DOI: 10.1590/0100-6991e-20202558 Technical Note

Laparoscopic or robotic intraoperative management to minimize aerosol dispersion: Adaptations to the context of the COVID-19 pandemic

Manejo intraoperatório em cirurgia laparoscópica ou robótica para minimizar a dispersão de aerossóis: Adaptações ao contexto da pandemia por COVID-19

Andre Luiz Gioia Morrell[1,2,3]; Francisco Tustumi, ACBC-SP[4]; Alexander Charles Morrell-Junior[1,3]; Allan Gioia Morrell[1,3,5]; Duarte Miguel Ferreira Rodrigues Ribeiro[3,6]; Paulo Roberto Corsi, TCBC-SP[5]; Alexander Charles Morrell, TCBC-SP[1,2,3]

A B S T R A C T

The coronavirus infection, also known as SARS-COV2, has proven to be potentially fatal, representing a major global health problem. Its spread after its origin in the city of Wuhan, China has resulted in a pandemic with the collapse of the health system in several countries, some with enormous social impact and expressive number of deaths as seen in Italy and Spain. Extreme intra and extra-hospital measures have been implemented to decrease the transmission and dissemination of the COVID-19. Regarding the surgical practice, a huge number of procedures considered non-essential or elective were cancelled and postponed until the pandemic is resolved. However, urgent and oncological procedures have been carried out. In this publication, we highlight and teach adaptations to be made with commonly used materials in laparoscopy to help prevent the spread and contamination of the healthcare team assisting surgical patients.

Headings: Laparoscopy. Aerosol Propellants. Coronavirus. Pandemics. Perioperative Period.

INTRODUCTION

The new coronavirus, first diagnosed in Wuhan, China, in December 2019, has spread all over the world[1]. In March 2020, the World Health Organization declared a pandemic status, raising healthcare awareness around the world to the highest level of attention. Health, social, economic and political consequences, in an attempt to control the worldwide spread, have dramatically impacted all countries, and the aim is to focus on the best solutions to face the problem.

There has been an exponential spread of the disease with an increase in the number of studies reporting on the COVID-19 transmission, clinical symptoms, diagnosis and possible therapies. Up to now, most of the recently reported data lack adequate levels of scientific evidence. However, the current chaotic situation makes it very difficult to carry out studies which good scientific method. Hospitals worldwide have been experiencing supply crisis, with a shortage of beds and the adequate number of professionals to take care and assist patients. Also, mechanical ventilation devices and personal protective equipment (PPE) essential to control of the disease and prevent contaminations among healthcare professionals are lacking. The transmission of the disease occurs from person to person, mainly by direct contact or by droplets spread by aerosols (coughing or sneezing) of an infected individual[2].

The COVID-19 pandemic has had a huge impact on the routines of all different healthcare departments, including surgeries, which has required frequent changes of protocols.

1 - Instituto Morrell, Cirurgia do Aparelho Digestivo Minimamente Invasiva e Robótica - São Paulo - SP - Brasil. 2 - Sociedade Beneficente Israelita Brasileira Albert Einstein, Cirurgia Geral e do Aparelho Digestivo Minimamente Invasiva e Robótica - São Paulo - SP - Brasil. 3 - Rede D'Or São Luiz, Cirurgia do Aparelho Digestivo e Robótica - São Paulo - SP - Brasil. 4 - Universidade de São Paulo (FMUSP), Departamento de Cirurgia - São Paulo - SP - Brasil. 5 - Faculdade de Ciências Médicas da Santa Casa de São Paulo, Departamento de Cirurgia - São Paulo - SP - Brasil. 6 - Clínica Duarte Miguel Ribeiro, Cirurgia Geral e Ginecologica - São Paulo - SP - Brasil.

Recommendations and literature data are scarce to guide those caring for surgical patients on how to behave in the surgical environment . In this regard, expert societies, as the Brazilian College of Surgeons (CBC), aware of the current low scientific evidences, published general safety measures for patients and healthcare workers[3,4].

There is evidence that laparoscopic procedures can disperse aerosol attached to viral particles[5,6]. However, it is still questionable whether conventional open access procedures are safer than laparoscopic in the context of COVID-19[7]. Products such as the AirSeal iFS® System or Laparoshield ™ Laparoscopic Smoke Filtration System, manufactured specifically for laparoscopic smoke filtering with the goal of removing particles, cells and viruses, have already been developed and approved to use, although there are no studies showing their effectiveness, specifically against COVID-19, so far. However, the availability of these devices in a pandemic scenario, and specifically in low income countries are scarce.

