COVID Innovations in Airway Management the Thalaiva Techniques

Sathy Narayanan K, Geeta Bhandari, Ilango Ganesan, Kedar Singh Shahi

Abstract: **Aim:** Innovative techniques employed to manage airway during COVID pandemic and other major emergencies inside operation room during emergencies. **Background:** These following innovations were made during residency days and it included an aerosol shield from cardboard and clothes hangers, a simple hack to ventilate two patients from one single source of oxygen named as ‘Biventilation from a single oxygen (BVSO)’, a needle cricothyroidotomy made from a suction naso catheter and a blood warmer using convection principle. These innovative ideas along with a manual resuscillator made up of an intravenous fluid bottle-SAMBU were presented as a paper in powerpoint format during 1st YUVA ISACON 2020 on 5th and 6th September, 2020 organized by ISA-A Virtual Conference and won 1st prize in Innovation category. **Technique:** A ‘No cost aerosol shield ‘ to prevent aerosol blast during laryngoscopy and intubation made from metallic cloth hangers, Cardboard roll / metal pipe / plastic pipe, Transparent sheets, HMEF filter. BVSO is a connection simply made out of silicon Y piece with multiple connectors and ET Tube 15 mm connectors from which one can make a bifid O2 supply from a single oxygen source. Two breathing circuits can be attached and two different patients could be ventilated with parameters (tidal volume, peak) adjusted accordingly. This can be used in primitive health care settings with limited oxygen supply. A Blood warmer made out of warmed intravenous fluid bottle attached to the stand and tubing of the blood bag is passed through it and it helps in emergency administration of blood in setups where there is warming devices. **Conclusion:** Innovations in health care is exorbitant and tasking. These simple cheap common techniques come in handy during demand- supply crises. We need to be frugal in thinking and flexible in action and make our own breakthrough. **Clinical Significance:** In Resource limited settings like a primary health care facility usually lacking in central oxygen and limited oxygen supplies, ‘BVSO’ helps in emergency ventilation of two patients simultaneously at a time till a definite help arrives. ‘Aerosol shield’ helps in preventing aerosol blast and since this is reproducible and cost effective it can be discarded easily after each use.

**Keywords:** COVID 19, Innovation in Anaesthesia, Airway

1. **Background**

The ongoing COVID-19 pandemic had brought the world to a standstill during the last two years. The Anaesthesiologists being the main upfront workers braved many risks to combat the deadly pandemic. The vast skill set along with leadership roles made them indispensable during the pandemic. [1]

Patients with severe COVID-19 presented with ARDS required invasive ventilation. Many hospitals were converted into COVID specialty centres and their ICUs transformed into COVID-19 specific catering those infected. An acute shortage of ventilators for non COVID infected patients occurred as they were mainly reserved for COVID patients. This led to non COVID patients getting no access to ventilators in worst scenarios.

These following innovations were made during residency days and it included an ‘No cost aerosol shield ‘ to prevent aerosol blast during laryngoscopy made from cardboards and clothes hangers and a simple hack to ventilate two patients from one single source of oxygen named as “Biventilation from a Single Oxygen (BVSO) ”.

These innovations have been rightly named as ‘The Thalaiva Techniques’ synonymous with the superstar actor ‘Rajnikanth’ known for his ‘commonly techniques ‘ and ‘Rags to Riches’ templates in his movies and thus applying the same principles to my innovations which is making use of little insignificant things for a greater use.

2. **Techniques**

**Aerosol Shield**

This aerosol shield was designed out of materials available at our daily disposal and is meant to be used in resource limited settings. The skeletal framework of the shield was made up of cardboard rolls and metallic cloth hangers. The entire frame was draped with transparent plastic sheets with two openings at the back for introducing the clinician hands for laryngoscopy and intubation. These opening were curtained with cut plastic of an intravenous fluid bottle to minimize aerosol leak. One HMEF filter was attached at the sides with suction to create negative air pressure inside the shield (FIGURE 1), (FIGURE 2), (FIGURE 3). (https://www.youtube.com/watch?v=DZXHQq0guJE)
Biventilation From Single Oxygen Source (BVSO)
This is a simple hack that facilitates ventilation of two patients from a single oxygen cylinder or a flowmeter in a primitive heath care setting. [6] This setup was made by connecting Et Tube Connectors, Y Connector, Cut Catheter Mount and Cut Fresh Gas Hose. Two breathing circuits was attached and two different patients can be ventilated with parameters (tidal volume, peep) adjusted accordingly (FIGURE 4), (FIGURE 5), (FIGURE 6), (https://www.youtube.com/watch?v=GQ725v7smgc)

Jugaad Cricothyroidomy Set:
This is a simple cricothyroidotomy set made out of a cut nelaton catheter, a Et connector and intravenous cannula (14G, 16G). In setups where one cannot afford to buy a cricothyroidotomy sets and unanticipated difficult airway during administration of anaesthesia, this can be made instantaneously and used after puncturing the cricothyroid membrane (FIGURE 7).

