $2.3\pm 3.6$  (-0.4, 5.1;  $n = 11$ ) vs  $0.3\pm 6.0$  (-3.3, 3.9;  $n = 16$ ),  $P = 0.38$  (-6.7, 2.6)；潜伏期N1： $2.3\pm 3.6$  (-0.4, 5.1) vs  $0.3\pm 6.0$  (-3.3, 3.9),  $P = 0.38$  (-6.7, 2.6)；潜伏期P1： $-1.6\pm 13.4$  (-11.9, 8.7) vs  $-1.4\pm 8.1$  (-6.3, 3.5),  $P = 0.97$  (-9.3, 9.7)。二级终点两组各数据之间比较也无统计学差异。无论T1还是T2在左右眼的视觉EPs均无差异。

**结论：**临床相关剂量下，将右美托咪啶作为静脉麻醉辅助用药并不会改变EPs，因此其可以在EPs监测下安全用于外科手术。

（仪修文译 薛张纲校）

**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 remifentanyl 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  $\mu\text{g}/\text{kg}$  infused over 10 minutes, followed by 0.6  $\mu\text{g}/\text{kg}/\text{h}$ , or a corresponding volume of IV normal saline (placebo). EP measures at  $60 \pm 30$  minutes after initiation of study drug were defined as T1 and at  $150 \pm 30$  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  $\pm$  SD (95% confidence interval).

**RESULTS:** Data from 40 patients (dexmedetomidine: n = 20; age,  $54 \pm 3$  years; 10 males; placebo: n = 20; age,  $52 \pm 2$  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:  $0.01 \pm 1.3$  (-0.64, 0.65) vs  $0.01 \pm 1.3$  (-0.64, 0.65), P = 0.43 (-1.24, 0.45); amplitude:  $0.03 \pm 0.14$  (-0.06, 0.02) vs  $-0.01 \pm 0.13$  (-0.07, 0.05), P = 0.76 (-0.074, 0.1); motor EPs amplitude at T1:  $65.1 \pm 194.8$  (-35, 165; n = 18) vs  $109.2 \pm 241.4$  (-24, 243; n = 16), P = 0.57 (-113.5, 241.57); visual EPs at T1 (right eye), amplitude:  $2.3 \pm 3.6$  (-0.4, 5.1; n = 11) vs  $0.3 \pm 6.0$  (-3.3, 3.9; n = 16), P = 0.38 (-6.7, 2.6); latency N1:  $2.3 \pm 3.6$  (-0.4, 5.1) vs  $0.3 \pm 6.0$  (-3.3, 3.9), P = 0.38 (-6.7, 2.6); latency P1:  $-1.6 \pm 13.4$  (-11.9, 8.7) vs  $-1.4 \pm 8.1$  (-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黄体酮改变成年后术后的痛觉过敏反应：一项雌性大鼠研究

#### 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：**目前早产儿的存活率有显著上升，而进行宫内手术的量也有所增加。新生儿时期受到的有害刺激会引起成年后对疼痛反应的改变。已知孕妇体内含有高浓度的黄体酮，而黄体酮同时是一种有效的抗痛觉过敏药物。因而，我们研究出生早期使用黄体酮对成年大鼠术后的影响。

**方法：**选择雌性新生大鼠在出生后的 1 到 7 天内 (P1-P7) 分别注射黄体酮或溶剂。第二对照组则不进行注射。每组中一半的大鼠在 P3 时接受后爪切割手术而另一半则没有。在 P60 时大鼠成年，所有组内的大鼠都受到一次后爪切割手术。我们对大鼠进行触觉敏感性和热敏感性的测试，在 P14-P42 每周进行一次 (第一阶段)，在 P60 受到第二次损伤刺激前进行一次以及在 P61-P70 每两天进行一次 (第二阶段)。在 P67，将大鼠注射多聚甲醛固定后取出脊髓染色并通过免疫细胞化学方法分析活化 p-p38 丝裂原活化蛋白激酶。

**结果：**在 P3 时接受手术的大鼠在第一阶段的触觉和热敏感性都高于非手术大鼠，但在注射黄体酮的大鼠组内则没有这种差异。P3 时受到的切割刺激也导致在 P60 的切割刺激后 (第二阶段) 持续的触觉和热的高敏性，而在早期注射黄体酮的组内，疼痛的程度显著降低并且疼痛消退的速度更快。即使在第一阶段没有接受手术刺激的大鼠中，出生时注射黄体酮减弱了第二阶段中的触觉高敏性。脊髓细胞染色中，溶剂注射组的大鼠表现出更多的 p-p38 提示出生早期受到损伤刺激，但在黄体酮注射组内则没有这种表现。

**结论：**我们的结果提示子宫内的高内源性黄体酮水平可能有相同的保护作用以及新生儿的黄体酮水平能极大地影响伤害性刺激传导通路的发育。

（施芸岑 译 薛张纲 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.

