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

Perioperative Medicine

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Can aviation-based team training elicit sustainable behavioral change? Arch Surg 2009; 144:1133–7

Crew resource management is a technique used in aviation to address problems related to how effectively people work together to reduce errors. A catastrophic collision of two jets in 1977 was part of the impetus to develop methods to prevent similar disasters. Many healthcare enterprises are using crew resource management to reduce human error in the perioperative period. This article describes a multidisciplinary perioperative program initiated at two medical centers, one at a tertiary care hospital and the other at a community hospital affiliated with a medical school. Instructions were given by means of team building exercises, open forums, and video.

As a part of the program, a preoperative checklist was instituted. This checklist included what was considered "killer items," that is, tasks that needed to be performed to prevent errors and minimize complications. On the list were, among other things, the site and type of surgery, whether antibiotics had been given, and the status of deep vein thrombosis prophylaxis. Use of the checklist was monitored, along with acceptance. Initially, surgeons were resistant but the circulating nurses and scrub technician or nurse were empowered to not assist the surgeon until the checklist was completed. Compliance and acceptance increased, especially as errors began to be identified, such as when antibiotics were not given or a vital piece of equipment was not present.

Personnel involved felt more comfortable reporting errors and perceived incompetence during the course of the crew resource management program. Personal behavior can be influenced by such a program although the demonstration that errors are prevented and complications reduced might take years to come to full fruition.

Interpretation

The operating room has many similarities to the cockpit of an airplane, and using a preoperative checklist may reduce human errors. Institutions should consider using such a checklist and should support participation by staff, including nurses and technicians. These individuals are vital team members who are capable of identifying and preventing errors.

Duration and magnitude of the postoperative risk of venous thromboembolism in middle aged women: Prospective cohort study. BMJ 2009; 339:b4583

The risk of venous thromboembolism is highest during the weeks immediately after surgery, varies based on surgery type, and is highest for patients undergoing major orthopedic surgeries or those with cancer. To examine the duration and magnitude of increased risk, data were collected from a prospective cohort study of 1.3 million women in the United Kingdom ("Million Women Study").

Patients with a history of venous thromboembolism or multiple surgeries were excluded. Adjusted relative risks and standardized incidence rates for first diagnosis, hospital admission, or death from pulmonary embolism or deep vein thrombosis were assessed.

The mean age of participants (N = 947,454) was 56 yr, most were postmenopausal (85%), and patients were followed up for a mean of 6.2 yr. Less than 1% of the population (0.6%) was admitted to the hospital with pulmonary embolism (n = 2,487), had deep vein thrombosis (n = 3,529), or had a first diagnosis of venous thromboembolism at death (n = 270). Compared with those not having surgery, women were 70 times more likely to be admitted with venous thromboembolism in the first 6 weeks after an inpatient operation and 10 times more likely after a day case. The risks were lower but still substantially increased 7 to 12 weeks after surgery. The highest relative risks after inpatient surgery occurred after hip or knee replacement and for cancer (the relative risks were 220.6 and 91.6, respectively, 1–6 weeks after surgery).

Interpretation

In this study of risk of postoperative venous thromboembolism of nearly 1 million participants, middle aged United Kingdom women undergoing inpatient surgery were at a risk of one in 140 during the 12-week period after the operation. The risk of being admitted for venous thromboembolism was one in 6,200 for a comparable nonoperated group. Despite advances in preventative treatments for postoperative venous thromboembolism, this complication rate is high in middle aged women.

Erythropoiesis stimulating agent administration improves survival after severe traumatic brain injury: A matched case control study. Ann Surg 2010; 251:1–4

Clinical studies have demonstrated the neuroprotective effects of erythropoiesis stimulating agents (ESA) in patients

with nontraumatic intracranial hemorrhage, schizophrenia, and progressive multiple sclerosis. However, the utility of ESA in patients with severe traumatic brain injury has only been speculated based on *in vitro* preclinical data. Therefore, the authors conducted a retrospective-matched case-control study to investigate the potential clinical efficacy of ESA.

Patients with severe traumatic brain injury (Abbreviated Injury Scale score of 3 or greater) receiving ESA (n = 89) while in the surgical intensive care unit (ICU) were matched 1 to 2 (n = 178) with patients who did not receive ESA during a 12-yr period.

