Anesthesiology 2010; 113:209–13

Timothy J. Brennan, Ph.D., M.D., Editor

Perioperative Medicine

J. Lance Lichtor, M.D., Joseph F. Antognini, M.D., Editors

Comanagement of hospitalized surgical patients by medicine physicians in the United States. Arch Intern Med 2010; 170:363–8

Improved efficiency (*e.g.*, reduced time to surgery) and reduction in adverse outcomes (*e.g.*, fewer postoperative complications, reduced length of stay, and lower readmission rates) have been demonstrated when comanagement of surgical patients by medicine physicians (generalist physicians or internal medicine subspecialists) occurs. However, it is not clear how often comanagement occurs and the patients in whom it is most common.

A retrospective cohort study of Medicare fee-for-service beneficiaries hospitalized for 1 of 15 inpatient surgical procedures from 1996 to 2006 (n = 694,806) was conducted, and the proportion of Medicare beneficiaries comanaged by medicine physicians (generalist physicians or internal medicine subspecialists) during hospitalization was calculated. Comanagement was defined by relevant physicians (generalist or internal medicine subspecialist) submitting a claim for evaluation and management services on 70% or more of the days that the patients were hospitalized.

Overall, 35.2% of patients were comanaged by a medicine physician, and the rates remained relatively unchanged from 1996 to 2000, which then increased sharply (by 11.4% per year). Female patients with advanced age, more comorbidities, and low socioeconomic status, or receiving care in nonteaching, midsize (200–499 beds), or for-profit hospitals were more likely to receive comanagement. Throughout the study period, comanagement significantly increased (42%) in patients undergoing orthopedic surgery but decreased for cardiothoracic surgery (12.5%).

Interpretation

In the past, postoperative care was managed primarily by surgeons. Because of economic and manpower pressures, many hospitals now employ internists, such as hospitalists, to comanage these patients. In this retrospective study from 1996 to 2006, approximately 35% of surgical patients were comanaged by a medical physician, with a marked increase occurring around the year 2000. Anesthesiologists should expect to see increased involvement of internists in the perioperative care of surgical patients.

Clinical and economic outcomes attributable to health care-associated sepsis and pneumonia. Arch Intern Med 2010; 170:347–53

Healthcare-associated infections affect millions of patients every year and are associated with increased patient morbidity, risk of mortality, and increased cost. Together, healthcare-associated pneumonia and sepsis affect approximately 600,000 hospitalizations in the United States every year. However, reliable estimates of the economic costs have not yet been established because of discrepancies in reporting.

This was a retrospective review of hospital discharge records (69 million discharges from hospitals in 40 the United States) from the Nationwide Inpatient Sample database to distinguish the rates of healthcare-associated infections (sepsis and pneumonia) from community-acquired infections and the associated economic outcomes. Community-acquired infections were defined based on the criteria from previous studies, and the outcomes were examined separately for cases associated with invasive procedures, which were unlikely to result from preexisting infections. A total of 557,957 hospitalizations were identified as healthcare-associated sepsis or pneumonia cases.

	Healthcare-associated Sepsis (n = 493,250)	Healthcare-associated Pneumonia (n = 79,835)
Invasive procedures		
Length of stay, mean days (median)	10.9 (6.1)	14.0 (9.3)
Costs, mean $ (median)	32,900 (16,100)	46,400 (29,200)
Mortality, %	19.5	11.4
No invasive procedures		
Length of stay, mean days (median)	6.0 (2.9)	9.7 (4.7)
Costs, mean $ (median)	12,700 (4,400)	22,300 (8,100)
Mortality, %	11.7	4.6

Interpretation

This retrospective analysis separated sepsis and pneumonia infections associated with invasive surgical procedures and found that the impact of hospital-acquired infections is substantial, reaching yearly costs of 8 billion dollars nationwide; and 48,000 deaths were attributed to hospital-acquired infections.

Scoliosis surgery in children with neuromuscular disease: Findings from the US National Inpatient Sample, 1997 to 2003. Arch Neurol 2010; 67:231–5

Pediatric neuromuscular disease (NMD) is often associated with the development of progressive scoliosis requiring surgery. However, scoliosis surgery in children with NMD has been associated with an increased risk of morbidity and mortality. Differences in terminology used in retrospective studies may have contributed to inaccurate estimates of the complications of scoliosis surgery in patients with NMD, and a prospective study would be timely and costly.

