



The Surgeon at Risk, or the Hazards of Practicing Surgery

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"If a doctor treat a wounded person and causes his death or loss of eye, the physician's hands will be amputated" (Hammurabi Codex). At the beginning of the 21st century, surgeons thankfully no longer face such harsh threats. Instead, we face many special environmental risks, to such an extent that we could almost consider ourselves as being exposed to a "nosocomial disease." As in any other "disease," there is a population at risk, causative agents, routes of transmission, signs and symptoms, resulting injuries and consequences, and prevention and treatment modalities. An extensive review of the literature revealed that while many before us addressed various aspects of harmful environmental effects on the surgeon, there is no available overview of these factors taken all together. Our intent, then, is to give a comprehensive presentation of the dangers lurking in the surgeon's milieu. We found that the "disease" is endemic, multifaceted, and causes morbidity and mortality. The good news is that it may often be prevented and treated.

The population at risk

The community of surgeons has some very specific characteristics differentiating them from fellow physicians and other human beings in general. Those differences are pinpointed, accentuated and used as fodder for novels, TV series and films [1]. Psychologists see the surgeon in a somewhat different light and use special tests to evaluate surgical candidates – starting when they are in college and extending through medical school, internship and on to surgical maturity [2]. In his presidential address, J.M. Shuck [3] struggled to find "why" a person chooses to be a surgeon, and the best way he finds to describe the surgeon's personality is as a "Pollyanna" – "one having a disposition or nature characterized by irrepressible optimism and a tendency to find good in everything: an overly and often blindly optimistic person, an irritatingly cheerful person." Schwartz et al. [4] studied a group of physicians in an effort to define the surgical personality. Using three sets of inventories – the Krug adult personality inventory, the Strelau temperament inventory and Barclay's adjective checklist – and comparing surgeons to primary care physicians, they report that surgeons constitute a distinct and homogeneous group based on temperament and personality traits. Ramirez et al. [5] found

that surgeons cope best with stress and had the highest satisfaction among hospital consultants, and so are likely to be best protected from burnout and psychiatric morbidity.

Although there are differences among subspecialties in surgery, we will discuss the entire surgical community as being the population at risk.

The causative agents

We categorized these agents into trauma, infection, litigation, and exhaustion.

Trauma

- *Ergonomics*

Our workplace, the operating theater, ceased to be a "theater" some time ago. Although we do sometimes behave as actors, and not infrequently as "prima donnas," the operating room is a highly sophisticated working area within a home-garage environment [6]. Computers and lasers lie side by side with hammers, screwdrivers and saws. Knives, needles and drills are often companions to video cameras, fiberoptics and working microscopes. The "supporting cast" includes 10, sometimes 15, people who crowd the room, coming and going, and all very busy. At the hub of all this activity is, of course, the *raison d'être* of this production: the patient. Tension runs high, activity is at its peak, and the busiest person in the room, the surgeon, must be alert to everything that goes on, being, as he or she is, the "Captain of the ship." Or, is he really? Can the surgeon be master over all the turmoil and over every act of every participant? We all know that we surgeons can and do orchestrate this kind of show every day. We also know how hard we sometimes need to struggle at the helm of the ship. How much, however, do we pay the Piper?

Surgeons report muscle strain, fatigue, tachycardia, back pain, and sore ankles [7,8]. Standing at the operating table for hours, sometimes in a physiologically unsuitable posture [9] and tensed to the maximum, takes its toll [10].

- *Instrumental*

Scalpels, needles, drills, electric currents, and lasers have all been reported to cause injuries to surgeons. Sharp object injuries occur at the average of 6.9%, and laser injuries are reported to occur to

the patient or surgical team at a rate as high as 9% [11,12]. Rarely do these injuries cause a permanent disability, but their occurrence to surgeons can have a significant effect on their ability to work, however temporarily.