### 黏弹性参数 $\alpha$ -角能否鉴别纤维蛋白原和血小板缺乏并指导纤维蛋白原补充?

#### Can the Viscoelastic Parameter $\alpha$ -Angle Distinguish Fibrinogen from Platelet Deficiency and Guide Fibrinogen Supplementation?

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作为一项床边检验项目，全血的黏弹性试验，例如血栓弹力图 (TEG<sup>®</sup>, Haemoscope Inc., Niles, IL) 和血栓弹力测定 (ROTEM<sup>®</sup>, Tem International GmbH, Munich, Germany)，正在被越来越多地运用于描述凝血障碍状态和指导止血治疗。TEG<sup>®</sup> 专利 (发表于 2004 年) 提出了基于单一分析 (高岭土活化分析) 的一种算法，其得出的  $\alpha$ -斜率和最大振幅参数分别用来指导纤维蛋白原补充和血小板管理。虽然 TEG<sup>®</sup> 和 ROTEM<sup>®</sup> 的仪器都能做到多重分析，但是基于 TEG<sup>®</sup> 的单一分析算法仍然在很多机构中使用。最近研究讨论了单一分析方法的局限性和不准确性。研究表明  $\alpha$ -角和最大振幅参数都反映了纤维蛋白原和血小板形成血栓强度的综合作用。因此，虽然 TEG<sup>®</sup> 单一分析可用于识别凝血障碍状态，但无法被用于鉴别纤维蛋白 (纤维蛋白原) 和 (或) 血小板的缺陷。反之，两种黏弹性方法同时进行测定，一项加入而另一项不加血小板抑制剂，能切实辨别特定的凝血障碍状态，如纤维蛋白形成不足或血小板形成血栓强度不足。这些信息是选择适当止血治疗的关键。

（刘洋 译 陈杰 校）

Viscoelastic tests such as thrombelastography (TEG<sup>®</sup>, Haemoscope Inc., Niles, IL) and thromboelastometry (ROTEM<sup>®</sup>, 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<sup>®</sup> patent (issued in 2004) where the  $\alpha$ -angle and the maximum amplitude parameters are used to guide fibrinogen supplementation and platelet administration, respectively. Although multiple assays for both the TEG<sup>®</sup> and ROTEM devices are now available, algorithms based on TEG<sup>®</sup> 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  $\alpha$ -angle and maximum amplitude parameters reflect the combined contribution of fibrinogen and platelets to clot strength. Therefore, although TEG<sup>®</sup> 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.

### 持续硬膜外输注左旋布比卡因和罗哌卡因的静脉药代动力学对比研究：一项前瞻、随机、多中心、双盲、对照试验

#### 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：**与静脉注射阿片类药物相比，硬膜外输注左旋布比卡因和罗哌卡因可以为患者提供足够的术后镇痛同时减少药物副作用，并提高患者预后。药代动力学比药物的客观副作用能更好地评价不同药物的安全性。由于左旋布比卡因和罗哌卡因的药代动力学特性不同，本研究主要目的是研究两种药物在同一人群的硬膜外持续输注过程中是否具有不同药代动力学特性。此项随机对照双盲多中心试验，比较对接受大型腹部、泌尿外科、妇科手术的成年患者进行 0.125%左旋布比卡因或 0.2%罗哌卡因持续硬膜外输注作为术后镇痛管理的药代动力学特征。本研究主要通过变异系数（CV）评估左旋布比卡因和罗哌卡因的系统风险和个体差异的等效值，及预测两种药物在持续硬膜外输注后血浆药物浓度的可能差异。

