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December, 2013

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Drug Infusion System Manifold Dead-Volume Impacts the Delivery Response Time to Changes in Infused Medication Doses In Vitro and Also In Vivo in Anesthetized Swine
BACKGROUND: IV infusion systems can be configured with manifolds connecting multiple drug infusion lines to transcutaneous catheters. Prior in vitro studies suggest that there may be significant lag times for drug delivery to reflect changes in infusion rates set at the pump, especially with low drug and carrier flows and larger infusion system dead-volumes. Drug manifolds allow multiple infusions to connect to a single catheter port but add dead-volume. We hypothesized that the time course of physiological responses to drug infusion in vivo reflects the impact of dead-volume on drug delivery.

METHODS: The kinetic response to starting and stopping epinephrine infusion ([3 mL/h] with constant carrier flow [10 mL/h]) was compared for high- and low-dead-volume manifolds in vitro and in vivo. A manifold consisting of 4 sequential stopcocks with drug entering at the most upstream port was contrasted with a novel design comprising a tube with separate coaxial channels meeting at the downstream connector to the catheter, which virtually eliminates the manifold contribution to the dead-volume. The time to 50% (T50) and 90% (T90) increase or decrease in drug delivery in vitro or contractile response in a swine model in vivo were calculated for initiation and cessation of drug infusion.

RESULTS: The time to steady state after initiation and cessation of drug infusion both in vitro and in vivo was much less with the coaxial low-dead-volume manifold than with the high-volume design. Drug delivery after initiation in vitro reached 50% and 90% of steady state in 1.4 ± 0.12 and 2.2 ± 0.42 minutes with the low-dead-volume manifold and in 7.1 ± 0.58 and 9.8 ± 1.6 minutes with the high-volume manifold, respectively. The contractility in vivo reached 50% and 90% of the full response after drug initiation in 4.3 ± 1.3 and 9.9 ± 3.9 minutes with the low-dead-volume manifold and 11 ± 1.2 and 17 ± 2.6 minutes with the high-volume manifold, respectively. Drug delivery in vitro decreased by 50% and 90% after drug cessation in 1.9 ± 0.17 and 3.5 ± 0.61 minutes with the low-dead-volume manifold and 10.0 ± 1.0 and 17.0 ± 2.8 minutes with the high-volume manifold, respectively. The contractility in vivo decreased by 50% and 90% with drug cessation in 4.1 ± 1.1 and 14 ± 5.2 minutes with the low-volume manifold and 12 ± 2.7 and 23 ± 5.6 minutes with the high-volume manifold, respectively.
CONCLUSIONS: The architecture of the manifold impacts the in vivo biologic response, and the drug delivery rate, to changes in drug infusion rate set at the pump.

使用依託咪酯而非異丙酚進行麻醉誘導可增加非心臟手術後 30 天內死亡及心血管發病率

Anesthetic Induction with Etomidate, Rather than Propofol, Is Associated with Increased 30-Day Mortality and Cardiovascular Morbidity After Noncardiac Surgery

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Anesthesia & Analgesia: 2013 117 1329–1337

BACKGROUND: Because etomidate impairs adrenal function and blunts the cortisol release associated with surgical stimulus, we hypothesized that patients induced with etomidate suffer greater mortality and morbidity than comparable patients induced with propofol.

METHODS: We evaluated the electronic records of 31,148 ASA physical status III and IV patients who had noncardiac surgery at the Cleveland Clinic. Among these, anesthesia was induced with etomidate and maintained with volatile anesthetics in 2616 patients whereas 28,532 were given propofol for induction and maintained with volatile anesthetics. Two thousand one hundred forty-four patients given etomidate were propensity matched with 5233 patients given propofol and the groups compared on 30-day postoperative mortality, length of hospital stay, cardiovascular and infectious morbidities, vasopressor requirement, and intraoperative hemodynamics.

RESULTS: Patients given etomidate had 2.5 (98% confidence interval [CI], 1.9–3.4) times the odds of dying than those given propofol. Etomidate patients also had significantly greater odds of having cardiovascular morbidity (odds ratio [OR] [98% CI]: 1.5 [1.2–2.0]), and significantly longer hospital stay (hazard ratio [95% CI]: 0.82 [0.78–0.87]). However, infectious morbidity (OR [98% CI]: 1.0 [0.8–1.2]) and intraoperative vasopressor use (OR [95% CI] 0.92: [0.82–1.0]) did not differ between the agents.

CONCLUSION: Etomidate was associated with a substantially increased risk for 30-day mortality, cardiovascular morbidity, and prolonged hospital stay. Our conclusions, especially on 30-day mortality, are robust to a strong unmeasured binary confounding variable. Although our
study showed only an association between etomidate use and worse patients’ outcomes but not causal relationship, clinicians should use etomidate judiciously, considering that improved hemodynamic stability at induction may be accompanied by substantially worse longer-term outcomes.

Airway Management in Patients with Subglottic Stenosis: Experience at an Academic Institution

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Anesthesia & Analgesia: 2013 117 1352–1354

We describe a pilot study investigating the airway techniques used in the anesthetic management of subglottic stenosis. We searched the electronic clinical information database of the University of Michigan Health System for cases of subglottic stenosis in patients undergoing surgery. Demographics, airway techniques, incidence of hypoxemia, and technique failure were extracted from 159 records. A lower incidence of hypoxemia was found between the 4 most commonly used techniques and the less common techniques. We detected no difference in outcome between individual techniques. This study suggests a larger prospective multicenter study is required to further investigate these outcomes in patients with subglottic stenosis.

Anesthesia Induction Using Video Glasses as a Distraction Tool for the Management of Preoperative Anxiety in Children

Kerimoglu, Beklen MD*; Neuman, Avishai MD†; Paul, Jonathan BA‡; Stefanov, Dimitre G. PhD*; Twersky, Rebecca MD*

Anesthesia & Analgesia: 2013 117 1373–1379

Background: Suitable perioperative entertainment technology is available, but there is currently no evidence that preoperative oral midazolam alleviates anxiety compared to nebulized midazolam. Use of visual glasses can provide visual and auditory distraction to patients and may be an effective distraction tool for preoperative anxiety. Following the use of visual glasses, sedation scores were lower than those in the midazolam group.

