The Health Care Supply Chain Response to COVID-19: Provider and Supplier Collaboration Case Study

Rapid Design and Conversion of Anesthesia Circuits to Meet COVID-19 Challenges Through Partnership Between Supply Chain, Clinicians, and Supplier

Presenters

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Responding to the first patient and preparing for the surge
- Jan 21, 2020: First case in the US
- 300 world wide, in 6 countries
- 6 deaths, all in China
- Feb 29, 2020: First death in US reported from WA
- Mar 4, 2020: 10th US death reported from WA
### Projections for all regions (3/18/20)

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<th>Max Med/Surg occupancy</th>
<th>Max ICU occupancy</th>
<th>Max Ventilator need</th>
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Converting anesthesia machines to ventilators
Background

- Ventilator shortage expected = COVID-19 pandemic
- Anesthesia machines (AMs) can be used as ventilators with Anesthesia professionals to operate and manage
- The American Society of Anesthesiologists guidelines on how to convert and manage AMs as ventilators
- The three major manufacturers provided specifications
- FDA temporary approval

Proactive approach

- 1700 ventilators
- 800 anesthesia machines, multiple models, three companies
- Allotment for emergency surgeries
- Assignment of anesthesia professionals
- ASA, APSF guidelines
- Machines need to be run by anesthesia professional
**Project launch**

- Began with SBAR to initiate system-wide project
- **Goals:**
  - Develop playbook with step-by-step instructions
  - Identify key stakeholders and leaders
  - Create education plan for anesthesia professionals and perioperative leaders

**Key stakeholders**

- Anesthesia directors
- Anesthesiology professionals
- Anesthesia techs/assts
- Anesthesia group executives
- OR directors
- ICU directors
- Clinical engineers
- Infection Prevention
- Supply Chain (REH)
- Clinical Education
- IT
- Suppliers/vendors
- CMOs
Converting the anesthesia machine into a ventilator

- Different machines for different purposes
- Different skillsets required
- Run by different professionals
- EHR interface is different
- More monitoring and maintenance required

Converting the anesthesia machine into a ventilator

- Logistical challenges
- Privileging/training
- Protecting the patient
- Protecting the caregivers
- Protecting the machine
- What products do we need
- Can current products meet the different needs
Prepare – Ventilator Process

- Assign local ventilator “lead”
  - Tracks availability of ventilator & AM inventory
  - Serve as liaison between ICU and OR
  - Create a process for critical care staff to request an AM
- Assign specific AMs to the reserve stock
- Create an “vent on-call” list for the AMs

Prepare – Anesthesia Process

- Assign anesthesia professional(s)
  - Responsible for AMs
  - Set up, monitor, maintain, round hourly
  - Coordinate with clinical team to recommend appropriate settings
- Predetermine role of ANES professional in care team
- Create “vent on-call” schedule for ANES prof’s
- Predetermine appropriate settings and limits to match severity of illness (see ASA document for details)
- Address any issues, (i.e. privileges, compensation, org. structure, etc.) in advance with local leaders
Prepare – Dry Run Practice

- Perform “dry run” to identify potential problems.
- Ensure ANES profs are familiar with any changes in Epic workflow documentation
- If OR or PACU is to be used as ICU
  - Ensure patient transport/access routes are detailed to avoid exposure to non-COVID patients
  - Ensure that proper level or isolation is feasible (e.g. negative or neutral pressure)
- AMs may need to be moved to non-surgical site
- Ensure appropriate gas, suction, exhaust, and power sources are available at each potential site

Validating the products to meet clinical needs
General Considerations

- Inventory report of available AMs and their specs to facility admin.
- Plan for deployment and staffing in advance
- ANES prof. immediately available at all times to manage and assist
- Consult with intensivists on individual ventilator strategies if possible

General Considerations

- Routine rounding by ANES prof. on all AMs in use as long term ventilators
- Observation for CO2 absorber exhaustion, moisture accumulation in circuit and HMEF function degradation part of routine rounding
- Create schedules and checklists for specific requirements for each AM (e.g., daily machine check)
- Other personnel (e.g. CC RNs/CRTs) instructed to not adjust AM ventilators without ANES prof. involvement
Specific mechanical guidelines

- Remove or drain & lock vaporizers and nitrous cylinder and hoses
- Assure that hospital pipeline air and oxygen, or appropriately sized cylinders, are available
- If WAGD or main vacuum line suction connections are unavailable the scavenger system should be disconnected to avoid dangerous over pressurization of breathing circuit
- If O2 supplies are in question, bellows ventilator drive gas can be reconfigured by biomedical engineering to use compressed air (GE)
- APL set to 0 cm H2O and large reservoir bag if available
- Power should be cycled between patients

Specific mechanical guidelines

- A HMEF with high viral filtration efficiency (VFE) should be installed at the “Y” and a second high VFE (HEPA) filter should be installed at the expiratory inlet to the AM
- Replacement HMEF/HEPA filters should be immediately available and a means to occlude the ETT during HMEF replacement should be assured (e.g., chest tube clamp) in order to reduce airborne contamination
Specific mechanical guidelines

