Key Papers from the Most Recent Literature Relevant to Anesthesiologists


A number of studies have demonstrated differences between data in administrative when compared to registry databases. This study compared administrative databases from five hospitals with the National Surgical Quality Improvement Program (NSQIP) database for documentation of postoperative venous thromboembolism and pulmonary thromboembolism between 2012 and 2015. A total cohort of 43,336 patients were included in the analysis. One hundred and sixty-five patients had venous thromboembolism on admission; accordingly, only 43,171 patients were included in the analysis for postoperative venous thromboembolism. Among these patients, a total of 298 had documentation of postoperative venous thromboembolism with 40% being identified in both the NSQIP and administrative databases (kappa = 0.57; 95% CI, 0.51 to 0.62). A total of 43,272 operations were analyzed for pulmonary embolism after identifying 64 patients as having pulmonary embolism at the time of admission. Among these patients, 113 patients were noted to have a postoperative pulmonary embolism that were identified in both databases 72% of the time (kappa = 0.83; 95% CI, 0.78 to 0.89). Some of the discrepancies were thought to be explained by differences in the criteria used to identify each outcome. (Summary: Deborah J. Culley. Illustration: ©ThinkStock/J. P. Rathmell)

**Take home message:** Administrative and registry databases may differentially identify patients with postoperative venous thromboembolism or pulmonary thromboembolism.


Immunosuppressive properties have been described for a variety of opioids in animal and in vitro studies. This study describes a retrospective, nested case-control study that compared Medicaid, Medicare, and Active Bacterial Core surveillance system databases to identify associations between opioid use based on pharmacy prescription fills and invasive pneumococcal disease based on the presence of *Streptococcus pneumoniae* in a normally sterile body site. Opioid use was stratified by current, recent past, and remote use based on the number of days between the last opioid prescription and the onset of invasive infection. Patients with invasive pneumococcal disease (n = 1,233) were matched to 24,399 control patients at risk but without laboratory-confirmed invasive pneumococcal disease. Case patients were more likely to be male and had more risk factors for pneumococcal disease. More than one quarter were current opioid users (adjusted odds ratio 1.62; 95% CI, 1.36 to 1.92) and a larger percentage were using long-acting (adjusted odds ratio 1.87; 95% CI, 1.24 to 2.82) and high-potency opioids (adjusted odds ratio 1.72; 95% CI, 1.32 to 2.25). (Summary: Martin J. London. Image: J. P. Rathmell)

**Take home message:** Opioid use may be associated with an increased risk for invasive pneumococcal disease.

**Cognitive outcomes of children born extremely or very preterm since the 1990s and associated risk factors: A meta-analysis and meta-regression. JAMA Pediatr 2018; 172:361–7.**

Despite significant decrease in mortality, long-term neurocognitive outcome remains poor after extreme or very preterm birth. Several neonatal morbidities have been associated with an increased risk for cognitive impairment in preterm children but the relative contribution of each of these possible risk factors to neuromorbidity remains to be determined. In this meta-analysis, which included 71 studies with 7,752 extremely preterm and 5,155 term children, the authors aimed to clarify the specific contribution of perinatal and demographic factors for long-term cognitive outcome defined by intelligence scores. They found that children born preterm had an 0.86 standard deviation (SD; 95% CI, −0.94 to −0.78; P < .001) lower intelligence quotient (IQ), corresponding to approximately 13 points in IQ, when compared to term counterparts. Multivariate regression analysis with identified perinatal and demographic covariates revealed bronchopulmonary dysplasia as a major factor in determining cognitive outcome: each percent increase in bronchopulmonary dysplasia rate across studies was associated with a 0.01 SD decrease in IQ points (change −0.15; 95% CI, −0.19 to −0.10; P < 0.001). (Summary: Laszlo Vutskits. Image: J. P. Rathmell)

**Take home message:** Bronchopulmonary dysplasia in preterm infants is a significant predictor for long-term neurocognitive outcome. Strategies aimed to lower the incidence of bronchopulmonary dysplasia may lead to improved cognitive function.
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There is broad interest in the use of artificial intelligence to enhance medical practice. This review summarized the use, major topics, and limitations of artificial intelligence in surgery. They identified four main subfields of artificial intelligence, including machine learning, artificial neural networks, language processing, and computerized vision; all of which are well described in this review. The authors note that much of the potential of artificial intelligence in surgery involves the ability to analyze both structured and nonstructured data to aid in clinical decision-making and enhance innovations. Noted limitations to artificial intelligence include the finding that traditional analytical methods may outperform machine learning, the availability of accurate data, and asking the correct questions that can be answered by the data available, cost and risks of systematic biases in data collection, and interpretability of the algorithms used. In the future, it is likely that artificial intelligence will aid in the analysis of population and patient data in all phases of perioperative care. (Summary: Deborah J. Culley. Image: ©ThinkStock.)