Methods: This prospective, randomized, double-blind study included 96 children aged 4-9 years. After obtaining informed consent, the patients were randomized to receive either midazolam or visual glasses. Sedation scores were assessed at the end of the procedure and at discharge.

Results: The visual glasses group had lower sedation scores compared to the midazolam group. The visual glasses group was also associated with lower anxiety scores on the Yale Preoperative Anxiety Scale.

Conclusion: The use of visual glasses during preoperative sedation is an effective distraction tool for reducing anxiety and improving patient experience.
BACKGROUND: Distraction technology suitable for the perioperative setting is readily available, but there is little evidence to show how it compares with oral midazolam in managing anxiety. Video glasses, which enable children to view and listen to cartoons and movies, may be used through the completion of inhaled induction. We compared the efficacy of oral midazolam and behavioral distraction with video glasses in managing preoperative anxiety in children.

METHODS: In this prospective, randomized study, 96 children aged 4 to 9 years undergoing outpatient surgery were recruited to one of 3 intervention groups receiving midazolam, video glasses, or both. The Modified Yale Preoperative Anxiety Scale was the primary dependent measure used to assess anxiety at baseline before intervention, 20 minutes later at transport to the operating room (OR), and during mask induction.

RESULTS: There was no significant increase in anxiety score within any group between baseline and OR transport (P = 0.21, 0.42, and 0.57 for midazolam, video glasses, and combined groups, respectively). An increase in anxiety, though not large enough to be clinically significant, was observed from baseline to induction in the midazolam and combined groups (P = 0.02 and 0.03) but not in the video glasses group (P = 0.38). Confidence intervals for pairwise comparisons in Modified Yale Preoperative Anxiety Scale changes among groups were all within a clinically significant difference of 15 units.

CONCLUSIONS: The use of video glasses and midazolam alone or in combination maintains baseline levels of anxiety at time of transport to the OR and prevents significantly increased anxiety during induction of anesthesia in children. Video glasses are not inferior to midazolam for preoperative anxiolysis and provide a safe, noninvasive, nonpharmacologic, and pleasant alternative.
BACKGROUND: Caudal block (CB) has some disadvantages, one of which is its short duration of action after a single injection. For hypospadias repair, pudendal nerve block (PNB) might be a suitable alternative since it has been successfully used for analgesia for circumcision. We evaluated PNB compared with CB as measured by total analgesic consumption 24 hours postoperatively.

METHODS: In this prospective, double-blinded study, patients were randomized into 2 groups, either receiving CB or nerve stimulator-guided PNB. In the PNB group, patients were injected with 0.3 mL/kg 0.25% bupivacaine and 1 µg/kg clonidine. In the CB group, patients were injected with 1 mL/kg 0.25% bupivacaine and 1 µg/kg clonidine. Analgesic consumption was assessed during the first 24 hours postoperatively. The “objective pain scale” developed by Hannahal and Broadman17 was used to assess postoperative pain.

RESULTS: Eighty patients participated in the study, 40 in each group. The mean age in the PNB group was 3.1 (1.1) years and in the CB group was 3.2 (1.1) years. The mean weights in the PNB and CB groups were 15.3 (2.8) kg and 15.3 (2.2) kg, respectively. The percentage of patients who received analgesics during the first 24 hours were significantly higher in the CB (70%) compared with the PNB group (20%, P < 0.0001). The average amount of analgesics consumed per patient within 24 hours postoperatively was higher in the CB group (paracetamol P < 0.0001, Tramal P = 0.003).

CONCLUSION: Patients who received PNB had reduced analgesic consumption and pain within the first 24 hours postoperatively compared with CB.

BACKGROUND: The inhaled anesthetic sevoflurane is commonly used for neonates in the clinical setting. Recent studies have indicated that exposure of neonatal rodents to sevoflurane...
causes acute widespread neurodegeneration and long-lasting neurocognitive dysfunction. Although acute toxic effects of sevoflurane on cellular viability in the hippocampus have been reported in some studies, little is known about the effects of neonatal sevoflurane exposure on long-term hippocampal synaptic plasticity, which has been implicated in the processes of learning and memory formation. Our study is the first to examine the long-term electrophysiological impact of neonatal exposure to a clinically relevant concentration of sevoflurane.

METHODS: On postnatal day 7, rats were exposed to sevoflurane (1% or 2% for 2 hours) with oxygen. To eliminate the influence of blood gas abnormalities caused by sevoflurane-induced respiratory suppression, a group of rats were exposed to a high concentration of carbon dioxide (8% for 2 hours) to duplicate respiratory disturbances caused by 2% sevoflurane exposure.

RESULTS: Exposure of neonatal rats to 2% sevoflurane for 2 hours caused significant suppression of long-term potentiation (LTP) induction in the postgrowth period. There was no significant difference between the control group and the CO2-exposed group in LTP induction, indicating that sevoflurane-induced LTP suppression was not caused by blood gas abnormalities.

CONCLUSION: Our present findings indicate that neonatal exposure to sevoflurane at a higher concentration can cause alterations in the hippocampal synaptic plasticity that persists into adulthood.
BACKGROUND: We performed this randomized trial to compare the recovery profile of patients receiving single injection (SISB) and continuous interscalene brachial plexus block (CISB) or general anesthesia (GA) for arthroscopic rotator cuff repair surgery through the first postoperative week. Our primary hypothesis was that the highest pain numeric rating scale (NRS) (worst pain score) at the end of the study week would be lower for patients in the CISB group than for patients in the SISB or GA groups.

