

肝移植手术围术期高血糖或血糖波动与术后急性肾损伤的关系：一项回顾性观察研究

**Association Between Perioperative Hyperglycemia or Glucose Variability and Postoperative Acute Kidney Injury After Liver Transplantation: A Retrospective Observational Study**

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**背景：**肝移植术中和术后早期的血糖调控较为困难。在重症患者中高血糖和血糖波动可能与急性肾损伤（AKI）的发生有关。通过此项回顾性研究来验证以下假设：围术期血糖水平（以时间加权的平均血糖水平和血糖波动值代表）是肝移植患者术后 AKI 发生的独立相关因素。

**方法：**以肝移植术中和术后 48h 内的血糖水平为基准，根据时间加权的血糖平均水平将成人肝移植受体分成 4 组：正常血糖组（80-200 mg/dL）、轻度高血糖组（200-250 mg/dL）、中度高血糖组（250-300 mg/dL）和重度高血糖组（>300 mg/dL）。同时根据以血糖测值的标准差定义的血糖波动情况将患者分入 4 个分位数。主要预后指标为术后 AKI 的发生。

**结果：**肝移植术后 AKI 的发生更常见于围术期血糖波动较大的患者（与第 1 四分位数相比，第 3 四分位数的比值比为 2.47, [95% 置信区间, 1.22-5], P=0.012；与第 1 四分位数相比，第 4 四分位数的比值比为 2.16, [95% 置信区间, 1.05-4.42], P = 0.035）。

**结论：**此研究提示围术期血糖波动增加而非高血糖是肝移植受体术后 AKI 发生的独立危险因素。

（戴依利 译 陈杰 校）

**BACKGROUND:** Glucose control can be difficult in the intraoperative and immediate postoperative period of liver transplantation. Hyperglycemia and glucose variability have been associated with acute kidney injury (AKI) in critically ill patients. We performed a retrospective study to test the hypothesis that perioperative glucose levels represented by time-weighted average glucose levels and glucose variability are independently associated with the incidence of postoperative AKI in patients undergoing liver transplantation.

**METHODS:** On the basis of blood glucose levels during liver transplantation and the initial 48 hours postoperatively, adult liver transplant recipients were classified into 4 groups according to their time-weighted average glucose: normoglycemia (80-200 mg/dL), mild hyperglycemia (200-250 mg/dL), moderate hyperglycemia (250-300 mg/dL), and severe hyperglycemia (>300 mg/dL) group. Patients were also classified into quartiles depending on their glucose variability, defined as the standard deviation of glucose measurements. The primary outcome was postoperative AKI.

**RESULTS:** AKI after liver transplantation was more common in the patients with greater perioperative glucose variability (first versus third quartile; OR, 2.47 [95% CI, 1.22-5.00], P = .012; first versus fourth quartile; OR, 2.16 [95% CI, 1.05-4.42], P = .035).

**CONCLUSIONS:** Our study suggests that increased perioperative glucose variability, but not hyperglycemia, is independently associated with increased risk of postoperative AKI in liver transplantation recipients.

机械通气病人脉搏血氧仪监测的进展

**Advanced Uses of Pulse Oximetry for Monitoring Mechanically Ventilated**

## Patients

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脉搏血氧仪是临床上监测手段中一项毋庸置疑的标准方法，它将分光光度测定法和容积描记法相结合检测低氧血症，用于诊断、监测以及随访心血管疾病。脉搏血氧仪对机械通气病人监测以及评估呼吸和循环状态非常有用。一方面，通过关键的光谱衍生技术进行持续、无创动脉血氧饱和度（SpO<sub>2</sub>）监测可以评估特定通气治疗方案下患者的气体交换情况。测得数据有助于防止病人低氧，设置适当的呼吸机参数和吸入气中氧浓度分数。然而，当患者吸入高于正常的氧时，SpO<sub>2</sub>可以掩盖机械通气患者存在的氧合不足。这种局限性来源于氧合血红蛋白饱和度S型曲线，可以通过控制性、逐步降低吸入氧分数的方式改善，从而不需要采集血液就可获得SpO<sub>2</sub>/FIO<sub>2</sub>图形，进一步得出患者气体交换、肺内分流、低通气/血流比的粗略情况。另一方面，光电容积脉搏波检测的血氧功能很少被用于监测机械通气患者的血液动力学。光电容积脉搏波分析的数据能提供正压通气期间心肺相互作用的有效、实时、无创信息。血流动力学检测和前负荷评估和血管阻力相关，前者主要依赖于光电容积脉搏波信号分析得到的呼吸变异度数值，而后者用于检测光电容积脉搏波的振幅、波形、衍生指数的变化。本文提出并描述脉搏血氧仪衍生的监测功能，提出一个更全面的监测概念，即监测机械通气患者生命体征时充分利用脉搏血氧测量。如果这样高级的功能应用于临床，现在的监测技术将会得到改进。未来的发展和临床评估需要先进的脉搏监测手段。

(傅丹云 译 陈杰 校)

Pulse oximetry is an undisputable standard of care in clinical monitoring. It combines a spectrometer to detect hypoxemia with a plethysmograph for the diagnosis, monitoring, and follow-up of cardiovascular diseases.

These pulse oximetry capabilities are extremely useful for assessing the respiratory and circulatory status and for monitoring of mechanically ventilated patients. On the one hand, the key spectrography-derived function of pulse oximetry is to evaluate a patient's gas exchange that results from a particular ventilatory treatment by continuously and noninvasively measuring arterial hemoglobin saturation (SpO<sub>2</sub>). This information helps to maintain patients above the hypoxemic levels, leading to appropriate ventilator settings and inspired oxygen fractions. However, whenever higher than normal oxygen fractions are used, SpO<sub>2</sub> can mask existing oxygenation defects in ventilated patients. This limitation, resulting from the S shape of the oxyhemoglobin saturation curve, can be overcome by reducing the oxygen fraction delivered to the patient in a controlled and stepwise manner. This results in a SpO<sub>2</sub>/FIO<sub>2</sub> diagram, which allows a rough characterization of a patient's gas exchange, shunt, and the amount of lung area with a low ventilation/perfusion ratio without the need of blood sampling. On the other hand, the photoplethysmography-derived oximeter function has barely been exploited for the purpose of monitoring hemodynamics in mechanically ventilated patients.

The analysis of the photoplethysmography contour provides useful real-time and noninvasive information about the interaction of heart and lungs during positive pressure ventilation. These hemodynamic monitoring capabilities are related to both the assessment of preload dependency—mainly by analyzing the breath-by-breath variation of the photoplethysmographic signals—and the analysis of arterial impedance, which examines the changes in the plethysmographic amplitude, contour, and derived

indexes. In this article, we present and describe these extended monitoring capabilities and propose a more holistic monitoring concept that takes advantage of these advanced uses of pulse oximetry in the monitoring of ventilated patients. Today's monitors need to be improved if such novel functionalities were to be offered for clinical use. Future developments and clinical evaluations are needed to establish the true potential of these advanced monitoring uses of pulse.

急性深度缺氧对健康人的影响：评估脉搏血氧饱和度或组织血氧饱和度性能相关测试的安全性

**Effects of Acute, Profound Hypoxia on Healthy Humans: Implications for Safety of Tests Evaluating Pulse Oximetry or Tissue Oximetry Performance**

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长时间的缺氧可导致机体产生酸中毒、炎症反应、能量衰竭、细胞应激甚至是细胞死亡。然而，短暂的深度缺氧（定义为血氧饱和度维持 50%~70% 大约 10 分钟）与心血管系统疾病无关，而且可为健康人所耐受，并不会引起明显的疾病效应。相反，慢性缺氧会产生一系列适应和应激的改变，这会导致对缺氧状态或疾病的耐受性增加，比如适应高原生活或者减轻慢性高山病的症状。在健康人中，短暂深度缺氧会增加分钟通气量和心输出量，但对血液中生化物质含量几乎没有影响。急性深度缺氧的中枢神经系统症状包括基于额叶/大脑中心连接中断引起的注意力改变，短暂认知功能水平下降。不同的是，假使短暂深度缺氧不会降低心输出量以及造成缺血，那么在健康人中就会耐受良好，且无酸中毒或长期认知功能损害的表现。

(方洪伟 译 陈杰 校)

Extended periods of oxygen deprivation can produce acidosis, inflammation, energy failure, cell stress, or cell death. However, brief profound hypoxia (here defined as SaO<sub>2</sub> 50%-70% for approximately 10 minutes) is not associated with cardiovascular compromise and is tolerated by healthy humans without apparent ill effects. In contrast, chronic hypoxia induces a suite of adaptations and stresses that can result in either increased tolerance of hypoxia or disease, as in adaptation to altitude or in the syndrome of chronic mountain sickness. In healthy humans, brief profound hypoxia produces increased minute ventilation and increased cardiac output, but little or no alteration in blood chemistry. Central nervous system effects of acute profound hypoxia include transiently decreased cognitive performance, based on alterations in attention brought about by interruptions of frontal/central cerebral connectivity. However, provided there is no decrease in cardiac output or ischemia, brief profound hypoxemia in healthy humans is well tolerated without evidence of acidosis or lasting cognitive impairment.

先天性中枢性肺通气不足综合征（CCHS）患者的麻醉评估：一项系统性回顾分析

**Anesthetic Considerations for Patients With Congenital Central Hypoventilation Syndrome: A Systematic Review of the Literature**

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先天性中枢性肺通气不足综合征（CCHS）是一种睡眠呼吸障碍疾病，其特征为尽管存在进行性加重的高碳酸血症和低氧血症，睡眠期间呼吸驱动仍然不足。这种症状是由于等位的同源基因 2B（PHOX2B）突变引起的。本篇综述目的为对 CCHS 当前研究的数据进行系统性搜索，涉及围手术期的注意事项，并对其分类、流行病学、病理生理、临床表现、遗传学和治疗进行讨论。对 2015 年 10 月之前在 Medline，EMBASE，Cochrane 系统评价数据库和 Cochrane 对照试验中心登记系统的数据进行了系统性搜索。结果限于以英语发表的人体研究。对研究标题和摘要进行筛查以确定与麻醉管理相关的 CCHS 研究。所有研究设计包括随机对照试验、观察性研究、病例个案或系列报道。共搜索出 165 篇文章，其中 45 篇与围术期管理相关。有 15 个相关病例报告归类为以下内容：（1）镇静/麻醉后疾病的新发症状；（2）对确诊的 CCHS 患者实施的麻醉技术；（3）发生麻醉并发症的 CCHS 患者。回顾病例报告显示患者的年龄范围从新生儿到 59 岁。接受小手术前行镇静或麻醉后的疾病新发症状常用于诊断。未确诊 CCHS 发生的后遗症可导致并发症如下：低氧血症、低血氧饱和度、呼吸暂停、癫痫、计划外入 ICU、住院时间延长和长期气管切开。确诊 CCHS 患者术后并发症较少。麻醉医师需要警觉未确诊的迟发性 CCHS，并将这种情况纳入不明原因术后呼吸抑制的鉴别诊断中。麻醉管理应最大程度地减少使用进一步对呼吸抑制的药物并确保充分监测以及时发现患者术后呼吸暂停。

（高浩 译 陈杰 校）

Congenital central hypoventilation syndrome (CCHS) is a form of sleep-disordered breathing characterized by a diminished drive to breathe during sleep, despite progressive hypercapnia and hypoxia. The condition results from mutations in the paired-like homeobox 2B (PHOX2B) gene. The aim of this review was to conduct a systematic search of the current data on CCHS as it relates to perioperative considerations and to discuss the classification, prevalence, pathophysiology, presentation, genetics, and management of the condition. A systematic search of Medline, EMBASE, Cochrane Database of Systematic Reviews, and the Cochrane Central Register of Controlled Trials was done up to October 2015. The results were limited to human studies published in the English language. Study titles and abstracts were screened to identify studies relating to CCHS relevant to anesthetic care. All study designs including randomized controlled trials, observational studies, case reports, or case series were included. The searches yielded 165 articles, of which 45 were relevant to perioperative considerations. There were 15 relevant case reports categorized as pertaining to the following: (1) novel presentations of the condition after sedation/anesthesia; (2) anesthetic techniques used in patients with established CCHS; and (3) patients with CCHS who experienced anesthetic complications. Review of the case reports showed that patients ranged from neonates up to 59 years of age. Novel presentations of the disease after sedation or anesthesia for minor procedures often led to diagnosis. The sequelae of undiagnosed CCHS led to complications, such as hypoxia, desaturations, apneas, seizures, unplanned intensive care admissions, prolonged hospital stays, and long-term tracheostomies. There appeared to be few postoperative complications in patients with known CCHS. Anesthesiologists need to be aware of undiagnosed late-onset CCHS and include this condition in the differential diagnosis of patients with unexplained postoperative respiratory depression. Anesthetic techniques should minimize the use of agents that further depress respiration postprocedure and ensure adequate monitoring to detect postoperative apneas.