Anecdotal injuries are frequently reported, with one of the most curious having happened in the 19th century to Robert Liston, a surgeon at University College in London. During an amputation, he managed to cut the fingers of his assistant who died from sepsis, he cut into the coat-tails of a spectator who died instantly from shock and, when the patient died later on from sepsis, poor Liston wound up with a 300% operative mortality rate.

Prevention from instrumental injuries is based on skill, awareness and adherence to surgical techniques, and protection can be provided by double-gloving or using blunt needles [13].

● *Incidental*

Unexpected trauma is usually unavoidable. Sharp splinters, electrical injuries from diathermic instruments and many other bizarre accidents may occur in the operating room environment [14,15].

● *Violence*

The surgeon, as other medical professionals, is exposed daily to violence. Violence may have several sources: patient (or relatives)-surgeon, surgeon-surgeon, and war or warlike situations-surgeon. Violence can be verbal or physical and both have repercussions on the ability of surgeons to perform their duties. The usual reasons for a violent attack are poor communication, intoxication, mental disturbance, dissatisfaction, and vengeance.

Infection

Blood-borne organisms, inhaled microorganisms, exposure to ionizing radiation or contact with toxic agents, experimentation in special laboratories with infected animals – all are encountered by the surgeon to a greater or lesser degree [13,16–18]. Surgeons and the operating room staff are among the healthcare workers at highest risk for occupational exposure, which includes eye, mouth or other mucous membranes, broken skin and parenteral contact with blood or other potentially infected body fluids.

The incidence of procedures during which one or more members of the surgical team sustains one or more blood contacts of any type ranges from 6% to 50%, while the incidence of procedures with one or more penetrating injuries ranges from 1% to 15% [17,18]. Infection with blood-borne pathogens has long been recognized as an occupational risk for health personnel, particularly surgeons. The three blood-borne pathogens most commonly involved in occupational transmission are hepatitis B virus, hepatitis C virus and human immunodeficiency virus.

● *Hepatitis B virus*

Numerous studies have shown that healthcare workers have prevalence rates of HBV infection three- to fivefold higher than

that of the general United States population, and 0.8–4% of healthcare workers are chronically infected with HBV, as compared with 0.3% of the general U.S. population [20]. The prevalence among surgeons ranges from 13% to 18% [20]. The risk of HBV infection is related to several factors: the degree of exposure to blood, to body fluids, or to blood-contaminated sharp items such as needles and other medical instruments. Another risk factor is the underlying prevalence of HBV infection among patients: for example, the risk of infection to healthcare workers is greater in urban hospitals compared with rural hospitals and in tertiary care hospitals compared with primary care hospitals [21]. The risk of transmission of HBV to non-immune health personnel after a needle stick correlates with the presence or absence of hepatitis B e antigen in the source patient [22].

● *Hepatitis C virus*

There is some evidence for occupational and nosocomial transmission of HCV infection. Healthcare workers have a higher prevalence of HCV than the general population, but the cumulative risk appears to be low relative to that for HBV [20]. The risk associated with occupational exposure to HCV is 3–10% [22]. The observed anti-HCV seroprevalence rate ranged from 0 to 1.7% among healthcare workers [22]. As with HBV infection, the expected risk factors for HCV infection among health personnel include the degree of contact with blood or with sharp instruments and the prevalence of anti-HCV among patients.

● *Human immunodeficiency virus*

The risk of HIV infection in the surgical setting is a composite of overlapping risks related to the local prevalence of HIV, the route of exposure to HIV-infected blood, and the susceptibility of the healthcare workers [22]. The prevalence of HIV patients varies widely, and the rate of HIV infection has a considerable geographic variation: it was less than 1% in patients undergoing elective surgery at John Hopkins Hospital [21], was found in 4–9% of patients in six emergency department in the U.S. [24], and occurred in up to 30% in surgical inpatients aged 21–40 years in Zambia [25]. Blood is the single most important source of HIV infection among health personnel, and the risk of seroconversion after needle stick injury is 0.2–0.5% [22,23]. Nearly all the documented seroconversion events occurred after an injury with a hollow bore needle: there is no documented seroconversion after injury with a solid suture needle.