- If continuous ETCO2 monitoring is in use the source should be from the machine side of the HMEF
- If not feasible due to materials then insert a Luer lock disc HEPA filter at the insertion point to the AGM
- Back up manual resuscitator with appropriate HEPA filter available at all times
- While AM self-testing is recommended every 24 hours manufacturers have extended this to 72 hours during the crisis
- Power should be cycled between patients

Clinical guidelines

- Due to rebreathing in a circle system, FiO2 must be monitored
- Oxygen sensors must be recalibrated at regular intervals
- Fresh gas flow and FiO2 may be adjusted in different ways based on manufacturer
Clinical guidelines

- Rebreathing of exhaled gas is the distinguishing feature when comparing AMs and other ventilators
  - The percentage of rebreathed gas is the result of Fresh Gas Flow (FGF) in to the circle system
  - Higher FGF = less rebreathing until FGF exceeds Minute Ventilation (MV) at which time there is little to no rebreathing
  - CO2 absorber (e.g., soda lime) is necessary to allow rebreathing without CO2 accumulation
  - Higher FGFs result in lower humidity and potential mucous plugging and endothelial injury but spare the CO2 absorbent
  - Lower FGFs result in higher passive humidity and potential water accumulation in the circuit as well as early degradation of the CO2 absorbent and decreased filter efficiency
  - Active humidification of the circuit is not recommended and accumulated water must be removed from the circuit

Clinical guidelines

- Available ventilator modes vary by manufacturer, consult with CC physician regarding the ventilation strategy for each patient individually
  - The highest featured AMs should be deployed first and should at a minimum have SIMV+PS ventilation mode
What is the best strategy for protecting the anesthesia machine from contamination?

- Place a “high quality” viral filter between breathing circuit and patient’s airway with capability to sample gas from the machine side of the filter.
  - HMEF (Heat and Moisture Exchange Filter) is preferred to preserve humidification.
  - If filter only is used, reducing fresh gas flow is an important strategy for preserving humidity. (1-2 L/min or less)
- Place a second filter at the end of the expiratory limb at the connection to the anesthesia machine.
- Breathing circuits should be discarded after every patient.

Apsf.org
Collaboration and partnership with Supply Chain

Supply chain (REH): key partner for anesthesia

- Capital strategy (preexisting project to replace machines)
  - About 800 anesthesia machines with majority at or near end of life
  - Developed multi-year replacement schedule to align financial resources with critical needs
- Circuits and filters: meet the clinical need
  - Confirm clinical need and criteria for patient and caregiver safety
    - The product needed to meet criteria for both OR use and ICU (long-term) use
    - Provide protection for the anesthesia machines
  - Work with supplier to create the correct product
  - Convert and distribute across the system
Supply chain (REH): key partner for anesthesia

- Strategic Partnerships
  - Comprehensive relationship – cost effective clinical outcomes rather than line item savings
  - Leverage established internal teams (Supply Chain, Clinical Resource Integration) with supplier's teams
  - Longer term commitment & Quality Products leads to stronger product availability

Anesthesia machine circuits

- Usage roughly 20,000 units monthly
- About 30+ different configurations developed locally over the years
- Providence was already working on reducing variation in circuit configuration pre-COVID
- Strong pre-existing relationship with supplier crucial to success as healthcare institutions were struggling to find components to meet ASA recommendations
- Circumstances forced a quick pivot to meeting new expectations
- Trust and collaboration to move from planning to production in rapid order
COVID-19 ARRIVES!

ANESTHESIA CIRCUITS FOR COVID PATIENT CARE:
- Resources already available due to our previous efforts.
- Clinical leaders and team members from throughout the health system.
- REH (Supply Chain) with knowledge of available products.
- Vendor Strategic Partner with awareness of need.

Mobilization of efforts:
- Clinical requirements to meet ASA and APSF guidelines.
- Circuit configuration
- Filtration requirements
- REH (Supply Chain) to assess new, specific need.
- Reconfigure existing circuits?
- COVID specific circuit?

Vendor
- Understood clinical need
- Expedited sourced materials

HOW can we provide ALL needed supplies?

COMMUNICATION ■ TRUST ■ TEAMWORK

Anesthesia Circuit Logistics

- Challenges to Logistics
  1. Visibility to Critical Products
  2. Inventory Management Platforms
  3. How do we get these products to our caregivers quickly and efficiently?

- Solutions Generated
  - Team Approach
  - HUB Strategy

- Communication
  - How do we communicate to many different groups a new process?
  - Connections already established
  - Two communication documents with strong consistency

- Looking ahead
  - Increased visibility to processes
  - Established trust in the system approach
Supplier perspective

Customer Challenges

- Supply
- Physician Preference
- Waste
- Multiple Vendors
- Standardization

Increased Costs
Decreased Efficiency
Variability
Utilization Review
Consultative Approach

3-Step Process:

1. Review current circuits configurations & market need

2. Observation: Look for items regularly added or discarded

3. Recommendations and samples – Review with key clinical personnel

IDENTIFY A SOLUTION

Simplify | Order One Item Number
Reduce  | Touchpoints & Setup Time
Streamline | Inventory
Improve | Turnover Time
Decrease | Labor Costs
Questions?

Thank you for joining us.

Please send additional feedback or questions to ahrmm@aha.org.