**Take home message:** Artificial intelligence will eventually be used for evidence-based clinical decision support.

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**What regulatory requirements and existing structures must change if competency-based, time-variable training is introduced into the continuum of medical education in the United States?** Acad Med 2018; 93:S27–31.

Competency-based, time-variable training refers to the concept that training should take as long as it needs to allow the learner to achieve competency, rather than training for a defined period of time. Some medical schools are creating tracks for students based on this principle and there are residency programs outside of the United States that currently using competency-based, time-variable training. This article, part of a supplement focused on competency-based, time-variable training, explores the obstacles that medical schools and residencies face when adopting competency-based, time-variable training, including funding variability, workforce stability, licensure and certification issues, and on-boarding times and processes. Specific consideration should be given to: (1) revised standards for medical school accreditation, (2) tuition models that facilitate both the school and the learner, (3) revised graduation requirements from the school or program, (4) revision in graduate medical education funding mechanisms, (5) changing the way rotations are scheduled to address competency, (6) revised requirements from licensing and certifying bodies, (7) development of milestones that link medical school and residency training, and (8) how to communicate competence and handoff learners. (Summary: Dawn Dilman. Image: ©ThinkStock.)

**Take home message:** Anesthesiology training programs may want to consider how they will address graduates from competency-based, time-variable training medical schools, and whether they would consider adopting competency-based, time-variable training.

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The use of 0.9% sodium chloride has been associated with laboratory abnormalities and adverse clinical outcomes. This study randomized patients in five intensive care units at Vanderbilt University Medical Center between 2015 and 2017 to either balanced crystalloids or 0.9% sodium chloride. The primary outcomes included a major adverse kidney event and a composite outcome score. Patients in the saline group (n = 7,860) were more likely to have plasma chloride concentrations that were greater than 110 mmol/l (35.6% vs. 24.5%, P < 0.001) or a plasma bicarbonate level less than 20 mmol/l (42.1% vs. 35.2%, P < 0.001) when compared to those treated with balanced crystalloids (n = 7,942). The incidence of the primary outcome was lower in the balanced crystalloid group when compared to the 0.9% sodium chloride group (14.3% vs. 15.4%; odds ratio 0.90; 95% CI, 0.82 to 0.99; P = 0.04). Prespecified subgroup analyses demonstrated a greater difference in the primary outcome among patients receiving larger volumes of fluid and in patients that developed sepsis. Thirty-day in-hospital mortality was significantly reduced among patients with sepsis who received a balanced crystalloid (25.2% vs. 29.4%; odds ratio 0.80; 95% CI, 0.67 to 0.97; P = 0.02). (Summary: Martin J. London. Image: J. P. Rathmell.)

**Take home message:** Outcomes may be improved in critically ill patients by the use of balanced crystalloid solutions rather than 0.9% sodium chloride.

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**Association of prenatal ultrasonography and autism spectrum disorder.** JAMA Pediatr 2018; 172:336–44.

Laboratory investigations indicate that prenatal ultrasound exposure can adversely affect neuronal development. Given the parallel increase in the incidence of autism spectrum disorders and the use of prenatal ultrasonography over the past few decades, a causal link between these concomitant changes is an intriguing hypothesis. In this retrospective case-control study, the authors evaluated whether prenatal ultrasonography frequency, timing, duration, or strength was associated with a later diagnosis of an autism spectrum disorder. The authors identified a total of 420 participants that were included in this study. Interestingly, the authors found that patients subsequently diagnosed with an autism spectrum disorder had shorter durations of ultrasound exposure but greater mean depth of ultrasonographic penetration during the first and second trimester of intrauterine life. Autism spectrum disorder was not associated with the total duration of ultrasound exposure, nor with the number of scans. (Summary: Laszlo Vutskits. Image: J. P. Rathmell.)

**Take home message:** Intrauterine ultrasound with penetration at higher mean depths and shorter durations of exposure may be associated with autism spectrum disorder, although the total duration of ultrasound exposure or the number of ultrasound scans does not appear to be associated with autism spectrum disorder.

The use of 0.9% sodium chloride has been associated with laboratory abnormalities and adverse clinical outcomes. This study randomized patients treated with IV fluids in the emergency department and subsequently admitted to a nonintensive care unit at Vanderbilt University Medical Center between 2016 and 2017 to either balanced crystalloids or 0.9% sodium chloride. The primary outcome was hospital-free days, and secondary outcomes included major adverse kidney events within 30 days and a composite outcome score. Patients in the balanced crystalloid group (n = 6,708) were less likely to have hyperchloremia (P < 0.01) or a metabolic acidosis (P < 0.01) when compared to those in the saline group (n = 6,639). There were no differences in the number of hospital-free days (primary outcome) between the two groups (P = 0.41). However, patients in the balanced crystalloid group had a lower incidence of major adverse kidney events (4.7% vs. 5.6%; odds ratio 0.82; 95% CI, 0.70 to 0.95; P = 0.01). Prespecified subgroup analyses identified that patients presenting to the emergency department with renal dysfunction or hyperchloremia were more likely to avoid major adverse kidney events when balanced crystalloids were administered compared to those who received normal saline (28.0% vs. 37.6%, P < 0.001).

