

APSF/ASA Guidance on Purposing Anesthesia Machines as ICU Ventilators

Anesthesia machines are equipped with ventilators that in many cases are capable of providing life-sustaining mechanical ventilation to patients with respiratory failure. They are used for this purpose every day in the operating room. FDA approved labeling does not provide for using anesthesia ventilators for long term ventilatory support.

Nevertheless, anesthesia ventilators are an obvious first-line backup during the COVID-19 pandemic when there are not sufficient ICU ventilators to meet the patient care needs. Local resources and constraints will impact how this solution can best be implemented. Anesthesia machines not currently being used may be located in your own hospital op

Key Points to Consider in Preparing to Use Anesthesia Machines as ICU Ventilators

GENERAL TOPICS

IS THIS USE OF ANESTHESIA MACHINES AS ICU VENTILATORS APPROVED BY FDA AND MANUFACTURERS?

The FDA has temporarily approved the use of anesthesia machines as ICU ventilators.

<https://www.fda.gov/medical-devices/letters-health-care-providers/ventilator-supply-mitigation-strategies-letter-health-care-providers>

FDA ENFORCEMENT POLICIES FOR VENTILATORS DURING COVID-19: <https://www.fda.gov/media/136318/download>

GE, Draeger, Mindray, and Getinge have released guidance documents on this off label use of their machines. These guidance documents have useful recommendations for the long term use of these machines as ICU ventilators.

GE HEALTHCARE: 24x7 phone support 800-345-2700

GENERAL: <https://www.gehealthcare.com/corporate/covid-19>

SPECIFIC: <https://www.gehealthcare.com/-/jssmedia/3c655c83bd6b427e9824994c12be0da5.pdf?la=en-us>

DRAEGER Medical: 1-800-437-2437

MINDRAY: 800.288.2121 or 877.913.9663

<https://www.mindraynorthamerica.com/covid-19-response/>

GETINGE

https://www.getinge.com/dam/hospital/documents/marketing-sales/customer-letters/english/mcv00103387_reva_covid-19_customer_letter_long_term_ventilation_with_flow-en-us.pdf

WHO SHOULD MANAGE THE MACHINE?

An anesthesia professional should be immediately available q0.2500BT/F3 12 Tf1 0 0 1 429.3 2

IF WE HAVE A CHOICE, DOES IT MATTER WHICH ANESTHESIA MACHINE WE USE? (UPDATED APRIL 1, 2020)

The most capable anesthesia machines should be utilized first, and it is preferable to use one model rather than introduce a mix into the ICU. Start with

interventions will prevent high pressures in the scavenger system which would cause gas to back up into the breathing system resulting in high airway pressures and unintended PEEP at the airway.

Scavenging is required if inhalation agents may be used for sedation and any suction supply is acceptable. Since the OR often uses WAGD connectors, the tubing used in the OR may not work in the ICU and alternate tubing or connectors may be required.

Changing the drive gas if the anesthesia ventilator contains a bellows. 100% oxygen is the standard drive gas for a bellows-type ventilator, and it is consumed at approximately the minute ventilation (which is significantly more than the fresh gas oxygen consumption). If oxygen supplies are limited or being conserved, modifications can be made on some anesthesia machines to use compressed air as the drive gas. Such modifications can be done in less than one hour by a trained clinical engineer following the manufacturer's instructions.

To convert a GE bellows ventilator from 100% O₂ to compressed Air:

MANAGING THE SELF TEST (UPDATED APRIL 2, 2020)

Most modern anesthesia machines have startup-test procedures to be performed before use that should be repeated every 24 hours to ensure proper function. The patient cannot be ventilated with the anesthesia machine during the startup-test, even in manual mode, so alternative means of ventilation are necessary during this time. Although it is not considered ideal, guidance from manufacturers during this crisis allows for a startup-

and amount of rebreathing. Fresh gas oxygen concentration may require adjustment to maintain the desired inspired oxygen concentration.

TOTAL FRESH GAS FLOW SETTINGS (

STRATEGIES FOR CONSERVING OXYGEN (UPDATED APRIL 1, 2020)

The availability of oxygen will vary from place to place. If an adequate supply of oxygen is a concern, strategies can be employed that will reduce oxygen utilization substantially when using an anesthesia ventilator. Without modification, some anesthesia machines can use 10-12 liters per minute or more of oxygen, compared to 7-10 liters per minute by an ICU ventilator. Options to conserve oxygen include:

Using an electrically-powered anesthesia ventilator (currently, only made by Draeger): These ventilators do not consume any oxygen to develop pressure and flow; oxygen consumption equals the oxygen fresh gas flow rate.

Converting the bellows ventilator (typically powered by compressed oxygen) to use compressed air as the drive gas.

GE has a documented procedure for converting any of their anesthesia ventilator models to compressed air. This can be done by a qualified clinical engineer in less than an hour. Anesthesia techs and anesthesia clinicians will not typically have the training or documentation to perform this conversion. Manufacturers' instructions are referenced above.

Mindray ventilators cannot be converted to air.

Reduce fresh gas flow below minute ventilation in increments of 500

ventilated by hand while this is done.

MONITORING VENTILATION (UPDATED APRIL 7, 2020)

While anesthesia professionals are trained to monitor ventilation during operative cases, there are additional considerations due to the use of extra filters in the breathing circuit, the accumulation of condensed water over time, and the potential for aerosolizing COVID-19 virus.

Baseline monitored parameters (Pressure, Flow, Volume, Minute ventilation) should be recorded when therapy is initiated. If spirometry is available, the baseline reference loops should be saved for later comparison.

One problem with airway filters is that the resistance 7(t)7(h)-osos shabe res re 792 reW

PROVIDING POTENT ANESTHETIC AGENTS (UPDATED APRIL 2, 2020)

Anesthesia machines have the capability of providing inhaled anesthetics for sedation during long-term care. While this might be an attractive option if intravenous sedatives are in short supply, it is not generally recommended when the machines are used as ICU ventilators for the following reasons:

EDUCATIONAL MATERIAL ON CLINICAL MANAGEMENT OF CRITICALLY ILL PATIENTS WITH COVID 19

CAESAR ICU

COVID Activated Emergency Scaling of Anesthesiology Responsibilities (CAESAR) ICU is an educational program from the ASA Committee on Critical Care and the Society of Critical Care Medicine. This program is intended to provide guidance for managing critically ill patients with COVID 19 and is available to any healthcare professional. The program can be accessed at <https://www.asahq.org/in-the-spotlight/coronavirus-covid-19-information/caesar>