## 肾脏缺血再灌注损伤过程中氧化应激的抑制

### Inhibition of Oxidative Stress in Renal Ischemia-Reperfusion Injury

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**背景：**超氧化物、一氧化氮 (NO) 和过氧亚硝酸盐是缺血再灌注 (I/R) 损伤发病机制中的重要介质。分别通过选择性抑制超氧化物、NO 和过氧亚硝酸盐，检测别嘌呤醇 (ALP)、黄嘌呤氧化酶抑制剂、N-硝基-L-精氨酸甲酯 (L-NAME) 和 5,10,15,20-四 (N-甲基-4-吡啶基) 卟啉铁 (III) (FeTMPyP) 产生的肾脏保护作用。

**方法：**将雄性 Sprague-Dawley 大鼠随机分为 5 组 (每组 n = 6)。组 1 是假手术组。组 2 是肾 I/R 组 (缺血 30min，随后再灌注 24h)。在再灌注前 5min，组 3、4 和 5 中的大鼠分别接受 ALP，L-NAME 或 FeTMPyP 处理。评估血清肌酐 (Cr)、血尿素氮 (BUN) 和肾组织丙二醛、超氧化物歧化酶、组织学变化、凋亡和单核细胞浸润情况。此外在第二个独立实验中，将 ALP 和 L-NAME 的联合处理与 FeTMPyP 处理进行比较。

**结果：**ALP、L-NAME 和 FeTMPyP 处理减少了由 I/R 损伤诱导的 Cr (对于三者，P = 0.0066) 和 BUN (对于 ALP，P = 0.0066，对于 L-NAME，P = 0.013) 增高并减少组织学损伤 (P = 0.0066)。此外，ALP、L-NAME 和 FeTMPyP 处理通过减弱氧化应激反应的作用降低了丙二醛水平 (P = 0.0066)，减少肾小管细胞凋亡 (P = 0.0066) 并减少单核细胞浸润 (P = 0.0066)。与 FeTMPyP 处理相比，ALP 和 L-NAME 的联合处理使 Cr 和 BUN 水平降低幅度更大 (对于 Cr，P = 0.016; 对于 BUN，P = 0.0079)。

**结论：**超氧化物、NO 和过氧亚硝酸盐参与肾 I/R 损伤。通过减少过氧亚硝酸盐形成，抑制超氧化物或 NO 生成或诱导过氧亚硝酸盐分解，来减轻肾 I/R 损伤。  
(邵甲云 译 陈杰 校)

**BACKGROUND:** Superoxide, nitric oxide (NO), and peroxynitrite are important mediators in the pathogenesis of ischemia-reperfusion(I/R) injury. We tested the renoprotective effects of allopurinol (ALP), a xanthine oxidase inhibitor, N-nitro-L-arginine methyl ester (L-NAME), and 5,10,15,20-tetrakis (N-methyl-4-pyridyl) porphyrinato iron (III) (FeTMPyP) by selective inhibition of superoxide, NO, and peroxynitrite, respectively.

**METHODS:** Male Sprague-Dawley rats were randomly assigned to 5 groups (n = 6 per group). Group 1 was a sham-operated group. Group 2 was the renal I/R group (30-minute ischemia followed by 24-hour reperfusion). Rats in groups 3, 4, and 5 received ALP, L-NAME, or FeTMPyP, respectively, at 5 minutes before the reperfusion. Serum creatinine (Cr), blood urea nitrogen (BUN), renal tissue malondialdehyde, superoxide dismutase, histological changes, apoptosis, and monocyte infiltration were evaluated. In addition, the combined treatment with ALP and L-NAME was compared with FeTMPyP in a second independent experiment.

**RESULTS:** The administration of ALP, L-NAME, and FeTMPyP diminished the increase in Cr (P = .0066 for all) and BUN (P = .0066 for ALP; and P = .013 for L-NAME) induced by I/R injury and decreased the histological damage (P = .0066 for all). In addition, ALP, L-NAME, and FeTMPyP attenuated the oxidative stress response as determined by a decrease in malondialdehyde level (P = .0066 for

all), apoptotic renal tubular cells ( $P = .0066$  for all), and monocyte infiltration ( $P = .0066$  for all). The combined treatment of ALP and L-NAME decreased Cr and BUN levels to a greater degree than FeTMPyP ( $P = .016$  for Cr;  $P = .0079$  for BUN). **CONCLUSIONS:** Superoxide, NO, and peroxynitrite are involved in renal I/R injury. The reduction of peroxynitrite formation, viainhibition of superoxide or NO, or the induction of peroxynitrite decomposition may be beneficial in renal I/R injury.

儿科双侧鼓膜切开术和置管术后肌肉注射芬太尼和酮咯酸可提供良好的疼痛控制：一项回顾性队列研究

**Intramuscular Fentanyl and Ketorolac Associated with Superior Pain Control After Pediatric Bilateral Myringotomy and Tube Placement Surgery: A Retrospective Cohort Study**

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**背景：**双侧鼓膜切开术和压力平衡管置入术（BMT）是儿童最常见的手术。对于 BMT 有多个麻醉方案，但何种方案能可靠地促进理想复苏仍不清楚。本研究试图评估不同麻醉方案，包括单药（芬太尼或酮咯酸）或联合用药（芬太尼和酮咯酸）镇痛治疗，与主要预后指标---恢复室最高疼痛评分之间的关系。次要预后指标包括住院期间疼痛解救管理、复苏时间和呕吐发生率。

**方法：**对 3669 名，年龄在 6 个月至 7 岁之间，接受为期 16 个月的 BMT 手术术中注射芬太尼和/或酮咯酸的儿童进行主成分分析。常规麻醉管理包括术前口服咪达唑仑，通过面罩给予七氟醚和 N<sub>2</sub>O 或空气混合氧气进行全麻维持，并肌肉注射药物行镇痛。运用多变量分析研究镇痛方案与以下预后之间的关系：恢复室最高 FLACC 评分（分为面部表情、腿部活动、体位、哭闹及可安慰度方面）=0 或 7 到 10 分，羟考酮注射及出院时间。将人口统计变量、咪达唑仑暴露及机构位置（主要医院 vs 日间手术中心）作为潜在混杂因素纳入多变量分析。另外以相似纳入标准对 2725 名儿童在随后不重叠的 12 个月内术后呕吐发生情况进行分析。芬太尼和酮咯酸剂量反应相关性作为选择的预后变量进行评估。

**结果：**FLACC 最低 = 0，FLACC 最高为 7 到 10 分，羟考酮解救与联合用药还是酮咯酸单药使用密切相关：优势比为 4.98（95%可信区间[CI]，4.04-5.93），分别是 0.13（95%可信区间，0.10-0.16）和 0.11（98.3% CI，0.09-0.14），每项  $P < 0.01$ 。年龄、西班牙裔、咪达唑仑暴露和机构位置有轻微相关；性别或种族无相关。接受高剂量芬太尼（ $\geq 0.75$  mg/kg）和酮咯酸（ $\geq 0.75$  mg/kg）患者中的 90% 没有明显疼痛、激动或痛苦。平均出院时间分别是  $21 \pm 11$ min(酮咯酸组),  $26 \pm 16$ min(芬太尼组), 和  $24 \pm 14$ min（联合用药组）( $P < .0001$ )。术后呕吐发生率与酮咯酸(2.7%)还是联合用药(4.5%)( $P = 0.08$ )无差异。

**结论：**在这项儿科 BMT 相关的大样本量、回顾性研究中，肌注芬太尼/酮咯酸联合用药与良好的恢复室镇痛和减少羟考酮解救有关，而这并不明显增加复苏时间或呕吐发生率。联合 1.5-2  $\mu$ g/kg 的芬太尼和 1 mg/kg 酮咯酸与理想的预后相关。联合用药对欧洲白种或非洲裔或拉美裔种族的儿童似乎同样有效。

（李东星 译 陈杰 校）

**BACKGROUND:** Bilateral myringotomy and pressure equalization tube insertion (BMT) is the most common surgery in children. Multiple anesthetic techniques for

BMT have been proposed, but that which reliably promotes ideal recovery remains unclear. We sought to assess associations between anesthetic regimens that included single-agent (fentanyl or ketorolac) or dual-agent (fentanyl and ketorolac) analgesic therapy and the primary outcome of maximal postanesthesia care unit (PACU) pain score. Secondary outcomes included in-hospital rescue analgesic administration, recovery time, and emesis incidence.

**METHODS:** Principal analysis was conducted on a retrospective cohort of 3669 children aged 6 months to <7 years who underwent BMT over a 16-month period and received intraoperative fentanyl and/or ketorolac. Routine anesthetic care included preoperative oral midazolam, general anesthesia via a mask maintained with sevoflurane and N<sub>2</sub>O or air in O<sub>2</sub>, and intramuscular analgesic administration. Multivariable analyses were performed examining relationships between analgesic regimen with the following outcomes: maximum PACU Face, Legs, Activity, Cry, and Consolability (FLACC) score = 0 or 7 to 10, oxycodone administration, and time to discharge readiness. Demographic variables, midazolam exposure, and location (main hospital vs ambulatory surgery center) were included in the multivariable analyses as potential confounders. Associations with postoperative vomiting were studied separately in 2725 children from a subsequent, nonoverlapping 12-month period using similar inclusion criteria. Fentanyl and ketorolac dose-response relationships were evaluated for selected outcome variables.

**RESULTS:** Maximum FLACC = 0, maximum FLACC score of 7 to 10, and oxycodone rescue were most strongly associated with dual-agent therapy versus single-agent ketorolac: odds ratios 4.89 (95% confidence interval [CI], 4.04-5.93), 0.13 (95% CI, 0.10-0.16), and 0.11 (98.3% CI, 0.09-0.14), respectively,  $P < .001$  for each). Minor associations were found for age, Hispanic ethnicity, midazolam, and location, and none for sex or race. For subjects managed with higher dose fentanyl ( $\geq 1.5$   $\mu\text{g}/\text{kg}$ ) and ketorolac ( $\geq 0.75$   $\text{mg}/\text{kg}$ ), 90% had no demonstrable pain, agitation, or distress. Mean discharge readiness times were  $21 \pm 11$  minutes (ketorolac),  $26 \pm 16$  minutes (fentanyl), and  $24 \pm 14$  minutes (dual) ( $P < .0001$ ). Postoperative emesis incidences associated with ketorolac (2.7%) versus dual therapy (4.5%) were not different ( $P = 0.08$ ).