METHODS: Seventy-one patients scheduled for elective outpatient arthroscopic rotator cuff repair were enrolled. CISB patients received 20 mL of 0.5% ropivacaine as a bolus through a catheter, whereas SISB patients received the same injection volume through a needle. CISB patients received an infusion of 0.2% ropivacaine at 5 mL/h with a patient-controlled bolus of 5 mL hourly for 48 hours. GA-only patients received a standardized general anesthetic. Postoperative highest NRS pain scores through the first postoperative week, time-to-first pain, analgesic consumption, fast-tracked postoperative anesthesia care unit (PACU) bypass rate, length of PACU stay, time-to-discharge home, total hours of sleep, and related adverse effects were recorded in the PACU and at home on postoperative days 1, 2, 3, and 7.

RESULTS: No patient in the CISB or SISB groups reported a NRS ≥1 or required analgesics while in the PACU. While most patients in the CISB and SISB groups were fast-tracked to PACU discharge, no patient in the GA group was fast-tracked (χ²(P = 0.003). Length of stay in the PACU was significantly shorter for the CISB and SISB groups than for the GA group (20 ± 31, 30 ± 42, and 165 ± 118 minutes, respectively (CISB vs GA, P < 0.001; SISB vs GA, P <0.001), and time-to-discharge home was significantly shorter when compared with the GA group. Time to first pain report was longer in the CISB group. Mean NRS scores were lower for patients in the CISB group than in the SISB and GA groups on postoperative days 1 and 2, and use of narcotics (doses ≥1) was lower until postoperative day 3. Patients who received CISB slept significantly longer than patients who received SISB or GA (P < 0.01) during the first 48 hours postoperatively. By the end of the study week, 26% of patients in the CISB group, 83% in the SISB group, and 58% of GA patients reported NRS ≥4 (both P-values).

CONCLUSION: The analgesic benefits of CISB found in the PACU and immediately after discharge extend through the intermediate recovery period ending on postoperative day 7.
BACKGROUND: Measuring cardiac output accurately during anesthesia is thought to be helpful for safely controlling hemodynamics. Several minimally invasive methods to measure cardiac output have been developed as alternatives to thermodilution with pulmonary artery catheterization. We evaluated the reliability of a novel pulse wave transit time method of cardiac output assessment to trend with thermodilution cardiac output in patients undergoing partial hepatectomy.

METHODS: Thirty-one patients (ASA physical status II or III) undergoing partial hepatectomy under general anesthesia were evaluated. Cardiac output measurements by pulse wave transit time method and by thermodilution were recorded after induction of anesthesia, after a change in body positioning to 20° head up, after a change to 20° head down, after volume challenge with 10 mL•kg⁻¹ hydroxyethyl starch 6%, during the Pringle maneuver, and immediately after Pringle maneuver release. Trending was assessed using Bland-Altman analysis and concordance analysis.

RESULTS: The direction of change between consecutive pulse wave transit time measurements and the corresponding thermodilution measurements showed a concordance rate of 96.0% (lower 95% confidence interval = 64%), with limits of agreement −1.51 and 1.61 L•min⁻¹.

CONCLUSIONS: The pulse wave transit time method had good concordance but fairly wide limits of agreement with regard to trending in patients with changes in preload and systemic vascular resistance. There are potential inaccuracies when vasopressors are used to treat hypotension associated with decreased systemic vascular resistance. The study limitations are that the cardiac output data were collected in a nonblinded fashion, and an existing intraarterial catheter was used, although the system requires only routine, noninvasive cardiovascular monitors. This is a promising technique that currently has limitations and will require further improvements and clinical assessment.

使用 COOK 換管器時的換管失敗和併發症：對 1177 名患者的單中心佇列研究
Airway Exchange Failure and Complications with the Use of the Cook Airway Exchange Catheter®: A Single Center Cohort Study of 1177 Patients
McLean, Sheron MD; Lanam, Carolyn R. BS; Benedict, Wendy BS; Kirkpatrick, Nathan BS; Kheterpal, Sachin MD, MB; Ramachandran, Satya Krishna MD, FRCA
Anesthesia & Analgesia 2013 117 1325–1327
There are limited data on rates of failure and airway injury with the use of airway exchange catheters. We performed a single-center retrospective analysis of airway exchange catheters to determine the incidence and associated factors for tube exchange failure and airway injury. Among 1177 cases, failed intubation during attempted tube exchange was noted in 73/527 (13.8%). Airway exchange failure rates were greatest during exchange catheter use for double-lumen tube insertion and when intubation was attempted over the catheter postoperatively. Pneumothorax was noted after 1.5% of attempted tube exchanges. Difficult tube exchange was encountered in 6 of 8 patients with pneumothorax.

**甲状腺高度: 用於預測喉鏡檢查困難的一項新的臨床測試**

**Thyromental Height: A New Clinical Test for Prediction of Difficult Laryngoscopy**

Etezadi, Farhad MD; Ahangari, Aylar; Shokri, Hajar; Najafi, Atabak MD; Khajavi, Mohammad Reza MD; Daghhigh, Mahtab MA; Moharari, Reza Shariat MD

Anesthesia & Analgesia 2013 117 1347–1351

**背景:** 據報導喉鏡檢查困難的發生率為 1.5% 至 20%。我們假設喉鏡檢查困難的發生與當患者仰臥口唇閉合時下頦前緣至甲狀軟骨的高度密切相關。我們稱之為甲頦高度測試 (TMHT)。此項研究目的在於確定其預測喉鏡檢查困難的實用性。

**方法:** 314 例大於等於 16 歲計畫接受全身麻醉的連續的男女患者被邀請入組。在術前門診使用改良 Mallampati 分級、甲頦距離和胸頦距離及甲頦高度進行氣道評估。之後，在氣管插管時評價喉鏡檢查視野的 Cormack 和 Lehane 分級。喉鏡檢查者不知道氣道評估結果。分別計算出甲頦高度的有效性和預測指數作爲主要觀察指標。對其他三種氣道評估方法的有效性進行計算是本研究的次要觀察指標。

