Occupational Hazards and Health for Anesthesiologists

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INTRODUCTION

Employment in the health care industry can be hazardous to one’s health. According to the U.S. Bureau of Labor, health care is second only to manufacturing in the number of occupational illnesses and injuries sustained by their workers.¹ Anesthesia personnel are at risk of acquiring a number of occupational illnesses and injuries that are endemic to the high intensity environment of the operating room. Workplace hazards include exposure to waste anesthetic gases, ionizing radiation, and to infectious agents. Anesthesia care providers are vulnerable to injury from accidents, fires, or explosions. Additionally, anesthesia personnel are susceptible to emotional and psychological disorders such as burnout and substance abuse engendered at least in part by the high stress and other demands inherent in their work.

In the following discussion we will consider the sources of many of these injuries and practical means of avoidance. We will also discuss the growing awareness of the importance of preventative strategies that encourage wellness among our colleagues.

PHYSICAL HAZARDS

Accidents: Injuries as a result of accidents are the most common of the physical hazards in the operating room. However, few of these injuries are reported and much of the information on accidents in the operating room comes from anecdotes or incident reports.

   Needle stick injury is the most frequent accident suffered by anesthesiologists. The majority of needle stick injuries occur during use, but many occur during recapping and disposal. Needle stick injuries are preventable and potentially lethal.

Waste Anesthetic Gases: Potential health hazards from waste anesthetic gases have been a concern since the introduction of inhalation anesthetics into clinical practice. Extensive investigation has failed to identify any link between the level of exposure to trace gases that anesthesiologists receive in a modern, scavenged operating room and adverse health effects.² Effective scavenging of waste gases is essential as demonstrated by reports of reduced fertility and elevated spontaneous abortion among female dental assistants and veterinarians working in unscavenged operating rooms.

Ionizing Radiation: A growing concern within modern operating suites is exposure of personnel to radiation as a result of the increasing number and complexity of procedures requiring x-ray imaging. Anesthesia personnel are at risk of exposure from both direct and indirect sources of ionizing radiation.

   The biologic consequences of radiation exposure vary depending on age, gender, and specific organ site of exposure. The deterministic effects of radiation cause cell death and organ injury and are cumulative in a dose related fashion. Common examples of deterministic injuries include skin damage, infertility, and certain types of cataracts. Stochastic effects of radiation are those that result in DNA injury and the development of cancer. There is no known threshold below which the risk of developing these consequences completely disappears. And there is frequently a long latency period before the clinical presentation of an induced neoplasm.

   The Occupational and Safety Health Administration (OSHA) has set an annual limit for workers with potential exposure to ionizing radiation of 5 Rems and a lifetime limit of \((N-18) \times 5\) Rems (where \(N\) is the age in years). Early studies found the exposure to radiation among anesthesia personnel to be safely below these limits. However, more recent studies, conducted subsequent to the increased utilization of ionizing radiation in operating rooms and many other anesthetizing locations, such as cardiac catheterization labs, have revealed a trend towards increased exposure among anesthesia personnel. In one study, the mean radiation exposure for members of a department of anesthesiology doubled in the six months after a new electrophysiology service was introduced.³ Anesthesiologists in this study increased their average exposure to almost 500 mRem on an annualized basis. A
similar study reported a significant level of exposure to anesthesiologists during endoscopic retrograde cholangiopancreatography (ERCP) and cardiac catheterization. In both of these studies, exposure remained well below the annual limit set of 500 mRem. However, it must be appreciated that many of the diseases associated with radiation exposure exhibit a direct dose response relationship—making as low as reasonably practical (ALARP) the safest practice. Preventative strategies for anesthesiologists to limit their radiation exposure include decreasing the exposure time, distancing oneself from the source of the radiation, and using maximal shielding from both primary and scattered sources of radiation.