**CONCLUSIONS:** In this large retrospective pediatric BMT study, combination intramuscular fentanyl/ketorolac was strongly associated with superior PACU analgesia and reduced need for oxycodone rescue without clinically significant increases in recovery time or emesis incidence. Combination fentanyl at 1.5 to 2  $\mu\text{g}/\text{kg}$  and 1  $\text{mg}/\text{kg}$  ketorolac was associated with optimal outcomes. Dual therapy appears similarly effective in children of either European Caucasian or African ancestry or of Hispanic ethnicity.

连续外周神经阻滞：证据更新以及与新型、替代性镇痛模式的比较

### **Continuous Peripheral Nerve Blocks: An Update of the Published Evidence and Comparison With Novel, Alternative Analgesic Modalities**

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Anesthesia & Analgesia: 2017 124 308–335

连续周围神经阻滞（CPNB）由一个经皮插入的导管，其尖端接近目标神经/神经丛，通过尖端给予局部麻醉药以提供长时的阻滞效果，也可通过药物滴定而达到预期阻滞效果。在 1946 年进行首次发表之后的几十年，大量连续周围神经阻滞的相关文献发布，其中大部分是在 2011 年的“麻醉与镇痛”杂志中发表。一

项 CPNB 相关循证综述作为近期更新在期间发表。新的阻滞部位包括内收肌管、胸肌间、腰方肌、腭、尺、深浅腓神经。值得注意的是新适应证包括提供外伤性肋骨/股骨骨折后、肩周炎手法治疗后以及怀孕期间腹壁疼痛的镇痛治疗。最新出版的证据表明在超声引导联合神经刺激仪引导下的导管置入显示其优势，尽管可用来指导操作者关于超声引导导管置入（例如最佳的针-神经定位）的新数据有限。根据先前自动化、重复注射较基础速率注射更好的建议，在过去的几年缺乏数据支持。现在越来越多的一次性输注泵允许对基础速率、负荷量、锁定时间进行调整，可与电子可编程输注泵相媲美，可以通过互联网远程操控泵，是一个有前途的研究领域。现在大型前瞻性的研究文章表明连续周围神经阻滞期间主要并发症相对较少，虽然随机对照研究证明实际的住院时间缩短很少。最近的证据表明，跟股神经连续阻滞相比，内收肌管连续阻滞引起的股四头肌无力更少，提高了移动/活动能力。新公布的数据表明，短时的术后 CPNB 可减少慢性、持续性术后疼痛的发病率和/或降低严重程度。一些新的跟周围神经阻滞相关的并发症已确定，虽然大样本量前瞻性试验提供了关于不良事件发生率的数据。最后，正在开发和研究大量的替代镇痛模式，对四项此类技术进行描述，并将其与周围神经阻滞进行对比，包括用一种新的佐剂行单次周围神经阻滞，布比卡因脂质体行伤口浸润和周围神经阻滞，冰冻与神经冰冻以及经皮周围神经刺激。

（朱碧君 译 陈杰 校）

A continuous peripheral nerve block (CPNB) consists of a percutaneously inserted catheter with its tip adjacent to a target nerve/plexus through which local anesthetic may be administered, providing a prolonged block that may be titrated to the desired effect. In the decades after its first report in 1946, a plethora of data relating to CPNB was published, much of which was examined in a 2011 *Anesthesia & Analgesia* article. The current update is an evidence-based review of the CPNB literature published in the interim. Novel insertion sites include the adductor canal, interpectoral, quadratus lumborum, lesser palatine, ulnar, superficial, and deep peroneal nerves. Noteworthy new indications include providing analgesia after traumatic rib/femur fracture, manipulation for adhesive capsulitis, and treating abdominal wall pain during pregnancy. The preponderance of recently published evidence suggests benefits nearly exclusively in favor of catheter insertion using ultrasound guidance compared with electrical stimulation, although little new data are available to help guide practitioners regarding the specifics of ultrasound-guided catheter insertion (eg, optimal needle-nerve orientation). After some previous suggestions that automated, repeated bolus doses could provide benefits over a basal infusion, there is a dearth of supporting data published in the past few years. An increasing number of disposable infusion pumps does now allow a similar ability to adjust basal rates, bolus volume, and lockout times compared with their electronic, programmable counterparts, and a promising area of research is communicating with and controlling pumps remotely via the Internet. Large, prospective studies now document the relatively few major complications during ambulatory CPNB, although randomized, controlled studies demonstrating an actual shortening of hospitalization duration are few. Recent evidence suggests that, compared with femoral infusion, adductor canal catheters both induce less quadriceps femoris weakness and improve mobilization/ambulation, although the relative analgesia afforded by each remains in dispute. Newly published data demonstrate that the incidence and/or severity of chronic, persistent postsurgical pain may, at times, be decreased with a short-term postoperative CPNB. Few new CPNB-related



complications have been identified, although large, prospective trials provide additional data regarding the incidence of adverse events. Lastly, a number of novel, alternative analgesic modalities are under development/investigation. Four such techniques are described and contrasted with CPNB, including single-injection peripheral nerveblocks with newer adjuvants, liposome bupivacaine used in wound infiltration and peripheral nerveblocks, cryoanalgesia with cryoneurolysis, and percutaneous peripheral nerve stimulation.

先天性心脏病儿童紫绀和旋转式血栓弹力计 (ROTEM) 之间的关系：一项回顾性队列研究

**The Association Between Cyanosis and Thromboelastometry (ROTEM) in Children With Congenital Heart Defects: A Retrospective Cohort Study**

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**背景：**先天性心脏病儿童的凝血功能与健康儿童有量与质的差别。继发于红细胞增多症和红细胞变形性增加，紫绀可能是这类人群凝血改变的一个重要混杂因素，这对解释经历大手术的先天性心脏病儿童围术期血栓形成有潜在意义。这项研究的主要目标是评估先心病儿童紫绀与凝血功能（使用 ROTEM 监测）之间的关系。

**方法：**在这项回顾性队列研究中，他们研究了 2014 年 4 月至 2015 年 4 月这 12 个月期间经历过先心病手术的儿童，其中围术期使用抗血小板药和抗凝药的儿童排除在外，入选的儿童按照是否出现紫绀（依据氧合血红蛋白，含量 $\leq 85\%$ 即定义为紫绀）分类。应用多变量线性回归分析来决定紫绀和血栓弹力计结果（结局指标，纤维蛋白原/纤维蛋白原聚合物[FibTEM]最大凝血块稳固性[MCF])调整潜在的混杂因素）之间的关系。

**结果：**分析队列中的 320 个儿童共 345 个血栓弹力计曲线。22%(76/345)的儿童有紫绀型先心病。先心病紫绀儿童相对于非紫绀儿童凝血块稳固性（使用 FibTEM 分析来测量）降低，中位数差异 (95% 可信区间) 中间期 [2 (0-3) mm;  $P = .01$ ]，凝血块稳固性最大值 [2 (1-3) mm;  $P = .01$ ]。调整混杂因素（血细胞比容、血小板计数和性别）之后，紫绀和纤维蛋白原/纤维蛋白原聚合物凝血块稳固性之间的相关性不明显(A10,  $P = .7$ ; MCF,  $P = .7$ )。调整混杂因素后，紫绀和实际活化的凝血块稳固性之间有明显的相关性(A10,  $P = .03$ ; MCF,  $P = .02$ )，但与其他的 TEM 结果无关。

**结论：**紫绀儿童凝血块稳固性相对于非紫绀儿童降低，但是紫绀和凝血块稳固性的相关性是由组间血细胞比容、血小板计数和性别之间的差异引起的。这个发现将有助于指导这类易发人群凝血病的识别和治疗。

（王亚楠译 薛张纲校）

**BACKGROUND:** Children with congenital heart defects (CHD) have quantitative and qualitative differences in coagulation compared with healthy children. Secondary to polycythemia and increased deformability of red blood cells, cyanosis may be an important confounding factor for altered whole-blood coagulation in this population with potential implications for interpreting intraoperative thromboelastometry (TEM) for children with CHD undergoing major surgery. The primary aim of the study was to evaluate the association between cyanosis in children with CHD and measures of

whole-blood coagulation determined using TEM (ROTEM [Tem International, GmbH, Munich, Germany]).

**METHODS:** In this retrospective cohort study, children who underwent congenital cardiac surgery in a 12-month period between April 2014 and 2015 were investigated. Children who were receiving antiplatelet or anticoagulant medications in the preoperative period were excluded. Eligible children were categorized by the presence of cyanosis, defined as an oxyhemoglobin concentration  $\leq 85\%$ . Multivariable linear regression analyses were used to determine the relationship between cyanosis and TEM outcomes (primary outcome, fibrinogen/fibrin polymerization [FibTEM] maximal clot firmness [MCF]) adjusting for potential confounding factors.

**RESULTS:** Three hundred forty-five TEM profiles from 320 children were included in the cohort for analysis. Twenty-two percent (76/345) of children had cyanotic CHD. Clot firmness measured using the FibTEM assay was decreased in cyanotic children compared with noncyanotic children, median difference (95% confidence interval) interim [2 (0–3) mm;  $P = .01$ ], and maximal [2 (1–3) mm;  $P = .01$ ] clot firmness. The association between cyanosis and fibrinogen/fibrin polymerization clot firmness was not significant (A10,  $P = .7$ ; MCF,  $P = .7$ ) after adjusting for confounding factors (hematocrit, platelet count, and sex). There was a significant association between cyanosis and intrinsically activated clot firmness (A10,  $P = .03$ ; MCF,  $P = .02$ ), but not other TEM outcomes, after adjusting for confounding factors.

**CONCLUSIONS:** Cyanotic children had decreased clot firmness in the fibrinogen/fibrin polymerization component of the clot compared with noncyanotic children, but the association between cyanosis and clot firmness was accounted for by differences in hematocrit, platelet count, and sex between groups. These findings will help guide the identification and treatment of coagulopathy in this vulnerable population.