**方法：**181 名接受腹部大手术的成年患者随机分成两组，分别接受硬膜外输注 0.125%左旋布比卡因 +0.75  $\mu\text{g}/\text{mL}$  舒芬太尼或 0.2%罗哌卡因+0.75  $\mu\text{g}/\text{mL}$  舒芬太尼，持续 48 小时。主要终点指标是在 48 小时持续硬膜外输注期间，通过在 15%变异系数范围内的曲线下面积分析左旋布比卡因和罗哌卡因的血浆药物浓度变异性。变异系数反映局麻药物相对中值浓度的离散情况，从而提示预测血浆药物浓度的可靠程度。次要终点指标是评价包括平均血浆药物浓度峰值分析在内的局麻药药理学特性，同时评价血浆清除率、副作用、疼痛程度（通过数字化量表评估，比如，静态数字化量表和动态数字化量表）和需要解救剂量的次数。

**结果：**两组 CV 的差异无统计学意义：即曲线下面积的差异在 15%范围内。左旋布比卡因的变异系数为 0.54，罗哌卡因为 0.51（ $p=0.725$ ）。罗哌卡因的血浆药物浓度达峰比左旋



布比卡因更迅速。罗哌卡因的清除速率随病人年龄的增长而降低。两组之间的静态数字评定量表、动态数字评定量表分数、解救次数以及副作用情况均无统计学意义。

**结论：**考虑变异系数，成年患者接受持续硬膜外输注左旋布比卡因和罗哌卡因的血浆药物浓度个体差异性是一致的。本研究发现罗哌卡因的清除随着患者年龄增长而减弱，但是这个发现也有一些局限性。48 小时的输注时间并未达到稳态血药浓度。由于可能达到中毒水平，左旋布比卡因和罗哌卡因持续输注 48 小时以上的血浆药物浓度特性还需进一步研究。总之，两种药物局部麻醉在临床效能和副作用发生率两方面均无显著差异。

(杨中伟 译 陈杰 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  $C_{max}$  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.

关于七氟烷麻醉下 Sugammadex 逆转哌库溴铵介导的中度神经肌肉阻滞的一项随机试验

## 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：**哌库溴铵是一种甾体类神经肌肉阻滞剂。Sugammadex 是一类可与肌松剂结合的  $\gamma$ -环糊精衍生物，能逆转罗库溴铵、维库溴铵和泮库溴铵的药理作用。本研究目的是考察 sugammadex 可否能逆转哌库溴铵介导的中度神经肌肉阻滞（NMB），以及其所需要的剂量。

**方法：**此项单中心、随机、双盲、包含 5 个平行实验组的研究纳入 50 名接受异丙酚、七氟烷、芬太尼和哌库溴铵全麻的患者。根据国际标准使用加速度监测仪（TOF-Watch SX®）进行神经肌肉功能监测。当 NMB 自行恢复到 TOF 值等于 2 时，患者随机接受 1.0、2.0、3.0、4.0mg/kg 的 sugammadex 或安慰剂。主要终点指标为从注射 sugammadex 到标准化 TOF 值恢复至 0.9 时所需时间。次要终点指标为从注射 sugammadex 到最后 T1 所需时间。同时评估术后神经肌肉功能状况。

**结果：**所有接受 sugammadex 注射的患者 5 分钟内标准化 TOF 比值恢复至 0.9（最小剂量的 95%可信区间下限为 70.1%；所有剂量的则为 90.8%），其中 79%患者在 2 分钟内标准化 TOF 比值恢复至 0.9（最小剂量的 95%可信区间下限为 26.7%；所有剂量的则为 63.7%）。在 TOF 数分钟后 T1 也恢复正常。术后未发现残余 NMB。

**结论：**Sugammadex 可充分和迅速逆转七氟烷麻醉下哌库溴铵介导的中度 NMB。给予哌库溴铵后当 TOF 值自发恢复到 2 时，2.0mg/kg 剂量的 sugammadex 即能有效逆转 NMB。

（宣伟 译 陈杰 校）

**BACKGROUND:** Pipecuronium is a steroidal neuromuscular blocking agent. Sugammadex, a relaxant binding  $\gamma$ -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

外科监护改进计划（SCIP）抗生素指南：是否能不流于美好愿望？

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

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从 2006 年起，外科监护改进计划（SCIP）提出 3 项术前抗生素使用的指导意见，以减少手术部位感染发生。尽管指导意见被证明是有效的，但 SCIP 的努力并没有使感染率确实下降。本文提出了 3 项 SCIP 没有达到预期目标的原因。建议重新定位改善治疗方案，包括关注减少报道，鼓励坚持未完成的检测指标，创建更多的地区性合作完善治疗方案指导临床。最终只有通过提高每一个临床医生的积极性，在专业方面不断的练习，在挑战性工作中认识到失败，并且反复训练直至通向成功。

（冯羽敬 译 陈杰 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.