**結果:** 最佳靈敏度和特異性值的範圍為 47.46 至 51.02 毫米。為了便於臨床應用，選用 50mm 作爲臨界值。甲頦高度比其他測試更準確 (所有 P<0.0001)。

**結論:** 甲頦高度測試比現有解剖學測量更能準確預測喉鏡檢查困難。

（邢怡安 譯 馬皓琳 李士通 校）

**BACKGROUND:** The incidence of difficult laryngoscopy is reported in the range of 1.5% to 20%. We hypothesized that there is a close association between the occurrence of difficult laryngoscopy and the height between the anterior borders of the mentum and thyroid cartilage, while the patient lies supine with her/his mouth closed. We have termed this the “thyromental height test” (TMHT). Our aim in this study was to determine its utility in predicting difficult laryngoscopy.

**METHODS:** Three hundred fourteen consecutive male and female patients aged ≥16 years scheduled to undergo general anesthesia were invited to participate. Airway assessments were performed with the modified Mallampati test, thyromental distance and sternomental distance, and TMHT in the preoperative clinic. Afterward, Cormack and Lehane grade of laryngoscopy views was assessed during intubation. The laryngoscopist was unaware of airway assessments. As a primary end point, the validity and prediction indexes for the TMHT were calculated. Calculation of validity indexes for the 3 other methods of airway assessment was a secondary objective of this study.

**RESULTS:** The optimal sensitivity and specificity values were in the range of 47.46 to 51.02 mm. To facilitate clinical application, a cutoff value equal to 50 mm was chosen. TMHT was more accurate than the other tests (all P < 0.0001).

**CONCLUSIONS:** The TMHT appears to be a more accurate predictor of difficult laryngoscopy than the existing anatomical measurements.
A Retrospective Assessment of the Incidence of Respiratory Depression After Neuraxial Morphine Administration for Postcesarean Delivery Analgesia

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Anesthesia & Analgesia 2013 117 1368–1370

Respiratory depression can occur after neuraxial morphine administration. In the obstetric population, there are little data on respiratory depression after neuraxial morphine administration in women undergoing cesarean delivery. In this single-center, retrospective study in 5036 obstetric patients (mean body mass index = 34 kg/m2) who underwent cesarean delivery and received neuraxial morphine, we did not identify any instances of respiratory depression requiring naloxone administration or rapid response team involvement. Therefore, the upper 95% confidence limit for respiratory depression in our study is 0.07% (1 event per 1429 cases).

The Effect of Cisatracurium and Rocuronium on Lung Function in Anesthetized Children

Yang, Charles I. MD*; Fine, Gavin F. MBChB*; Jooste, Edmund H. MBChB, DA†; Mutich, Rebecca BS, RCP‡; Walczak, Stephen A. RRT, CPFT‡; Motoyama, Etsuro K. MD*

Anesthesia & Analgesia 2013 117 1393–1400

Background: Muscle relaxants and airway secretions may be related. We studied the lung function of children in the operating room who received either intravenous (IV) cisatracurium or rocuronium. The study was performed in ASA I–II patients who were undergoing therapeutic and diagnostic procedures. The IV muscle relaxants were administered to the patients, and the lung function was measured before and after the IV muscle relaxants and after extubation.

Methods: Twenty-five patients were studied in the operating room. The lung function was measured before and after IV muscle relaxants and after extubation. The lung function was also measured after the administration of an additional IV muscle relaxant (either cisatracurium or rocuronium). The lung function was measured before and after the additional IV muscle relaxant.

Results: The lung function before and after the IV muscle relaxants and after extubation was measured in 25 patients. The lung function was measured before and after the additional IV muscle relaxant. The lung function was measured before and after the additional IV muscle relaxant.

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The Effect of Cisatracurium and Rocuronium on Lung Function in Anesthetized Children

Yang, Charles I. MD*; Fine, Gavin F. MBChB*; Jooste, Edmund H. MBChB, DA†; Mutich, Rebecca BS, RCP‡; Walczak, Stephen A. RRT, CPFT‡; Motoyama, Etsuro K. MD*

Anesthesia & Analgesia 2013 117 1393–1400

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库钾组给予沙丁胺醇后，FVC 与基础值比较略增加但有显著意义（1.02 ± 0.02, P = 0.005）。MEF10 与基础值比较显著增加（1.24 ± 0.43, P = 0.04）。在罗库溴铵组，FVC (1.02 ± 0.02, P = 0.004) 和 MEF10 (1.23 ± 0.29, P = 0.01) 在给予沙丁胺醇后与基线比较也有显著差异。

结论：在临床相关剂量时，顺阿曲库铵和罗库溴铵都可引起肺功能改变，表明小气道有收缩。一般而言，这些改变是轻微的在临床不被观察到。然而，在罗库溴铵组，13 个病人中的 3 个在 MEF10 表现出明显的减少（≤50%），证明了在敏感的病人有显著的支气管-细支气管收缩的潜在性。

王晓莉译 马皓琳 李士通校

BACKGROUND: Neuromuscular blocking drugs have been implicated in intraoperative bronchoconstrictive episodes. We examined the effects of clinically relevant doses of cisatracurium and rocuronium on the lung mechanics of pediatric subjects. We hypothesized that cisatracurium and rocuronium would have bronchoconstrictive effects.

METHODS: We studied ASA physical status I and II pediatric subjects having elective dental or urological procedures, requiring general anesthesia with endotracheal intubations with either cisatracurium or rocuronium. Pulmonary function tests were performed before and after neuromuscular blocking drug dosing and again after albuterol administration. Using forced deflation and passive deflation techniques, forced vital capacity (FVC) and maximum expiratory flow rate at 10% (MEF10) of FVC were obtained. Fractional changes from the baseline were used to compare subjects. Changes in MEF10 of >30% were considered clinically significant. A Shapiro–Wilk test, paired t test, and Wilcoxon rank sum test were used to analyze the data.

