Surgical Plume

The whole story surrounding surgical plume is a little up in the air, only, in this case, there’s a pretty solid way to suck up all the fragments. Experts are starting to talk about it more – including the International Council on Surgical Plume (ISCP), suppliers and surgical team members.

Some people agree with the issue presented, and some say it’s all smoke and mirrors set up by the industry to get facilities to spend money on new equipment. Instead of arguing which side is right, let’s just take a moment and talk about the solutions so, if a facility sees surgical plume as a problem, options are identified.

Smoke capture and evacuation suppliers Buffalo Filter, Cooper-Surgical, I.C. Medical, Megadyne, Nascent Surgical and Stryker offered their input on the issue. Since there haven’t been independent associations or organizations to champion the cause, with the exception of the ICSP, which was formed in April, suppliers have tried to educate the industry about the issue they’ve seen for the last couple of decades. In recent years, a handful of professional organizations have created policies on how surgical smoke should be approached, including the Association of periOperative Registered Nurses (AORN).

Defining the Problem

To better understand the solutions, surgical smoke, also known as surgical plume, has to be defined. According to AORN, surgical smoke is created during electrosurgical and laser surgery procedures when a patient’s tissue is cauterized with devices that transfer heat to the surgical site. The plume that is released contains about 150 different identified chemicals, such as acrolein, benzene, carbon monoxide, formaldehyde, hydrogen cyanide, methane, toluene and polycyclic aromatic hydrocarbons. Many of these are found in cigarettes, so the common argument from capture and evacuation advocates is: facilities wouldn’t allow smoking in the facility, so why would they allow plume to float around the operating room?

In addition to these chemicals, viruses, bacteria, carbonized tissue and more are released from the patient and carried around by the plume. Combined, AORN reports these elements make up about 5 percent of the smoke created during surgery. The other 95 percent of the plume is water, which acts as the carrier.

AORN reports chronic inhalation affects healthcare workers in a variety of ways, including: eye, nose and throat irritation; headaches; nausea and dizziness; runny nose; coughing; respiratory irritants; fatigue; skin irritation and allergies. While the electrosurgical smoke and its impacts are reportedly similar to those of laser surgery, regulations don’t surround electrosurgery procedures like they do laser surgery procedures.

Some facilities and staff take precautions against electrosurgical plume by wearing surgical masks and respirators. Normally, surgical masks only filter out particles that are five microns in size and larger. The particles in electrosurgical smoke come in two relative sizes – large and small, the Journal of Endourology reported. The larger particles are bigger than 500 nanometers and the smaller ones are smaller than 500 nanometers. Just for some perspective, 1,000 nanometers is the size of one micron.

So, while these masks do offer some protection, surgical smoke capture and evacuation suppliers argue it isn’t enough. They also agree any exposure to it for any length of time isn’t healthy for anyone, including patients. Factors like genetics, pre-existing illnesses and exposure levels can result in greater impacts on some patients than others.

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by Rebecca Rudolph, editor
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There are no national or state laws in place in the United States concerning surgical smoke for electrosurgical equipment, so it’s really up to the facility if they want to address this concern. Various groups have tried pushing for legislation that they argue would protect healthcare workers and patients, but nothing has come of it.

“According to the ICSP, the United States is far behind Europe in terms of embracing and implementing smoke evacuation as standard operating procedure,” Dave Osborn, Stryker Instruments brand manager, said. “Ultimately, the Joint Commission may step in and stiffen their guidelines relative to smoke evacuation. It is our hope that facilities will get out in front of this change as opposed to operating in reaction mode.”

The Canadian Standards Association (CSA) published a specific set of standards on smoke evacuation, which includes electrosurgical smoke, in January 2009. In addition to the OR, Canada’s policy identified risks in dental clinics, morgues and research and testing facilities. This document was used as reference for polices in other countries, including New South Wales, Australia, which released its policy in January 2015. More countries have followed suit, including Denmark, Great Britain and Norway.

“The United States is recognized for being an extremely progressive and health conscious nation, so it is startling when you take a step back and realize that we are exposing our surgical teams and patients to toxins and carcinogens for hours at time in a very confined area (the OR),” Jill Skoczen, Megadyne marketing manager, said.

**Advocates for Change**

Without the incentive of government mandates, facilities make the decision themselves. “I believe the primary motivating factor for facilities who make the move to evacuate smoke is staff safety, and in most cases, movement in that direction begins with pressure from nurses on doctors and OR managers,” Osborn said.

James White, I.C. Medical sales manager, agrees nurses are the big advocates. “They are the ones that are in the operating room all day, every day. The nurses need to work with the surgeons and other O.R. staff to really drive the change in their hospitals,” he said.

Leonard Schultz, M.D., Nascent Surgical founder and CEO, agreed, but added the only problem is when they try to stand up for their health, the patients’ health and their coworkers’ health and they’re told no, normally they drop the issue. They’re starting to stand their ground though, he noted, mentioning the other countries that have established encouraging policies.