Of the 1,651 admissions to the surgical ICU, ESAs were administered to 89 patients. No differences in baseline characteristics or complications were noted between groups. Despite differences in overall length of stay and surgical ICU length of stay, patients with ESA+ had significantly improved survival.

	ESA+ Patients (n = 89)	ESA− Patients (n = 178)	*P* Value
Baseline characteristics			
Mean age, yr	43.3	43.0	0.91
Injury severity score	27.8	26.6	0.39
Complications, %	46	75	0.15
Pneumonia	25.8	23.0	0.84
Acute respiratory distress syndrome	10.1	11.2	0.65
In-hospital mortality			
Death, %	7.9	24.2	0.001
Mean surgical ICU days	18.3	13.8	0.007
Mean hospital days	31.8	34.4	0.007

Interpretation

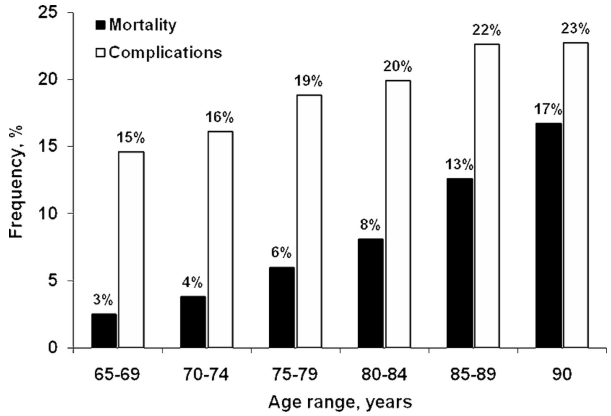
ESA have been shown to improve neurologic outcome in laboratory studies of traumatic brain injury. In this retrospective case–control study, administration of ESA improved survival in patients who suffered from severe traumatic brain injury. These results suggest future randomized control trials to be undertaken to validate this observation in patients with severe traumatic brain injury.

Impact of advancing age on abdominal surgical outcomes. Arch Surg 2009; 144:1108–14

Approximately 2 million older Americans undergo abdominal surgery annually. Although older adults have a potential risk of difficulty in recovery after surgery, clinical data on adverse outcomes are conflicting. This retrospective study was conducted to evaluate the population-level risk of adverse outcomes among older patients undergoing common abdominal surgical procedures (*e.g.*, cholecystectomy, colectomy, and hysterectomy).

Using the Washington State hospital discharge database, in a total of 101,318 adults aged 65 yr or older and who underwent common abdominal procedures, 90-day rates of postsurgical morbidity and mortality were assessed. The mean age of patients was 74.4 yr; the majority of patients underwent colectomy (31.2%) or cholecystecomy (30.4%), and most surgeries were conducted as outpatient procedures (75.4%). Comorbid conditions included chronic obstructive pulmonary disease (12.2%), diabetes mellitus (8.9%), and congestive heart failure (6.5%).

The 90-day cumulative incidence of complications was 17.3%, with a 90-day mortality rate of 5.4%. Result trends were consistent regardless of demographics, patient or surgical characteristics, cancer diagnosis, and reason for admission (elective *vs.* nonelective).



Interpretation

At 90 postoperative days, older patients (older than 65 yr) who had undergone abdominal surgery had increased risk for postoperative complications, including death. Trend analysis revealed that, within the age range studied (65 yr to >90 yr), there was increasing incidence of complications and death. These data could be useful when discussing risks with older patients about to undergo abdominal surgery.

Nutritional risk is a clinical predictor of postoperative mortality and morbidity in surgery for colorectal cancer. Br J Surg 2010; 97:92–7

Malnutrition may occur in up to 50% of in-hospital patients after gastrointestinal surgery and is associated with increased risk of postoperative complications, prolonged hospital stay, increased hospitals costs, and mortality.

This prospective Swiss study investigated whether nutritional risk scores applied at hospital admission predict mortality and complications after elective colorectal cancer surgery. Clinical details, Reilly's Nutrition Risk Score, and Nutritional Risk Screening 2002 score, tumor stage, and surgical procedure were recorded for 186 patients with a mean age of approximately 65 yr.