RESULTS: Twenty-five subjects (median age = 5.25 years; range = 9 months–9.9 years) were studied; 12 subjects received cisatracurium and 13 subjects received rocuronium. Data are shown as mean proportional change ± SD or, in the case of not normally distributed, median proportional change (first, third quartile) with P values. In the cisatracurium group, there were no differences between baseline and postneuromuscular blocker administration in the fractional change from the baselines of FVC (1.00 ± 0.04, P = 0.5), but there was a significant decrease in MEF10 (0.80 ± 0.18, P = 0.002). In the rocuronium group, there were small yet significant decreases of FVC (0.99 [first quartile 0.97, third quartile 1], P = 0.02) and significant decreases in MEF10 (0.78 ± 0.26, P = 0.008). After administration of albuterol in the cisatracurium group, FVC increased slightly but significantly from baseline values (1.02 ± 0.02, P = 0.005). MEF10 increased significantly beyond baseline values (1.24 ± 0.43, P = 0.04). In the rocuronium group, there were also significant differences between baseline and postalbuterol administration from the baseline value of FVC (1.02 ± 0.02, P = 0.004) and MEF10 (1.23 ± 0.29, P = 0.01).

CONCLUSIONS: At clinically relevant doses, both cisatracurium and rocuronium caused changes in lung function, indicating constriction of smaller airways. In general, these changes were mild and not clinically detectable. However, in the rocuronium group, 3 of 13 patients showed more noticeable decreases in MEF10 (≤50%), demonstrating the potential for significant broncho-bronchiolar constriction in susceptible patients.

The Effects of Exposure to General Anesthesia in Infancy on Academic Performance at Age 12
Bong, Choon Looi MBChB, FRCA*; Allen, John Carson PhD†; Kim, Josephine Tan Swee MBBS, MMED*
Anesthesia & Analgesia 2013 117 1419–1428
BACKGROUND: Recent evidence from juvenile animal models has shown that exposure to anesthetic drugs above threshold doses during a critical neurodevelopmental window causes widespread neuronal apoptosis, resulting in irreversible brain damage and subsequent learning difficulties. The relevance of this to human infants having general anesthesia for minor surgery is unknown. In this pilot observational cohort study, we sought to determine whether children exposed to general anesthesia for minor surgery during infancy exhibited differences in academic achievement at age 12 years, as evidenced by (1) lower aggregate scores in the Singapore standardized Primary School Leaving Examination (PSLE) and (2) formally diagnosed learning disability, compared with children who were never exposed to anesthesia or sedation.

METHODS: We compared 100 full-term, apparently healthy children aged 12 years who were exposed to general anesthesia for minor surgery before age 1 at our institution with an age-matched cohort of 106 children who were never exposed to anesthesia or sedation. Parents of children completed a 20-minute telephone interview with questions regarding their children’s medical history, school environment, and home environment.

RESULTS: The difference in mean PSLE aggregate scores (3.0; 95% confidence interval [CI], −8.3 to 14.3) between exposed (197.0; 95% CI, 185.6–208.4) and control groups (194.0; 95% CI, 182.9–205.1) was not statistically significant (P = 0.603). The presence of formally diagnosed learning disability was 15% (15 of 100) in the exposed group compared with 3.77% (4 of 106) in the control group (P < 0.001). The odds ratio for a formal diagnosis of learning disability in those exposed to general anesthesia relative to controls was 4.5 (95% CI, 1.44–14.1).

CONCLUSION: The odds of a formal diagnosis of learning disability by age 12 years in apparently healthy children exposed to general anesthesia for minor surgery during infancy were 4.5 times greater than their peers who had never been exposed to anesthesia. However, study precision was inadequate to detect a clinically relevant difference in PSLE scores.

Datta短喉鏡手柄的發展及歷史背景
The Development and Historical Context of the Datta Short Laryngoscope Handle
Chang, Laura Y. MD; Tsen, Lawrence C. MD
Anesthesia & Analgesia 2013 117 1480–1484
The hormonal, physiologic, and anatomic changes of pregnancy have a number of significant anesthetic implications, including the potential for difficulties and failures in tracheal intubation. The American Society of Anesthesiology closed claims database in the 1970s observed that maternal deaths were involved in 30% of all obstetrics claims, most stemming from difficulty with intubation or ventilation. In the late 1970s, Dr. Sanjay Datta, MBBS, an obstetric anesthesiologist at Brigham and Women’s Hospital (Boston, MA), observed a number of differences in the practice of obstetric anesthesia in the United States when compared with his prior experiences in the United Kingdom and Canada. Dr. Datta perceived that parturients within North America had a higher body mass index. In addition, he observed an increased rate of cesarean delivery and general anesthesia use. These differences led him to evaluate ways in which the laryngoscope itself could be altered to improve the ease of intubation of parturients; this led to the development of the short laryngoscope handle. The genesis of the Datta short laryngoscope handle, and the accompanying historical context, will be explored.

脂肪乳剤對細胞內布比卡因的影響為脂質復蘇的機制: 使用電壓門控質子通道的電生理研究

The effect of lipid emulsion on intracellular bupivacaine as a mechanism of lipid resuscitation: an electrophysiological study using voltage-gated proton channels.
Hori K, Matsuura T, Mori T, Kuno M, Sawada M, Nishikawa K.
Anesthesia & Analgesia 2013 117 1293–1301
Bupivacaine (1 mM) decreased proton currents to 43% ± 10% of the control and shifted the Vrev to positive voltages (from -88.0 ± 4.1 to -76.0 ± 5.5 mV, n = 5 each, P = 0.02). An addition of the lipid emulsion recovered the currents to 79% ± 2% of the control and returned the Vrev toward the control value (to -86.0 ± 7.1 mV, n = 5, P = 0.03). Both recoveries of the current and Vrev in the centrifuged aqueous extract were almost the same as in the 4% lipid solution (-85.6 ± 4.9 mV, n = 5, P = 0.9, 95% confidence interval for difference = -9.3 to 8.6). When 1 mM bupivacaine was applied extracellularly, the intracellular concentration of the charged form of bupivacaine was estimated to reach about 18.1 ± 3.9 mM but decreased to 5.4 ± 1.8 mM by the 4% lipid solution.

