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

Perioperative Medicine

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

Autologous blood transfusion during emergency trauma operations. Arch Surg 2010; 145:690–4

Transfusion with allogeneic blood products, although necessary for patients in hemorrhagic shock, is associated with multiple complications and is often difficult and expensive due to blood supply shortages and high costs of processing. Intraoperative cell salvage (CS) with autotransfusion may offer a cost-effective alternative with fewer complications for trauma patients.

To compare directly outcomes of patients who received allogeneic transfusions or CS and autologous blood products, a retrospective matched cohort study was conducted at a single level 1 trauma center. Patients who underwent a trauma operation, including laparotomy, thoracotomy, or orthopedic operations, within 6 h of admission and who received intraoperative CS were included. In the matched cohort population, patients were identified from the remaining trauma admissions who underwent trauma operation and required transfusion but did not receive CS.

Of 76 patients identified in the 2-yr period, 47 were matched for age, sex, mechanism of injury, Injury Severity Score, and operation performed. The CS group had a significantly larger average intraoperative blood loss (1,795 ml *vs.* 978 ml; $P < 0.001$) than the no-CS group. Hospital length of stay (18 *vs.* 20 days) and intensive care unit stay (8 *vs.* 8 days) were similar between the groups. However, the cost of blood product transfusion was significantly lower in the CS group ($1,616 *vs.* $2,584 per patient; $P = 0.004$) compared with the no-CS group. Mortality was also similar between the groups (13% *vs.* 21%; $P = 0.56$).

Interpretation

Blood salvage techniques are useful tools to minimize heterologous blood transfusions. In this study of trauma patients, erythrocyte salvaging was less expensive than transfusion of packed red blood cells and other blood components. More research is needed to determine whether there is any difference in complications with blood salvage *versus* heterologous transfusion.

Preoperative hypoalbuminemia is an independent risk factor for the development of surgical site infection following gastrointestinal surgery: A multi-institutional study. Ann Surg 2010; 252:325–9

Surgical site infections (SSI) account for 16% to 18% of all hospital infections, leading to approximately 1.8 billion U.S. dollars in healthcare costs. Various risk factors have been associated with SSI, including malnutrition. Although hypoalbuminemia has also been associated with postoperative complications, few studies have looked directly at hypoalbuminemia and SSI.

A retrospective study of patients (n = 524) who underwent gastrointestinal surgery at four separate institutions was conducted based on a prospective SSI database and hospital records.

The median age was 66 yr, approximately half of all patients were male, and the majority had grade I or grade II ASA scores (78.2%). Overall, 20% of patients developed a SSI. Of these, 65.7% were superficial, 28.6% were deep, and 5.7% were organ space infections. Patient age, sex, type of surgery, type of anesthesia, and duration of surgery (unless the procedure lasted more than 3 h) did not impact the development of SSI; however, ASA grade 3 was associated with an increased incidence of SSI ($P = 0.03$). Emergency (*vs.* elective) and open (*vs.* laparoscopic) procedures were associated with an increased incidence of SSI ($P = 0.003$ and $P = 0.004$, respectively.) Hypoalbuminemia (less than 30 mg/dl) was independently associated with SSI development (relative risk, RR = 5.68). Serum albumin was lower than 30 mg/dl in 46.4% of patients with a superficial wound infection, 80% with deep wound infections, and 83.3% of patients with organ space infections.

Interpretation

Surgical wound infection is a major complication after surgery. Risk factors include emergency procedure, long duration surgeries, and coexisting disease. In addition, hypoalbuminemia increases risk for wound infection. Increased attention to preventing wound infections is warranted in patients with low albumin.

Hospital complication rates with bariatric surgery in Michigan. JAMA 2010; 304:435–42

Although bariatric surgery is the second most common abdominal operation performed in the United States, concern remains regarding the safety and outcomes across hospitals. The Michigan Bariatric Surgery Collaborative (MSBC) is a payor-funded quality improvement program that administers a prospective, externally audited clinical outcomes registry to help gain insight into this question.

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In this retrospective study of data from 25 hospitals participating in the MSBC registry, clinical outcomes of patients (n = 15,275) who underwent bariatric surgery over a 3-yr period were assessed. Surgery, surgeon, and hospital characteristics were also evaluated to examine potential impact on clinical outcomes.