In this article we present a simple and reproducible technique to be performed, using common materials, which can be adopted for the surgical patient during the pandemic of COVID-19, while undergoing laparoscopic or robotic procedures. In the current pandemic scenario, more reliable evidence on the effectiveness of the virus transmission and its reduction as well as the results of the various initiatives are lacking. Nonetheless, a series of recommendations can be shared aiming at reducing the possible spreading of the virus[7,8]. The current described adaptation specifically aims to minimize the dispersion of aerosols while performing surgical interventions in order to preserve the healthcare professionals.

TECHNICAL REPORT

Operating room setup: Currently, the use of personal protective equipment is mandatory in any procedure performed due to the COVID-19[9]. All healthcare professionals involved in surgical procedure must wear hats, goggles, gloves, N95 masks, face shields, along with the usual sterile garments for the surgical team. Ideally, rooms with negative pressure should be the rule. The induction and definitive airway procedure should be performed in the absence of the complete surgical team, only carried out by an anesthesiologist and an assisting nurse, guaranteeing as few professionals as possible inside the operating room. Once the airway is secured and the ventilatory system is connected, the remaining surgical team may enter the theater for patient positioning, table setting and any procedures required for the operation.

Materials: Before starting the procedure, be sure to have two conventional plastic suction or irrigation cables, a water seal device and a sterile transparent plastic bag used for the laparoscopic optic coverage. Certify that the nurse assistant prepares a 2 or 2.5% hypochlorous acid (HClO) solution, diluted in water in a proportion of 25 mL of hypochlorous acid into 975 mL of water, totalizing a 1000mL solution, since this has recently been reported to kill the virus[10]. Another possible chemical solution is chlorine dioxide stabilized at 7%, diluting 5mL of the product into 1000mL of water[11]. These solutions are to fill the water seal reservoir in order to submerge the end tip of the plastic cannula (Figure 1). Finally, close the reservoir with the appropriate cover and connect the first suction cable to the water seal into orifice A, as shown in the following figure (Figure 2A).

Trocars placement and pneumoperitoneum: It is recommended to use a Veress needle puncture technique to perform the pneumoperitoneum. The use of intraperitoneal pressure should be the lowest safe for the first puncture, and maintenance of the surgical field is desirable, with levels between 10-15 mmHg. Before introducing any trocar, always assure that its valves are closed to prevent inadvertent air leakage from the pneumoperitoneum into the room.

Figure 1. *Water seal filled with the chemical solution.*

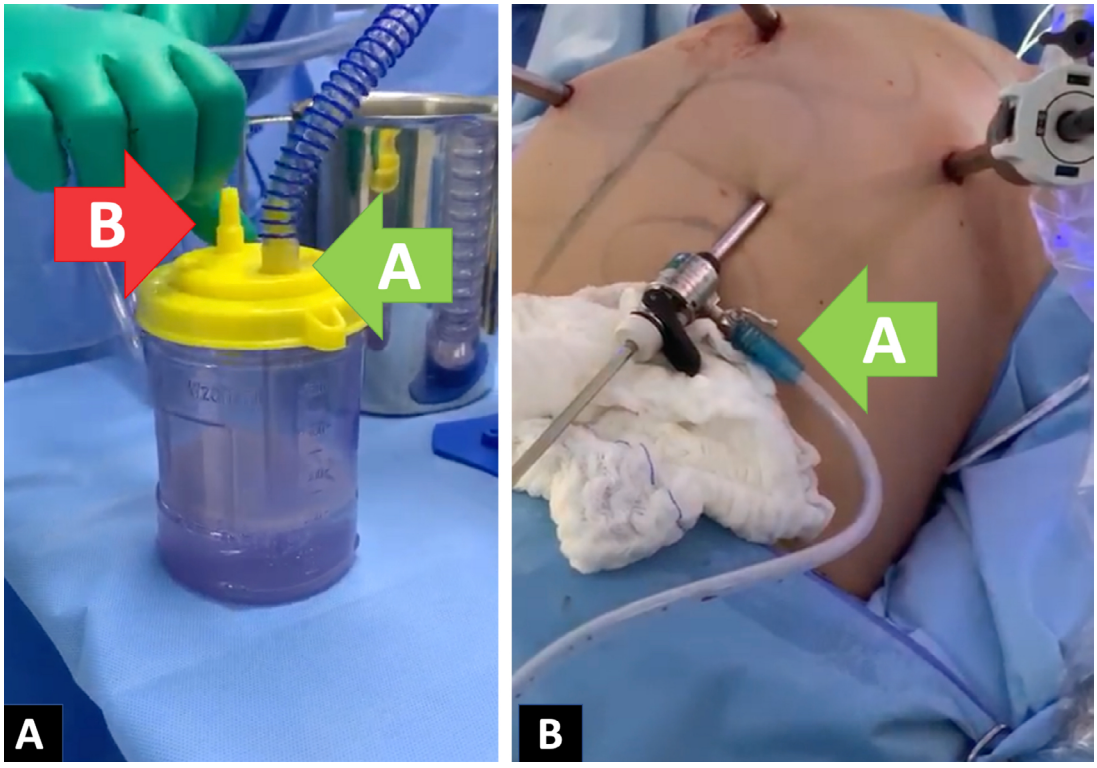

Figure 2. *2A: Water seal device A and B sites for suction tube connection 2B: Port site connected to the aspiration tube.*

