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LETTER TO THE EDITOR

Management of CO_2 absorbent while using the anesthesia machine as a mechanical ventilator on patients with COVID-19

O manejo do absorvedor de CO_2 durante o uso do aparelho de anestesia como respirador mecânico em pacientes com COVID-19

Dear Editor,

With the expansion of the COVID-19 pandemic, the world is experiencing a crisis related to lack of ventilators. In Brazil, it will not be different and maybe even worse. According to the Brazilian Critical Care Association (*Associação de Medicina Intensiva Brasileira*) census, there are roughly 42 thousand ICU beds in Brazil, albeit not all beds have mechanical ventilators.[1] Brazil has roughly 20 beds per 100 thousand inhabitants, a little less than Germany, which is the country with the best ratio in Europe, and in compliance with World Health Organization recommendations of 10–30 beds per 100 thousand inhabitants.[2] According to the Ministry of Health, over 20 thousand cases of COVID-19 were diagnosed in Brazil until April 12, 2020, but we lack data on Intensive Care Unit bed occupation.[3]

What is known is that many Intensive Care Unit patients will require mechanical ventilation. Retrospective data on Intensive Care Unit patients admitted with COVID-19 in Italy have shown that 88% of 1590 patients required mechanical ventilation.[4] The United States, and especially the state of New York, are the current epicenter of the pandemic. There, the deficit of mechanical ventilators is a major concern, and it can also be the case in Brazil.[5]

In order to try to minimize the deficit of ventilators, many groups of researchers, linked to the industry or not, are trying to develop new ventilators at a lower cost in a short period of time. However, the development of such equipment may take time due to the technical complexity and also because scale production is required. It is also important to underscore that currently we are facing a worldwide electronic component shortage crisis, which adds an extra caveat.

Bearing this scenario in mind, there is a proposal to use anesthesia machines as ventilators for COVID patients admitted to intensive care.[6] By using an anesthesia machine as a mechanical ventilator, with a high fresh gas flow (FGF), the CO_2 absorbent (soda lime) lasts longer and can be kept in the breathing circuit. However, one of the problems that can occur would be an extended period of ventilation, such as days or weeks, with low FGF use. The scenario would require the CO_2 absorbent (soda lime) to be replaced several times a day. Excessive soda lime consumption can lead to its shortage. In addition, during the CO_2 absorbent replacement procedure nursing and physiotherapy teams can be exposed.

Therefore, we performed several tests at the São Paulo University School of Medicine Anesthesiology Discipline Biophysics Lab (*Laboratório de Biofísica da Disciplina de Anestesiologia da Faculdade de Medicina da Universidade de São Paulo*) on a test lung with an injection of CO_2 (250 mL.min^{-1}) to detect scenarios of CO_2 rebreathing. Experiments were performed with the AVANCE S/5 (GE Healthcare,™ Chicago, US) anesthesia machine, with an empty absorbent reservoir (without soda lime) simulating ventilation with normal and low compliance lungs, 0.05 L.cm^{-1} H_2O and 0.02 L.cm^{-1} H_2O, respectively.

In order to test ventilation of the normal compliance lung the following parameters were used: Tidal Volume (TV) of 500 mL, respiratory rate (RR) of 12 cycles per minute, minute-volume (MV) of 6 L.min^{-1} and PEEP of 4 cm H_2O. For the low compliance lung, parameters were: TV of 300 mL, RR of 40 cycles per minute, MV of 12 L.min^{-1} and PEEP of 10 cm H_2O (Table 1). We started to change the FGF of the anesthesia machine and registered the inspired fraction of CO_2. We observed that when we used a FGF 20% higher than the adjusted minute-volume, no CO_2 was registered in the inspired gas, in both tests.

In face of the current crisis, we believe that using anesthesia machines for the management of critical patients

Table 1 Ventilation parameters used in tests.

Compliance	TV (mL)	RR (per minute)	MV (L.min^{-1})	PEEP (cm H_2O)
0.05 L.cm^{-1} H_2O	500	12	6	4
0.02 L.cm^{-1} H_2O	300	40	12	10

TV, tidal volume; RR, respiratory rate; MV, minute-volume.

with COVID-19 who require artificial ventilation would take some pressure off the strained health system. There are thousands of anesthesia machines distributed throughout the surgical blocks of Brazilian hospitals ready to be used.

Conflicts of interest

The authors declare no conflicts of interest.

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Spinal anesthesia in COVID-19 patients, more research is needed

Anestesia espinhal em pacientes com COVID-19, mais pesquisa é necessária

Dear Editor,

It has not been long since the pandemic engulfs the whole world. In the same short period of time, some comprehensive advice has been given to health care providers, particularly anesthetists, about patient care during the Coronavirus 2019 (COVID-19) outbreak.[1,2] Neuraxial blocks may be considered preferred methods of anesthesia in the presence of respiratory disease risks. There are few valuable reports regarding the safety of neuraxial anesthesia in COVID-19 patients recently published.[3] While spinal anesthesia has some advantages in COVID-19 patients, there are other considerations in the choice of anesthesia technique that require further research:

1. Coagulation derangement is not uncommon in Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) infected patients.[4,5] Although hypercoagulation status is more common in these patients, the unknown nature of this disease and the medications the patient is taking require special attention to the preoperative coagulation status, especially when dural puncture for intrathecal injection of local anesthetics is to be performed on a patient.
2. The coexistence of myocardial involvement can make anesthesia challenging. Many of COVID-19 patients have underlying cardiovascular disease and a lot of them develop acute cardiac injury in the course of the illness. Potential long-term consequences of the disease is another worrying issue that could be problematic in the future.[6,7] Therefore, special attention to the patient's heart condition before spinal anesthesia is of particular importance so that if there is a cardiac disorder, appropriate measures can be taken to maintain hemodynamic stability and prevent unwanted hypotension.
3. Spreading the SARS-CoV-2 to the central nervous system can cast doubt on the safety of spinal anesthesia.[8,9] The mechanism of this neuroinvasion is still not fully understood. Viral encephalitis, infectious toxic encephalopathy and acute cerebrovascular events are three nervous system disorders related to coronavirus infections. Maybe neurological symptoms such as headache, consciousness disorder, paresthesia, and other pathological signs which are seen in COVID-19[8] interfere with block evaluations following spinal anesthesia.
4. Particular attention should be paid to airway exams before performing any regional anesthesia. If the COVID-19 patient is considered a case of difficult airway, it may be futuristic to have general anesthesia at the outset, so that if regional anesthesia suddenly fails, airway management will not be in an emergency situation, what would increase the risk of virus transmission to the operating room medical personnel.
5. COVID-19 patients are more anxious than other surgical patients entering the operating room.[10] The administration of an anxiolytic such as midazolam as a medication