### 心脏毒性的止吐药胃复安和多潘立酮阻滞心脏钠离子的电压门控通道

#### Cardiotoxic Antiemetics Metoclopramide and Domperidone Block Cardiac Voltage-Gated $\text{Na}^+$ Channels

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Anesthesia & Analgesia: 2017 124 52–60

**背景:** 胃复安和多潘立酮分别作为促进胃动力和止吐的药物常常被用于临床实践。尽管多潘立酮的副作用更小而作为一线药物，但使用两种药物对心脏的副作用已有报道。心脏钠离子通道通常是心脏治疗毒性作用的靶点。因此，这项研究的目的是为了观察胃复安和多潘立酮对心脏毒性作用的差异是否与阻滞钠离子通道相关。

**方法:** 通过采用整体细胞膜片钳记录技术来观察胃复安和多潘立酮对人体肾脏胚胎 293 细胞上 Nav1.5 $\alpha$  亚单位以及新生小鼠心肌细胞钠电流的影响。

**结果:** 与胃复安( $\text{IC}_{50} 458 \pm 28 \mu\text{M}$ ; 95% CI, 403-513)相比，多潘立酮( $\text{IC}_{50} 85 \pm 25 \mu\text{M}$ ; 95% 置信区间[CI], 36-134)对 Nav1.5 通道的阻滞作用更强。这两种药物在 10-100 Hz 诱发使用依赖的阻滞，稳定快慢失活，并且从失活状态恢复过来是有延迟的。然而，与多潘立酮比较，胃复安引起相当小的影响。两种药物均会对小鼠心肌细胞钠电流产生较强和使用依赖的阻滞，并且在这个系统中，多潘立酮( $\text{IC}_{50} 312 \pm 15 \mu\text{M}$ ; 95% CI, 22-602)和胃复安( $\text{IC}_{50} 250 \pm 30 \mu\text{M}$ ; 95% CI, 191-309)诱发相似程度的较强阻滞。

**总结：**我们的数据表明与临床相关的多潘立酮和胃复安的心脏毒性是一种较强的类似于局麻药抑制心脏钠通道（包含 Nav1.5）的作用。这些数据提示 Nav1.5 可能是一种迄今为止对于一些心血管副作用未被认识的分子机制，例如，由促进胃动力和止吐药物引起的恶性心律失常。

（罗培挺译 薛张纲校）

**Background :** Metoclopramide and domperidone are prokinetic and antiemetic substances often used in clinical practice. Although domperidone has a more favorable side effect profile and is considered the first-line agent, severe cardiac side effects were reported during the administration of both substances. Cardiac Na channels are common targets of therapeutics inducing cardiotoxicity. Therefore, the aim of this study was to investigate whether the differential cardiotoxicities of metoclopramide and domperidone correlate with the block of Na channels.

**METHODS:** Effects of metoclopramide and domperidone on the human  $\alpha$ -subunit Nav1.5 expressed in human embryonic kidney 293 cells and on Na currents in neonatal rat cardiomyocytes were investigated by means of whole-cell patch clamp recordings

**RESULTS:** Tonic block of resting Nav1.5 channels was more potent for domperidone ( $IC_{50} 85 \pm 25 \mu M$ ; 95% confidence interval [CI], 36-134) compared with metoclopramide ( $IC_{50} 458 \pm 28 \mu M$ ; 95% CI, 403-513). Both agents induced use-dependent block at 10 and 1 Hz, stabilized fast and slow inactivation, and delayed recovery from inactivation. However, metoclopramide induced considerably smaller effects compared with domperidone. Na currents in rat cardiomyocytes displayed tonic and use-dependent block by both substances, and in this system, domperidone ( $IC_{50} 312 \pm 15 \mu M$ ; 95% CI, 22-602) and metoclopramide ( $IC_{50} 250 \pm 30 \mu M$ ; 95% CI, 191-309) induced a similar degree of tonic block.

**CONCLUSIONS:** Our data demonstrate that the clinically relevant cardiotoxicity of domperidone and metoclopramide corresponds to a rather potent and local anesthetic-like inhibition of cardiac Na channels including Nav1.5. These data suggest that Nav1.5 might be a hitherto unrecognized molecular mechanism of some cardiovascular side effects, for example, malignant arrhythmias of prokinetic and antiemetic agents.

## 组织血氧测量法和临床预后

### Tissue Oximetry and Clinical Outcomes

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Anesthesia & Analgesia:2017 124 72-82

目前为止已经发明了很多不同的技术来测量组织氧饱和度，其目的是用来识别组织缺氧和指导治疗来避免患者受伤害。在一些特殊的病例中，比如在急性脑缺血期间，组织血氧测量法可能不能清楚地预示组织氧合下降。然而一个器官（如脑或肌肉）中，组织血氧饱和度降低与整体预后，如死亡率，ICU 滞留时间长短，远隔器官功能障碍之间的因果关系仍值得推测。在这篇综述中，我们描述了从组织血氧测量法来预测临床预后当前的一些证据并同时意识到了一些需要解决的问题，比如如何阐明组织氧合和预后之间联系。我们主要关注的是用近红外光谱来评估组织如脑和肌肉深部的动脉和静脉血氧饱和度的静脉加权混合的扩展应用。我们的分析发现在一些领域还需要投入更多的工作：建立组织氧饱和度降低的阈值预测-特定器官的相关损伤，定义改善组织氧合干预措施

的类型，确定这些干预措施对临床预后的效果。此外，应该做一些设计良好的前瞻性研究，这些研究能检测出一个假设即监测一个器官的氧合状态能预测其他器官预后。最后，我们提倡更多工作应该去确定组织氧合的一些区域变化并且改善技术对重要器官氧合的测量甚至成像。这些研究将有助于确立组织氧合的监测和成像并将成为高危患者重症监护的常规，因为这些监测会提供输出，这些输出能指导改善临床预后的治疗。

（邹丽云译 薛张纲校）

A number of different technologies have been developed to measure tissue oxygenation, with the goal of identifying tissue hypoxia and guiding therapy to prevent patient harm. In specific cases, tissue oximetry may provide clear indications of decreases in tissue oxygenation such as that occurring during acute brain ischemia. However, the causation between tissue hemoglobin-oxygen desaturation in one organ (eg, brain or muscle) and global outcomes such as mortality, intensive care unit length of stay, and remote organ dysfunction remains more speculative. In this review, we describe the current state of evidence for predicting clinical outcomes from tissue oximetry and identify several issues that need to be addressed to clarify the link between tissue oxygenation and outcomes. We focus primarily on the expanding use of near-infrared spectroscopy to assess a venous-weighted mixture of venous and arterial hemoglobin-oxygen saturation deep in tissues such as brain and muscle. Our analysis finds that more work is needed in several areas: establishing threshold prediction values for tissue desaturation-related injury in specific organs, defining the types of interventions required to correct changes in tissue oxygenation, and defining the effect of interventions on outcomes. Furthermore, well-designed prospective studies that test the hypothesis that monitoring oxygenation status in one organ predicts outcomes related to other organs need to be done. Finally, we call for more work that defines regional variations in tissue oxygenation and improves technology for measuring and even imaging oxygenation status in critical organs. Such studies will contribute to establishing that monitoring and imaging of tissue oxygenation will become routine in the care of high-risk patients because the monitors will provide outputs that direct therapy to improve clinical outcomes.

比较用 **exspiron** 无创呼吸量监测和二氧化碳监测仪测量有自主呼吸志愿者的呼吸状态变化的研究

### **A Comparison of Measurements of Change in Respiratory Status in Spontaneously Breathing Volunteers by the ExSpirom Noninvasive Respiratory Volume Monitor Versus the Capnostream Capnometer**

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**背景：**当前呼吸监测技术，如脉搏血氧仪和二氧化碳监测仪都能有效的识别插管的患者呼吸道危害的早期信号。当被适当地使用时，脉搏血氧仪将警告监护者血氧不足的危险。然而，去饱和作用落后于肺换气不足和由于报警错误引起的报警疲劳会造成额外的问题。二氧化碳监测仪，用来测量呼末二氧化碳(Etco<sub>2</sub>)和呼吸频率(RR)，没有被普遍用于插管病人原因有多个,其中包括无法可靠地将Etco<sub>2</sub>与即将发生的呼吸道危害水平相联系和缺乏病人的顺应性。与呼吸道危害相关的严重并发症继续在麻醉学 2015 非正式主张报告中被证明。麻醉病人安全基金会已经强调了需要改进监测模式，以便“没有病人会因阿片类诱导的呼吸道

损害而受到伤害。“最近，食品和药品管理局批准了无创呼吸容量监测(RVM)可以连续、准确地监测实际通气指标:潮气量、RR 和分钟通气量(MV)。我们设计了本研究以比较二氧化碳监测仪与 RVM 检测呼吸指标变化的性能。

**方法：**48 名受试志愿者完成了研究。RVM 测量 (MV 和 RR) 和二氧化碳监测技术(Etco2 和 RR)同时被收集，均使用 2 种抽样方法 (鼻插管和喉舌通气管内置 Etco2 传感器)。对于每个抽样法，每个研究执行 6 次呼吸试验在三种不同的呼吸频率下，慢(5 次/分钟)，正常的( $12.6 \pm 0.6$  次/分钟)，和快速[25 次/分钟])。所有数据提出了均值 $\pm$ SEM，除非另有指示。

**结果：**在规定的呼吸频率的过渡下，在  $37.7 \pm 1.4$  秒时 RVM 达到了一个新的 MV 的稳态值而 ETco2 变化明显变慢，在 2.5-minute 阈值前经常无法达到一个新的渐近线。在平稳的呼吸下 RMV 和二氧化碳监测仪测量的 RRs 显著相关 ( $R = 0.98 \pm 0.01$ ，偏差=二氧化碳监测仪基础 RR-RVM 基础 RR =  $0.21 \pm 1.24$  [SD] /分钟)。正如预期的那样，MV 变化与 Etco2 的变化密切相关。然而，在规定的 RR 转换后的 MV 的大变化导致的 Etco2 变化相对较小 (仪器灵敏度 =  $\Delta$ ETco2 / $\Delta$ MV =  $-0.71 \pm 0.11$  和  $-0.55 \pm 0.11$  mmHg/L/分钟,分别在鼻插管和气管内取样)。鼻插管 ETco2 测量平均为 4 mmHg 低于气管内测量。

**结论：**用 RVM 测量 MV 比二氧化碳监测仪更快速和更大程度的反映插管患者的呼吸道变化。早期监测就可以早期干预以便于减少由于呼吸抑制引起的并发症及其严重程度。

(童颀译 薛张纲校)

**BACKGROUND:** Current respiratory monitoring technologies such as pulse oximetry and capnography have been insufficient to identify early signs of respiratory compromise in nonintubated patients. Pulse oximetry, when used appropriately, will alert the caregiver to an episode of dangerous hypoxemia. However, desaturation lags significantly behind hypoventilation and alarm fatigue due to false alarms poses an additional problem. Capnography, which measures end-tidal CO<sub>2</sub> (Etco<sub>2</sub>) and respiratory rate (RR), has not been universally used for nonintubated patients for multiple reasons, including the inability to reliably relate Etco<sub>2</sub> to the level of respiratory and lack of patient compliance. Serious complications related to respiratory compromise continue to occur as evidenced by the Anesthesiology 2015 Closed Claims Report. The Anesthesia Patient Safety Foundation has stressed the need to improve monitoring modalities so that “no patient will be harmed by opioid-induced respiratory depression.” A recently available, Food and Drug Administration–approved noninvasive respiratory volume monitor (RVM) can continuously and accurately monitor actual ventilation metrics: tidal volume, RR, and minute ventilation (MV). We designed this study to compare the capabilities of capnography versus the RVM to detect changes in respiratory metrics.

**METHODS:** Forty-eight volunteer subjects completed the study. RVM measurements (MV and RR) were collected simultaneously with capnography (Etco<sub>2</sub> and RR) using 2 sampling methods (nasal scoop cannula and snorkel mouthpiece with in-line Etco<sub>2</sub> sensor). For each sampling method, each subject performed 6 breathing trials at 3 different prescribed RR slow [ $5 \text{ min}^{-1}$ ], normal [ $12.6 \pm 0.6 \text{ min}^{-1}$ ], and fast [ $25 \text{ min}^{-1}$ ]). All data are presented as mean  $\pm$  SEM unless otherwise indicated.

