

# RESOURCES FOR SMOKE & GAS EVACUATION DURING OPEN, LAPAROSCOPIC, AND ENDOSCOPIC PROCEDURES

March 29, 2020 by [SAGES Webmaster](#)

Released 3/29/2020 – this document will continue to be updated as needed.

Recently, SAGES, and/or SAGES in conjunction with [EAES](#), published [guidelines for surgeons concerning the use of laparoscopy during the current COVID-19 pandemic](#). We recognize that during this time of challenge to resources and personnel, every surgeon and institution is providing the very best care it can with the circumstances it finds itself in. This document represents a resource for smoke and gas evacuation based on known science, vetted publications, and potential strategies that offer the best protection to both patients and the health care team. This document is designed as a "living document" of resources and will be regularly updated when new evidence presents.

## The Science of SARS-CoV-2

There is a constant influx of new information regarding the virology of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and the disease, COVID-19. What we know so far regarding the SARS-CoV-2, is the RNA virus has a size range of 0.06 to 0.14 microns<sup>3</sup>. Along with the nasopharynx, the upper respiratory tract and lower respiratory tract, the virus has been found in the entire gastrointestinal tract from the mouth to the rectum. The virus has been found in nasal swabs, saliva, sputum, throat swabs, blood, bile, and feces. Urine and CSF evaluations have been negative. The virus has also been found within the cells lining the respiratory tract and gastrointestinal tract. It is suspected that the virus has multiple modes of transmission.

The potential of aerosolization as a mode of transmission during endoscopy or minimally invasive surgery is the focus of this document.

## Filtration

Filtration may be an effective means of protection from the release of the virus during minimally invasive surgery (MIS) and endoscopy. [Masks such as N95 respirators are designed to filter out 95% of particles that are 0.3 microns and larger](#). Powered Air Purifying Respirators (PAPR) may be beneficial for intubation, extubation, bronchoscopy, endoscopy, and possibly tracheostomy. Intraoperatively, filters are used to remove smoke and particulate matter including viruses. High-Efficiency Particulate Air (HEPA) filters have a minimum 99.97% efficiency rating for removing particles greater than or equal to 0.3 microns in diameter<sup>4</sup>. [Ultra-Low Particulate Air \(ULPA\) filters can remove from a minimum of 99.999% of airborne particles with a minimum particle penetration size of 0.05 microns](#)<sup>5</sup>. The Association of periOperative Registered Nurses (AORN) guidelines define ULPA as filters capable of removing particles of 0.1 microns. Filtration is also essential on a larger scale in the positive pressure operative suites. HEPA filters that are placed in the ceiling provide a terminal cleaning. Clean rooms are favored over HEPA filters placed in the ductwork.

Currently, the best practice for mitigating possible infectious transmission during [open, laparoscopic and endoscopic procedures is to use a multi-faceted approach, which includes proper room filtration and ventilation, appropriate PPE, and smoke evacuation devices with a suction and filtration system](#),<sup>6</sup> as available.

## Practical Measures for Use of Filtration During Laparoscopy:

- All pneumoperitoneum should be safely evacuated from the port attached to the filtration device before closure, trocar removal, specimen extraction or conversion to open.
- Once placed, ports should not be vented if possible. If movement of the insufflating port is required, the port should be closed prior to disconnecting the tubing and the new port should be closed until the insufflator tubing is connected. The insufflator should be "on" before the new port valve is opened to prevent gas from back-flowing into the insufflator.
- During desufflation, all escaping CO2 gas and smoke should be captured with an ultra-filtration system and desufflation mode should be used on your insufflator if available.
- If the insufflator being used does not have a desufflation feature, be sure to close the valve on the working port that is being used for insufflation before the flow of CO2 on the insufflator is turned off (even if there is an in-line filter in the tubing). Without taking this precaution contaminated intra-abdominal CO2 can be pushed into the insufflator when the intraabdominal pressure is higher than the pressure within the insufflator.
- The patient should be flat and the least dependent port should be utilized for desufflation.
- Specimens should be removed once all the CO2 gas and smoke is evacuated.
- Surgical drains should be utilized only if absolutely necessary.
- Suture closure devices that allow for leakage of insufflation should be avoided. The fascia should be closed after desufflation.
- Hand-assisted surgery can lead to significant leakage of insufflated CO2 and smoke from ports and should be avoided. If used to remove larger specimens and protect the wound, it can be placed after desufflation. The specimen can then be removed and the closure performed.

## Smoke and Gas Evacuation Products

SAGES and EAES do not endorse any of the following products. This is a working list of commercially available products that could potentially be used to filter CO2 gas or smoke evacuated during open, laparoscopic, and endoscopic procedures. Please be aware of the products your facility utilizes and contact your manufacturer's representative or refer to the product's instructions for use (IFU) documents for further information. We have sought information from as many companies that we are aware of, but we understand there are many other companies that may have similar products. We will do our best to add information as it becomes available to us. In addition to smoke evacuation products, the [Ultravision system may minimize aerosolized particles within pneumoperitoneum](#).

Current wall suction devices do not use ultrafiltration.