A second form of radiation with potential health hazards comes from chronic exposure to low-frequency electromagnetic fields such as those emitted by MRI equipment. It is often necessary for the anesthesia care provider to remain in close proximity to the patient, and thus the magnet during MRI studies. Data are not yet available to determine the safety of long-term exposure to high-intensity magnetic fields. Therefore, until such time that safety thresholds have been determined for this type of exposure, anesthesiologists should obey the general admonition regarding all radiation exposure as low as reasonably practical.

**Infectious Agents:** The risk to anesthesia personnel of acquiring infections in their workplace continues to increase because of the growing number of antimicrobial resistant bacteria, and the frequent appearance in operating rooms of immune-compromised patients who might serve as vectors for resistant and opportunistic organisms. Additionally, diseases that were once thought to be noninfectious, such as peptic ulcer disease (Helicobacter pylori), invasive cervical cancer (human papillomavirus), Kaposi’s sarcoma (human herpesvirus type 8) and certain lymphomas (Epstein-Barr virus) are now understood to be long-term consequences of infection, making occupational health precautions even more important.

Immunity against some viral pathogens, such as hepatitis B, can be obtained through vaccination. Transmission of other blood-borne pathogens, such as hepatitis and human immunodeficiency virus (HIV) can be prevented by rigorously applying “Standard Precautions” as detailed by the Centers for Disease Control and Prevention (CDC). These precautions include the appropriate use of hand washing, personal protective equipment (PPE), and respiratory hygiene/cough etiquette. The selection of specific barriers or PPE can be as basic as wearing gloves for some patient contacts, or as complicated as employing advanced personal protection gear, such as gown, mask, and face shield or respirator for many invasive procedures.

In addition to CDC guidelines, OSHA has developed standards designed to protect employees from occupational exposure to blood-borne pathogens. Among other requirements, these standards require that an employer encourage strategies to reduce blood exposures, furnish appropriate PPE, and provide an annual educational program focused upon employees’ risk of blood-borne infection. In addition, the institution’s employee health service is required to maintain protocols for workers exposed to contagious diseases such as Tuberculosis, HIV or hepatitis.

Case reports of occupationally acquired infection have appeared for virtually every communicable disease. Pathogens of special concern for anesthesiologists include: influenza types A B and C, human respiratory syncytial virus, SARS-associated coronavirus, norovirus, c. difficile, herpes simplex viruses, Epstein-Barr virus, rubella, rubeola, hepatitis virus A B and C, human immunodeficiency virus, methicillin resistant staphylococcus aureus, and tuberculosis.

In the event of an exposure to a pathogenic microorganism, the incident should be reported to the employee health service. There are extensive post-exposure treatment protocols for many of the pathogens that should be initiated immediately after exposure to many of these pathogens. Detailed recommendations for post-exposure prophylaxis in the event of exposure to HIV can be obtained from the National Clinicians' Post-Exposure Prophylaxis Hotline (PPELine) at 888-448-4911.

**Work Hours, Night Call, and Fatigue:** Inadequate sleep resulting from any number of factors, including obstructive sleep apnea or disruptive work schedules, can have deleterious effects upon work practices and contribute to illness. Workers who are sleep deprived suffer a decrement in performance and are at greater risk of
committing workplace errors and to suffer work related injuries. The impairments associated with sleep deprivation bear a striking similarity to those seen with alcohol intoxication.

The contribution of sleep loss and fatigue to accidents has been documented in many well-publicized industrial catastrophes, including those that occurred at Chernobyl, Three Mile Island, Exxon-Valdez, and the Challenger space shuttle disaster.

The changes imposed by fatigue have the potential to adversely impact an anesthesiologist’s ability to conduct a safe anesthetic. Important fatigue related changes include: impairment of mood, alertness, short term memory and cognition, prolonged reaction time, diminished, compromised clinical decision making, and reduced attention, vigilance and performance. In one study, 58% of New Zealand anesthesiologists reported that they had exceeded their self-defined limit for safe continuous administration of anesthetic and 86% reported that that they had committed a fatigue-related error. Similar reports of fatigue-related complications have appeared in the surgical literature where as many as 16% of preventable adverse surgical events have been attributed to surgeon fatigue. However, others disagree and cite reports in which there was no evidence that suboptimal clinical management or poor outcomes occurred to patients managed by sleep deprived clinicians.