Regarding the length of the incision, the smallest possible is desirable to also avoid air leakage.

Practical measures: Once the trocars are inserted, link the other cable tip from connection A to one of the trocars other than the one containing the insufflator (Figure 2B). Then, the second cable must be used and its tip connected to the water seal orifice B while the other tip is connected to a slow flow continuous suction device (Figure 3). After the whole system setting is assured, the trocar valve is opened.

Another possible way to perform the smoke evacuation suction circuit in the absence of the previously mentioned chemical substances is by connecting a ventilation machine filter to the terminal portion of the suction cable connected to the surgical trocar. The remaining part of the filter system is then connected to a second plastic suction cable, directing the smoke to the water seal device filled with saline solution.

Electric scalpels or ultrasonic devices: Use as little as possible, with the lowest coagulation power to avoid dispersion of aerosol particles.

Deflation: At the end of the procedure, the infusion of carbon dioxide is stopped and through one of the trocars, the intracavitary air should be aspirated to the fullest. Once the aspiration is finished and the patient's abdomen is flat, the surgeon's arm is placed under the sterile transparent plastic bag mentioned before, which will partially cover his arm and the entire hand.

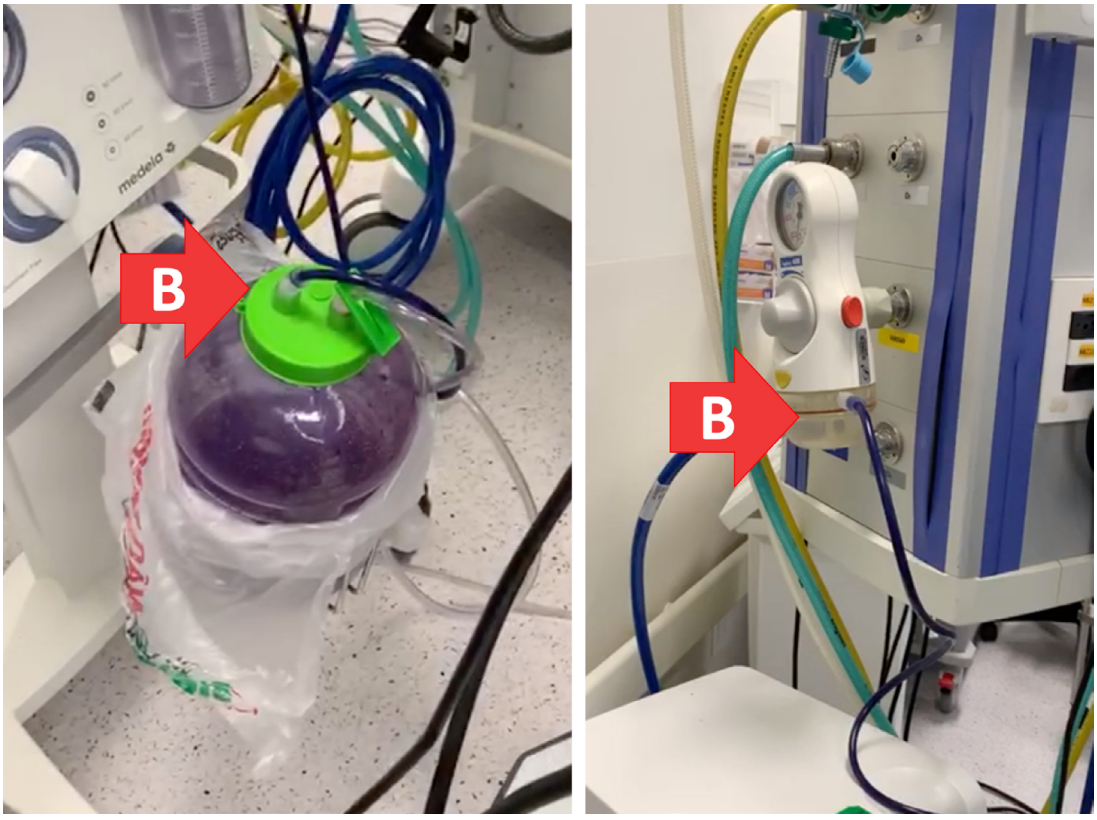

Figure 3. *Continuous vacuum system linked to the end portion of the aspiration tube.*

The covered hand removes the trocars in this "wrapped" manner, while the other hand presses the plastic to completely seal the incision site, protecting the professionals from possible spray of secretions and aerosol, as well as from dissemination to the room. The used disposable materials must be placed into usual plastic disposal bags, closing it and twisting the neck of the bag creating a knot, ensuring its sealing from the outside environment.