CONCLUSIONS: Here we quantitatively evaluated for the first time the partitioning effect of lipid emulsion therapy on the intracellular concentration of bupivacaine in real-time settings by analyzing behaviors of voltage-gated proton channels. Our results suggested that lipid emulsion markedly reduced the intracellular concentration of bupivacaine, which was mostly due to the partitioning effect. This could contribute to our understanding of the mechanisms underlying lipid resuscitation, especially the importance of the partitioning effect.
How to improve the performance of intraoperative risk models: an example with vital signs using the surgical apgar score.

Hyder JA, Kor DJ, Cima RR, Subramanian A.
背景：通過電腦整合病人資料，早期準確地區分出風險病人和安全病人，可提高臨床服務品質。病人生命體征資料抽樣策略的重要性尚不明確。通過SAS評分系統實例，我們假設更大的抽樣間隔可改進此項工具的特異性和總體預測能力。

方法：我們使用電子化圍手術期資料，病人來源於美國外科醫師協會品質改進計畫納入的單中心註冊的普通外科和血管外科的病人。SAS評分系統包括最低心律，最低平均動脈壓，以及切皮與皮膚縫合期間評估的血液丟失量，並通過5種方法計算：即刻、5分鐘間隔或不伴間隔重疊、10分鐘間隔或不伴間隔重疊。包括死亡在內的主要併發症於術後30天評估。

結果：3000例病人中，272（9.1%）例發生了主要併發症或死亡。隨著抽樣間隔由即時增加到10分鐘不伴間隔重疊，靈敏度、陽性預測值和陰性預測值沒有顯著改變，然而特異度（79.5%到82.9%，P<0.001）和準確度（76.0%到79.3%，P<0.01）在多變數模型中，通過c統計計算出SAS系統的預測效用幾乎由最短抽樣間隔的Δc = +0.012 (P = 0.038)增加到最長抽樣間隔的Δc = +0.021 (P < 0.002)。與術前風險評估模型相比，淨改敘得以改善0.01 (P = 0.8) vs 0.06 (P = 0.02)，綜合歧視同樣得以改善0.008 (P < 0.01) vs 0.015 (P < 0.001)。

結論：當生命體征資料按照ASA標準相容方式記錄時，抽樣間隔顯著影響SAS評分系統的實施。電腦整合病人資料受抽樣方法的影響，具有優化安全有效臨床策略的潛能。

（李春譯 薛張綱校）
sampling methods for vital signs and may have the potential to be optimized for safe, efficient patient care.

**臨床產科麻醉期間的過敏反應：文獻綜述**

*Anaphylaxis in the Clinical Setting of Obstetric Anesthesia: A Literature Review.*

Hepner, David L. MD, MPH*; Castells, Mariana MD, PhD†; Mouton-Favre, Claudie MD‡; Dewachter, Pascale MD, PhD

*Anesthesia & Analgesia* 2013 117 1357–1367

妊娠期間過敏反應的發生率大約為 3/100000 例。由於存在主動脈、腔靜脈壓迫和過敏引起的心血管功能障礙這兩方面的累加效應，妊娠末三個月內發生的過敏反應的臨床處理極具挑戰性。這篇綜述總結了自然分娩和剖宮產手術期間發生過敏反應的臨床表現，探討了此期間造成過敏反應較為常見的過敏源，並制定合理的方法來鑒別誘發過敏反應的物質。我們還對妊娠晚期過敏反應的處理策略提出建議，包括在處理嚴重過敏性休克的患者時緊急應用腎上腺素和行急診剖宮產。從個案報導、非致死性和致死病例，病理生理學的解釋和共識意見獲得的證據是有限的。

**兒童輸液反應預測：系統性綜述**

*Predicting Fluid Responsiveness in Children: A Systematic Review*

Gan, Heng MBBCh, MRCPCH, FRCA*†; Cannesson, Maxime MD, PhD‡; Chandler, John R. MBBCh, FCARCSI, FDSRDS§; Ansermino, J. Mark MBBCh, MSc (Inf), FFA (SA), FRCP*C†

*Anesthesia & Analgesia* 2013 117 1380–1392

背景：血流動活力復蘇的主要方法是通過輸液來提高心排血量。但輸液並不是對所有患者都起作用，而且過多地輸液是有害的。預測輸液的反應具有挑戰性，特別是對於兒童。大量血流動物學數量被當作液體反應的預測指標而提出。基於心肺相互反應的動態數量似乎可以作為預測成年人液體反應的良好指標，但是其對患兒的液體反應卻沒有預測作用。

方法：我們系統地回顧了患兒液體反應預測指標的現有證據。使用文獻服務检索系統（PubMed（1947-2013））和荷蘭醫學文摘資料庫（EMBASE（1974-2013））進行了一個系統的搜索。搜索術語包括液體，體積，反應，回應，挑戰，推注，負荷，預測和指
BACKGROUND: Administration of fluid to improve cardiac output is the mainstay of hemodynamic resuscitation. Not all patients respond to fluid therapy, and excessive fluid administration is harmful. Predicting fluid responsiveness can be challenging, particularly in children. Numerous hemodynamic variables have been proposed as predictors of fluid responsiveness. Dynamic variables based on the heart-lung interaction appear to be excellent predictors of fluid responsiveness in adults, but there is no consensus on their usefulness in children.