Seroconversion after injury is affected by several other factors: a) the circumstance of injury (i.e., the interval between needle use and exposure, the depth or severity of exposure, the quantity of blood injected, and the bore of the needle); b) the infectiousness of the source patient (to date, there are no studies with sufficient power to reliably estimate the independent effect of the source patient's disease stage or viral titer on the risk of transmission) [22]; c) the healthcare worker's susceptibility to infection possibly affected by the use of barriers such as gloves, which may decrease

HBV = hepatitis B virus

HVC = hepatitis C virus
HIV = human immunodeficiency virus

the volume of blood injected by solid suture needles by 70%, while a second layer of gloves results in a further reduction of 50% or more [21].

Although the risk attributed to HIV transmission to health personnel is highly significant, there are only a few sporadic documented case reports. Contrarily, the real risk of HBV transmission is clear, and immunization is practiced on a regular basis in most medical institutions.

It should be mentioned that malignant disease or tuberculosis are not reported to be more prevalent in the medical community than in the general population.

Litigation

Over two decades ago, Altemeier [27] stated: "The public has become conditioned to expect compensation for any untoward development, no matter how caused, on the assumption that all doctors are rich, that they carry insurance, and that insurance companies have inexhaustible funds."

Surgeons are exposed to malpractice suits resulting from their own negligence, their arrogance, or from patients seeking revenge for presumable wrong doing and from the wish to seek financial gain [28]. A fair number of these complaints are rejected by courts of law, but when there is a trial the surgeon's reputation suffers, the surgeon suffers distress and anger, and there may be painful professional and social repercussions. Whether the "frustrating patient," the violent patient or the non-informed patient, all may seek compensation [29].

The surgeon is also sometimes held responsible for acts of another member of the team, such as the nurse or the anesthesiologist [30]. In some courts of law, the surgeon is still viewed as the "Captain of the ship" and must take full responsibility [31–34].

Exhaustion

The surgeon in the non-medical literature is perceived as a confident and competent individual, arrogant and patronizing, impatient, irascible and aggressive [1]. "A good surgeon must have an eagle's eye, a lion's heart and a lady's hand" [1]. Specific studies found the surgeon to be a "stress-immune" personality, supporting the layman's stereotype of a "Sir Lancelot" [1]. The junior surgeon, usually a young person, suffers from sleep deprivation, surgical stress [2] and emotional involvement. These elements are all manifested in elevated cortisol levels and bouts of tachycardia [8], although the physician is oblivious to those effects [35]. When the surgeon gets older and more senior, general administrative duties and other responsibilities of rank will result in even more stress, presenting as the "busy doctor syndrome." Although most surgeons will deny that stress affects their physical or mental health [36], surveys have shown precisely the opposite. In California, retired doctors are 12 times more likely to commit suicide than men aged 25 to 34, and 4 times as likely than other retired men.

Divorce, alcohol, substance abuse and suicide are more frequent in doctors than among members of a comparable professional group [37]. Spouses of doctors usually feel that their husband/wife

comes home emotionally drained, and report marital conflicts and dissatisfaction as a result. During a 5 year period, a special psychiatric board examined 115 doctors who were referred after psychiatric hospitalization, as required by the Israel Ministry of Health. None was a general surgeon, although four were gynecologists and one was an orthopedic surgeon [38].

It is likely, then, that surgeons are protected from burnout and psychiatric morbidity, in part by the considerable control and discretion they have over their work, and by the positive and immediate feedback they get from their patients and relatives [39,40].

Reflections

When individuals choose to practice medicine, they volunteer to dedicate their lives to the well-being of their fellow men and women. The ancient Jewish "Doctor's prayer," written by Maimonides, appeals to the Almighty to bestow mental and physical courage and strength upon the physician before he treats a patient. Each and every day we come across new aspects of our profession, and we learn more than we teach. We discover new paths, we are curious and we are rewarded. Let not this enthusiasm deter us, however, from being aware of the multitude of risks in our way.

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