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Benefits and Limitations of Barrier Enclosures for Airway Procedures

To the Editor:

GIRGIS ET AL.[1] described one of several airway barrier enclosures made in part of transparent plastic sheets of varying stiffness, for placement around the head and upper torso.[1-10] The benefits and limitations of the barriers are summarized in Table 1 and are discussed here.

The barrier is expected to provide source control by trapping and suctioning out most but not all the infectious droplets and aerosol generated during airway procedures. Use of the barrier does not change the requirement to observe sterility precautions including use of full personal protective equipment (PPE). The benefit of the barrier is that it potentially reduces the inoculum received by the practitioner. Risk of infection may be reduced but not eliminated in cases in which PPE is not used appropriately. A reusable barrier is especially beneficial in international locations where the supply of PPE is inadequate.

The barriers have ports for the passage of the practitioner's arms, suction tubing, and airway equipment. They do not have an airtight seal around the patient's torso. If one of the suction devices commonly available in hospitals is used, contrary to what some of the authors state,[9,10] negative pressure is not achieved inside the barrier. Most of the droplets and aerosol stay inside the barrier and even escape outside it, instead of being suctioned out.

Table 1
Benefits and Limitations of a Barrier Enclosure

Benefits:
Potentially beneficial if PPE not used appropriately
Especially beneficial if supply of PPE inadequate
Limitations:
Need for PPE not reduced
Not beneficial for uninfected patients
Difficulty in central venous cannulation
Difficulty in single- and double-lumen intubation
Claustrophobia
Infection of decontaminating personnel
Infection from inadequate decontamination
Difficulty in disposing of a nonfolding contaminated barrier
Added cost, storage requirement

Preoperative testing for COVID-19 is the norm in the United States. Only a small percentage of surgeries are emergent and performed even in patients who are COVID-19−positive or have not been tested. This is especially true for cardiac, thoracic, and vascular surgeries. A vast majority of the surgeries are performed in patients who tested negative and are free of symptoms of COVID-19. A barrier is not beneficial in these cases.

When an internal jugular or a subclavian catheter is being inserted, it is difficult to maintain sterility while using a barrier enclosure. Many of the practitioners are not proficient in using barriers during intubation as they impede visibility and maneuverability. The length of the double-lumen tube makes it difficult to maneuver inside a barrier. The barrier complicates expected or unexpected difficult airway management, during single- or double-lumen intubation. On occasion, the barrier is required to be doffed urgently, breaching sterility.

Most of the authors demonstrategd the use of their barriers on mannequins or healthy volunteers who are inside the barrier for brief periods.[1-10] Many COVID-19 patients requiring an airway procedure are agitated and become claustrophobic inside the barrier. Urgent doffing is required, breaching sterility.

Inside the barrier a suction is used, and the patient receives oxygen via a mask. During endotracheal intubation and extubation, the mask of the anesthesia breathing circuit is used. Always covering the patient's nose and mouth with the mask provides source control. A barrier makes it difficult to maintain a tight mask fit at all such times, thus degrading the source control provided by the mask.

All the described barriers are wholly or partially reusable.[1-10] Their authors do not describe the process of doffing, decontamination after each use, and eventual disposal of their barriers. The inside of the barrier should be suctioned thoroughly prior to doffing. Some of the described barriers have moving parts that are especially difficult to decontaminate.[4] For one of the described barriers, the pipe frame is a part of the suction circuit.[9] After each use, inside of the pipe frame requires decontamination, which is difficult and time -consuming.

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Decontamination is usually performed by nonphysician healthcare personnel (HCP) using PPE and following protocol. During decontamination, a break in safe practice can lead to infection of the HCP. According to the Centers for Disease Control and Prevention,[11] as of July 6, 2020, out of 504,915 COVID-19–positive persons in the US with available data, 92,957 (18.4%) were HCP. This high incidence indicates that HCP at all levels are at high risk. The task of decontaminating the frame of the barrier or the entire barrier will add to the risk.

An inadequately decontaminated barrier jeopardizes subsequent users. Storage of barriers that may be inadequately decontaminated needs to be planned. When a barrier is used for consecutive cases, delay occurs while the barrier is being decontaminated.

A single-patient-use barrier, with transparent flexible walls over an adjustable folding frame, can be disposed of after each use. It is substantially less likely to spread infection than a barrier with reusable parts. Compared with a barrier with rigid walls, one with flexible walls is likely to cost less and provide greater maneuverability for the practitioner. A single-use folding barrier can be made easily and for a low cost. Such a barrier is easier to store and dispose of compared with the reusable barriers described.[1-10]

The partial source control provided by the barrier should be balanced against its limitations, including cost. It is beneficial if appropriate PPE is not available. Its use may be considered on a case-by-case basis, primarily for infected patients and for persons under investigation.

Conflict of Interest

None.

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Aerosol-Containment Device for Prevention of Aerosol Dispersion During Nebulization in COVID-19 Patients

To the Editor:

CORONAVIRUS disease 2019 (COVID-19) is an infectious disease caused by severe acute respiratory syndrome coronavirus 2 and is transmitted primarily through respiratory droplets, contact routes, and aerosol transmission. The selection of respiratory support for patients affected by COVID-19 must balance the clinical benefit of the intervention against the risks of nosocomial spread. Aerosol-generating procedures and nebulization have the potential for fugitive emissions and carry a higher risk of transmission of the virus to the surrounding environment and should be performed only when absolutely necessary in negative- pressure environments, with frequent air exchanges, under the care of highly trained personnel. It is advised to consider pressurized metered-dose inhalers and dry powder inhalers for aerosol drug delivery instead of nebulizers whenever feasible in COVID-19 patients.[1] However, the nebulizer is irreplaceable in uncooperative patients, patients with life-threatening respiratory disease, and poor response to metered-dose inhaler with spacer. The nebulization of drugs with a jet nebulizer causes sideways leakage of exhaled air, and the distance increases with increasing lung injury, ranging from 45 cm to 80 cm.[2]

Some high-flow/high-velocity systems and closed positive-pressure systems have capabilities to add nebulized medications without an increased risk of particle dispersal. Placement of a viral filter in-line with a nebulizer likely decreases the risk for nosocomial or healthcare worker infection,[3] but the efficiency of these filters in preventing the transmission and the magnitude of the risk of acquiring COVID-19 through filtered nebulizers are not fully known.

As we are in midst of the pandemic, many countries are facing deficiency of equipment and supplies. At All India Institute of Medical Sciences, Patna, India, we recognized the need for a viable solution for the delivery of aerosolized medications to patients with COVID-19. To address this objective, we modified a high-flow, nonrebreathing mask with an oxygen reservoir bag, which is readily available in a hospital setting (Fig 1, *A*). Three valves included in this assembly were reversed to