METHODS: We systematically reviewed the current evidence for predictors of fluid responsiveness in children. A systematic search was performed using PubMed (1947-2013) and EMBASE (1974-2013). Search terms included fluid, volume, response, respond, challenge, bolus, load, predict, and guide. Results were limited to studies involving pediatric subjects (infant, child, and adolescent). Extraction of data was performed independently by 2 authors using predefined data fields, including study quality indicators. Any variable with an area under the receiver operating characteristic curve that was significantly above 0.5 was considered predictive.

RESULTS: Twelve studies involving 501 fluid boluses in 438 pediatric patients (age range 1 day to 17.8 years) were included. Twenty-four variables were investigated. The only variable shown in multiple studies to be predictive was respiratory variation in aortic blood flow peak velocity (5 studies). Stroke volume index, stroke distance variation, and change in cardiac index (and stroke volume) induced by passive leg raising were found to be predictive in single studies only. Static variables based on heart rate, systolic arterial blood pressure, preload (central venous pressure, pulmonary artery occlusion pressure), thermodilution (global end diastolic volume index), ultrasound dilution (active circulation volume, central blood volume, total end diastolic volume, total ejection fraction), echocardiography (left ventricular end diastolic area), and Doppler (stroke volume index, corrected flow time) did not predict fluid responsiveness in children. Dynamic variables based on arterial blood pressure (systolic pressure variation, pulse pressure variation and stroke volume variation, difference between maximal or minimal systolic arterial blood pressure and systolic pressure at end-expiratory pause) and plethysmography (pulse oximeter plethysmograph amplitude variation) were also not predictive. There were contradicting results for plethysmograph variation index and inferior vena cava diameter variation.

CONCLUSIONS: Respiratory variation in aortic blood flow peak velocity was the only variable shown to predict fluid responsiveness in children. Static variables did not predict fluid responsiveness in children, which was consistent with evidence in adults. Dynamic variables...
based on arterial blood pressure did not predict fluid responsiveness in children, but the evidence for dynamic variables based on plethysmography was inconclusive.

**Quality and Safety in Pediatric Anesthesia**

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Anesthesia & Analgesia 2013 117 1408–1418

Health care quality and value are leading issues in medicine today for patients, health care professionals, and policy makers. Outcome, safety, and service—the components of quality—have been used to define value when placed in the context of cost. Health care organizations and professionals are faced with the challenge of improving quality while reducing health care related costs to improve value. Measurement of quality is essential for assessing what is effective and what is not when working toward improving quality and value. However, there are few tools currently for assessing quality of care, and clinicians often lack the resources and skills required to conduct quality improvement work. In this article, we provide a brief review of quality improvement as a discipline and describe these efforts within pediatric anesthesiology.

**Under general anesthesia arginine vasopressin prevents hypotension but impairs cerebral oxygenation during arthroscopic shoulder surgery in the beach chair position.**

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Anesthesia & Analgesia 2013 117 1436–1443

Background: Under general anesthesia arthroscopic shoulder surgery in the beach chair position is associated with a risk of cerebral ischemia. We evaluated whether arginine vasopressin (AVP) can prevent hypotension while still impairing cerebral oxygenation.

Methods: Thirty patients undergoing arthroscopic shoulder surgery in the beach chair position were randomly assigned to receive AVP (0.07 U/kg) or saline in the anesthesia induction phase. Cerebral oxygenation was evaluated using near-infrared spectroscopy.

Results: AVP significantly increased mean arterial pressure (MAP) and mean arterial oxygen saturation (O2s) compared to the control group. However, AVP reduced cerebral oxygen saturation (O2s) compared to saline.

Conclusions: Arginine vasopressin can prevent hypotension during arthroscopic shoulder surgery in the beach chair position, but it may impair cerebral oxygenation.
結果：AVP 本身在給藥後能增加平均動脈壓，降低 SjvO2 和 SctO2（P < 0.0001），同時不影響心率。雖然在 BCP 過程的兩組中 MAP 都會下降，但是它在精氨酸加壓素組降得更多（P < 0.0001）。而在 BCP 過程中，HR 在對照組保持不變，在 AVP 組降低。頸靜脈血氧飽和度在 BCP 過程中的兩組沒有顯著差異。SctO2 在 BCP 過程中兩組都下降，在 AVP 組直到研究結束更顯著。低血壓的發生率 (13% 比 67%；P = 0.003) 不常見，而腦部氧供減少 (>20% presitting SctO2 下降) (80% 比 13%；P = 0.0003) 明顯高於 AVP 組。頸靜脈氧飽和度 (SjvO2 < 50%) 組與組之間可比較。

結論：預防性注射精氨酸升壓素可以對全麻狀態下的肩部手術因 BCP 引起的低血壓有預防作用。然而，它與局部腦組織而不是頸靜脈氧飽和度降低的垂直位置。

（徐崢譯 薛張綱校）

BACKGROUND: Patients undergoing surgery in the beach chair position (BCP) are at a risk of cerebral ischemia. We evaluated the effect of arginine vasopressin (AVP) on hemodynamics and cerebral oxygenation during surgery in the BCP.

METHODS: Thirty patients undergoing shoulder surgery in BCP under propofol-remifentanil anesthesia were randomly allocated either to receive IV AVP (AVP group) or an equal volume of saline (control group) 2 minutes before taking BCP. Mean arterial blood pressure (MAP), heart rate (HR), jugular venous bulb oxygen saturation (SjvO2), and regional cerebral tissue oxygen saturation (SctO2) were measured after induction of anesthesia and before (presitting in supine position) and after patients took BCP.

RESULTS: AVP itself given before the positioning increased MAP and decreased SjvO2 and SctO2 (P < 0.0001), with HR unaffected. Although MAP was decreased by BCP in both groups, it was higher in the AVP group (P < 0.0001). While in BCP, HR remained unaltered in the control and decreased in the AVP group. SjvO2 in BCP did not differ between the groups. SctO2 was decreased by BCP in both groups, which was more pronounced in the AVP group until the end of study. The incidence of hypotension (13% vs 67%; P = 0.003) was less frequent, and that of cerebral desaturation (>20% SctO2 decrease from presitting value) (80% vs 13%; P = 0.0003) was higher in the AVP group. The incidence of jugular desaturation (SjvO2 <50%) was comparable between the groups.

