

Swerdlow 2.2.21

Good afternoon. My name is Barry Swerdlow. I am a physician anesthesiologist, currently employed by Oregon Health & Science University. I have practiced clinical anesthesia for the past 35 years, and I wanted to share with you my perspectives concerning surgical smoke (SS). Specifically, I would like to talk briefly on three topics: the prevalence of SS; the hazards of SS; and what we can do to reduce those hazards.

I. Prevalence

When I teach anesthesia residents about the occupational hazards of their profession, I usually begin by asking how many of them are smokers. No one raises their hand. Then I tell them the bad news. All of them, just by showing up at work each day, are **significant** smokers. For example, the data is that in a normal day of plastic surgery, SS with the carcinogenic potential of 27-30 unfiltered cigarettes (roughly a pack and a half) is inhaled by the operating room team.

II. Why is SS bad?

Three major reasons:

(1) Particulate matter (PM). SS generated by a variety of instruments including electro-surgical units, lasers, and ultrasonic scalpels generates large volumes of fine and ultrafine PM that penetrate standard operating room masks as well as high performance N95 masks, and deposit in the lung and tracheobronchial tree, causing both acute and chronic illnesses.

(2) Chemical Toxicity, Mutagenicity and Carcinogenicity

In addition to the hazards posed by PM inhalation, several hundred volatile organic compounds with potential harmful effects have been identified in SS. Noxious effects of these compounds include eye, nose, and throat irritation, as well as the development of acute and chronic lung pathology. Furthermore, collection of plume from face height above the area of tissue cautery demonstrates concentrations of numerous carcinogens that is 10 or more times their concentration in second hand cigarette smoke.

(3) Transmission of Infectious Agents

SS has been shown to contain bacteria – including TB – as well as viable virus particles including Hepatitis B virus and HIV. Furthermore, surgical plume causes three distinct diseases in operating room personnel due to transmission of human papilloma virus, or HPV: oral warts; oropharyngeal cancers; and laryngeal and pulmonary papillomatosis with warts occurring on the vocal cords and in lung

tissue. Furthermore -- because such viruses are known to be present and/or transmitted by SS, and because the novel COVID-19 virus is normally transmitted as an aerosol and is present in tissues that routinely undergo vaporization to aerosol form during surgery, the COVID-19 virus may well be transmitted via SS.

III. What can be done about the hazards of SS?

While room ventilation and face masks provide some protection against SS, they are ineffective in meaningfully reducing smoke exposure. **[SLIDE 1]** The most effective means to reduce exposure is with use of smoke evacuation devices or SEDs. **[SLIDE 2]** SEDs have a capture device that is either free standing or attached to an electrosurgical pencil, a vacuum system capable of generating 30-50 cubic feet per minute of suction (compared with 5 CFM with wall suction), and a filtration unit capable of removing ultra-low particulate size matter. They can be employed with open and minimally invasive surgical procedures. In addition, many of these systems utilize these filtration systems in conjunction with charcoal filters that are capable of removing the large majority of volatile organic compounds in SS.

Unfortunately, despite recommendations from a multitude of professional and governmental organizations, including the CDC and the National Institute of Occupational Safety and Health, voluntary use of SEDs has largely failed. Less than 20% of US operating rooms routinely employ such devices during use of electrocautery, largely due to surgeon resistance or refusal despite educational efforts and technological advances. As a result, surgeons, anesthesia providers, nurses, surgical technicians, and an abundance of other health care individuals who work in the operating room are exposed to the hazards of SS inhalation on a daily basis. For this reason, it is imperative that evacuation of SS be mandated as a matter of law -- as it is in Australia, New Zealand, Canada, Denmark, and now in Rhode Island and Colorado – rather than leaving the decision whether to jeopardize the health and well-being of thousands of health care providers to a relatively few individuals.