The current retrospective study reviewed the data from the Kids Inpatient Database to examine the demographics, comorbidities, outcomes, and cost of scoliosis surgery in patients with NMD.

Children with NMD accounted for 2.5% of all hospitalizations (17,780) for scoliosis surgery. Children with NMD were typically younger (12.4 *vs.* 14.2%), male (73.5 *vs.* 38.3%), white (71.2 *vs.* 68.3%), and insured by Medicaid (35.6 *vs.* 20.3%) compared with children undergoing scoliosis surgery for other indications. Hospital length of stay was significantly longer in patients with NMD (10.3 *vs.* 7.7 days; $P < 0.001$), hospitalization expenditures were higher ($80,251 *vs.* $62,154), and mortality was significantly higher (1.6 *vs.* 0.2%; $P < 0.001$). Lung disease, chronic respiratory failure, and cardiomyopathy were significantly higher comorbidities in NMD patients ($P < 0.001$).

Interpretation

Children undergoing scoliosis surgery often have associated NMD, which is hypothesized to increase perioperative risks. This analysis of scoliosis patients with and without NMD undergoing corrective surgery revealed that those with NMD had more comorbidities and increased incidence of pulmonary and cardiovascular complications. Furthermore, costs, length of stay, and mortality were greater. Increasing efforts to decrease complications in this group of patients with NMD undergoing scoliosis surgery are needed.

Perfusion computed tomography in the acute phase of mild head injury: Regional dysfunction and prognostic value. Ann Neurol 2009; 66:809–16

The majority of traumatic brain injuries are classified as mild head injuries; however, these patients may still experience disabling symptoms up to approximately 6 months after insult. Approximately 20% of patients with mild to moderate head injuries without abnormalities on a noncontrast computed tomography (CT) scan experience problems with resuming work. Therefore, improved techniques are necessary for the detection of this subgroup of patients.

The aim of this prospective study was to perform perfusion CT imaging in the acute phase of mild head injury in patients without intracranial abnormalities on the noncontrast CT scan, to assess whether these patients had cerebral perfusion abnormalities and to test the relationship between perfusion CT parameters and severity of head injury and 6-month outcomes. Perfusion data were compared with the data of 25 healthy control subjects.

Of 76 patients included in the study, the mean age was 35.0 yr, and the mean Glasgow Coma Scale score was 14. Patients with decreased Glasgow Coma Scale scores (< 15) had a significantly lower cerebral blood flow in frontal and occipital gray matter and cerebral blood volume in occipital gray matter compared with healthy controls. These differences were predictive of worse 6-month outcome according to the extended Glasgow Coma Outcome Scale scores. Only 59% of patients were able to achieve a complete return to work. Patients who resumed work on a lower level had significantly lower cerebral blood flow in the frontal gray matter compared with patients who resumed work completely.

Interpretation

Patients who suffer from mild head injury often have normal noncontrast CT but later have incomplete or prolonged recovery. Using perfusion CT, these authors identified patients who had abnormal cerebral perfusion and had worse outcome at 6 months after injury. Whether obtaining this information will change clinical practice beyond improving prognostic value is not known.

Bacterial meningitis after intrapartum spinal anesthesia—New York and Ohio, 2008–2009. MMWR Morb Mortal Wkly Rep 2010; 59:65–9

Infections, such as bacterial meningitis, may be prevented by adherence to guidelines. Despite the recent recommendation by the Healthcare Infection Control Practice Advisory Committee that surgical masks be worn during spinal procedures, five cases of bacterial meningitis were reported in the last 2 yr in postpartum women.

In this report, case studies of women who developed symptoms of meningitis and tested positive (four of five patients) for *Streptococcus salivarius* are presented. All of the women were healthy, aged 24–37 yr, admitted to two separate hospitals (three women to New York hospital and two women to Ohio hospital) in active labor. The patients received spinal-epidural anesthesia from one of two anesthesiologists delivered healthy babies and then subsequently experienced symptoms including headache, lethargy, confusion, back pain, rigors, nausea, and vomiting. One anesthesiologist reported routine mask use; however, unmasked visitors were present in the room during spinal anesthesia procedures. The other anesthesiologist was not masked, tested positive for *S. salivarius*, and was associated with the reported death.

Interpretation

In this analysis of two clusters of *S. salivarius* meningitis after spinal anesthesia for labor, transmission was linked to oral con-

tamination from the anesthesiologist. In one cluster, that physician did not wear a mask. These case descriptions highlight the need to use properly fitting masks, aseptic techniques, and safe injection practices when performing spinal anesthesia.