If a facility does say yes, there are quite a few options on the market for them to choose from, but they really boil down to four product categories – wall suction devices with in-line filters, portable smoke evacuation systems, central smoke evacuation systems and laparoscopic evacuation devices.

Because open surgical smoke disperses at a rate of about 40 miles an hour, meaning the room’s inhabitants are quickly exposed to the contaminants, suppliers agree a powerful suction device needs to be hooked up to the capture tool so the tainted air doesn’t have a chance to escape and carry the chemicals and other components of the plume away from the surgical site. Since there is some debate as to whether wall suction is strong enough to remove the majority of the plume, suppliers recommend portable, high-powered suction devices be used with a disposable filter.

While the suction tool is important, the methods of getting the plume away from the surgical site is also a strong component to the program, expert say. In open surgery, different options, such as surgical smoke pencils, adapter pens, open tubing and larger capture devices are available. Smoke evacuation pencils are available both in fully integrated electrosurgical/smoke hand pieces or attachable shrouds with tubing that connects to existing electrosurgical pencils, and both collect plume as the surgeon works. The larger devices can be secured about one to two inches from the smoke source in...
the sterile field to collect the plume. No matter the tool, the goal is always the same – place the capture tool as close to the surgical site as possible to collect the most smoke.

“What we’re trying to say is, because we’ve come to realize the negative effects of chronic inhalation of nanoparticles on people’s health over time, you’re best using a product with maximum smoke capture efficiency,” Schultz said.

For laparoscopic surgery, there’s another set of options. During the procedure, the patient’s abdomen is typically inflated with CO2, and the tools work inside the inflated cavity, meaning all the smoke would be contained. At the end of the procedure, the patient’s stomach is compressed to release CO2 and accumulated plume. When using a smoke evacuation device, the air is evacuated from the abdomen, running through intra-abdominal tubing, which is filtered to remove any harmful bacteria before being released into the OR environment. There are two options for capture devices that hook onto trocars – ones that capture and evacuate the plume throughout the procedure, and ones that do it at the end of the procedure. “For laparoscopic procedures, smoke evacuation helps keep the patient from absorbing all of the surgical plume,” White said. “In addition, smoke evacuated in laparoscopic procedures helps clear the view for the surgeon, making his or her job easier and save time per procedure.”

All of these capture tools are single-use because of the bacteria they collect and their direct contact with patient fluids.

“In today’s environment, when people are trying to contain costs, they always worry about adding something that has a new cost to a procedure. I think as more and more (surgical teams and hospital administrators) become aware of the dangers of surgical smoke, we would hopefully see an increase in utilization of devices,” Dr. Robert Auerbach, FACOG, Cooper-Surgical’s executive vice president and chief medical officer, said.

Although they all prefer their own tools, most suppliers say it doesn’t matter what suction or filtration device facilities buy or what capture devices are chosen as long as a facility recognizes the problem and finds a solution that fits best with their team. “While there are variations in features and design, is one really better than another? The best smoke evacuation pencil is the one the surgeon is comfortable with and will use, thus protecting the OR staff from hazardous smoke exposure. When it comes down to it, something is better than nothing,” Skoczzen said.

Another way to manage surgical plume is proper air flow in the OR, Auerbach said. “I don’t believe a facility will get away with one product meets all. I do believe they will be able to have a triple approach,” he said. This includes having an option for open surgery and laparoscopic surgery, but also effective ventilation, or air turnover, in the room.

In open surgery, ideally, air would be forced down in an appropriate pressure over the sterile field, pushing the contaminants down and away from the surgical site as plume is captured, he explained. If that’s not done, wall suction can be used, but those displaced particles can still float or linger by the patient, increasing their risk, and the surgical team’s exposure.

**Policy**

Once a facility adopts the new method and agrees to purchase the equipment, the next hurdle is getting it to be consistently used. The suppliers all agreed this requires policy.

“Education has played, and will continue to play, a key role in the acceptance. However, driving change is not easy,” Sherri Lloyd, Buffalo Filter product marketing manager, said. “The first step in any change process is deciding that you want to and will change your practice.”

This is done by identifying stakeholders who want to create change, adhere to regulations and provide recommendations, she explained. “Finding a surgeon to help champion the cause is especially helpful,” she added.

“Once a hospital mandates plume evacuation, surgeon acceptance is key.”

Education is a big part of it, because if staff members understand why they have to use it, they’re more willing to integrate it in their process, Osborn added. “We generally start the process with problem education and then transition into helping with the product implementation,” Osborn said. “During product trials, there tends to be a large amount of problem education along with coaching of staff on the subtle changes to room set-up and equipment usage.”

Other suppliers also say they find themselves being the go-to sources on surgical plume, but, with the ICSP, new, objective data is starting to be organized.