Don't be a victim of surgical smoke

If you saw a low-lying cloud that was labeled clearly with its contents, and the label contained the words *benzene, carbon monoxide, formaldehyde, hydrogen cyanide, methane, phenol, styrene,* and *toluene,* would you go out of your way to walk through that cloud and inhale those toxic chemicals? Of course not. But you expose yourself to these same toxic chemicals each time you participate in a surgical procedure in which smoke from tissue interaction with an electrosurgical device or laser is not evacuated. The aerosols produced when lasers or electrosurgical devices are used contain particulate matter, gases, mutagens, carcinogens—and sometimes, DNA components.[1]

Smoke evacuators may be gathering dust in your OR storage areas while you and your colleagues, patients, and OR observers are exposed to these toxins on a daily basis. The most likely reasons for this supply/use mismatch are

- cost of using smoke evacuators,
- noise from smoke evacuators,
- lack of scrubbed personnel to hold smoke evacuator wands,
- surgeons' beliefs that smoke evacuators impair their dexterity and interfere with surgical approaches,
- denial by staff members that smoke plume is a health hazard,
- misconceptions that surgical masks offer adequate protection from smoke plume hazards, and
- lack of conclusive data correlating surgical smoke exposure with actual physical effects.

EXPOSURE IS WIDESPREAD

Do you and your colleagues experience headaches, nausea, myalgia, rhinitis, or conjunctivitis after just a few hours of breathing surgical smoke plume? Does your department contend with high rates of employee absences due to respiratory illnesses? Can you walk into an empty OR, perform a "sniff test," and determine what type of smoke-producing surgical procedure was performed recently? Do your family members comment about the odor of your hair after you have spent a day working in surgical smoke?

Patients also experience the toxic effects of surgical smoke. A physician-engineer from Mercer University, Macon, Ga, studied methemoglobin levels in women undergoing laparoscopic procedures. Methemoglobin is formed from unoxygenated hemoglobin, is not capable of carrying oxygen to tissues, and increases the oxygen affinity of the remaining normal hemoglobin, further inhibiting tissue oxygenation. To complicate the problem, pulse oximetry usually overestimates oxygen saturation and is less responsive to changes in oxygen saturation in the presence of methemoglobinemia.[2]

Through careful preoperative screening, this physician-engineer determined that none of the women in the study smoked, had hereditary methemoglobinemias, or had been exposed to environmental or medication sources that elevate methemoglobin levels.

BEVERLY P. GIORDANO

Half of the women underwent laparoscopic procedures in which smoke-generating devices) ie, lasers, electrosurgical devices) were used. The other half served as the control group (ie, underwent similar surgical procedures but lasers or electrosurgical devices were not used).

All the women in this study had normal (ie, less than 1%) methemoglobin levels before anesthesia induction, and the women in the control group maintained these normal levels throughout the study. The women who were exposed to smoke plume during surgery had statistically significant elevations in methemoglobin levels beginning five minutes after surgical smoke production began. Postoperatively, eight of the 25 women required three hours to rid their bodies of excess methemoglobin; one patient did not return to her baseline level until six hours after surgery.[3]

Surgical smoke's toxic effects are not limited to patients or personnel standing near the surgical field. Observers in the OR also are exposed to these toxic effects. Researchers at Washington University, St Louis, are conducting ongoing studies of electrosurgical smoke. In one study, they measured particulate matter in electrosurgical smoke during breast reduction procedures. When

smoke evacuators were not used, ORs filled rapidly (ie, within five minutes) with particulates, and the smoke plume did not dissipate through the ventilation system until 20 minutes after electrosurgical device use ceased. The same team of investigators sampled particle counts in various locations in the OR (ie, six inches, four feet, 10 feet from the smoke-producing source). The maximum particle count was uniform throughout the OR, exposing OR observers to the same particle levels as the surgeon. When smoke evacuators were used throughout the same types of procedures, the particle concentration decreased significantly.[4]

PUT SMOKE IN ITS PLACE

AORN is concerned about your welfare. AORN and the AORN Foundation cosponsored a roundtable discussion on surgical smoke at Headquarters in January. Researchers, perioperative nurses, government regulatory officials, and industry representatives discussed recent research findings about surgical smoke hazards and concerns about air quality in health care settings in which surgical procedures expose patients and personnel to hazardous air contaminants produced by lasers, electrosurgical devices, and powered surgical instruments. The attendees reached consensus on the following points.

- Smoke generated by electrosurgical devices deserves the same level of concern as laser-generated smoke; therefore, surgical smoke plume always should be evacuated.
- Government agencies (eg, Occupational Safety and Health Administration [OSHA]) should apply the same regulations to smoke generated by lasers and electrosurgical devices.
- An expert advisory panel should be established to write and disseminate a white paper on surgical smoke hazards and to develop a peer-reviewed protocol for evaluating the efficacy of smoke evacuators.
- AORN should build alliances with other experts (eg, industrial hygienists, professional engineers, facility designers) to discuss and investigate the hazards of surgical smoke.
- The roundtable participants should reconvene in one to two years to assess new research findings and action taken in the interim.[5]

You and your colleagues also can take action to protect yourselves and your patients from surgical smoke hazards. You do not have to be victims of surgical smoke. You can

- educate yourself, your colleagues, and your nurse managers about the known risks of surgical smoke exposure;
- use smoke evacuators that already are available in your ORs;
- improve the ventilation systems in your ORs, working with professional engineers who understand why most exhaust systems cannot overcome the velocity of the toxic particles in surgical smoke;
- study new and revised standards (eg, American National Standards Institute Z136.3 "Safe Use of Lasers in Health Care Facilities"[6]) pertaining to surgical smoke and workplace safety;
- identify heavy smoke-producing surgical procedures, and ask your surgeons to reduce tissue combustion levels when they use electrosurgical devices and lasers;
- demand and be sure to use improved personal protective equipment;
- participate in well-controlled studies to capture and analyze surgical smoke;
- document staff members' absenteeism rates and correlate these data with the number of smoke-filled surgical procedures in which they participate;
- design and participate in studies that compare OR nurses' pulmonary functions with those of non-OR nurses who have equivalent years in the workplace; and
- submit your documentation to OSHA with a petition (anonymous, if necessary) asking OSHA to investigate your workplace for the presence of surgical smoke hazards.[7]

Indifference to surgical smoke can be hazardous to your health. Don't be a victim.

BEVERLY P. GIORDANO
RN, MS
EDITOR

NOTES

1. D Ott, "Smoke production and smoke reduction in endoscopic surgery: Preliminary report," *Endoscopic Surgery and Allied Technologies* 1 (August 1993) 230-232.
2. *Ibid.*
3. *Ibid.*
4. H Branden, "Perspective on surgical smoke," speech presented at AORN Foundation Surgical Smoke Roundtable Panel, Denver, 19 January 1996.
5. E Moss, B Garner, D Ott, G Paul, "Perspectives on surgical smoke," speeches presented at AORN Foundation Surgical Smoke Roundtable Panel, Denver, 19 January 1996.
6. P Smalley, "Perspective on surgical smoke," speech presented at AORN Foundation Surgical Smoke Roundtable Panel, Denver, 19 January 1996.
7. R Yodaiken, "Perspective on surgical smoke," speech presented at AORN Foundation Surgical Smoke Roundtable Panel, Denver, 19 January 1996.