

Ophthalmology News

Laser plume may carry hidden health hazards

by Gregory Sandler Contributing Editor

OSHA prepares guidelines to deal with laser surgery, which may be more dangerous to the surgeon than previously thought.

erald L. Tennant, MD, began performing photorefractive keratectomy with an excimer laser in October 1990. Five years later, the surgeon was forced to retire due to health problems he believes may have been caused by airborne corneal particles or viruses contained in the plume generated from the laser. Tennant, who lives in Texas, developed idiopathic thrombocytopenic purpura (ITP), a rare condition in nonHIV-positive adults, in which the body's immune system produces antibodies that attack and destroy platelets. Another ophthalmologist, who prefers to remain anonymous, also developed ITP since beginning to use the excimer laser in 1990. "The incidence of ITP in the general public is rare," Tennant said. "To have two excimer laser surgeons develop ITP after the same amount of exposure is suspicious. That is why I have recommended that excimer surgeons follow their platelet count until the issue is resolved."

Now 58, Tennant developed health problems despite taking every recommended precaution in the operating room. "I set up a dedicated room with its own dedicated air-handling system," Tennant said. "We had a dehumidifier, a gas-leak detection unit, and the laser was serviced regularly by trained technicians. But we were told by the company that made our laser that we did not need to wear masks, because the odor we smelled was only ozone from the ultraviolet radiation passing through the oxygen." Tennant declined to disclose the manufacturer. "My concern applies to all excimers," he said.

Researchers have documented that the laser plume can pose a potential health hazard. Michael J. Taravella, MD, an associate professor of ophthalmology at the University of Colorado in Denver, has found live virus in the laser plume. Taravella's research found that some viruses seem to survive ablation better than others. "We have found that oral polio vaccine virus survives ablation; varicella vaccine virus does not, although we did find viral DNA for varicella vaccine virus in material collected from the plume," he said.

Taravella indicated that he has not cultured virus from any patients. He has also performed research on particle debris size which indicates that ablated material from eye bank corneas creates respirable-size particles.

In "Guidelines For Health Care Workers Exposed To Laser and Electrocautery Smoke," a draft report that is still being reviewed and is expected to be finalized by year's end, the Occupational Health and Safety Administration (OSHA) states, "Surgeons performing PRK and LASIK (laser in situ keratomileusis) may be at risk from the plume created from laser usage."

In an earlier report, the National Institute for Occupational Safety and Health (NIOSH) concluded that "the constituents of the laser/ESU (electrosurgical unit) plumes include respirable particles of carbonized tissue and may include infectious organisms, such as bacteria and viruses. It is unknown if these agents result in transmitted infection or allergic responses. Although smoke products have been shown to be mutagenic in bacteria, there is no documented evidence that neoplasia is induced by ESU or laser smoke."

The OSHA draft, which is subject to change, recommends that "engineering controls should be in place wherever ESUs or lasers are in use. These should effectively assure 15 air changes per hour (three with outside air). Also, the smoke should be evacuated by exhaust devices close to the burning tissue and/or larger room equipment or wall evacuators."

The draft report also said, "Personal protective equipment is essential where engineering controls are not

used or where they are inadequate. Surgical masks should not be used; instead, fitted respirators with appropriate filter qualities should be available for all staff exposed to ESU or laser smoke.”

Michael S. Korenfeld, MD, an ophthalmologist in Washington, Mo., reviewed the OSHA draft and agrees with its recommendations. “The OSHA guidelines make sense because of the potential for infectious transmission,” he said. “If it means you have to spend an extra \$20 per procedure to take as many safety precautions as you can, OSHA is saying that’s what you should do.”

NIOSH, part of the Centers for Disease Control, has issued recommendations for controlling laser plume. “During surgical procedures using a laser or electrosurgical unit, the thermal destruction of tissue creates a smoke byproduct,” the NIOSH Hazard Controls report said. “Research studies have shown that this smoke plume can contain toxic gases and vapors, such as benzene, hydrogen cyanide, and formaldehyde, dead and live cellular material — including blood fragments — and viruses.”

In order to control the smoke plume hazard, NIOSH said, a combination of general room and local exhaust ventilation (LEV) should be used. “General room ventilation is not by itself sufficient to capture contaminants generated at the source. The two major LEV approaches used to reduce surgical smoke levels for healthcare personnel are portable smoke evacuators and room suction systems.”

As a further safeguard, NIOSH recommends that “at the completion of the procedure, all tubing, filters, and absorbers must be considered infectious waste and be disposed of appropriately.”

Taravella agrees that more stringent precautions are in order. “I strongly feel that the laser plume should be treated as potentially biologically hazardous material,” he said. “The plume should be evacuated and filtered through a filter capable of removing potentially infectious virus.”

As an added precaution, Taravella recommends that surgeons wear surgical masks and scrubs when using a laser and wash their hands between cases. “This protects the patient from infection and the physician from potential particle contamination of his hands,” he said. “There are obviously many unanswered questions ... which viruses survive, which don’t; what is the actual risk of infection from inhalation of a virus-contaminated plume; and does inhalation of respirable size corneal fragments predispose the surgeon to autoimmune or other diseases? Further research is needed to assess the risks and answer these questions; until then, the precautions I outlined are reasonable and should not pose a burden to any laser center.”

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