Guideline for Utilization of Anesthesia Workstations for Ventilation in the ICU during the COVID-19 Surge (4/16/2020)

Objective:

Anesthesia workstations (machines) contain mechanical ventilators with many of the same capabilities as ICU ventilators. It is anticipated that using these machines to support ICU patients will become necessary as the number of COVID-19 patients requiring mechanical ventilation exceeds the number of ICU ventilators in our system. This document provides technical and process guidance to facilitate the safe and efficient use of anesthesia machines in this role.

Personnel:

Anesthesia workstation ventilators are different from ICU ventilators in design and operation. In order to facilitate safe use of these machines in the ICU setting multidisciplinary teams composed of Respiratory Therapists (RT) and at least one Certified Registered Nurse Anesthetists (CRNA) or Anesthesiology Resident (MD/DO) will manage the ventilators.

Since the Anesthesia workstations are designed to be continuously attended by trained personnel, **unsafe conditions may not produce an audible alarm** or be obviously apparent. For this reason and per manufacturer recommendations, **anesthesia ventilator settings may only be adjusted by members of the multidisciplinary team.**

For emergency contact call:
Anesthesia Tech Supervisor x63826
Attending Anesthesiologist in Charge x59922 (OR main desk) and ask for the anesthesiologist in charge.

UR Medicine Guidelines:

1. Authorized users: Only authorized users may manipulate the machine settings. Please see personnel for more details.
2. Safety Equipment:
    a. A manual ventilation bag (Ambu Bag) must be present in the patient room at all times.
3. General Considerations
    a. Since anesthesia machines allow for rebreathing a HEPA filter should always be used on the expiratory limb of the circuit. Additionally, consider prioritizing COVID-19 patients for conventional ICU ventilators if possible.
    b. Waste Anesthesia Gas scavenging (WAG) is not necessary when an anesthesia machine is used according to this workflow. Avoid connecting suction to the machine as it is a poor utilization of resources.
    c. Drager anesthesia workstation ventilator differ in their ability to deliver PEEP
        i. Fabius 15 cm H2O
        ii. Apollo 20 cm H20
        iii. Perseus 35 cm H20

4. Initial Machine Check: Prior to initially placing a patient on the Anesthesia machine ventilator, a machine check should be performed by a member of the multidisciplinary team consistent with manufacturer and FDA guidelines. The following elements are specific to this guideline:
    a. Confirm that there is no nitrous oxide tank present and that the machine is not connected to a central (wall) supply of nitrous.
    b. Confirm that there are no anesthetic vaporizers attached to the machine.
    c. Confirm that a CO2 absorbent canister **is** installed
    d. Confirm that a 3L breathing bag is installed.
    e. Set alarm volumes to maximum (100%).
    f. Set simulated breath sounds volume to minimum / off.
    g. Install a heat moisture exchanger (HME) in between the Y piece and the Ballard suction device.
    h. Install a viral (HEPA) filter between the expiratory limb and the machine.
    i. Following the machine check, set the APL to a suitable setting for positive pressure ventilation (30 cm H20 suggested) in case emergency manual ventilation is initiated.
    j. Set the fresh gas flows to 150% of the minute ventilation for initial settings
5. Periodic rechecks: The machine will alarm after in use for 12 hours that a re-check is due. The following re-check procedure should be repeated once every 24-72 hours according to the following process. (This is necessary for proper function of the flow sensors)
    a. Switch the ventilation mode to manual / spont
    b. Disconnect the patient and initiate ventilation with alternate means
    c. Turn off the fresh gas flow, Place the machine on standby.
    d. Perform a **Full** machine check, using the longer built in protocol.
6. Regular monitoring and maintenance:
    a. Every 8 hours, the water trap, HME and breathing circuit should be checked for excess water collection and emptied as needed and the absorbent canister should be checked for depletion.
    b. Every 8 hours or whenever the ventilator settings are changed, the fresh gas flow should be confirmed to be 150% of the minute ventilation.
7. Alarms
    a. **Note that the anesthesia machine ventilator does not alarm when placed on standby.**
    b. Alarms are non-latching (they do not display if the condition generating the alarm ceases), alarm history should be checked every 8 hours and whenever the ventilator settings are to be changed.
    c. Set the FiO2 alarm with tight parameters since the FiO2 is determined by flow rates and is not auto-regulated.
    d. Physiologic alarms (Peak Pressure, Minute ventilation, ETCO2 should be set in appropriate ranges for the patient.
    e. During **pressure support trials**, set the “Apnea Ventilation” to medium priority. Patients must be monitored closely as the ventilator has no dedicated apnea time and **no apnea backup mode**.