Patients who underwent laparoscopic adjustable gastric bands were considered lower risk and had lower body mass index at baseline and lower rates of associated comorbid conditions. Overall, 7.3% of patients experienced at least one perioperative complication. Life-threatening complications (3.1%), fatalities (0.14%), and complications resulting in permanent disability (0.33%) were highest in patients undergoing gastric bypass *versus* sleeve gastrectomy or laparoscopic adjustable gastric bands. Surgical site complications (8.7%) and infection (4.4%) were also highest in patients undergoing gastric bypass. More patients undergoing gastric bypass required reoperation compared with sleeve gastrectomy (2.5% *vs.* 0.59%). Gastric bypass was also associated with a higher rate of both readmission and emergency department visits.

Most hospitals had serious complication rates between 2% and 3%; this was inversely associated with average annual bariatric procedure volume. Serious complication rates were nearly double in low-volume surgeons at low-volume hospitals than high-volume surgeons at high-volume hospitals (4.0% *vs.* 1.9%). However, the rates did not differ for procedures performed at accredited Centers of Excellence (COE) *versus* non-COE hospitals.

Interpretation

In this study, 7% of bariatric surgery patients developed perioperative complications, most of which were non–life-threatening and wound-associated. Gastric bypass patients had the highest complication rates. The rate of serious complication was inversely related to hospital and surgeon procedure volume.

A systematic quantitative assessment of risks associated with poor communication in surgical care. Arch Surg 2010; 145:582–8

Preventable adverse events contribute to a significant number of deaths in U.S. hospitals. Of these, communication breakdown, especially for surgery patients, is a significant cause of problems. The current study is the first to observe the entire chain of communication for a surgical patient.

In this study, a systematic quantitative validated method, healthcare failure mode and effect analysis (HFMEA), was applied to the information transfer and communication process to asses potential risks to surgical patients. HFMEA was performed at a teaching hospital and included a multidisciplinary team of surgeons, anesthetists, nurses, and a psychologist. The team was trained on the HFMEA procedure, and then communication processes were examined in the preoperative, intraoperative, and postoperative phases, which were then divided into four main phases to identify potential failure modes. Validation of all potential failure modes was conducted through independent observation of 10 patients undergoing major elective gastrointestinal surgery.

Overall, 132 failures were identified, including 31.3% high-risk failures. Of the high-risk failures, 26 were covered by current protocols; however, 22 different causes were identified by the remaining failures. In the preoperative phase, memory lapses, lack of knowledge, blurring responsibility boundaries, and hierarchical/power differences led to problems with information transfer. During the 10 patient follow-up periods, there were 39 failures, including communication care between providers (13), medication and prescription errors (11), thromboprophylaxis administration errors (8), failure to make plans for comorbidities (2), and failure to assess patients (5). Recommendations to reduce errors included a preoperative checklist, clearly established team roles and responsibilities for patient care tasks, electronic communication system with automated alerts, and multidisciplinary ward rounds for integral assessment and management of patients.

Interpretation

Surgical care is fraught with risks, especially related to errors in communication. HFMEA is one method that can be used to evaluate processes in health care and thereby minimize errors. These data suggest that such an approach can decrease poor outcomes, especially errors, in the care of surgical patients.

Endovascular repair of aortic aneurysm in patients physically ineligible for open repair. N Engl J Med 2010; 362:1872–80

The Endovascular Aneurysm Repair 2 (EVAR 2) trial examined whether endovascular aneurysm repair prolonged life expectancy through elimination of the risk of fatal ruptures. Although previously published short-term results of this study were negative, it is possible that a longer follow-up period is required to observe any benefit. Therefore, the long-term results (up to 10 yr) of patients ineligible for open aneurysm repair are reported in this article.

EVAR 2 was a randomized trial conducted at 33 hospitals in the United Kingdom which enrolled patients at least 60 years of age with an abdominal aortic aneurysm at least 5.5 cm in diameter and who were ineligible for open repair. Patients were randomly assigned to undergo either endovascular aneurysm repair (n = 197) or no intervention (n = 207).

The mean age was 76.8 yr, and the mean aneurysm diameter was 6.7 cm. Of the patients who underwent aneurysm repair, the rate of death per 100 person years was 3.6% in the endovascular repair group compared with 7.3% in the no-intervention group.