DISCUSSION

The COVID-19 pandemic is of major relevance in the current scenario. It has been the topic of discussions in the scientific journals, popular and social media. It is believed that global cooperation and information exchange will help with better patients' outcomes while protecting the healthcare professionals. Therefore, safety initiatives are more than ever mandatory.

The increased demand for medical assistance and the worldwide healthcare system overload has exposed the society to a severe shortage of medical supplies, such as PPE or patient care equipment. Meanwhile, emergency, urgency and oncological procedures must be carried out, and cannot wait for the normalized viral control.

Shaoqing et al.[12] recently described a group of 34 patients who needed hospital treatment due to severe COVID-19 symptoms that were only present after they had undergone surgery. In the study, asymptomatic patients, with no sign or symptoms of any previous viral infection, residing in Wuhan, underwent surgery. All had post-operative pneumonia. These findings suggest the procedure may have accelerated and exacerbated the COVID-19 disease progression.

Healthcare professionals who are in contact with COVID-19 patients have a higher risk of becoming infected[13]. Procedures that disseminate aerosols, such as NIV, high flux nasal cannula, mask ventilation and intubation are of higher risk[14]. Lima et al.[15] have recently published a technical note directed to surgeons and emergency physicians on how to perform cricothyroidostomies and tracheostomies while providing safe alternatives throughout the procedure. Similarly, minimally invasive operations use carbon dioxide flux to increase intra-abdominal pressure, and therefore they can spread aerosols. Richard et al.[16] have demonstrated environment contamination by blood and other body fluids during fast pneumoperitoneum deflation, under regular conditions.

Recent cases have shown that not only subclinical patients can effectively transmit the virus but also, they can contaminate others after recovering from the acute disease, depending on the viral load[17]. These reports justify the need for PPE as well as aggressive measures to guarantee safe handling to healthcare professionals throughout the whole process. Every healthcare professional involved in the treatment of patients in the COVID-19 pandemic era must follow the strict guidelines of hand washing and PPE use.

The questionable effectiveness and potential limitations of the reported method aiming at the reduction of aerosol dispersion should be acknowledged. Nonetheless, studies with better levels of evidence are lacking. We believe that in the current COVID-19 pandemic scenario when uncertainties and lack of good quality information are a reality, the spreading of preliminary data or techniques may be helpful, without acknowledging the need for future studies to be carried out.

CONCLUSIONS

Practical measures and its systematization in surgery may help prevent viral transmission to the involved healthcare professionals. Aerosol dispersion in the operating room may be prevented by simple measures without the need of expensive or sometimes unavailable devices.

R E S U M O

A infecção pelo coronavírus determinante da doença COVID-19, também conhecida como SARS-COV2 foi classificada nos últimos meses como pandemia. Essa é potencialmente fatal, representando enorme problema de saúde mundial. A disseminação, após provável origem zoonótica na cidade de Wuhan, China, resultou em colapso do sistema de saúde de diversos países, alguns com enorme impacto social e número grande de mortes descritas na Itália e Espanha. Medidas extremas intra e extra-hospitalares têm sido implementadas a fim de conter a transmissão e disseminação da COVID-19. No âmbito cirúrgico, enorme quantidade de procedimentos considerados não essenciais ou eletivos foram prorrogados ou suspensos até resolução da pandemia. No entanto, cirurgias de urgência e oncológicas não permitem que o paciente espere. Nesta publicação, sugerimos e ensinamos adaptação a ser feita com materiais de uso corriqueiro em laparoscopias para evitar a contaminação ou a disseminação entre as equipes assistenciais e os pacientes.

Descritores: *Laparoscopia. Aerossóis. Coronavirus. Pandemias. Período Intraoperatório.*

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Received in: 06/04/2020
Accepted for publication: 06/04/2020

Conflict of interest: None
Financing source: None

Mailing address:
Andre Luiz Gioia Morrell
E-mail: andremorrell@gmail.com
alternativo: andrelgmorrell@gmail.com