**RESULTS:** Following transitions in prescribed RRs, the RVM reached a new steady state value of MV in  $37.7 \pm 1.4$  seconds while Etco<sub>2</sub> changes were notably slower, often failing to reach a new asymptote before a 2.5-minute threshold. RRs as measured by RVM and capnography during steady breathing were strongly correlated

( $R = 0.98 \pm 0.01$ , bias = Capnograph-based RR – RVM-based RR =  $0.21 \pm 1.24$  [SD] min<sup>-1</sup>). As expected, changes in MV were negatively correlated with changes in Etco<sub>2</sub>. However, large changes in MV following transitions in prescribed RR resulted in relatively small changes in Etco<sub>2</sub> (instrument sensitivity =  $\Delta\text{Etco}_2/\Delta\text{MV} = -0.71 \pm 0.11$  and  $-0.55 \pm 0.11$  mm Hg per 1 L/min for nasal and in-line sampling, respectively). Nasal cannula Etco<sub>2</sub> measurements were on average 4 mm Hg lower than in-line measurements.

**CONCLUSIONS:** RVM measurements of MV change more rapidly and by a greater degree than capnography in response to respiratory changes in nonintubated patients. Earlier detection could enable earlier intervention that could potentially reduce frequency and severity of complications due to respiratory depression.

### 七氟醚减弱长期大鼠急性肺损伤模型氧合障碍

#### Sevoflurane Abolishes Oxygenation Impairment in a Long-Term Rat Model of Acute Lung Injury

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Anesthesia & Analgesia:2017 124 194–203

**背景：**急性肺损伤（ALI）病人通常需要机械通气，故而需要镇静。对于这种病人，首选静脉途径给药。然而，越来越多的证据表明吸入麻醉药（比如七氟醚）是也不错的选择。在这项研究中，我们在动物 ALI 模型中评估了分别使用七氟醚和异丙酚长时间镇静（24 小时）的肺部和全身效应。

**方法：**在成年雄性 Wistar 大鼠支气管内使用脂多糖（LPS）造成急性肺损伤模型，机械通气并使用七氟醚或异丙酚镇静不同时长，最多至 24 小时。监测生命体征并进行动脉血气分析。通过分析支气管肺泡灌洗液（BALF）、血和肺组织及炎症细胞中的细胞活素（单核细胞趋化蛋白 1 [MCP-1]、细胞因子诱导的中性粒细胞趋化蛋白 1[CINC-1]、白介素[IL-6]、IL-12/12a、转化生长因子  $\beta$  和白介素 10）来评价炎症反应。通过湿干比、BALF 中的白蛋白和总蛋白含量间接评估肺泡毛细血管屏障。

**结果：**9 小时通气和镇静后，LPS/七氟醚 (LPS-S) 组氧合指数较 LPS/ (LPS-P) 异丙酚组高，24 小时后达到了分别达到了  $400 \pm 67$ 、 $262 \pm 57$  mm Hg ( $P < .001$ )。七氟醚组动物 BALF 中细胞数在 18 小时 ( $P = .001$ ) 和 24 小时 ( $P < .001$ ) 都较丙泊酚组少。BALF 中 CINC-1 和 IL-6 在 LPS-S 较 LPS-P 低 (CINC-1:  $2.7 \pm 0.7$  vs  $4.0 \pm 0.9$  ng/mL; IL-6:  $9.2 \pm 2.3$  vs  $18.9 \pm 7.1$  pg/mL, both  $P < .001$ )，而 IL-10 和 MCP-1 在两张中并没有差别。同时，LPS-P 组 CINC-1、IL-6、IL-12a、IL-10 的 mRNA 都明显高于 LPS-S 组。MCP-1 和转化生长因子  $\beta$  在两组没有区别。LPS-S 组湿干比较低 ( $5.4 \pm 0.2$  vs  $5.7 \pm 0.2$ ,  $P = .016$ )。两组 BALF 中的总蛋白含量没有差别。

**结论：**在 LPS 诱导的 ALI 模型中，使用七氟醚长时间镇静较异丙酚改善了氧合，并减弱了炎症反应。我们的研究表明，对于急性肺损伤的病人，使用七氟醚镇静或许可以改善肺功能。

（方婕译 薛张纲校）

**BACKGROUND:** Patients experiencing acute lung injury (ALI) often need mechanical ventilation for which sedation may be required. In such patients, usually the first choice an intravenously administered drug. However, growing evidence suggests that volatile anesthetics such as sevoflurane are a valuable alternative. In this

study, we evaluate pulmonary and systemic effects of long-term (24-hour) sedation with sevoflurane compared with propofol in an in vivo animal model of ALI.

**METHODS:** Adult male Wistar rats were subjected to ALI by intratracheal lipopolysaccharide (LPS) application, mechanically ventilated and sedated for varying intervals up to 24 hours with either sevoflurane or propofol. Vital parameters were monitored, and arterial blood gases were analyzed. Inflammation was assessed by the analysis of bronchoalveolar lavage fluid (BALF), cytokines (monocyte chemoattractant protein-1 [MCP-1], cytokine-induced neutrophil chemoattractant protein-1 [CINC-1], interleukin [IL-6], IL-12/12a, transforming growth factor- $\beta$ , and IL-10) in blood and lung tissue and inflammatory cells. The alveolocapillary barrier was indirectly assessed by wet-to-dry ratio, albumin, and total protein content in BALF. Results are presented as mean  $\pm$  standard deviation.

**RESULTS:** After 9 hours of ventilation and sedation, oxygenation index was higher in the LPS/sevoflurane (LPS-S) than in the LPS/propofol group (LPS-P) and reached  $400 \pm 67$  versus  $262 \pm 57$  mm Hg after 24 hours ( $P < .001$ ). Cell count in BALF in sevoflurane-treated animals was lower after 18 hours ( $P = .001$ ) and 24 hours ( $P < .001$ ) than in propofol controls. Peak values of CINC-1 and IL-6 in BALF were lower in LPS-S versus LPS-P animals (CINC-1:  $2.7 \pm 0.7$  vs  $4.0 \pm 0.9$  ng/mL; IL-6:  $9.2 \pm 2.3$  vs  $18.9 \pm 7.1$  pg/mL, both  $P < .001$ ), whereas IL-10 and MCP-1 did not differ. Also messenger RNAs of CINC-1, IL-6, IL-12a, and IL-10 were significantly higher in LPS-P compared with LPS-S. MCP-1 and transforming growth factor- $\beta$  showed no differences. Wet-to-dry ratio was lower in LPS-S ( $5.4 \pm 0.2$  vs  $5.7 \pm 0.2$ ,  $P = .016$ ). Total protein in BALF did not differ between P-LPS and S-LPS groups.

**CONCLUSIONS:** Long-term sedation with sevoflurane compared with propofol improves oxygenation and attenuates the inflammatory response in LPS-induced ALI. Our findings suggest that sevoflurane may improve lung function when used for sedation in patients with ALI.

## 大部分妇科手术后预防手术部位感染的共识

### Consensus Bundle on Prevention of Surgical Site Infections After Major Gynecologic Surgery

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在美国，手术部位感染是最常见的并发症。在生育年龄女性中的手术类型里，子宫切除术是仅次于剖腹产术的最多见的术式之一。因此，对于接受妇科手术的女性患者预防手术部位感染的是患者安全包的理想主题。该安全包的主要目的是为了提供可在任何手术环境中实施的建议，来努力减少手术部位感染的发生率。这个安全包由妇女保健中的患者安全委员会所召集的多学科小组发展的。该安全包分为四个方面：准备，识别和预防，反应，报告和系统学习。除了对操作的建议外，每个方面都强调外科团队中所有成员之间的沟通和团队合作。尽管安全包内的组成部分被设计为适于在各种临床环境中工作，但我们还是要鼓励各体系内的标准化操作。

（李桂婷译 薛张纲校）

Surgical site infections are the most common complications of surgery in the United States. Of surgeries in women of reproductive age, hysterectomy is one of the most frequently performed, second only to cesarean birth. Therefore, prevention of surgical

site infections in women undergoing gynecologic surgery is an ideal topic for a patient safety bundle. The primary purpose of this safety bundle is to provide recommendations that can be implemented into any surgical environment in an effort to reduce the incidence of surgical site infection. This bundle was developed by a multidisciplinary team convened by the Council on Patient Safety in Women's Health Care. The bundle is organized into four domains: Readiness, Recognition and Prevention, Response, and Reporting and Systems Learning. In addition to recommendations for practice, each of the domains stresses communication and teamwork between all members of the surgical team. Although the bundle components are designed to be adaptable to work in a variety of clinical settings, standardization within institutions is encouraged.

### 寨卡病毒和患者血液管理

#### **Zika Virus and Patient Blood Management**

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偶发性寨卡病毒只发生在非洲和亚洲，直到 2007 年在密克罗尼西亚（大洋洲）爆发。在 2013 至 2014 年间，几个外太平洋岛屿报道了局部性爆发。不久之后，该病毒传入巴西，可能来自于法属波利尼西亚和其他参赛国家的运动员。通过蚊子叮咬传播，在免疫力低下的人群中传播。同样作为一种黄病毒，寨卡病毒由在美国中南部的伊蚊传播，它也是西尼罗病毒、登革热、基孔肯雅热病毒的传播媒介。在不到一年的时间里，巴西的医生报道，患小头症的新生儿数量增加了许多倍。尽管最初怀疑寨卡病毒流行与出生缺陷之间的因果关系，但是大量的基础和临床研究证据证实了这种关系。在美国，到 2016 年中期，疾病控制和预防中心收到了超过 4000 例旅游相关感染。此外，在波多黎各和佛罗里达发生了许多地方蚊子传播的感染。考虑到病毒引起的病毒血症中，80% 的感染者都没有症状，如果单独采用捐献者筛选而没有测试，则无症状血液捐献者引起的输血传播可能性高。在巴西，已经有 2 例血小板输注感染。尽管有研究性核酸实验测试捐赠者，但并非所有的血液中心最初都被要求参加。随后，美国食品和药物管理局在 2016 年 8 月发布了一项指南，建议对捐献者的寨卡病毒进行常规的核酸检测。在本报告中，我们总结了寨卡病毒在怀孕期间的潜在破坏性影响及对成人格林巴利综合征的影响。此外，我们督促临床医生和输血医学专家实施围术期患者血液管理策略，以避免血液成分输注出现新的病原体风险，这里是指寨卡病毒。最终，正如世界卫生组织所说的，目前全球的威胁是，未来不可避免面临着其他血源性病原体的爆发，围术期患者血液管理的原则和实践，不仅为我们的患者减少已知的输血相关风险，而且减少未知的输血相关风险。

（李倩倩译 薛张纲校）

Sporadic Zika virus infections had only occurred in Africa and Asia until an outbreak in Micronesia (Oceania) in 2007. In 2013 to 2014, several outer Pacific Islands reported local outbreaks. Soon thereafter, the virus was likely introduced in Brazil from competing athletes from French Polynesia and other countries that participated in a competition there. Transmission is thought to have occurred through mosquito bites and spread to the immunologically naive population. Being also a flavivirus, the Zika virus is transmitted by the Aedes mosquito that is endemic in South and Central America that is also the vector of West Nile virus, dengue, and chikungunya. In less



than a year, physicians in Brazil reported a many-fold increase in the number of babies born with microcephaly. Despite initial skepticism regarding the causal association of the Zika virus epidemic and birth defects, extensive basic and clinical research evidence has now confirmed this relationship. In the United States, more than 4000 travel-associated infections have been reported by the middle of 2016 to the Centers for Disease Control and Prevention. Furthermore, many local mosquito-borne infections have occurred in Puerto Rico and Florida. Considering that the virus causes a viremia in which 80% of infected individuals have no symptoms, the potential for transfusion transmission from an asymptomatic blood donor is high if utilizing donor screening alone without testing. Platelet units have been shown to infect 2 patients via transfusion in Brazil. Although there was an investigational nucleic acid test available for testing donors, not all blood centers were initially required to participate. Subsequently, the US Food and Drug Administration issued a guidance in August 2016 that recommended universal nucleic acid testing for the Zika virus on blood donors. In this report, we review the potentially devastating effects of Zika virus infection during pregnancy and its implication in cases of Guillain-Barre syndrome in adults. Furthermore, we urge hospital-based clinicians and transfusion medicine specialists to implement perioperative patient blood management strategies to avoid blood component transfusions with their potential risks of emerging pathogens, illustrated here by the Zika virus. Ultimately, this current global threat, as described by the World Health Organization, will inevitably be followed by future outbreaks of other bloodborne pathogens; the principles and practices of perioperative patient blood management will reduce the risks from not only known, but also unknown risks of blood transfusion for our patients.