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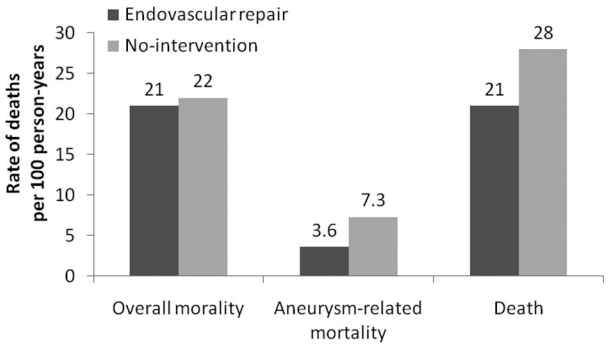

Interpretation

In this select group of patients, endovascular repair was associated with reduced aneurysm related mortality compared with no intervention. However, overall mortality rates and per-protocol-death rates were similar between groups. Other causes of death contributed to overall mortality so that even though aneurysm-related mortality was reduced, overall mortality was the same.

Critical Care Medicine

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

Compression-only CPR or standard CPR in out-of-hospital cardiac arrest. N Engl J Med 2010; 363:434–42

Several studies have recently proposed the utility of compression-only cardiopulmonary resuscitation (CPR) for patients who have undergone cardiac arrest. Small or retrospective studies have demonstrated comparable efficacy between compression-only or standard CPR.

In this prospective, randomized study conducted in Sweden, the 30-day survival rates were compared in patients who underwent cardiac arrest and received either compression-only CPR (n = 620) or standard CPR (n = 656) based on instructions from emergency medical dispatchers before the arrival of Emergency Medical System (EMS) personnel. Dispatchers received detailed written instructions for both types of CPR but were permitted to diverge from the instructions if necessary.

The majority of patients were male (67%) with a mean age range of 67–68 yr, and most cardiac arrests took place at home (76%). There was no difference in 1-day (24.0% *vs.* 20.9%) or 30-day survival (8.7% *vs.* 7.0%) between patients who received compression-only CPR or standard CPR. There was also no difference between compression-only CPR or standard CPR when various subgroups were assessed, such as age, time to EMS response, or first cardiac rhythm.

Interpretation

This prospective, randomized trial did not provide evidence for a difference between compression-only or standard CPR in the 30-day survival of patients with out-of-hospital, witnessed, primary cardiac arrest before the on-scene arrival of the EMS. Because of its simplicity, instructions for compression-only CPR will likely be recommended to callers by dispatchers in case of witnessed, out-of-hospital, cardiac arrest before arrival of the EMS.

CPR with chest compression alone or with rescue breathing. N Engl J Med 2010; 363: 423–33

After out-of-hospital cardiac arrest, early initiation of cardiopulmonary resuscitation (CPR) can improve a patient's changes of survival and long-term outcomes. Recently, new recommendations supporting compression-alone CPR compared with standard CPR with rescue breathing were announced, which may be more acceptable to the layperson or witness of cardiac arrest.

This multicenter, prospective, randomized trial (Dispatcher-assisted Resuscitation Trial [DART]) was conducted in the United States to determine the effects of dispatcher instructions for CPR with chest compression alone (n = 981) *versus* chest compression with rescue breathing (n = 960). Similar to the Swedish study, individuals who called 911 because of adult patients in arrest, were given the opportunity to administer CPR, and if they agreed the dispatcher would read instructions for one of the two types of CPR. Survival to hospital discharge was measured in all patients.

The majority of patients were male (66%), and the average time to EMS response was approximately 6 min. The percentages of patients who survived to hospital discharge were similar between the compression-only and compression plus rescue breathing groups (14.4% *vs.* 11.5%). In patients who underwent cardiac arrest, there was a trend toward increased proportion of patients surviving (15.5% *vs.* 12.3%) and improved neurologic status (18.9% *vs.* 13.5%) in the compression-alone group compared with the compression plus rescue breathing. However, in patients who underwent noncardiac arrest, the rates were similar.

Interpretation

CPR without rescue breathing may be more acceptable to the layperson. In this U.S. study of patients randomized to dispatcher-assisted CPR with or without rescue breathing, overall survival to discharge did not differ between groups. This study provides additional support for the use of compression-only CPR to improve patient outcomes.

Survival differences following lung transplantation among U.S. transplant centers. JAMA 2010; 304:53–60

When compared with the average 3-yr survival rate for patients who receive lung transplants (LT), single centers have reported outcomes as high as 75%. These data suggest differences in quality of care among various LT centers. Under-

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standing the reasons behind these differences may offer suggestions for improving care and outcomes for all LT patients.