Jugaad Blood Warmer:
This is made from a heated intravenous bottle which is attached to the stand. The opening of the bottle is cut and the proximal tubing of the blood bag is immersed inside it and the distal part coming out of it is attached to the patient end (FIGURE 8).
3. Discussion

Anaesthesiologists are an integral part of managing ICU s. Their importance is very well stressed by the MACOCHA score [3] where the ability to predict difficult intubation is decreased by the absence of an anaesthesiologist. Their innovative helped to combat the limitations in accessing and utilizing resources at a small peripheral health setup.

The aerosol shield made out of used cardboard rolls, metal hangers and transparent sheets are used to prevent aerosol blast from aerosol generating procedures like intubation, extubation, suctioning, cardiopulmonary resuscitation and even transporting non ventilated patients. [3] It serves only as an additional protection to personal protection equipment but not as an alternative. [4] It also protected the health care workers positioned in front of the patient allowed safe reuse of personal protective equipment (PPE) under circumstances of diminishing PPE supply. [3]

There is definitely restriction in the range of movements of the clinician while using the laryngoscope or suction throughout the opening. But in health facilities like peripheral health centres, at least usage of this shield for transporting non intubated COVID patients to a referral centre can be made possible.

BVSO is an out of the box idea to provide uninterrupted oxygen supply to two patients at the same time when there is availability of only one oxygen source. A Consensus on using a single ventilator for multiple patients has been snubbed off due to cross infection, compatibility between patient parameters. [8] A flowmeter connected to a single oxygen cylinder or a central supply through its Y piece assembly can be connected to two circuits thus ventilating or oxygenating two patients simultaneously. The disadvantage being it requires high flow due to splitting of the volume between patients and so an oxygen cylinder will be exhausted quite fast. Oxygen therapy for two patients from a single flow meter was earlier devised using a 3 way stop cock but with risks of disconnection and leakage. [7]

Emergency cricothyroidotomy sets are expensive and also mandatory part of a difficult airway cart. The use of nelaton catheter for airway management has already been discussed wherein it has been used instead of an endotracheal tube. The same can be used for cricothyroidotomy set and also as an airway exchange catheter after cutting the cap. [8]

Blood warmers are not available in primary healthcare facilities. In unanticipated blood loss, there is little time for passive warming the blood by rolling over sheets. We cannot aggressively warm the blood by putting inside a heated water bath as it will lead to hemolysis and charring of the tubing. This is particularly helpful in emergency times when blood has to be transfused straight away after receiving it from blood bank and no time is available to warm it passively or in situations where there is no availability of blood warmers like inline, cabinet warmers or blood warming bath. [9]

Clinical Significance:
In a resourced limited setup where equipments like oxiport mackintosh laryngoscope or auxiliary oxygen ports are not available. Same hack can be employed for apnea oxygenation. [10] From the Common Gas Outlet of a basic anaesthesia machine having no auxiliary O2, one connector was attached to the breathing circuit while the other one was attached to the nasal prongs. Hence during laryngoscopy, patient can receive simultaneous oxygenation through nasal cannula (FIGURE 2). 'Aerosol shield' helps in preventing aerosol blast and since this is reproducible and cost effective it can be discarded easily after each use. Jugaad Blood warmers and cricothyroidotomy set from nelaton catheter are handy but life saving.

4. Conclusion

The war against COVID is far from over but the anaesthesiologists role was and is still commendable in blunting the peak waves of the pandemic. Innovations in health care is exorbitant and tasking which can be overcome by devising an effective solution using limited resources. Jugaad techniques are the answers to our country of immense talent but scarce resources

References


LEGENDS:

FIGURE 1-Metal Hangers
FIGURE 2-Metal pipe and cardboard Rolls for base & HMEF filter Attached with suction
FIGURE 3-Opening made for introducing hands for Laryngoscopy and Inubation
FIGURE 4-Et Tube Connectors + Y Connector + Cut Catheter Mount + Cut Fresh Gas Hose
FIGURE 5-One O2 source (flowmeter attached to cylinder and two breathing circuits attached for ventilating 2 different patients). The length of hose can be made according to need by cutting it.
FIGURE 6-CGO of a boyles machine without auxillary O2 having bifid O2 supply one for nasal prongs for apnea oxygenation while the other one is breathing circuit for preoxygenation and ventilation.

Note: Here inner diameter of CGO is connected to std 15mm connector of ET tube (inner connectors) which is cut as below in case no outer connector available.