Medicine remains significantly behind other industries in regulating work hours. The Accreditation Council for Graduate Medical Education (ACGME) established the first set of standards to limit resident duty hours in 2000, which were revised in 2011. However, these restrictions on duty hours apply only to trainees and work hours in medical practice remain largely unregulated.

An unintended consequence of the restrictions on trainee’s duty hours has been a shift of work from residents to faculty. Practicing anesthesiologists continue to work long hours. Attending anesthesiologists and nurse anesthetists still commonly work 10- to 12-hour workdays and 24 hour on-call shifts. Gravenstein et al reported that the average anesthesiologist’s work week was 56 hours and that 74% of the respondents had worked without a break for longer periods than they personally thought was safe.

Noise: Noise levels in a modern operating room frequently exceed established limits for safe noise exposure and pose a potential health hazard. Ventilators, suction equipment, music, and conversation produce background noise at a level of 75 to 90 dB. Sporadic noises caused by surgical equipment and alarms can elevate these noise levels to greater than 100 dB with peak levels in excess of 120 dB. These are the noise levels produced on a busy freeway or by a rock and roll band.

Excessive levels of noise can diminish an anesthesiologist’s mental efficiency, short-term memory, and ability to multitask. Noise also interferes with the ability to hear crucial verbal communications and equipment alarms. There are also health ramifications of long-term exposure to excessive noise. Chronic exposure has been associated with elevated levels of endogenous catecholamines and heightened levels of stress, increased irritability, and elevated blood pressure.

Ultimately, exposure to excessive noise levels will result in hearing loss. Although no direct connection has been established with noise levels in operating rooms, it is interesting to note that more than 50% of anesthesiologists have a substantial hearing deficit and 7% have deficits that potentially interfere with their ability to hear operating room alarms.

Music is the one form of background noise that provides a number of beneficial effects. Music has proven advantageous as a supplement to sedation and analgesia for surgical patients. Self-selected background music can contribute to reducing autonomic responses and improving performance of operating room personnel. The beneficial effects are lost when a third party chooses the music. The selection of music, and the volume at which it is played, should be by mutual agreement of all parties present in the operating room.

Impairment and Disability: Impairment and disability can result from physical, mental, emotional, sensory or developmental etiologies. The onset can be sudden, as occurs with injury or acute illness, or more gradual, as is the case with many chronic diseases. Many cases of physician impairment are the result of substance abuse. Unwillingness or inability to keep up with current literature and techniques can be considered a form of impairment. Depression is often the presenting syndrome among impaired physicians. Unfortunately, many of the personality traits that serve as risk factors for depression are the same as those found, perhaps to a lesser degree, in...
the most successful physicians, such as self-sacrifice, achievement orientation, and intellectualization of emotions. Observations of alcoholic physicians offer examples of the potential association between emotional disturbance and achievement orientation. In one study, researchers found better first-year grades and higher scores on Part I National Board of Medical Examiners among those students identified as alcohol abusers. Similarly, more than one half of alcoholic physicians had graduated in the upper one third of their medical school class, and only 5% were in the lower one third of their class. It can be very challenging to appropriately respond to all of the problems created by an impaired or unsafe colleague. Management protocols for dealing with the impaired physician are covered in a series of articles by Canavan.  

EMOTIONAL HAZARDS
Stress: Chronic occupational stress can contribute to poor mental and physical health, industrial accidents and injury. Mild, brief, and controllable episodes of occupational stress are unavoidable and can serve as an impetus to personal achievement. On the other hand, extreme degrees of chronic stress are harmful and can contribute to mood and sleep disturbances, and gastrointestinal, musculoskeletal and cardiovascular disease. Stress-related outcomes in the workplace include physical injuries, absenteeism, decreased productivity and increased disability.