This study retrospectively reviewed 15,642 reports of adult patients undergoing LT between 1987 and 2009 in 61 U.S. LT centers from the United Network for Organ Sharing (UNOS) registry were included. The majority of reports came from centers that performed 10–25 (39.3%) or 25–50 (40.9%) LT annually. Overall median survival was 4.9 yr, and the 1-, 3-, and 5-yr survival rates were 79.7%, 63.0%, and 49.5%, respectively. There was a significant center effect ($P < 0.001$) which remained regardless of recipient, donor, and surgery characteristics. Volume was positively associated with survival. However, several low-volume centers also achieved good outcomes.

Interpretation

This study indicates that differences exist in the quality of care provided to recipients of LT and that these differences are not totally accounted for by the high-volume effect of some centers performing LT. Rather, beneficial effects on survival of procedures performed at some centers may, in part, explain the variability of the mortality rates after LT and should serve as a basis to improve quality of care in all LT centers.

Risk factors for ischemic and intracerebral hemorrhagic stroke in 22 countries (The INTERSTROKE study): A case-control study. Lancet 2010; 376:112–23

Despite the high incidence of stroke mortality (more than 85%) in low- and middle-income regions worldwide, specific risk factors for patients in these regions have not been identified. Therefore, this international, multicenter, case-control study, INTERSTROKE, was designed to establish the association between traditional and emerging risk factors with stroke and countries of all income levels. The current manuscript presents data on the feasibility of such a large study.

Participants from 84 centers in 22 countries were included. Patients admitted to the hospital with first acute stroke were included if they presented within 5 days of symptom onset, within 72 h of hospital admission, and if a computer tomography scan or magnetic resonance imaging was planned within 1 week of presentation. Where possible, control patients from the hospital or community with no history of stroke were matched for age, sex, and ethnicity to the stroke group.

Of the 3,000 cases and 3,000 controls in phase I, 78% had ischemic stroke and 22% had intracerebral hemorrhagic stroke. The risk of stroke was highest among patients with hypertension, specifically for intracerebral hemorrhagic stroke. Smoking was also associated with increased risk of stroke and increased with greater quantities of cigarettes smoked per day.

Variable	Risk
Hypertension	↑ *
Current smoking status	↑ †
Diet	
Increased fruit	↓
Increased fish	↓
Vegetables	—
Red meat, organ meats, eggs	↑
Fried foods, pizza, salty snacks	↑
Cooking with lard	↑
Diabetes	↑ †
Alcohol*	↓ †
1–30 drinks per month	↓
>30 drinks per month	↑
Regular physical activity	↓
Psychosocial stress	↑
Depression	↑ †

* Favored intracerebral hemorrhagic stroke.

† Favored/benefited ischemic stroke.

Interpretation

This worldwide, case-control study identified major factors accounting for 90% of the risk of stroke. Hypertension, smoking, waist-to-hip ratio, diet, and alcohol intake were common risk factors for stroke and intracerebral hemorrhage. These results support the suggestion that targeted interventions that reduce blood pressure and smoking and promote physical activity and healthy diet, represent simple, potentially efficient strategies to decrease the risk the burden of stroke.

Pain Medicine

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

Neurophysiological assessment of spinal cord stimulation in failed back surgery syndrome. PAIN 2010; 150:485–91

The mechanisms of action of spinal cord stimulation (SCS) for the treatment of chronic refractory neuropathic pain are still unknown despite widespread use. To understand the effects of SCS on segmental and suprasegmental neural pathways, a small prospective trial was conducted.

Neurophysiological testing was conducted in patients (n = 20) who were successfully treated by SCS for mostly unilateral, drug-resistant, lower-limb pain due to failed back surgery syndrome. Plantar sympathetic skin response (SSR), F-wave and somatosensory-evoked potentials (P40-SEP) to tibial nerve stimulation, H-reflex of the soleus muscle, and nociceptive flexion (RIII) reflex to sural nerve stimulation were recorded at the painful lower limb. The study included two recording sets while SCS was switched "ON" or "OFF" for 1 h.

Analgesia induced by SCS mainly correlated with RIII attenuation, supporting a real analgesic efficacy of the procedure. SCS inhibited both nociceptive and nonnociceptive myelinated sensory afferents and increased cholinergic sympathetic skin activity.