Critical Care Medicine

Jean Mantz, M.D., Ph.D., Editor

Mechanism, Glasgow Coma Scale, age, and arterial pressure (MGAP): A new simple prehospital triage score to predict mortality in trauma patients. Crit Care Med 2010; 38:831–7

Overall risk of death can be 25% lower when acute critical care is provided at a trauma center. Although numerous triage scores have been developed, many are too complicated to be used in a prehospital setting.

This multicenter, prospective, epidemiologic observational study was conducted to assess the prehospital variables associated with mortality in trauma patients. Assessments were made at prehospital physician-staffed emergency systems in university and nonuniversity hospitals in France. A simple score (the mechanism of trauma, Glasgow Coma Scale, age, and systolic arterial pressure [MGAP] score) was created and compared with the triage Revised Trauma Score (T-RTS), Revised Trauma Score (RTS), and Trauma Related Injury Severity Score. Trauma patients (n = 1,360) receiving care from prehospital mobile intensive care were evaluated, and the model was then validated in 1,003 patients. Evaluation by MGAP produced similar results compared with the T-RTS or RTS. However, when the sensitivity was fixed to more than 95% (resulting in an undertriage rate of 5%), the MGAP Score was more specific and accurate than T-RTS and RTS, approaching those of Trauma Related Injury Severity Score. By using the MGAP score, patients were stratified into low (23–29 points), intermediate (18–22 points), and high risk (< 18 points) with corresponding mortality rates of 2.8, 15, and 48%, respectively. Results were similar in the external validation cohort.

Interpretation

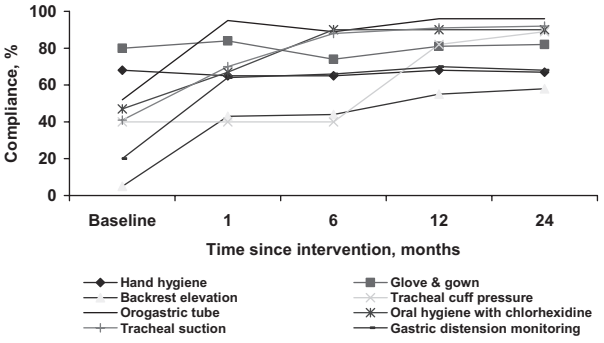
The availability of a simple score predictive of mortality is an attractive idea in the trauma patient subpopulation because it may accelerate triage and reduce mortality. The MGAP score developed in this prospective, multicenter, large cohort trial is such a score. The external validity and impact of the MGAP on the orientation and management of trauma patients remain to be determined.

A multifaceted program to prevent ventilator-associated pneumonia: Impact on compliance with preventive measures. Crit Care Med 2010; 38:789–96

Despite guidelines to prevent ventilator-associated hospital-acquired pneumonia, it remains the most common hospital-acquired infection in the intensive care unit. Understanding of and compliance with preventive measures may help to reduce the incidence of ventilator-associated hospital-acquired pneumonia.

Changes in compliance with targeted measures to prevent ventilator-associated hospital-acquired pneumonia throughout a multifaceted program were assessed over a 2-yr period in a medical intensive care unit in this preintervention and postintervention observational study. The program involved all healthcare workers and included an educational session, direct observations with performance feedback, technical improvements, and reminders. Compliance assessment consisted of five 4-week periods (before the intervention and 1, 6, 12, and 24 months thereafter).

Physicians (14), nurses (53), nurses' aides (30), and physiotherapists (5) and 1,649 ventilator days were included in this study. Hand hygiene and glove and gown use compliances were initially high (68 and 80%, respectively) and remained stable over time. Compliance with all other preventive measures (see fig.) was initially low and significantly increased steadily over the time ($P < 0.0001$). The rate of ventilator-associated hospital-acquired pneumonia prevalence significantly decreased from 26.7% before the program to 15.3 and 11.1% 1 and 2 yr after the program, respectively (a 51% decrease overall; $P < 0.0001$).



Interpretation

The results of this before and after study demonstrate that a significant decrease in the acquisition of ventilator-associated pneumonia is feasible when a multifaceted intensive care unit strategy has been initiated. The investigation emphasizes the importance and efficacy of top-level standard of nursing care in decreasing morbidity and mortality in intensive care units.