### 使用纳洛酮来评估迟发性术后呼吸抑制的预测因素

#### Predictors of Delayed Postoperative Respiratory Depression Assessed from Naloxone Administration

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**背景：** 本研究目的是确定患者和手术特征与需要纳洛酮干预的术后呼吸抑制或镇静之间的关系。

**方法：** 纳入 2008 年 7 月 1 日至 2010 年 6 月 30 日期间，以拮抗麻醉监护（从恢复室转出或是从手术室转入术后区域）后 48 小时内阿片类药物引起的呼吸抑制或镇静作用而接受纳洛酮治疗的患者。每位患者根据年龄、性别和确切的手术方式与两个同年的对照者相匹配。制作图表审查与纳洛酮干预风险相关的患者、麻醉和手术因素。另外确认在麻醉恢复第一阶段出现呼吸系统不良反应（通气不足，呼吸暂停，血氧饱和度下降，疼痛/镇静不匹配）的所有患者。考虑到 1：2 组匹配的病例对照研究设计，故进行条件 Logistic 回归来评估与纳洛酮使用相关的患者和手术特点。

**结果：** 确认使用纳洛酮 134 例，58% 发生在麻醉监护结束后 12 小时内，发生率为千分之 1.6 的（95% 的可信区间，1.3-1.9）。阻塞性睡眠呼吸暂停的发生（比值比 OR=2.45；95% CI，1.27-4.66；P=0.008）和对在恢复室呼吸不良事件的诊断（OR = 5.11；95% CI, 2.32–11.27；P < 0.001）均与纳洛酮使用的风险增加，以治疗麻醉监护结束后出现的呼吸抑

制或镇静相关。麻醉监护结束后，接受纳洛酮治疗的患者使用了更大中位数剂量的阿片类药物（10 [四分位间距，0-47.1] VS 5 [0-24.8]吗啡当量，P = 0.020）和更多与镇静副作用相关的药物（n= 41 [31%] VS 24 [9%]; P <0.001）。

**结论：**在恢复室出现阻塞性睡眠呼吸暂停和呼吸不良事件预示着使用纳洛酮来拮抗麻醉监护结束后出现的呼吸抑制或镇静风险增加。此外，接受纳洛酮治疗的患者往往在麻醉监护结束后使用了更多的阿片类药物和其他镇静药物。此项研究结果表明对于这些患者，麻醉监护结束后应继续加强监测可能是有益的。

（冯迪 译 陈杰 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.

### 未雨绸缪：对死产和畸形胎儿进行晚期终止妊娠的看法

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

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准妈妈和他们的配偶们准备了几个月来热切地欢迎他们期待已久的宝宝来到他们的家庭。而死产或者可能危及胎儿生命的胎儿畸形的诊断结果对受其影响的母亲和他们的家庭来说是一个可怕的故事。从诊断到采取干预措施（即引产死胎或对畸形胎儿终止晚期妊娠），患者经常感到无助和被抛弃，会对许多人有长期的心理和情绪的影响。产科知识管理，道德和医学的挑战，心理学方面近几年来有所发展。熟悉相关新兴知识使产科麻醉医生更好



地提供有效的移情关怀。考虑到临产妇的复苏需要，碰到这类经历过死胎或致命胎儿畸形的妇女促使麻醉医生对临产关怀的现有证据进行总结陈述。

(程鑫宇 译 陈杰 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.