## SUMMARY OF COMMERCIALY AVAILABLE SMOKE EVACUATION SYSTEMS

Company	ConMed <sup>4</sup>	Cooper	Ethicon	Medtronic <sup>5</sup>	Olympus	Stryker <sup>6</sup>	Northgate
Product Name <sup>1</sup>	<a href="#">AirSeal® (lap)</a> <a href="#">PlumePen® (open)</a> <a href="#">Buffalo Filter® Smoke Management</a>	<a href="#">SeeClear®</a> <a href="#">Plume-Away</a>	<a href="#">Megadyne</a> <a href="#">Mega Vac</a> <a href="#">PLUS<sup>3</sup></a> <a href="#">MegaVac™</a> <a href="#">Mini Vac™</a>	<a href="#">Valleylab</a> <a href="#">RapidVac™</a>		<a href="#">Pneumoclear™</a> PureView™ Neptune™ (open) Safe Air™ (open) Photonblade™ (open) Smoke Evac Retractors™ (open)	<a href="#">Nebulae™</a>
Open	Yes	No	Yes	Yes	No	Yes	No
Laparoscopic	Yes	Yes	Yes	Yes <sup>3</sup>	Yes	Yes	Yes
ULPA	Yes	Yes	Yes	Yes	<b>No</b>	Yes	Yes
Micron filtration	0.01 <sup>2</sup>	0.1	0.1	0.1-0.2	<b>NA</b>	0.051 – 0.1	0.12
Passive or Active Evacuation	Active	Passive	Active	Active	Active	Active	Active

[Summary of Commercially Available Pneumoperitoneum Smoke Evacuation Systems](#)

<sup>1</sup> All of these products were designed as smoke evacuators to improve vision in the laparoscopic field. It is recommended to have an ULPA filter which filters particles of 0.1 microns and larger.

<sup>2</sup> AirSeal has a 0.01 micron ULPA filter in both AirSeal Mode and Smoke Evacuation Mode. In AirSeal Mode, which is designed to prevent overinflation of the abdomen by the pneumoperitoneum, gas venting through the top of the AirSeal port is NOT filtered – only the gas returning to the IFS is filtered. As such, a viral load could be emitted through this port. This release can be mitigated by connecting another smoke evacuator with an ULPA filter to another port or by using a suction irrigator with an in-line filter through a separate port. Alternatively, AirSeal can be used in Smoke Evacuation Mode where the tube set is connected to two standard trocars in a "closed loop" configuration, one for insufflation and one for active smoke evacuation through a 0.01 micron ULPA filter.

<sup>3</sup> Only the Megadyne™ MegaVac PLUS™ has laparoscopic smoke evacuation capability.

<sup>4</sup> See [ConMed response to SAGES recommendations, Insufflation recommendations, smoke evacuation recommendations, AirSeal System Filtration Sheet](#), and [AirSeal Smoke Evacuation Mode](#).

<sup>5</sup> [Medtronic COVID-19 Customer Letter](#)

<sup>6</sup> See [Updated Stryker Response to SAGES-EAES Recommendations](#) and the [Stryker Viral Filtration Letter](#)

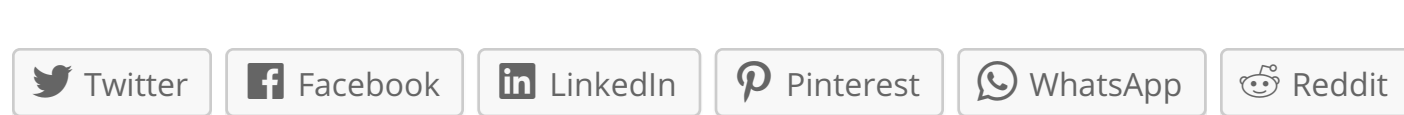
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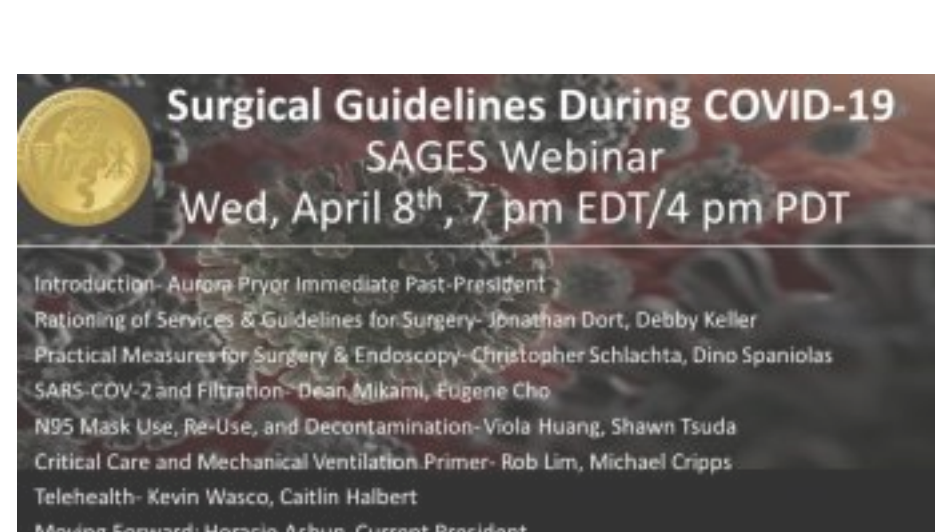
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