The work environment of an anesthesiologist contains many of the features of a classically defined stressful workplace. The background of chronic, low-level stress is frequently punctuated by intermittent episodes of extreme stress. Many of the clinical demands are externally paced and unpredictable in timing or urgency. Habituation to the ever changing demands is difficult. Finally, failure to meet the demands imposed by the workplace can result in serious consequences.

Certain specific stressors are commonly reported by anesthesiologists. These include the unpredictability of the work, the need for sustained vigilance during long intervals, production pressure, concern about litigation, difficult interpersonal relations, and economic uncertainties.

To many who work in the operating room, interpersonal relationships and conflict are the greatest source of workplace stress. Conflict can easily occur where overlapping areas of professional responsibility exist, as routinely occurs in the operating room, where surgeon and anesthesiologist simultaneously share patient responsibility. Recent work has focused upon applying the principles of Crisis Resource Management, first developed in the aerospace industry, to improve communication and team work in the operating room. Catastrophic intraoperative incidents, bad patient outcomes and the accompanying threat of litigation are frequent sources of stress to anesthesiologists. Many anesthesiologists experience long lasting emotional disturbances after being involved in a catastrophic incident in the operating room that resulted in patient injury or death. In a recent survey, 84% of anesthesiologists admitted to being involved in a serious or fatal incident and greater than 70% reported that they experience lingering guilt, anxiety or a sense of personal responsibility for the patient's injury or death. Approximately 20% never completely recovered from the episode.

Burnout: Burnout is characterized by physical and emotional exhaustion, poor judgment, cynicism, guilt, feelings of ineffectiveness, and a sense of depersonalization. Unfortunately, many of the attributes desired in health care providers, such as idealism, perfectionism, and a heightened sense of responsibility, can also make these individuals more vulnerable to feelings of inadequacy if their high standards are unmet.

Commonly cited causes of burnout among anesthesiologists are production pressure, excessive regulation, long hours of work, lack of control of one’s schedule, decreasing reimbursement, a rapidly expanding base of medical knowledge and difficulty balancing personal and professional lives.

Physicians suffering from burnout are prone to medical errors and malpractice lawsuits. Burnout has also been shown to be a contributor to various illnesses, including cardiovascular disease and substance abuse. Significant degrees of burnout have been identified among anesthesiologists. Greater than 50% of American academic chairs meet the criteria for high or moderate degrees of burnout.  

Substance abuse: Substance abuse occurs when an individual repeatedly abuses a drug despite significant adverse consequences. The addicted individual continues to use the substance in spite of the need for larger amounts of the
substance, unsuccessful attempts to control its use, the necessity of spending greater amounts of time seeking the substance, and symptoms of withdrawal.

The prevalence of alcoholism and substance abuse is approximately equal for physicians and the general population. However, physicians are less likely to abuse tobacco or illicit drugs and more likely to self-medicate with prescription drugs.

Many studies have reported a disproportionately high prevalence of substance abuse among anesthesiologists as compared to other physicians. Additionally, these reports demonstrate that anesthesiologists are more likely than other physicians to become addicted to potent intravenous drugs such as opioids or propofol that are potentially lethal. As a result, many authorities now consider substance abuse to be the number one occupational hazard of anesthesiology.

One particularly troubling aspect of this problem is the persistently high incidence of substance abuse among anesthesiology residents. In one of the most cited studies, anesthesiology residents constituted 33.7% of the resident population of the treatment group in the Medical Association of Georgia Disabled Doctors’ Program, despite representing only 4.6% of the overall resident population. The incidence of substance abuse within anesthesiology training programs continues to run close to 2% despite increased emphasis on substance abuse educational programs and more stringent accounting of controlled substances.