### 腹横肌平面阻滞与骶管阻滞在小儿下腹部手术中的应用比较：一项双盲随机对照试验

#### 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：**腹横肌平面阻滞（TAPB）作为一种安全而有效的区域阻滞方法，为术后提供了良好的下腹部镇痛。腹横肌平面阻滞的相关并发症较少，与被认为是小儿下腹部区域阻滞金标准的骶管阻滞相比，其整体风险更低。此项研究假设 TAPB 初期的镇痛效果与骶管阻滞效果相当，并且镇痛持续时间更优于骶管阻滞。

**方法：**本研究是一项双盲随机对照试验。研究对象为 45 名 1 至 9 岁，需通过低横切口行双侧输尿管再植手术的小儿。行阻滞后的 24 小时中，每隔 6 小时在麻醉后监护室（PACU）中记录每名患者的镇痛需求、疼痛评分（FLACC/Wong-Baker FACES）、呕吐发作和解痉需要。本研究方法针对所有患儿采用多模式的疼痛管理方式，包括区域阻滞、酮络酸、吗啡以及解痉药奥昔布林的按需使用。

**结果：**在前 12 小时中各组患者吗啡的需求量均无显著的统计学差异（恢复室中 6 小时和 12 小时，所有  $P \geq 0.68$ ）。24 小时后 TAPB 组的患儿所需的吗啡量少于骶管阻滞组（ $0.05 \text{ mg/kg} \pm 0.06$  vs  $0.09 \text{ mg/kg} \pm 0.07$ ,  $P = 0.03$ ）。TAPB 组在 18 和 24 小时的呕吐发生率更低（6 vs 1,  $P = 0.03$ ; 9 vs 2,  $P = 0.02$ ）。TAPB 组在 PACU 中的疼痛评分（0-10）较高（ $3.46 \pm 2.69$  vs  $1.71 \pm 2.1$ ,  $P = 0.02$ ），但在后面的时间点中两组间没有统计学差异（ $P \geq 0.10$ ）。TAPB 组在 24 小时中所需的膀胱解痉剂奥昔布林的量更大（ $0.49 \pm 0.58$  vs  $0.28 \pm 0.17$ ,  $P = 0.003$ ）。

**结论：**正如累积阿片类药物需求量，即主要研究终点，所显示出的两组统计学差异那样，TAPB 组患者在行阻滞后 6 到 24 小时内的阿片药物使用量下降，其麻醉效果优于骶管阻滞。而 TAPB 组的呕吐发生率下降也进一步证实阿片的使用量的减少。TAPB 的 24 小时 PACU 疼痛评分和奥昔布林的用量均高于骶管阻滞，尽管 TAPB 不如骶管阻滞能更好地抑制术后的膀胱痉挛，但可以通过临床上实施规范的解痉药物的使用来弥补这一缺陷。基于 TAPB 较骶管阻滞的整体安全优势，被认为是下腹部手术的首选区域阻滞方法。

(杨渝汀 译 陈杰 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  $P \geq 0.68$  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 ( $0.05 \text{ mg/kg} \pm 0.06$  vs  $0.09 \text{ mg/kg} \pm 0.07$ ,  $P = 0.03$ ). 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 ( $3.46 \pm 2.69$  vs  $1.71 \pm 2.1$ ,  $P = 0.02$ ), but there were no significant differences at all subsequent time points (all  $P \geq 0.10$ ). The TAPB group also had a higher requirement for the bladder antispasmodic oxybutynin at 24 hours ( $0.49 \pm 0.58$  vs  $0.28 \pm 0.17$ ,  $P = 0.003$ ).

**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.

### 利用血栓弹力计对小儿先心病患者行速率曲线测量以量化纤维蛋白溶解程度

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

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**背景：**本研究假设血栓弹力计(ROTEM®, Tem International GmbH, Munich, Germany)测得的血凝块振幅(A)和弹性(E)变化拟合得到的速率参数可以更准确地检测接受先天性心脏病纠正术患儿全血的纤溶风险。

**方法：**在全身麻醉诱导后获得患者的全血标本。对以下七种状态进行了研究：正常对照血(作为基线)和含不同渐进浓度的组织型纤溶酶原激活物(t-PA)(102, 255, 512, 1024, 1535, 2539个单位/毫升)的样血。使用ROTEM数据,在基于不同时间点间血凝块振幅和弹性变化来计算速率曲线。分析得出以下参数：基于血栓幅度或弹性变化的血栓形成最大速率,基于血栓幅度变化的血栓裂解最大速率(MTL),基于血栓弹性变化的血栓