慢性坐骨神经病变和同时存在的慢性机械性异常疼痛能减少大鼠的自发性转轮运动

### **Chronic Sciatic Neuropathy in Rat Reduces Voluntary Wheel-Running Activity With Concurrent Chronic Mechanical Allodynia**

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**背景：**多种操作产生的周围神经病的动物模型用于评估是否存在病理性疼痛状态，例如异常性疼痛。尽管刺激诱发的行为测定被频繁使用并且对于检查异常性疼痛（即对轻度机械触摸的敏感性；von Frey 纤维测试）是很重要的，但是反映总体功能的其他测量不仅是对刺激诱导反应性测量的补充，也是对疼痛模型如何影响生活质量获得完全理解的关键，这是疼痛一般功能相关的临床方面。在炎症和肌肉疼痛的啮齿动物模型中，自发性转轮运动超越了刺激性诱导的行为测定，成为一般功能的可靠指数。临床上，有关疼痛强度增加的报道发生在夜晚，这段时期通常是昼夜循环中活动减少的时间段。因此，在广泛使用的慢性外周神经性疼痛即坐骨神经慢性压迫性损伤（CCI）的啮齿动物模型中，我们检测大鼠在非活动期期间转轮运动的改变是否比其在昼夜周期的活动期更强。

**方法：**在成年雄性 SD 大鼠中，在使用易于进行的转轮（1 小时/天，连续 7 天）来测量基础活动水平之前采用 von Frey 试验评估轻度机械触摸的基础（BL）后爪阈值反应来量化行进距离。转轮活动 BL 值表示为总行进距离

(m)。整体实验设计是在 BL 测量之后，大鼠经历假手术或 CCI 手术，然后在术后长达 18 天内重复进行评估后爪阈值和转轮活动水平。具体来说，在昼夜周期的最初阶段（在前 2 小时内），大鼠在（1）无活性组（n = 8 /组）或（2）活性组（n = 8 /组）中分别进行转轮水平的评估（每次实验总时间 1 小时）。另一组 CCI 处理的大鼠（n = 8 /组）暴露于锁定的转轮，以控制转轮运动对异常性疼痛的潜在影响。1 小时的转轮期将以 20 分钟为间隔进一步检查，以确定 1 小时试验的开始，中间和最后部分活动模式可能存在的差异。通过测量转轮运动中 BL 到行进距离的变化来评估神经病变对活动水平的影响。

**结果：**虽然在昼夜周期中，检测非活动期组和活动期组大鼠转轮距离的 BL 值没有不同，但是与非活动期的假手术对照相比，坐骨神经 CCI 减少了转轮活动水平。此外，与假手术对照相比，在具有自由轮和锁定轮配置的大鼠中，在手术诱导神经病变后的所有时间点都观察到双侧低阈值机械性异常疼痛。与假手术相比，在昼夜周期的活动期期间检测到转轮活动的大鼠，其 CCI 中的异常性疼痛加倍。相反，当在昼夜周期的活动期检测活性水平时，在任何时间点，CCI 处理的大鼠与假手术对照相比没有观察到转轮运动水平的显著降低。最后，在昼夜周期的非活动期，1 小时试验期内的转轮运动模式在每个 20 分钟阶段都相对一致。

**结论：**与非神经性假性对照相比，在昼夜循环的非活动期期间，在 CCI 大鼠中观察到转轮运动有显著且稳定的减少。无论何时检测转轮运动或者它们是否在转轮，所有大鼠中都持续存在强烈的异常性疼痛，这表明急性转轮运动不改变使用 von Frey 纤维测试所测量的慢性低强度机械性异常性疼痛。总的来说，这些数据证明，有限重复暴露的急性转轮运动本身不会改变异常性疼痛，并提供与测量刺激诱导的神经性疼痛互补的行为测定。

（张楠译 薛张纲校）

**BACKGROUND:** Animal models of peripheral neuropathy produced by a number of manipulations are assessed for the presence of pathologic pain states such as allodynia. Although stimulus-induced behavioral assays are frequently used and important to examine allodynia (ie, sensitivity to light mechanical touch; von Frey fiber test), other measures of behavior that reflect overall function are not only complementary to stimulus-induced responsive measures, but are also critical to gain a complete understanding of the effects of the pain model on quality of life, a clinically relevant aspect of pain on general function. Voluntary wheel-running activity in rodent models of inflammatory and muscle pain is emerging as a reliable index of general function that extends beyond stimulus-induced behavioral assays. Clinically, reports of increased pain intensity occur at night, a period typically characterized with reduced activity during the diurnal cycle. We therefore examined in rats whether alterations in wheel-running activity were more robust during the inactive phase compared with the active phase of their diurnal cycle in a widely used rodent model of chronic peripheral neuropathic pain, the sciatic nerve chronic constriction injury (CCI) model.

**METHODS:** In adult male Sprague Dawley rats, baseline (BL) hindpaw threshold responses to light mechanical touch were assessed using the von Frey test before measuring BL activity levels using freely accessible running wheels (1 hour/day for 7 sequential days) to quantify the distance traveled. Running wheel activity BL values are expressed as total distance traveled (m). The overall experimental design was after BL measures, rats underwent either sham or CCI surgery followed by repeated behavioral reassessment of hindpaw thresholds and wheel-running activity levels for

up to 18 days after surgery. Specifically, separate groups of rats were assessed for wheel-running activity levels (1 hour total/trial) during the onset (within first 2 hours) of either the (1) inactive (n = 8/group) or (2) active (n = 8/group) phase of the diurnal cycle. An additional group of CCI-treated rats (n = 8/group) was exposed to a locked running wheel to control for the potential effects of wheel-running exercise on allodynia. The 1-hour running wheel trial period was further examined at discrete 20-minute intervals to identify possible pattern differences in activity during the first, middle, and last portions of the 1-hour trial. The effect of neuropathy on activity levels was assessed by measuring the change from their respective BLs to distance traveled in the running wheels.

**RESULTS:** Although wheel-running distances between groups were not different at BL from rats examined during either the inactive phase of the diurnal cycle or active phase of the diurnal cycle, sciatic nerve CCI reduced running wheel activity levels compared with sham-operated controls during the inactive phase. In addition, compared with sham controls, bilateral low-threshold mechanical allodynia was observed at all time points after surgical induction of neuropathy in rats with free-wheel and locked-wheel access. Allodynia in CCI compared with shams was replicated in rats whose running wheel activity was examined during the active phase of the diurnal cycle. Conversely, no significant reduction in wheel-running activity was observed in CCI-treated rats compared with sham controls at any time point when activity levels were examined during the active diurnal phase. Finally, running wheel activity patterns within the 1-hour trial period during the inactive phase of the diurnal cycle were relatively consistent throughout each 20-minute phase.

**CONCLUSIONS:** Compared with nonneuropathic sham controls, a profound and stable reduction of running wheel activity was observed in CCI rats during the inactive phase of the diurnal cycle. A concurrent robust allodynia persisted in all rats regardless of when wheel-running activity was examined or whether they ran on wheels, suggesting that acute wheel-running activity does not alter chronic low-intensity mechanical allodynia as measured using the von Frey fiber test. Overall, these data support that acute wheel-running exercise with limited repeated exposures does not itself alter allodynia and offers a behavioral assay complementary to stimulus-induced measures of neuropathic pain.

术前糖化血红蛋白(HbA1c)和术后血糖变异性在心脏单瓣膜手术中与手术后 30 天主要不良事件之间的关系

### **The Association Between Preoperative Hemoglobin A1C and Postoperative Glycemic Variability on 30-Day Major Adverse Outcomes Following Isolated Cardiac Valvular Surgery**

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**背景：**术前糖化血红蛋白(HbA1c)和术后血糖变异性对实施血糖控制的冠状动脉旁路移植手术后主要不良事件(MAEs)有预测价值。但是，术前糖化血红蛋白(HbA1c)和术后血糖变异性对心脏单瓣膜手术的影响还不明确。在本研究中，我们拟在心脏单瓣膜手术中明确 (a) 术前糖化血红蛋白 (HbA1c)能鉴别主要不良事件(MAEs)高危患者和 (b) 术后血糖变异性与主要不良事件(MAEs)相关。

**方法：**经伦理批准，本前瞻性、单中心、观察性队列研究选取 2008 年 1 月至 2013 年 12 月行单瓣膜手术的年龄大于 18 岁的患者。患者一般情况数据、术中数据和术后主要不良事件(MAEs)数据提取自胸外科协会 (STS) 数据库。主要结果 MAEs 是一个复合数据，包含住院期间死亡、心肌梗死、再次手术、胸骨感染、心脏压塞、肺炎、中风或肾功能衰竭。术后血糖变异性通过变异指数进行评价。患者通过糖化血红蛋白(HbA1c)水平 (<6.5% 或 ≥6.5%) 进行分层，数据采用多因素 logistic 回归进行分析。

**结果：**入选的 763 名患者中，109(14.3%)名患者术前糖化血红蛋白(HbA1c)水平 ≥6.5%。HbA1c 水平 ≥6.5% 患者组年龄较大(70 [63-79] 与 66 [56-75]， $P < .001$ )，且血脂异常(83.5% 与 57.0%， $P < .001$ )和充血性心力衰竭(39.5% 与 27.8%， $P = .01$ )发生的风险更高，该组胸科协会发病率和死亡率风险评分显著增高(0.18 [0.13-0.27] 与 0.13 [0.09-0.21]， $P < .001$ )。但是两组 MAEs 发生率相近(13.8% in HbA1c ≥6.5% 与 11.0% in HbA1c <6.5%， $P = .40$ )。多因素 logistic 回归分析提示术前糖化血红蛋白(HbA1c)水平 ≥6.5%(odds ratio [OR] 1.48，95% confidence interval [CI]：0.78-2.82； $P = .23$ )与术后血糖变异性(CV per quartile；OR 1.05，95% CI：0.85-1.30； $P = .67$ )均未发现与 MAEs 有相关性。但术前糖化血红蛋白(HbA1c)水平 ≥6.5%与术后血糖变异性增加相关(0.173 [0.129-0.217] 与 0.141 [0.106-0.178]， $P < .0001$ )。

**结论：**本研究并没有发现术前糖化血红蛋白(HbA1c)及术后血糖变异性在心脏单瓣膜手术中与术后 MAEs 有相关性。特别值得注意的是，与我们之前在 CABG 患者中发现的结果相反，术后血糖变异性与 MAEs 并无关联。以后的研究应该在 CABG 患者中重点关注术后血糖变异性降低与 MAEs 降低之间的联系，而该联系并不一定适用于其他心脏手术。

(陈峰译 李士通校)

**BACKGROUND:** Preoperative hemoglobin A1c (HbA1c) and postoperative glycemic variability predict major adverse events (MAEs) after coronary artery bypass grafting in a protocolized glycemic control setting. However, the influence of preoperative HbA1c and postoperative glycemic variability in isolated cardiac valvular surgery is unknown. In this study, we sought to establish (a) whether preoperative HbA1c could identify patients at increased risk of MAEs and (b) whether postoperative glycemic variability was associated with MAEs after isolated cardiac valvular surgery.