Addiction is a chronic progressive disease that, if untreated, is frequently fatal. Alexander et al calculated a relative risk of 2.79 for drug related deaths among anesthesiologists compared to a matched cohort of internists. Re-entry into clinical practice after rehabilitation is a particularly vulnerable period, with drug-related death rates as high as 20% among anesthesiology residents who were re-enrolled after treatment for chemical dependency.

There is an ongoing debate about the ultimate career path of the anesthesiologist in recovery. Reports have ranged from very pessimistic to more optimistic regarding the ability of recovering anesthesiologists to successfully return to practice. An early study reported only a 34% success rate for reentry for residents who had used parenteral opioids. Included among the 52 failures were 14 cases of suicide or lethal overdose. More recent data found that 76% of anesthesiologists who had completed rehabilitation in a state run physician health program remained in practice at 5 year follow up. There was no difference between anesthesiologists and non-anesthesiologists with regard to rates of relapse, mortality or disciplinary action. Guidelines from physician treatment centers may be helpful to assist in the decisions surrounding re-entry.

THE AGING ANESTHESIOLOGIST

Important physiologic changes can impact an older anesthesiologist’s ability to administer a safe anesthetic. Commonly observed physiological changes include impairments in hearing, vision, short term memory, and problem-solving abilities. Intellectual quickness, learning, and reaction time all slow. These changes have the potential to limit the older anesthesiologist’s ability to rapidly process information, assimilate and apply new knowledge, make complex decisions and initiate a proper response.

Age related changes in the cardiovascular and musculoskeletal systems can make it more difficult for older anesthesiologists to sustain the long, demanding work shifts common in anesthetic practice. Older individuals are particularly sensitive to disturbances of the sleep–wake cycle and are less well suited to night time work. Night call has been identified as the most stressful aspect of practice and most frequently cited impetus toward retirement among older anesthesiologists.

On the other hand, normal aging also contributes advantages, such as wisdom, judgment, and the experience acquired by a lifelong practice of the specialty. There is a strong positive correlation between experience and performance of many tasks required for administration of a safe anesthetic.

Anesthesiology is often regarded as a young person’s profession. Anesthesiologists tend to retire at a younger age than many other physicians. The decision to retire from anesthesiology is frequently precipitated by concerns about deteriorating clinical skills and the growing burdens of night call.
MORTALITY AMONG ANESTHESIOLOGISTS

A number of studies have examined mortality among anesthesiologists and arrived at different conclusions regarding the average life expectancy. The most recent study found that the average age at death among anesthesiologists was 78 years, the same as the national average for all Americans. 22 Inconsistent findings have also been reported about the most common causes of death among anesthesiologists. Earlier work found an increased incidence of certain types of cancer. More recent reports have failed to find any increase in cancer risk but a consistent finding of increased numbers of drug related deaths and suicide.

Malpractice law suits and substance abuse are two precursor events that have a strong association with suicide among anesthesiologists. One study reported that 4 of 185 anesthesiologists being sued for medical malpractice attempted or committed suicide. 23 In Alexander’s study, drug abuse was the most frequent method of suicide among anesthesiologists. 18

WELLNESS

It is estimated that half of the mortality in the US is premature. Many of these lives could have been preserved with the modification of just 10 behaviors - tobacco use, dietary pattern, physical activity level, alcohol consumption, exposure to microbial agents, exposure to toxic agents, use of firearms, sexual behavior, motor vehicle crashes, and illicit use of drugs.

One of the greater challenges for busy anesthesiologists is to balance the demands and stress of practice with the time necessary for wellness maintenance. A recent article describes the value of a proactive wellbeing program towards decreasing stresses and improving coping in a group of anesthesia residents. 24 The importance of wellness has also been recognized by the ASA. The ethical guidelines of the ASA state that anesthesiologists are obliged to maintain their “physical and mental health and special sensory capabilities”. 25 With this in mind, the ASA has developed a “Health and Wellness in Action” initiative whose primary mission is to promote the health and welfare of ASA members.

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