裂解最大速率(MTLe)。将这些参数与最大血凝的裂解参数进行比较并一直观察到凝固时间后的 30 分钟 (LI30, 百分率)。

**结果：**当 t-PA 大于 255 单位浓度/毫升时，LI30 (平均差, 255 单位/ mL 相较于基线, -31.05%,  $P < 0.0001$ ) 和基于血栓振幅的血栓形成最大速率 (平均差, 255 单位/ mL 对基线, -7.5,  $P = 0.005$ ) 开始减小。当 t-PA 大于 512 单位浓度/毫升时，基于弹性的血栓形成最大速率 (平均差, 512 单位/ mL 对基线, -10.9,  $P = 0.010$ )、MTL (平均差, 255 单位/毫升相对于基线, -3.2,  $p = 0.016$ ) 和 MTLE (平均差, 255 单位/ mL 相对于基线, -7.8,  $p = 0.004$ ) 发生变化。当 t-PA 浓度 $\geq$ 512 单位/毫升，血栓不再形成。为了检测最小的纤溶活化，LI30、MTL 和 MTLE 之间的受试者特征曲线下面积没有显著差异 (102 单位/ mL; 分别为 0.74、0.75 和 0.72,  $P = 0.708$ )，而灵敏度和特异性的极值：LI30 以 97% 为界值，MTL 以 -0.3 为界值和及 MTLE 以 -0.5 为界值，它们的敏感度和特异度分别为 52% 和 85%、83% 和 45% 及 83% 和 45%。

**结论：**基于血栓振幅或血栓弹性变化的速率曲线可为血液中血凝块形成和溶解提供客观的动力学量度指标，并能检测即使是轻微的纤溶。但还需要进一步研究，以评估这些参数的临床意义。

(袁亚伟 译 陈杰 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  $\geq$  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  $\geq$  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  $\geq$  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.

运用大鼠皮肤切口模型研究度洛西丁对痛觉异常和痛觉过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：**度洛西丁是一种对重度抑郁症有效的抗抑郁剂，同时也是糖尿病性周围神经病变、慢性骨骼肌疼痛和纤维组织肌痛患者缓解疼痛的良药。度洛西丁在缓解疼痛方面的作用机制尚不清楚。本次研究提出，度洛西丁是否可通过全身以及局部机制起到镇痛作用。

**方法：**在大鼠的皮肤作切口后，对在切口处皮下注射布比卡因和度洛西丁后抑制术后疼痛的疗效进行比较。对侧和腹膜内的注射是用来评估度洛西丁全身的效果。局麻作用是通过在大鼠坐骨神经功能的阻滞来分析的。度洛西丁对钠通道的抑制作用主要表现在大鼠的GH3细胞上。

**结果：**研究显示，在皮肤作切口后，皮下注射 2mg 的度洛西丁可以减轻几天的痛觉异常和痛觉过敏，而皮下注射 2mg 布比卡因并无此作用。在对侧注射 10mg 度洛西丁对术后疼痛缓解只有极小的作用。只有用了较高剂量（10 到 20mg），腹膜内注射度洛西丁才可以减轻痛觉异常和痛觉过敏。通过坐骨神经阻滞，度洛西丁（2mg）可以抑制运动和疼痛感觉功能大约 24 小时，同时也可以用 50% 的抑制浓度  $30.4 \pm 1.2 \mu\text{M}$  和  $4.26 \pm 0.19 \mu\text{M}$ （ $n=8$ ）分别使通道静止和快速灭活来减少钠电流。此外当受到 5Hz 刺激时，度洛西丁（ $10 \mu\text{M}$ ）产生阻断近 70% 的钠电流峰值。

**结论：**此研究显示度洛西丁可以起到局麻的作用，也是一种可以全身和局部应用的镇痛剂。由于度洛西丁可以高效地抑制神经元的钠电流，当它作用于许多中枢神经系统和外周靶点时，可以通过抑制由神经末梢损伤引起的自发神经冲动，发挥其抵抗痛觉过敏的作用。

（李悦 译 陈杰 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  $\text{Na}^+$  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  $\text{Na}^+$  currents with 50% inhibitory concentrations of  $30.4 \pm 1.2 \mu\text{M}$  and  $4.26 \pm 0.19 \mu\text{M}$  ( $n = 8$ ) for resting and fast-inactivated channels, respectively. Furthermore, duloxetine ( $10 \mu\text{M}$ ) elicited additional use-dependent block of peak  $\text{Na}^+$  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  $\text{Na}^+$  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.