Use of procalcitonin to reduce patients' exposure to antibiotics in intensive care units (PRORATA trial): A multicenter randomised controlled trial. Lancet 2010; 375:463–74

Multidrug-resistant bacteria severely negatively affect patient outcomes in the intensive care unit (ICU). Admin-

istration of antibiotics only to patients with identified bacterial infections, reduced duration of administration, or both may help to reduce antimicrobial consumption and subsequently multidrug resistance. Measurement of biomarkers of infection or sepsis, such as procalcitonin, may also help to reduce antibiotic exposure and improve agent efficacy.

In a multicenter, prospective, parallel-group, open-label trial, adult patients with suspected bacterial infections expected to stay in the ICU for more than 3 days were randomly assigned to procalcitonin (n = 311 patients) or control (n = 319) groups; investigators were blinded to assignment before, but not after, randomization. In the procalcitonin group, antibiotics were administered based on predefined cutoff ranges of procalcitonin concentrations; the control group received antibiotics according to the current guidelines. Drug selection and the final decision to start or stop antibiotics were at the discretion of the physician. Mortality at days 28 and 60 and number of days without antibiotics by day 28 were measured.

The majority (90 and 89%) were medical admissions to the ICU. Mortality of patients in the procalcitonin group (n = 307) at day 28 (21.2 *vs.* 20.4%) and day 60 (30.0 *vs.* 26.1%) appeared noninferior to those in the control group (n = 314). Patients in the procalcitonin group had significantly more days without antibiotics than did those in the control group (14.3 *vs.* 11.6 days). Rate of relapse (6.5 and 5.1%) and length of ICU stay (15.9 and 14.4 days) were also similar between groups.

Interpretation

Procalcitonin has been proven useful to assess success of antimicrobial therapy in nosocomial pneumonia. This study demonstrates that antimicrobial strategy guided by iterative procalcitonin blood levels reduces the duration of antibiotic therapy in ICU patients without increasing mortality. This strategy reduces antibiotic selective pressure and may be cost-effective in many ICU patient populations. However, its superiority to other infection treatment protocols remains to be established.

Association between acute care and critical illness hospitalization and cognitive function in older adults. JAMA 2010; 303:763–70

The number of patients who are survivors of critical illness is growing because of an increase in incidence of critical illness syndromes, mechanical ventilation, and an aging population. Critical illness has been associated with long-term cognitive impairment in many studies; however, these studies did not measure baseline cognitive function.

The associations between hospitalizations for acute or critical illness and cognitive decline and dementia in older patients were examined based on data from an ongoing prospective longitudinal cohort study comprising 2,929 individuals 65 yr and older without dementia at baseline. Individuals were screened with the Cognitive Abilities Screening Instrument every 2 yr at follow-up visits, and those with a score less than 86 underwent a clinical examination for dementia (see table below).

	No Hospitalizations (n = 1,601)	≥ 1 Noncritical Illness Hospitalization (n = 1,287)	≥ 1 Critical Illness Hospitalization (n = 41)
Baseline characteristics			
Age, mean years (SD)	74.6 (6.0)	75.4 (6.2)	75.4 (6.6)
Women, %	60.5	58.4	44
CASI score, mean (SD)	93.2 (4.7)	92.9 (4.7)	93.9 (4.4)
CHD, %	15.8	22.8	37
Time on study (posthospitalizations), yr	—	4.07	3.67
ΔCASI score after hospitalization	—	−1.01†	−2.14‡
ΔCASI IRT score after hospitalization	—	−0.12†	−0.19‡
Incidence of dementia	14.6 per 1,000	33.6 per 1,000†	31.1 per 1,000
Alzheimer disease, %	76	60	40

† $P < 0.001$. ‡ $P < 0.05$ vs. nonhospital visits.
CASI = Cognitive Abilities Screening Instrument; CHD = coronary heart disease; IRT = Item Response Theory.

Hospitalization was associated with a greater likelihood of cognitive decline compared with matched patients who had no hospitalization. Noncritical illness hospitalization was associated significantly with the development of dementia.

Interpretation

This extended prospective follow-up study highlights the interaction among aging, hospitalization, and critical illness on long-term cognitive function. Critical illness jeopardizes long-term cognitive function through multifactorial mechanisms such as hypoxemia, hypotension, delirium, sedative medication, and sleep disturbance. The factors linked to noncritical illness and hospitalization, which contribute to the development of dementia, remain to be investigated. These results are highly relevant to the increase in the number of elderly persons admitted to the intensive care unit for critical illness.