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Neurophysiological Effects of SCS (Results of Recording with SCS "On")	
SSR amplitude	↑
H reflex threshold	↑
RIII reflex threshold	↑
RIII latency	↑
SSR latency	↓
F-wave latency	↓
H-reflex amplitude	↓
P40-SEP amplitude	↓
RIII reflex area	↓

Interpretation

In this study, somatosensory evoked potentials were inhibited by SCS. Both the threshold and the magnitude of the nociceptive flexion reflex were reduced. A limitation of this study was that SCS was tested in patients who benefitted from the analgesic effect of the treatment. Evaluation of patients who failed SCS may provide further evidence as to the mechanism of its effect and the predictive benefit of inhibition of evoked potentials in pain patients.

Quantitative sensory testing in the German Research Network on Neuropathic Pain (DFNS): Somatosensory abnormalities in 1236 patients with different neuropathic pain syndromes. PAIN 2010; 150:439–50

Neuropathic pain is typically classified based on etiology. However, somatosensory profiles may provide additional information necessary to provide mechanism-based treatments for patients with neuropathic pain.

To explore the spectrum and frequency of somatosensory abnormalities in patients with various neurologic syndromes, a multicenter cohort study was conducted in Germany. Patients (n = 1,236) with a clinical diagnosis of neuropathic pain (*e.g.*, peripheral nerve injury [PNI], complex regional pain syndromes [CRPS], and postherpetic neuralgia [PHN]) were assessed by quantitative sensory testing (QST) after the protocol of the German Research Network on Neuropathic Pain. Both thermal and mechanical nociceptive stimuli, as well as nonnociceptive stimuli, were used for testing. QST was performed at the most painful site of the affected body area and the contralateral mirror control area.

The majority of patients were women (58% *vs.* 42%), and compared with men, more women had CRPS (77% *vs.* 23%), trigeminal neuralgia (67% *vs.* 33%), or postherpetic neuralgia (64% *vs.* 33%). Across all parameters, 92% of the patients presented at least one sensory abnormality. Thermosensory or mechanical hypoesthesia was more frequent than hypoalgesia. Mechanical hyperalgesia (*i.e.*, blunt pressure or pinprick) occurred more often than thermal hyperalgesia (*i.e.*, cold or heat), dynamic mechanical allodynia, paradoxical heat sensations, or enhanced wind-up. All abnormalities were observed in all pain syndromes. However, thermal and mechanical hyperalgesias were most frequent in patients with CRPS and PNI, and allodynia was most frequent in patients with PHN. Three patterns were evident: mixed thermal/mechanical loss without hyperalgesia (central pain and polyneuropathy), mixed loss with mechanical hyperalgesia in peripheral neuropathies, or mechanical hyperalgesia.

Interpretation

In this large study, which evaluated patients with neuropathic pain, categories and patterns from results of sensory testing included those with gain of function, loss of function, and mixed phenotypes. These categories may improve the classification of neuropathic pain syndromes and aid in categorizing patients for treatments in clinical trials.

A randomized add-on trial of an *N*-methyl-D-aspartate antagonist in treatment-resistant bipolar depression. Arch Gen Psychiatry 2010; 67:793–802

Multiple clinical trials have examined the utility of ketamine for adjunctive therapy for acute and chronic pain. This randomized, placebo-controlled, double-blind, crossover, add-on study was conducted to determine whether ketamine, an *N*-methyl-D-aspartate–receptor antagonist, produces rapid antidepressant effects in patients with bipolar depression. Patients (n = 18) diagnosed with treatment-resistant bipolar depression were maintained at therapeutic levels of their current medications and received an intravenous infusion of either ketamine hydrochloride (0.5 mg/kg) over 40 min or placebo on 2 test days 2 weeks apart. The Montgomery-Asberg Depression Rating Scale (MADRS) was used to rate patients at baseline and at 40, 80, 110, and 230 min and on days 1, 2, 3, 7, 10, and 14 postinfusion. Compared with placebo, patients who received ketamine had fewer depressive symptoms within 40 min. This effect remained significant through day 3, although the effect was greatest on day 2. Overall, more patients responded to ketamine than placebo at some point during the trial (71% *vs.* 6%).

Interpretation

Perioperative ketamine administration has been used to limit opioid administration and reduce acute pain. Ketamine has also been used to treat patients with complex regional pain syndrome. In this study, patients with refractory bipolar depression were treated with a single dose of ketamine, and improvement in depression occurred. When administering ketamine and evaluating its beneficial effects, other properties of the drug, including decreases in depressive symptoms, should be considered.

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