Learning and Mindfulness: Improving Perioperative Patient Safety

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In 1980, McLain[1] identified the top five risk management issues in the OR as wrong patient; wrong procedure performed; improper consent; unreconciled sponge, needle, or instrument count; and burns from equipment. Approximately 20 years later, the Institute of Medicine report *To Err Is Human: Building a Safer Health System*[2] described the complexity of health care systems in the United States and the epidemic occurrence of medical errors. Despite widespread awareness of medical errors, there has been little progress in this area to improve patient safety, and sentinel or never events continue to occur in the United States.[3]

With the expected steep rise in the median age of the US workforce, health care systems will have fewer resources (eg, time, human capital, money) to provide care to the increasing number of patients who will seek services. In addition, many institutions are now being penalized when care is not optimal.[4] As health care institutions shift to payment systems based on quality of care rather than quantity of services and are paid or penalized based on the quality of their services, new approaches to reducing harm to patients in the complex perioperative environment are paramount.

SURGICAL ENVIRONMENT ERRORS

Makary and Daniel[5] reported that medical errors are the third leading cause of death in US hospitals. Medical errors may occur at any point during the delivery of health care, and the surgical environment in particular presents special risks and challenges to safeguarding patients from unintended harm. Errors in the OR (eg, wrong site, wrong patient, wrong operation, loss of airway, intraoperative complications) are serious, and safety systems must be in place to reduce the

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likelihood of errors. Patients may also be injured during surgical procedures as a result of positioning, retained surgical items, burns, medication and transfusion errors, and mishandling of surgical specimens.

The fallibility of human performance can result in catastrophic errors that cause patient injury or death. The surgical team includes nurses, surgeons, anesthesia professionals, surgical technologists, and other staff members who provide care to patients. The intricacy of the OR environment, workload demands, varying levels of clinical urgency, and the need to interface with complex technology allow little room for unacceptable levels of performance. Health care providers expend a considerable amount of effort coordinating workflows to increase efficiency and productivity, however, so sometimes only limited time, energy, and resources are available to examine and manage patient safety processes.

Managing Safety Practices

An *error* is the failure of a planned action to be completed as intended.[6] In the health care context, an *adverse event* is an injury caused by medical care rather than the patient's underlying medical condition.[7] Errors and adverse events may overlap, but they also may be mutually exclusive. In some instances, errors may be fatal; in others, the error may never reach a patient. *Near misses* are errors or precursor acts that, because of timely correction or chance, do not become adverse events.[8]

The literature suggests that more than 80% of accidents in the workplace are attributable to human error.[6,9,10] These errors seldom occur in a vacuum; closer examination usually reveals the presence of hidden organizational vulnerabilities that conspire to create conditions that can precipitate or accelerate deviations from practice and result in harm. When amplified in a complex environment such as the OR, these organizational weaknesses may result in errors because of the large number of potential failure points and because the complexity of the environment can easily conceal dangers.

Major accidents can result from small, seemingly inconsequential errors or practice deviations. Any error can cause minor or major failures depending on the situation. There are a variety of ways in which individuals err, particularly when they are under stress and shouldering intense workloads. Rasmussen et al[11] developed the skill, rule, and knowledge framework based on how much control an individual has over a task. This framework defines three different types of individual errors as follows:

- skill-based errors (eg, momentary forgetfulness, lack of knowledge), which occur when the action an individual takes is not what was intended;
- rule-based mistakes, which occur because an individual's actions are not effective as a result of the incorrect application of a rule or the inadequacy of a plan of action; and
- knowledge-based mistakes, which occur because the individual did not possess the knowledge to achieve the desired result.

Most major failures (eg, wrong-site surgery), however, are believed to result from the design of systems and not from errors by one individual. Perrow[10] advanced the normal accident theory, which proposed that accidents should be expected in complex systems. Highly reliable organizations then design processes that identify and expose errors, allowing personnel to correct the errors or implement an alternate method for completing a task. Understanding that errors are not entirely preventable, safety system personnel should strive for building redundancies (ie, crucial processes should rely on more than one step to ensure mistakes are minimized) and safety into rules that are designed to expose mistakes early, and they should create rules and workflows engineered to limit the opportunity for error (ie, qualities in the design of equipment and workflows that force an individual to perform correctly and with less effort) wherever possible.[10]

Human performance is hindered by a number of cognitive factors and biases (eg, familiarity with tasks or procedures, not perceiving risks) that create precursor conditions for accidents and adverse events. A team's ability to function under demanding work conditions has been shown to be directly associated with patient care quality.[12] The complex effects of interruptions and multitasking in the fast-paced, high-risk environment of the OR can contribute to unsafe conditions and interfere with the human capacity to identify, prevent, intercept, and contain errors.

Humans' inability to truly multitask is well established in the cognitive psychology literature, and our limited working (ie, short-term) memory is quickly degraded under conditions of time pressure, heavy workload, and nonroutine task performance.[13] Under such conditions, the brain employs various techniques to reduce mental effort, including resorting to what are known as *heuristics* (eg, a rule of thumb) and shortcuts to complete tasks. It is under these conditions that mistakes occur.

Instituting a safety management system in the OR requires awareness and a thorough understanding of the conditions under which errors occur at all levels of the organization. Safety efforts should be aimed at anticipating, preventing,