Pain Medicine

Timothy J. Brennan, Ph.D., M.D., Editor

Pain perception is altered by a nucleotide polymorphism in SCN9A. Proc Natl Acad Sci U S A 2010; 107:5148–53

Up to 50% of all patients receive inadequate pain relief, and there is a need for an improved understanding of the molecular mechanisms of pain and individual pain tolerance. The *SCN9A* gene encodes for a C-fiber sodium channel (Nav1.7) subunit highly expressed in nociceptive neurons. Mutations in *SCN9A* are associated with three human pain disorders.

In this study, genotyping of *SCN9A* single-nucleotide polymorphisms (SNPs) was conducted to determine their association with differing pain perception. Twenty-seven SNPs were analyzed in an initial cohort of patients with osteoarthritis pain (n = 578). Based on these results, patients with sciatica (n = 195), phantom limb pain (n = 100), lumbar discectomy (n = 179), and pancreatitis (n = 205) were screened for specific SNPs and compared with a sampling of healthy volunteers (n = 186).

A significant association was found between the pain score for five SNPs. Only SNP rs6746030, the rare A allele, was associated with increased pain scores compared with the more common G allele ($P = 0.016$). This SNP was then further genotyped and the combined P value for increased A allele pain was 0.0001 in the five cohorts tested (n = 1,277 total). Based on the electrophysiology experiments, the A allele would be predicted to increase nociceptor activity.

Interpretation

Although pharmacogenomics has explained the variability in responses to several perioperative analgesic drugs, genetic studies have been less successful explaining the variability of pain in clinical disease. This study identified a relationship between the genetic variability of a C-fiber sodium channel and persistent pain. The authors suggest that prolonged depolarization of C-fibers produced by mutations of this gene may contribute to greater pain scores in several pain conditions.

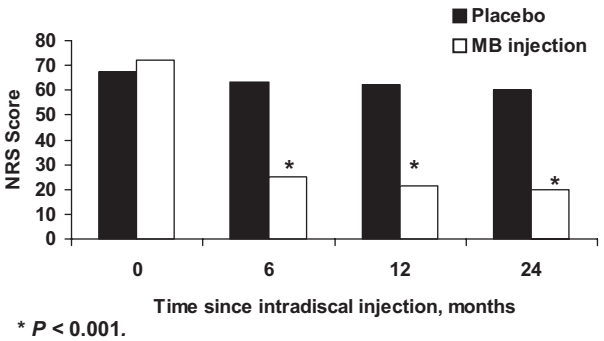
A randomized placebo-controlled trial of intradiscal methylene blue injection for the treatment of chronic discogenic low back pain. Pain 2010; 149:124–9

Accompanying editorial: A cure for back pain? Pain 2010; 149:7–8

Among patients with low back pain, discogenic low back pain accounts for 28–43% of patients with all cases. Current treatment options focus on the symptoms and not the underlying cause (*e.g.*, damage to sensory nerve endings of the disc).

The current prospective, randomized, placebo-controlled, double-blind clinical trial was conducted to explore further the efficacy of intradiscal methylene blue (MB) injection for the treatment of chronic discogenic low back pain. All patients (n = 72) had discogenic low back pain lasting longer than 6 months (mean of approximately 3 yr received either 1 ml of 1% MB and 1 ml of 2% lidocaine or 1 ml of saline and 1 ml of 2% lidocaine into the painful disc). Pain alleviation was assessed using a 101-point Numerical Rating Scale (NRS) and improvement in disability, as assessed with the Oswestry Disability Index for functional recovery was also evaluated at 6, 12, and 24 months after randomization.

MB injection significantly improved both Numerical Rating Scale and Oswestry Disability Index scores at all time points. Seven patients (19%) reported complete relief, and 28% reported dramatic improvement and no longer required medication. Overall medication usage was significantly decreased after MB injection. The editorial indicates that these pain reductions are the largest seen to date for any intervention for back pain including surgery, rehabilitation, and behavioral therapy, and call for further studies before intradiscal MB injection is used for treatment in patients.



* $P < 0.001$.

Interpretation

In this trial, the remarkable results were produced by injecting MB into the intervertebral disc of patients with chronic low back pain. In the accompanying editorial by Bogduk, it is proposed that many additional research studies should be performed to corroborate these results before MB injection becomes standard practice. Because early studies report exaggerated outcomes and no back pain treatment to date has provided such a remarkable result, these future studies are absolutely warranted.