UPDATE Q&A: Resumption of Elective Surgeries in the COVID-19 Pandemic: The Role of Aerobiotix in Reducing O.R. Airborne Pathogen Transmission

Introduction

SARS-CoV-2 is a novel coronavirus which originated in China in late 2019. Since that time, it has grown into a global COVID-19 pandemic, causing pneumonia and respiratory failure in certain patient populations. The virus can be spread via direct contact, respiratory droplet, feces and bioaerosol.

Due to the pandemic, elective surgical procedures including joint replacement have been curtailed in much of the world. This is due to reallocation of healthcare resources and the risk of viral transmission to patients and caregivers. Furthermore, social distancing restrictions have precluded patients from undergoing non-emergent procedures.

The delay in elective procedures has caused a backlog of patients needing surgical treatment. In many cases these patients have been suffering with prolonged pain, limitations of activity and other symptomology for extended periods. As restrictions are gradually lifted, opportunities will arise to treat this population in need. However, facilities including acute care hospitals, surgical hospitals and ambulatory surgical centers need to be prepared for the resumption of procedures in a higher-risk environment. Even though the acute phase of the pandemic may be declining, there will still be significant risk for community and hospital transmission of Covid, and additional precautions must be taken. The use of additional environmental controls in the O.R. setting will reduce the barriers to resumption of elective procedures.

Can SARS-CoV-2 be transmitted via an airborne route?

Yes. SARS-CoV-2 has been shown to be transmitted through the air in several studies. The virus can be spread by both large respiratory droplets and smaller bioaerosols which can remain airborne for extended periods. There is particular risk from respiratory secretions expelled during aerosol-generating procedures, such as surgical intubation, extubation and bag mask ventilation.

Can operating rooms be contaminated with airborne SARS-CoV-2?

Yes. Care areas exposed to SARS-CoV-2 positive patients or staff are likely to have airborne contamination with bioaerosols or respiratory droplets. Global studies detected the presence of persistent airborne virus in care, staff, and auxiliary areas.

What can be done to increase O.R. safety from potential airborne SARS-CoV-2?

Preoperative SARS-CoV-2 testing for all patients should be considered. However, many asymptomatic or convalescent patients have been exposed to the virus, including those carrying antibodies or viral fragments. The contagiousness and immunity status of this growing patient population is unknown. The best policy is to treat every patient as if they are SARS-CoV-2 positive, at least until the natural history of the infection is better understood.

Personal protective equipment (PPE) must be worn throughout the entire perioperative process. However, in the context of elective surgical procedures, full airborne isolation equipment such as respirators may not be functional or practical.

How will SARS-Cov-2 affect operating room ventilation and pressure relationships?

Operating rooms typically operate under positive pressure, with additional laminar flow systems employed in certain orthopedic procedures. Positive pressure prevents external airborne pathogens, traditionally bacteria, from entering the operating room and causing surgical site infections.

In the context of a patient with a suspected or diagnosed SARS-CoV-2, the role of positive pressure becomes controversial, since it can spread bioaerosols to surrounding perioperative areas. Some operating rooms allow for reversal of flow to negative pressure; however, this will increase the risk of bacterial surgical site infections, which may have greater morbidity than SARS-CoV-2. A possible compromise option is maintaining normal O.R. pressure, i.e. neither positive nor negative.

To date there have been no formal recommendations on this topic. However, a pending publication by Dr. Javad Parvizi and colleagues at the Rothman Institute states that filtration of the operating room with devices that intake the air and remove micro-organisms may be preferable to positive pressure laminar flow.

A recent technical report from the European Centre for Disease Prevention and Control indicates that in rooms where aerosol-generating procedures have been performed (including intubation and bag-valve ventilation) high-efficiency particulate air (HEPA) filtration should be utilized, including using a portable HEPA air filtration system placed in close proximity to where the patient was located.

What is the role of Aerobiotix Air Decontamination systems during SARS-CoV-2 response?

The use of Aerobiotix intraoperative air decontamination systems has been shown in multiple peer-reviewed publications to reduce particulate contamination levels, including large and small viable particles which harbor microorganisms.

High-grade HEPA filtration has long been the gold-standard for clearance of airborne viruses. Aerobiotix units combine HEPA filtration with ultraviolet germicidal irradiation in a free-standing air decontamination device with non-turbulent air outflow for use in procedural environments. The Illuvia® system is an FDA registered Class-II medical device which is labeled to reduce the risk of airborne infections in the surgical patient. Aerobiotix devices have undergone independent testing by the Center for Aerobiology at the Research Triangle Institute, demonstrating 100% inactivation efficiency in single-pass virus testing, using MS2 virus at 450 cubic feet of air per minute. Coronaviruses are larger and more radiosensitive than MS2, making them potentially more vulnerable to ultraviolet and mechanical filtration than the MS2 test organism.

Illuvia® systems also perform real-time monitoring and logging of O.R. airborne particulate levels, to provide functional feedback to caregivers and perioperative staff regarding environmental cleanliness.

It should be reiterated that surgical patients will still be at risk for traditional bacterial surgical site infections, and the treatment of these infections will be complicated by ongoing challenges with care access and resources. Additional precautionary measures are warranted.

Can commercial-grade air HEPA purifiers be used to mitigate SARS-CoV-2?

Under the SARS-CoV-2 pandemic, some hospitals and surgery centers have resorted to using residential and construction-grade air purifiers in patient care areas. Caution must be advised since they create turbulent outflow and are not compliant for electromagnetic compatibility (EMC) for use in hospitals. The Illuvia® system is specifically designed for medical environments and has been tested to the global IEC 60601-1-2 standard for EMC.

Conclusion

The resumption of elective surgical procedures during the SARS-CoV-2 pandemic will represent significant duties and challenges for the surgical community. This will not be “business as usual” and new procedures and resources will need to be employed to improve safety for patients and caregivers. Utilization of new technologies, such as Aerobiotix, will facilitate this transition and drive a higher standard of care in the post-pandemic world.

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