FAQ:

1. **What is the protocol for using volatile anesthetics (“Gas”) as sedation for ICU patients?**

   We are not currently planning to use volatile anesthetics for ICU sedation. These guidelines have been written accordingly. Use of volatile anesthetics would require reassessing multiple processes including fresh gas flow rates, use of absorbent, waste gas scavenging, patient monitoring and staff competencies. Any change in this principle will be communicated broadly.

2. **Can nebulized therapy or aerosolized therapy (Flolan) be administered via the anesthesia machine?**

   The use of nebulized and aerosolized therapy is not approved for use with anesthesia machines. Patients who require these therapies should be prioritized for ICU ventilators. Metered dose inhalers may be used with an inline adapter attached to the breathing circuit, distal to the HME. MDI administration will cause erroneous readings (artifact) in the side-stream gas monitor which will last several minutes.

3. **Is a breathing bag needed? Should it be moving? Can I use it to bag the patient?**

   The breathing bag is used as a reservoir during the normal function of the Drager anesthesia ventilator. It must be installed at all times during patient ventilation. Removal, will result in entraining room air into the inspired breath. The bag will normally move (with the respiratory cycle) during ventilator operation and the degree to which this is observed is dependent on ventilator settings and fresh gas flow rates. At the flow rates that will be used, the bag will remain mostly inflated during spontaneous breathing.

   The bag may be used to provide positive pressure breaths, however, this is recommended to be performed **only** by personnel trained in the use of the machine as it requires experience in the management of APL settings, fresh gas flow rates and understanding how leaks contribute to these factors. **First line emergency manual ventilation should be performed with a self-inflating (AMBU) bag as per current ICU practice.**

4. **What does it mean that leakages are not compensated on Drager devices? Can the PEEP level be maintained on these devices?**

   The statement in the manufacturers recommendations about leakages not being compensated are related to the way fresh gas is delivered to the breathing circuit, which is different than in ICU ventilators. At the fresh gas flow rates that we will be using (150% of MV) minor leaks are likely to be well tolerated. Large leaks (e.g. from circuit disconnects, or ruptured ETT cuff) may cause a sufficiently high leakage volume to prevent the complete tidal volume from being delivered, particularly in the setting of PEEP. This should not present a clinical problem in the normal operation of the ventilator, but could rapidly evolve into a situation where the ventilator is unable to deliver the programmed breath / PEEP. If it appears that there is a significant leak or that the patient is not receiving the programed tidal volume, **first line emergency manual ventilation should be performed with a self-inflating (AMBU) bag as per current ICU practice and the multidisciplinary Anesthesiology/RT team should be called to troubleshoot the ventilator.**

Resources:

1. American Society of Anesthesiologists (ASA) Anesthesia Patient Safety Foundation (APSF) Guidance on Purposing Anesthesia Machines as ICU Ventilators
   https://www.asahq.org/in-the-spotlight/coronavirus-covid-19-information/purposing-anesthesia-machines-for-ventilators

2. Drager Product information for Anesthesia Workstations (COVID-19)
   https://www.draeger.com/en_corp/Corporate/Coronavirus-COVID-19#anesthesia

3. ASA / APSF Anesthesia Machines as ICU Ventilators Hotline 1-800-224-1001
   To increase the availability of ventilators to support COVID-19 patients in the ICU, a new ASA/APSF hotline provides guidance for using anesthesia machines as ventilators in the ICU setting. It is requested that the available online materials be reviewed prior to calling the hotline if possible.

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