Take home message: In patients presenting to the emergency department and admitted to a nonintensive care unit, the incidence of major adverse renal events may be lower in patients receiving balanced crystalloids when compared to normal saline.


Postoperative hyperglycemia has been associated with an increased risk of postoperative infections. Preoperative administration of carbohydrates has been associated with a decreased rate of hyperglycemia in the postoperative period. The purpose of this study was to determine whether carbohydrate loading decreased infection rates in the postoperative period using a prospective, randomized study design. Patients were randomized to drink 800 ml of a carbohydrate-containing solution (n = 438) or water (control, n = 442) from 8 pm on the evening before surgery until 2 h after surgery, and their blood glucose was measured every 4 h. Insulin was administered if the blood glucose was greater than 180 mg/dl. The primary outcome was the development of a postoperative infection and the secondary outcome was the number of patients that required insulin administration. There were no differences in infection rate between the two groups (relative risk 1.02; 95% CI, 0.72 to 1.44; P = 1.00). However, insulin was administered more frequently in the control group when compared to patients randomized to a carbohydrate load (relative risk 0.15; 95% CI, 0.07 to 0.31; P < 0.001).

Take home message: Carbohydrate loading in the preoperative period may provide better postoperative glucose control but may not decrease the risk of postoperative infections.

Effect of opioid vs nonopioid medications on pain-related function in patients with chronic back pain or hip or knee osteoarthritis pain: The SPACE randomized clinical trial. JAMA 2018; 319:872–82.

Chronic osteoarthritis leading to chronic back or lower extremity joint pain is common, but there is little information demonstrating whether opioid therapy is better for treating that pain when compared to nonopioid medications (acetaminophen or nonsteroidal antiinflammatory drugs). This study randomized 265 patients between June 2013 and December 2015 and followed them for 12 months. The primary outcome was pain-related function over the 12 months, the secondary outcome was pain intensity over the 12 months, and the primary adverse outcome was medication-related symptoms. Among the 240 patients who completed the trial, there were no differences in pain-related function (difference 0.1; 95% CI, −0.5 to 0.7), but pain intensity was lower in the nonopioid group over the 12 months (difference 0.5; 95% CI, 0.0 to 1.0; P = 0.03). Adverse medication-related symptoms were more common in the opioid group (difference 0.9; 95% CI, 0.3 to 1.5; P = 0.03).

Take home message: Opioid administration to patients with osteoarthritis was not superior to nonopioid therapy in managing pain-related function and may not decrease pain intensity. In contrast, opioid administration was associated with an increased risk for adverse medication symptoms.

Postoperative agitation is a common complication in young children after sevoflurane anesthesia. Several reports suggest that administration of α-2-receptor agonists can reduce the incidence of agitation. In this prospective, randomised, double-blind trial that included 379 children between 1 and 5 yr of age with an American Society of Anesthesiologists I and II physical status, the authors investigated whether a single IV bolus of clonidine (3 μg/kg) administered 20 min before the completion of noncardiac surgery reduces the incidence of postoperative agitation. They found that while the incidence of agitation was 47% in the placebo group, it decreased down to 25% in the clonidine group (relative risk 0.56; 95% CI, 0.43 to 0.73; \( P < 0.0001 \)). Sex-specific analysis confirmed a statistically significant difference between clonidine versus placebo treatment in boys but not in girls (most probably due to the low number of female subjects included in the study). Additionally, clonidine was associated with reduced postoperative opioid consumption and a reduction in the incidence of postoperative nausea and vomiting. Adverse events were not associated with the use of clonidine. (Summary: Laszlo Vutskits. Image: ©ThinkStock.)

Take home message: Intraoperative administration of IV clonidine may reduce the incidence of postoperative agitation in otherwise healthy children undergoing noncardiac surgery.


There is broad interest in the use of artificial intelligence to enhance medical practice. This review describes the history of artificial intelligence, its use in medical image analysis (it has been tested in radiology, pathology, and dermatology), and how it may be implemented into medical practice to prevent diagnostic errors, eliminate cognitive biases, manage chronic diseases, and enhance patient outcomes by extracting relevant information from the electronic medical record. The authors also describe the concern of some physicians that artificial intelligence approaches to medical care may serve as a barrier to direct patient care and add cost to health care. With these concerns noted, the review ends by noting that “humans will remain essential to the intelligent use of artificial intelligence in medical practice.” (Summary: Deborah J. Culley. Image: ©ThinkStock.)

Take home message: Artificial intelligence combined with physician intelligence may lead to improved patient outcomes.