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Germ-Zapping Lasers Help Cut Down on Infections After Surgery

Medical technology company Ondine's photodisinfection process kills pathogens in a person's nostrils.



A nonthermal laser is used as part of Ondine's process for destroying microbes in the nose. *Source: Ondine Biomedical*

By [Lisa Pham](#)

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Surgery is one of the leading ways patients acquire infections in hospitals, and their noses are a major part of the problem. Germs in the nasal passages can travel to the site of an incision and cause minor skin infections or even sepsis and death. To reduce the risk, a company based in Vancouver is commercializing a way to zap those bugs right before an operation.

Ondine Biomedical Inc.'s process, called photodisinfection, involves swabbing the nose with a blue solution that clings to germs. Then a cable connected to a laser-generating machine is held to the nose. When the machine is turned on, the light activates the liquid, which is sensitive to a laser light calibrated to a certain wavelength, and destroys the pathogens.

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Carolyn Cross, chief executive officer of Ondine, demonstrated the technology on herself during an interview in London. "It's killing all the bugs," she said, with the red light of a laser shining into her blue-stained nostrils. Cross and her husband own more than two-thirds of the shares of Ondine, which is listed in London and has a market value of about £34 million (\$41 million). Ondine's share price has fallen since it started trading in late 2021, tracking a broader selloff in growth stocks last year.

The company's Steriwave technology is used in Vancouver General Hospital on patients before spine, orthopedic, cardiac and other major surgeries. It takes just a few minutes and requires minimal staff training. Adding this step before operations cut surgical-site infections by 47% on average across all surgery types, according to an Ondine study of more than 6,000 patients. Using Steriwave allowed Vancouver General to avoid more than C\$4 million (\$3 million) of annual infection costs on average from 2011 to 2017, the company says.



Ondine is working on getting its Steriwave machine approved in the US. Source: Ondine Biomedical

A patient has a 1% to 3% chance of developing a surgical-site infection after an operation, according to Johns Hopkins Medicine, in Baltimore. Surgical-site infections caused by the *Staphylococcus aureus* bacterium are the most common across all surgery types, according to England's National Institute for Health and Care Excellence. The bacteria usually live harmlessly in places like the nose and armpits, but if they enter the body, illnesses ranging from mild skin infections (known as staph infections) to life-threatening infections of the heart valves (endocarditis), lungs (pneumonia) and blood stream (bacteraemia) can occur.

It's easy for bacteria to spread from the nose, says Michael Wilson, an emeritus professor of microbiology at University College London. Someone can stick their finger in a nostril, Wilson says, and then touch other parts of the body. Also, every time a person exhales, they create an aerosol from the nose that contains the microbes that live there, and these aerosols can drift to other parts of the body and the surrounding environment, he says. Wilson's invention, which kills microbes by using a compound that gets activated by light, is the basis of Ondine's technology.

Repeated studies have shown that in about 80% of patients who get a hospital-acquired infection from *S. aureus* after surgery, the bacteria originate in their body's own flora, according to the World Health Organization. For patients known to be carrying the bacteria in the nose and who are preparing to undergo cardiothoracic and orthopedic surgery, the health agency recommends using the Mupirocin nasal ointment, which is typically applied to the nose twice a day for five days ahead of the procedure. This antibiotic may be used in combination with a disinfectant body wash, according to the guidelines.

The problem with this approach is that bacteria are becoming increasingly resistant to antibiotics. The WHO calls antimicrobial resistance a global threat, but just 6 of the 32 antibiotics in clinical development in 2019 that addressed the health agency's list of priority pathogens were classified as innovative. Mupirocin is prone to bacterial resistance, and patients don't always comply with its use, Cross says. Also, it cannot target viruses, fungi and many types of bacteria, she says.

Steriwave is approved in Canada and Mexico, and Ondine is working on getting FDA approval to make it available in the US. Ondine recently released results of a midstage clinical study conducted at HCA Healthcare Inc.'s Memorial Health University Medical Center in Savannah, Georgia, and has plans to conduct a late-stage trial. The midstage study showed photodisinfection eliminated or significantly reduced *S. aureus* in 86% of carriers. Analysis of follow-up data showed the rate of surgical site infections was 0.6%, much lower than the US historical average of 3%. The company is also in talks to run a pilot program at a handful of publicly funded hospitals in the UK.

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The technology is going after a market that could be worth \$9.1 billion annually in Western countries, RBC Europe Ltd. health-care analyst Jack Reynolds-Clark wrote in a research note. Almost half of that market is in major surgery, where Ondine is focusing its development. Other

areas to target could include chronic rhinosinusitis, ventilator-acquired pneumonia, burns and catheterization-related infections, he said. Ondine sees potential applications for intensive-care units, chemotherapy and commercial environments. The company has received federal funding to develop a photodisinfection process for Canada's meatpacking industry.

Steriwave is unique in its ability to immediately destroy nasal bacteria, viruses and fungi in a single, painless, 5-minute treatment, according to Ondine. A potential competitor also working to prevent post-surgical *S. aureus* infections is Destiny Pharma Plc, which is developing a nasal gel. "We think Ondine is better positioned due to its preferable treatment regimen and relationship with HCA," Reynolds-Clark said in an email, referring to Ondine's trials at the HCA hospital in Savannah, adding that the relationship "massively de-risks commercialization."

Destiny Pharma CEO Neil Clark said in an email that there is a clear unmet need for better approaches to decolonizing nasal carriers of *S. aureus* prior to surgery, and that his company's XF-73 nasal gel is easy to use, safe, fast and effective. "Destiny Pharma always assumes there is competition in all its market models but is confident that XF-73 has many advantages with regards to price, ease of use, clinical efficacy, safety and lack of resistance and can become a major new player in this area," Clark said.

For Ondine, which has focused on the development of photodisinfection since 1999, the path to commercialization has been slow. "When you're doing disruptive technology, it's not for the faint of heart, because you have to actually change the standard of care," Cross says. "You have to get a whole lot of clinical data," she says. "And little companies don't have the resources."

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