**METHODS:** Patients >18 years of age undergoing isolated valve surgery from January 2008 to December 2013 were enrolled in this prospective, single-center, observational cohort study with IRB approval. Patient demographics, intraoperative data, and postoperative MAEs were extracted from the institutional Society of Thoracic Surgery (STS) database. The primary outcome, MAEs, was a composite of in-hospital death, myocardial infarction, reoperations, sternal infection, cardiac tamponade, pneumonia, stroke, or renal failure. Glycemic variability in the postoperative period was assessed by the coefficient of variation. Patients were stratified by HbA1c levels (<6.5% or ≥6.5%) and assessed using multivariable logistic regression.

**RESULTS:** Of the enrolled 763 patients, 109 (14.3%) had a preoperative HbA1c level ≥6.5%. Patients with HbA1c ≥6.5% were older (70 [63-79] vs 66 [56-75],  $P < .001$ ) and had a higher incidence of dyslipidemia (83.5% vs 57.0%,  $P < .001$ ) and congestive heart failure (39.5% vs 27.8%,  $P = .01$ ). The calculated STS risk score for morbidity and mortality was also statistically higher in this group (0.18 [0.13-0.27] vs

0.13 [0.09-0.21],  $P < .001$ ). The occurrence of MAEs was similar between the 2 groups (13.8% in HbA1c  $\geq 6.5\%$  vs 11.0% in HbA1c  $< 6.5\%$ ,  $P = .40$ ). Multivariate logistic regression analysis revealed that neither preoperative HbA1c  $\geq 6.5\%$  (odds ratio [OR] 1.48, 95% confidence interval [CI]: 0.78-2.82;  $P = .23$ ) nor postoperative glycemic variability (CV per quartile; OR 1.05, 95% CI: 0.85-1.30;  $P = .67$ ) was found to be associated with MAEs. An HbA1c  $\geq 6.5\%$  was associated with the increased glycemic variability in the postoperative period (0.173 [0.129-0.217] vs 0.141 [0.106-0.178],  $P < .0001$ ).

**CONCLUSIONS:** This study did not show an association between preoperative HbA1c and postoperative glycemic variability with MAEs after isolated cardiac valvular surgery. Specifically, lack of association between postoperative glycemic variability and MAEs is noteworthy and is in contrast to our previous finding in CABG patients. Future studies should focus a targeted glycemic variability reduction in CABG patients and evaluate the reduction in MAEs, without risk of employing a one-size fits all approach when approaching other cardiac procedures.

### 曲马多的趋势：药理学，代谢和滥用

#### **Trends in Tramadol: Pharmacology, Metabolism, and Misuse**

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Anesthesia & Analgesia:2017 124 44–51

曲马多是一种独特的镇痛药物，可用于多种制剂，由于其单胺能再摄取抑制剂和阿片样物质受体激动剂活性的特性遂在世界范围内越来越多地被用作治疗急性和慢性疼痛的高亲和性阿片样物质药物的替代物。它是被细胞色素 P450

(CYP) 酶 CYP2D6 和 CYP3A4 代谢为其更有效的阿片样镇痛代谢物，特别是 O-脱甲基化产物 M1 的前药。给定剂量的曲马多的阿片样镇痛药效力受个体的 CYP 遗传学影响，其中不良代谢者经历很少转化为活性 M1 阿片样物质代谢物和具有高代谢分布的个体或超代谢剂，经历最大的阿片样镇痛作用。CYP 新陈代谢的重要性导致采用计算机临床决策支持，药物基因组学工具指导主要医疗中心的曲马多治疗。曲马多的同时阿片样物质激动剂作用和血清素 (5-HT) 和去甲肾上腺素再摄取抑制作用导致独特的副作用特征和重要的药物相互作用，必须考虑。曲马多的突然停止增加了阿片样物质和 5-羟色胺 - 去甲肾上腺素再摄取抑制剂戒断综合征的风险。该综述提供了关于曲马多的药理学、药代动力学、CYP 遗传多态性、药物相互作用、毒性、撤回和非法使用等更新的重要信息。

(顾明露译 李士通校)

Tramadol is a unique analgesic medication, available in variety of formulations, with both monoaminergic reuptake inhibitory and opioid receptor agonist activity increasingly prescribed worldwide as an alternative for high-affinity opioid medication in the treatment of acute and chronic pain. It is a prodrug that is metabolized by cytochrome P450 (CYP) enzymes CYP2D6 and CYP3A4 to its more potent opioid analgesic metabolites, particularly the O-demethylation product M1. The opioid analgesic potency of a given dose of tramadol is influenced by an individual's CYP genetics, with poor metabolizers experiencing little conversion to the active M1 opioid metabolite and individuals with a high metabolic profile, or ultra-metabolizers, experiencing the greatest opioid analgesic effects. The importance of the CYP metabolism has led to the adoption of computer clinical decision support

with pharmacogenomics tools guiding tramadol treatment in major medical centers. Tramadol's simultaneous opioid agonist action and serotonin (5-HT) and norepinephrine reuptake inhibitory effects result in a unique side effect profile and important drug interactions that must be considered. Abrupt cessation of tramadol increases the risk for both opioid and serotonin–norepinephrine reuptake inhibitor withdrawal syndromes. This review provides updated important information on the pharmacology, pharmacokinetics, CYP genetic polymorphisms, drug interactions, toxicity, withdrawal, and illicit use of tramadol.

应用医疗器械信息学在发展安全可互操作医疗系统的标准中的必要性

### **The Need to Apply Medical Device Informatics in Developing Standards for Safe Interoperable Medical Systems**

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Anesthesia & Analgesia:2017 124 127–135

在用户强烈要求增加可互操作性得背景下，医疗设备和健康信息技术系统越来越需要增加可互操作性。鉴于这些观点，我们必须制定相关的安全标准。在这篇文章中，我们描述了目前的医疗器械标准的发展和这些标准对医疗设备信息学的必要性。医疗器械信息应从广泛的临床场景收集，为安全医疗设备的可互操作性奠定基础。这五个临床病例表明了医疗器械信息学的作用，如果医疗器械标准的发展能够得到应用的话，可以帮助促进安全可互操作医疗设备系统的发展。这些例子说明了没有能够获取重要信号和设备属性信息的临床教训。我们提供的建议是关于历史上独立的标准发展小组与其它健康信息学之间的协调，其中一些独立的标准发展小组是专注于安全和有效性。我们觉得需要在共同的利益相关者和描述组织结构者之间建立理解来促进合作，以便于设备之间能相互作用，也能使相关的安全信息得到发展。

（顾明露译 李士通校）

Medical device and health information technology systems are increasingly interdependent with users demanding increased interoperability. Related safety standards must be developed taking into account these systems' perspective. In this article, we describe the current development of medical device standards and the need for these standards to address medical device informatics. Medical device information should be gathered from a broad range of clinical scenarios to lay the foundation for safe medical device interoperability. Five clinical examples show how medical device informatics principles, if applied in the development of medical device standards, could help facilitate the development of safe interoperable medical device systems. These examples illustrate the clinical implications of the failure to capture important signals and device attributes. We provide recommendations relating to the coordination between historically separate standards development groups, some of which focus on safety and effectiveness and others focus on health informatics. We identify the need for a shared understanding among stakeholders and describe organizational structures to promote cooperation such that device-to-device interactions and related safety information are considered during standards development.

应用计算机模型实现闭环新生儿氧气治疗

### **Applying Computer Models to Realize Closed-Loop Neonatal Oxygen Therapy**

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**背景：**在自动化新生儿氧疗的背景下，本文描述了一个通过计算机模型来验证的想法转换为一个计算机模型驱动的设备的一个概念。计算机建模整个新生儿氧气治疗系统可以通过提供一个验证平台和加速算法开发促进闭环控制算法的发展。

**方法：**在本文中，我们展示了一组数学建模系统的组成：患者体内运输的氧气，氧气机，控制器和脉搏血氧计。此外，在产品制造的约束下，新生儿氧气输送组件的一个理想化的模型可以有效地集成到一个设备的控制算法，称为自适应模型。在本文中，手控和闭环氧疗效果按以下顺序的重要性定义了3种标准：氧浓度正常（目标  $\text{SpO}_2 \pm 2.5\%$ ）、低氧（低于正常氧浓度）、高氧（高于正常氧浓度）分别的持续时间百分比；60秒内动脉血氧饱和度 $<85\%$ 和 $>95\%$ 的次数；手动调整的次数。

**结果：**对于7名低体重早产儿进行氧疗，从临床的角度比较三种闭环控制算法（状态机，比例、积分、微分，自适应模型）与手动氧疗，结果如下。与手动疗法相比，所有的闭环控制算法显著增加病人氧浓度正常的时间，减少高氧的时间( $P < 0.05$ )。所有的闭环控制算法也显著减少了手动调整的数量( $P < 0.05$ )。

**结论：**虽然3种控制算法的表现相同，自适应模型因其易用性，可能具有最好的效用。

（黄尧卿译 李士通校）

**BACKGROUND:** Within the context of automating neonatal oxygen therapy, this article describes the transformation of an idea verified by a computer model into a device actuated by a computer model. Computer modeling of an entire neonatal oxygen therapy system can facilitate the development of closed-loop control algorithms by providing a verification platform and speeding up algorithm development.

**METHODS:** In this article, we present a method of mathematically modeling the system's components: the oxygen transport within the patient, the oxygen blender, the controller, and the pulse oximeter. Furthermore, within the constraints of engineering a product, an idealized model of the neonatal oxygen transport component may be integrated effectively into the control algorithm of a device, referred to as the adaptive model. Manual and closed-loop oxygen therapy performance were defined in this article by 3 criteria in the following order of importance: percent duration of  $\text{SpO}_2$  spent in normoxemia (target  $\text{SpO}_2 \pm 2.5\%$ ), hypoxemia (less than normoxemia), and hyperoxemia (more than normoxemia); number of 60-second periods  $<85\%$   $\text{SpO}_2$  and  $>95\%$   $\text{SpO}_2$ ; and number of manual adjustments.

**RESULTS:** Results from a clinical evaluation that compared the performance of 3 closed-loop control algorithms (state machine, proportional-integral-differential, and adaptive model) with manual oxygen therapy on 7 low-birth-weight ventilated preterm babies, are presented. Compared with manual therapy, all closed-loop control algorithms significantly increased the patients' duration in normoxemia and reduced hyperoxemia ( $P < 0.05$ ). The number of manual adjustments was also significantly reduced by all of the closed-loop control algorithms ( $P < 0.05$ ).

**CONCLUSIONS:** Although the performance of the 3 control algorithms was equivalent, it is suggested that the adaptive model, with its ease of use, may have the best utility.