Common comorbid conditions included cardiovascular, metabolic, and pulmonary conditions. Overall, the median length of hospital stay was 20.2 days and mean weight loss was 2.97 kg. Nutritional risk was identified as an independent predictor of postoperative complications.

	Reilly's Nutrition Risk Score	Nutritional Risk Screening 2002
Patients at nutritional risk, %	31.7	39.3
Mortality rate, %		
At risk *vs.* not	8.0 *vs.* 1.6*	7.0 *vs.* 1.8
Postoperative complication, %		
At risk *vs.* not	58 *vs.* 44.1	62 *vs.* 39.8†

* $P = 0.033$. † $P = 0.004$.

Interpretation

Nutritional risk predicts outcome after colorectal surgery; however, risk outcome may differ based on the test used to classify nutritional risk. Further studies may determine whether nutrition is a causative factor in the development of certain postoperative complications (*e.g.*, wound infection or dehiscence). It is also not known whether improvement in nutritional status with supplements will reduce complications.

A sensitive cardiac troponin T assay in stable coronary artery disease. N Engl J Med 2009; 361:2538–47

There is a strong association between elevated troponin levels and recurrent coronary ischemic events in patients with suspected coronary syndromes, with even small elevations resulting in increased risk of adverse outcomes. In most patients with stable coronary artery disease, plasma cardiac troponin T levels are below the limit of detection for the conventional assay that may limit risk identification.

A newly developed high-sensitivity assay was designed to determine the concentration (10× lesser than conventional measurements) of cardiac troponin T in plasma samples. In this subgroup analysis of 3,679 patients with stable coronary artery disease and preserved left ventricular function enrolled in a large randomized prospective trial (Prevention of Events with Angiotensin Converting Enzyme Inhibition trial), cardiac troponin T levels were measured using this new assay. Results were analyzed in relation to the incidence of cardiovascular events during a median follow-up period of 5.2 yr.

Concentrations of cardiac troponin T were at or above the limit of detection (0.001 μg/L) in 3,593 patients (97.7%) and at or above the 99th percentile for apparently healthy subjects (0.0133 μg/L in 407 patients, 11.1%). After adjustment for other independent prognostic indicators, there was an increase in the cumulative incidence of cardiovascular death and heart failure in the group with elevated cardiac troponin T levels. There was no association between troponin T levels and the incidence of myocardial infarction.

Interpretation

Cardiac troponin T levels are usually below the limit of detection in patients with stable coronary artery disease. A more sensitive assay revealed that patients with elevated cardiac troponin T levels (compared with normal controls) were more likely to have cardiovascular death and heart failure, but not myocardial infarction. Further research will be needed to determine whether these subtle changes in troponin T portend an increased perioperative risk for cardiovascular complications and death.

Critical Care Medicine

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

Early exercise in critically ill patients enhances short-term functional recovery. Crit Care Med 2009; 37:2499–505

Clinical peripheral muscle weakness has been reported in 25–33% of patients mechanically ventilated for 4 to 7 days. This may lead to prolonged intensive care unit (ICU) stays and impaired functional status and quality of life up to 1 yr after discharge. Recent evidence suggests that early activity is possible for critically ill patients; however, there is limited evidence for its effectiveness in patients in ICUs while under sedation.

A randomized controlled trial was conducted to investigate whether a daily exercise session is a safe and an effective intervention in preventing or attenuating these detrimental effects. Critically ill patients (N = 90) were included when their cardiorespiratory condition allowed (beginning day 5) and if a prolonged ICU stay (at least 7 more days) was expected. Patients received respiratory physiotherapy and a daily standardized passive or active motion session of upper and lower limbs and the treatment group performed a passive or active bedside cycling session for 20 min/day.

Most patients (79%) were recruited in the surgical ICU and of these most had undergone cardiac surgery (39%), transplant surgery (25%), or thoracic surgery (16%). Eighty percent of patients received assisted pressure-support ventilation. The median number of cycling sessions was 7 and the median cycling frequency was 4 sessions/week. No severe adverse events were identified during and immediately after the exercise training.

At hospital discharge, all outcomes (*e.g.*, 6-min walking distance, isometric quadriceps force, and the subjective feeling of functional well-being) were significantly higher in the treatment group ($P < 0.05$).