

Aerosol Containment Box for General Anaesthesia under Spontaneous Ventilation

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Examination of eyes in children nearly always requires general anaesthesia (GA). Spontaneous ventilation via face mask can be suffice for simple eye examinations while insertion of laryngeal mask airway(LMA) allows ophthalmologists, easier access towards eyes for completion of short procedures under microscope, fundoscopy, measurement of intraocular pressure, retinoblastoma follow up etc. At our institute, it is carried out using an inhalational technique with facemask connected to Jackson's Rees circuit attached to a reservoir bag with pressure adjusting valve connected to the tail end.

In the COVID pandemic time, we attach a heat and moisture exchange filter (HMEF) between the LMA and circuit and a bacterial / viral filter between the circuit and the bag. Filters in mechanical breathing systems are designed to capture pathogens and particles

that range from 0.1 μm to larger than 10 μm . A SARS-CoV-2 virion is between 0.06 to 0.14 μm in diameter.¹ Respiratory transmissions of pathogens occur via carrier particles, classified as either a droplet or an aerosol. Respiratory droplets are particles sized larger than 5 to 10 μm in diameter^{2,3} and aerosols are particles sized smaller than 5 μm .⁴ Filters capture particles larger than 1.0 μm via inertial impact and interception, and particles ranging from 0.1 to 1.0 μm via diffusion.⁵ However, the combined effects of interception, inertia and diffusion have the least ability to efficiently capture particles sized 0.3 μm , well within the range of aerosols.⁵ No data exists examining the efficacy of breathing circuit filters in preventing SARS-CoV-2 transmission to patients or healthcare workers.⁵ Such an evaluation would require using live virus, and has yet to be concluded.⁵ Moreover, the microbial penetration value (MPVs) for the viruses were much greater than for the bacteria. Since the droplet sizes are the same, both the bacterial and viral droplets impact on the filter media, but that the viruses, released from the droplet after contact with moisture accumulated on the filter, can be driven onwards by the flow of gas, whereas

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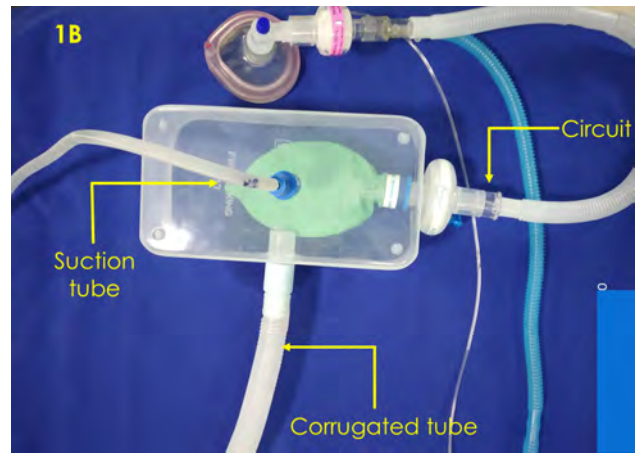
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the bacteria remain attached to the filter media. Thus, in spite of the usage of above filters in the circuit, there is possibility of operation theatre (OT) contamination during spontaneous ventilation under GA. To prevent OT contamination when the child is under spontaneous ventilation, indigenous aerosol containment box was developed at our Institution, see Figure 1A.



Figure 1A Aerosol containment box used in spontaneous ventilation

A transparent plastic box of dimension 8.5 x4.5x4.5 meter was taken and three holes were made; one hole at the front side, second one at the side, the third hole at the top of the box. Anaesthesia circuit was passed through the hole at the front side of the box, a corrugated tube connected to the return air duct was passed through the hole at the side of the box and a suction tube attached to suction machine, was passed through the hole at the top of the box, see Figure 1B.



1B The tubing connections given to the box

The suction bottle was filled with 1% hypochlorite solution. During inhalational technique, the box was kept over the reservoir bag. Anaesthetic contaminated gases exiting from the reservoir bag through the pressure adjusting valve is vented through the corrugated tubing to the return air duct. Routine monitoring of heart rate, etCO₂ and pulse oximetry was done as shown in Fig.1C.



1C Monitoring being used during the procedure

At the end of the procedure, to ensure more complete and effective suctioning of the contaminated air, suction machine is switched on. Following the procedure and after each case the box is cleaned with 1% Virkon solution and at the end of the day the box is cleaned with 1% Sodium hypochlorite solution.

The box is easier and cheaper to make. As children with retinoblastoma requires repeat GA examination of eyes quite often, it is not practical to subject them to Reverse Transcriptase Polymerase Chain Reaction(RT-PCR) test for COVID-19 often. Hence, at our Institution we do not take RTPCR for examination of eyes alone under GA. In such scenario, and also in cases of false negative RTPCR report, this aerosol box for spontaneous ventilation gives an extra protection against virus transmission to health care workers from any asymptomatic children.

Also, this box prevents OT theatre contamination with anaesthetic gases during spontaneous ventilation. Since the box is transparent, movement of the reservoir bag can be observed easily throughout the procedure. One of the limitation encountered in using such box is that, in case of any episode of apnea or breath holding, the box needs to be removed for assisting ventilation.

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