CONCLUSIONS: A prophylactic bolus administration of AVP prevents hypotension associated with BCP in patients undergoing shoulder surgery under general anesthesia. However, it was associated with regional cerebral but not jugular venous oxygen desaturation on upright positioning.

Intrathecal Ultra-Low Dose Naloxone Enhances the Antihyperalgesic Effects of Morphine and Attenuates Tumor Necrosis Factor-α and Tumor Necrosis Factor-α Receptor 1 Expression in the Dorsal Horn of Rats with Partial Sciatic Nerve Transection

Chih-Ping Yang, MD, Chen-Hwan Cherng, MD, DMSc, Ching-Tang Wu, MD, Hui-Yi Huang, MS, Pao-Luh Tao, PhD, Sing-Ong Lee, MD, and Chih-Shung Wong, MD, PhD

Anesthesia & Analgesia 2013 117 1493–1502

背景：谷氨酸鹽穩態和小膠質細胞啓動在神經病理性疼痛形成及持續過程中起到了重要的作用。我們設計本實驗旨在研究超低劑量納洛酮單獨給藥或複合給予嗎啡是否能夠改變經坐骨神經部分離斷術（PST）的大鼠興奮性氨基酸（EAAs）谷氨酸和天冬氨酸的濃度，以及脊髓背角 TNF-α 及其受體 TNFR1 和 TNFR2 的表達。
方法：選取雄性 Wistar 大鼠，行鞘內導管置入並根據不同的手術給藥方案分為 7 組：假手術 + 生理鹽水 (sham)，PST + 生理鹽水 (S)，PST + 15 ng 納洛酮 (n)，PST + 15 μg 納洛酮 (N)，PST + 10 μg 嗪啡 (M)，PST + 15 ng 納洛酮 + 10 μg 嗪啡 (Mn)，PST + 15 μg 納洛酮 + 10 μg 嗪啡 (MN)。觀察指標包括有：熱退縮潛伏期和機械退縮閾值，TNF-α 和 TNFR 在脊髓和背根神經節的表達，腦滲析液中興奮性氨基酸谷氨酸和天冬氨酸濃度的濃度。

結果：PST 術後 10 天大鼠出現痛覺過敏 (P < 0.0001) 和痛覺異常 (P < 0.0001)，且同側脊髓背角 TNF-α (P < 0.0001) 和 TNFR1 (P = 0.0009) 表達上調。大劑量的納洛酮 (15 μg; P = 0.0031) 抑制了啡啡 (10 μg) 的抗痛覺過敏和抗痛覺異常作用，而超低劑量的納洛酮 (15 ng; P = 0.0015) 使其作用增強，並同時下調背脊髓背角 TNF-α (P < 0.0001)、TNFR1 (P = 0.0009) 的表達和降低腦滲析液中興奮性氨基酸濃度 (谷氨酸 P = 0.0001；天冬氨酸 P = 0.004)。採用方差分析或 Bonferroni 校正的 T 檢驗進行統計學分析。

結論：PST 大鼠給予超低劑量納洛酮後，可能通過下調脊髓背角的 TNF-α 和 TNFR1 表達及降低興奮性氨基酸濃度，從而增強啡啡的抗痛覺過敏作用及抗痛覺異常作用。在治療神經病理性疼痛時，給予超低劑量納洛酮也許可作爲增強啡啡抗痛覺過敏作用的有效佐劑。 （朱怡琦譯 薛張綱校）

BACKGROUND: Glutamate homeostasis and microglia activation play an important role in the development and maintenance of neuropathic pain. We designed this investigation to examine whether ultra-low dose naloxone administered alone or in combination with morphine could alter the concentration of the excitatory amino acids (EAAs) glutamate and aspartate, as well as the expression of tumor necrosis factor-α (TNF-α) and its receptors (TNFR1 and TNFR2) in the spinal cord dorsal horn of rats with partial sciatic nerve transection (PST).

METHODS: Male Wistar rats underwent intrathecal catheter implantation for drug delivery and were divided in 7 groups: sham-operated + saline (sham), PST + saline (S), PST + 15 ng naloxone (n), PST + 15 μg naloxone (N), PST + 10 μg morphine (M), PST + 15 ng naloxone + 10 μg morphine (Mn), PST + 15 μg naloxone + 10 μg morphine (MN). Thermal withdrawal latency and mechanical withdrawal threshold, TNF-α and TNFR expression in the spinal cord and dorsal root ganglia, and EAAs glutamate and aspartate concentration in cerebrospinal fluid dialysates were measured.

RESULTS: Ten days after PST, rats developed hyperalgesia (P < 0.0001) and allodynia (P < 0.0001), and increased TNF-α (P < 0.0001) and TNFR1 expression (P = 0.0009) were measured in the ipsilateral spinal cord dorsal horn. The antihyperalgesic and antiallodynic effects of morphine (10 μg) were abolished by high-dose naloxone (15 μg; P = 0.0031) but enhanced by ultra-low dose naloxone (15 ng; P = 0.0015), and this was associated with a reduction of TNF-α (P < 0.0001) and TNFR1 (P = 0.0009) expression in the spinal cord dorsal horn and EAAs concentration (glutamate: P = 0.0001; aspartate: P = 0.004) in cerebrospinal fluid dialysate. Analysis of variance (ANOVA) or Student t test with Bonferroni correction were used for statistical analysis.

CONCLUSIONS: Ultra-low dose naloxone enhances the antihyperalgesia and antiallodynia effects of morphine in PST rats, possibly by reducing TNF-α and TNFR1 expression, and EAAs concentrations in the spinal dorsal horn. Ultra-low dose naloxone may be a useful adjuvant for increasing the analgesic effect of morphine in neuropathic pain conditions.