了解睡眠呼吸暂停综合征的表现形式：将其应用于麻醉、手术和围术期用药

## **Understanding Phenotypes of Obstructive Sleep Apnea: Applications in Anesthesia, Surgery, and Perioperative Medicine**

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*Anesthesia & Analgesia*:2017 124 179–191

睡眠呼吸暂停综合征(OSA)是一种常见的潜在的长期主要神经认知的睡眠呼吸紊乱,并伴有心血管后遗症。OSA的病理生理改变存在于不同的个体间,包含不同潜在的机制。其中一些包括上呼吸道解剖,上呼吸道扩张肌肉如颏舌肌的有效性,不同个体的唤醒阈值,呼吸系统控制系统的固有稳定性决定OSA的发病机理。OSA是一种常见的潜在的长期主要神经认知的睡眠呼吸紊乱,围术期医护人员应引起关注。例如,OSA病人的高唤醒阈值可能对镇静和止痛药很敏感,围术期存在更高风险的呼吸抑制。OSA病人存在固有呼吸紊乱,而氧疗法能帮助其稳定呼吸。OSA病人仰卧位有上呼吸道塌陷的倾向,而避免仰卧位能减轻呼吸道梗阻。

此综述对OSA临床相关症状和表现做了描述。持续气道正压可用于治疗大多数病人,但病人的耐受性和坚持便是个问题。以病人为中心的个体化治疗对将来OSA潜在治疗方法的研究将是个重点,这将有效减少疾病负担,提高治疗效果。

(廖汝婷译 李士通校)

Obstructive sleep apnea (OSA) is a prevalent sleep-disordered breathing with potential long-term major neurocognitive and cardiovascular sequelae. The pathophysiology of OSA varies between individuals and is composed of different underlying mechanisms. Several components including the upper airway anatomy, effectiveness of the upper airway dilator muscles such as the genioglossus, arousal threshold of the individual, and inherent stability of the respiratory control system determine the pathogenesis of OSA. Their recognition may have implications for the perioperative health care team. For example, OSA patients with a high arousal threshold are likely to be sensitive to sedatives and narcotics with a higher risk of respiratory arrest in the perioperative period. Supplemental oxygen therapy can help to stabilize breathing in OSA patients with inherent respiratory instability. Avoidance of supine position can minimize airway obstruction in patients with a predisposition to upper airway collapse in this posture. In this review, the clinically relevant endotypes and phenotypes of OSA are described. Continuous positive airway pressure (CPAP) therapy is the treatment of choice for most patients with OSA but tolerance and adherence can be a problem. Patient-centered individualized approaches to OSA management will be the focus of future research into developing potential treatment options that will help decrease the disease burden and improve treatment effectiveness.

产科患者血液管理国内外指南：一项定性评估

## **National and International Guidelines for Patient Blood Management in Obstetrics: A Qualitative Review**

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*Anesthesia & Analgesia*:2017 124 216–232

发达国家产后出血(PPH)需要输血比例逐步增加。因此,麻醉医师被要求协助严重产后大出血患者的管理。急救员,包括麻醉医师,可以采用国内协会或其他机构



的患者血液管理(PBM)建议。然而,目前尚不清楚国内外产科产后出血指南是否包括患者血液管理。我们定性评估了由以下国家产科协会和国际组织发表的PBM建议:美国妇产科学;英国皇家妇产科学院,澳大利亚和新西兰皇家妇产科学院;加拿大的妇产科协会;一个来自奥地利、德国和瑞士的跨学科组织专家团,一个国际多学科共识组织,法国大学妇产科。我们也回顾了由国家孕妇安全合作伙伴发表的产后出血指南。基于本文评估,我们确认了国内外协会的输血和患者血液管理指南的重要差异。根据PBM非产科设置的进步,产科协会应该确定其在产科设置的适用性。医疗、产科和麻醉的合作也可以帮助规范输血和确定产科PBM指南。

(黄婷译 李士通校)

In developed countries, rates of postpartum hemorrhage (PPH) requiring transfusion have been increasing. As a result, anesthesiologists are being increasingly called upon to assist with the management of patients with severe PPH. First responders, including anesthesiologists, may adopt Patient Blood Management (PBM) recommendations of national societies or other agencies. However, it is unclear whether national and international obstetric societies' PPH guidelines account for contemporary PBM practices. We performed a qualitative review of PBM recommendations published by the following national obstetric societies and international groups: the American College of Obstetricians and Gynecologists; The Royal College of Obstetricians and Gynecologists, United Kingdom; The Royal Australian and New Zealand College of Obstetricians and Gynecologists; The Society of Obstetricians and Gynecologists of Canada; an interdisciplinary group of experts from Austria, Germany, and Switzerland, an international multidisciplinary consensus group, and the French College of Gynaecologists and Obstetricians. We also reviewed a PPH bundle, published by The National Partnership for Maternal Safety. On the basis of our review, we identified important differences in national and international societies' recommendations for transfusion and PBM. In the light of PBM advances in the nonobstetric setting, obstetric societies should determine the applicability of these recommendations in the obstetric setting. Partnerships among medical, obstetric, and anesthetic societies may also help standardize transfusion and PBM guidelines in obstetrics.

关于大量输血协议：一项来自美国医学研究中心的调查

### **Massive Transfusion Protocols: A Survey of Academic Medical Centers in the United States**

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**背景：**很多医院都已经采用了大量输血协议，这可能对提高血制品的输注结果以及减少没必要的血制品输注数量有好处。然而，在这些协议中，关于血制品的输注数量和种类没有明确的指导。各个医院的大量输血协议也可能很不同。

**方法：**一个简短的、以网络为基础的调查被送到学术中心的血库医疗主管单位以了解每个单位大量输血协议的具体细节。

**结果：**我们一共发出了 107 份调查问卷，其中收到的完成份数是 56 份，(52% 的回执率)。所有回复的单位都有采用大量输血协议。几乎所有(n = 55, 98.2% [95% 可信区间是 90.6%–99.7%])的单位会依据他们的协议输注一定数量和比率

的血液制品，仅包括很少部分的以实验为指导的输血治疗。最常见的目标是，红细胞与血浆之比是 1:1 (n = 39, 69.9% [95% 可信区间是 56.7%–80.1%]在回执调查里)。大多数会提供 6 个甚至更多单位的红细胞在大量输血的第一个阶段。**结论：**收到回执的所有单位中全部都有大量输血协议。尽管缺乏关于大量输血的发布指导，这个调查结果显示在输血制品数量和目标输注率还是有很大的统一性。

(解健译 李士通校)

**BACKGROUND:** Massive transfusion protocols (MTPs) have been adopted in many hospitals, and they may improve outcomes, as well as decrease the number of blood products transfused. However, there are no specific guidelines regarding the number and types of products that should be included in these protocols. MTPs may vary from hospital to hospital.

**METHODS:** A short, web-based survey was sent to blood bank medical directors at academic institutions to learn details about MTPs.

**RESULTS:** A total of 107 survey requests were sent, and 56 were completed (52% response rate). All who responded had an MTP in place. Nearly all (n = 55, 98.2% [95% CI, 90.6%–99.7%]) base their protocol on delivery of fixed amounts and ratios of blood products, with only a minority incorporating any elements of laboratory-directed therapy. The most common target, red blood cell (RBC):plasma ratio, is 1:1 (n = 39, 69.9% [95% CI, 56.7%–80.1%] of respondents). The majority (n = 36, 64.3% [95% CI, 51.2%–75.6%]) provide 6 or more units of red blood cells in the first MTP packet.

**CONCLUSIONS:** One-hundred percent of survey respondents had an MTP in place. Despite a lack of published guidelines regarding MTPs, the survey results demonstrated substantial uniformity in numbers of products and target transfusion ratios.

开放肾切除术后硬膜外镇痛、连续手术部位的镇痛和病人自控镇痛药吗啡的有效性对于术后疼痛管理和痛觉过敏、康复以及健康相关的生活质量的研究：一个前瞻性随机对照研究

**Effectiveness of Epidural Analgesia, Continuous Surgical Site Analgesia, and Patient-Controlled Analgesic Morphine for Postoperative Pain Management and Hyperalgesia, Rehabilitation, and Health-Related Quality of Life After Open Nephrectomy: A Prospective, Randomized, Controlled Study**

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**背景：**没有公认有效的技术来优化减少疼痛分数和防止肾切除术后持续的术后疼痛。我们比较接受连续手术部位镇痛(CSSA)，硬膜外镇痛(EA)和对照组(病人自控镇痛药吗啡)在开放肾切除术的患者。

**方法：**60 个病人被随机分成三组，手术部位镇痛组硬膜外组以及对照组在术后 72 小时。所有患者，如果必要时接受病人自控镇痛药吗啡。痛觉过敏评估在术后第一、第二和第三天。慢性疼痛的特点对于 1 和 3 个月的生活质量进行了分析。主要的结果是在 24 小时内疼痛评分。次要的结果是对于吗啡的使用量、术后康复、痛觉过敏、慢性疼痛发生率,和生活质量参数关系。

**结果：**EA、CSSA 和对照组在 24 小时均值±标准差疼痛值分别为 2.4±1.7，2.4±1.7，4.2±1.2 (P<0.01)，EA 和 CSSA 组咳嗽发生率较低。吗啡总消费量高于对照组。EA 和 CSSA 组康复参数改善得更快。在 48 小时内 EA 组和对照组痛觉过敏的中位数的值为 36.4 厘米和 52 厘米之间 (P = 0.01)；72 小时之内，EA 组、CSSA 组和对照组分别为 40 厘米、39.5 厘米和 59 厘米 (P = 0.002)。CSSA 组减少 1 个月时疼痛的严重程度和痛觉过敏，并且优化手术后 3 个月的生活质量(主要的生理成绩，P = 0.005)。

**结论：**CSSA 和 EA 显著改善术后镇痛，减少术后吗啡消费，伤口痛觉过敏，加速开放肾切除术患者康复。CSSA 显著减少手术后 1 个月的残余疼痛和优化手术后 3 个月生活质量参数。

(吴昕菀译 李士通校)

**BACKGROUND:** There is no widely recognized effective technique to optimally reduce pain scores and prevent persistent postoperative pain after nephrectomy. We compared continuous surgical site analgesia (CSSA), epidural analgesia (EA), and a control group (patient-controlled analgesic morphine) in patients undergoing open nephrectomy.

**METHODS:** Sixty consecutive patients were randomized to be part of EA, CSSA, or control groups postoperatively for 72 hours. All patients received patient-controlled analgesic morphine, if needed. Hyperalgesia was assessed on the first, second, and third postoperative days. Chronic pain characteristics and quality of life were analyzed at 1 and 3 months. The primary outcome was the pain score at 24 hours. Secondary outcomes were morphine consumption, postoperative rehabilitation, hyperalgesia, chronic pain incidence, and quality-of-life parameters.

**RESULTS:** At 24 hours, mean ± standard deviation pain values at rest ( $2.4 \pm 1.7$ ,  $2.2 \pm 1.2$ , and  $4.2 \pm 1.2$ , respectively, in EA, CSSA, and control groups,  $P < .001$ ) and during coughing was lower in the EA and CSSA groups. Total morphine consumption was higher in the control group. Rehabilitation parameters improved sooner in the EA and CSSA groups. Median values of area of hyperalgesia differed at 48 hours between the EA group and the control group (36.4 cm) and (52 cm) ( $P = .01$ ) and at 72 hours among the EA group, CSSA group, and the control group (40 cm, 39.5 cm, and 59 cm, respectively;  $P = .002$ ). CSSA reduced the severity of pain and hyperalgesia at 1 month and optimized quality of life 3 months after surgery (role physical scores,  $P = .005$ ).

**CONCLUSIONS:** CSSA and EA significantly improve postoperative analgesia, reduce postoperative morphine consumption, area of wound hyperalgesia, and accelerate patient rehabilitation after open nephrectomy. CSSA significantly reduces the severity of residual pain 1 month after surgery and optimizes quality-of-life parameters 3 months after surgery.