

Review Article

**Recommendations for prophylaxis of COVID-19 in elective surgeries:
literature review***Recomendações para profilaxia de COVID-19 em cirurgias eletivas:
revisão de literatura***Valentina Lacerda de Oliveira Gregolin¹, Marcela Schwam¹, Mariana Mendes Toscano¹,
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Gregolin VLO, Schwam M, Toscano MM, Solera ALP. Recommendations for prophylaxis of COVID-19 in elective surgeries: literature review / *Recomendações para profilaxia de COVID-19 em cirurgias eletivas: revisão de literatura*. Rev Med (São Paulo). 2022 March-April;101(2):e-175065.

ABSTRACT: The coronavirus pandemic (COVID-19) made organizational and security adaptations necessary, in order to prevent contamination of patients and staff during surgical procedures. The purpose of this review is to point out the main recommendations necessary for surgical procedures to be performed safely during the COVID-19 pandemic. Articles restricted to the year 2020 were selected in the PUBMED, LILACS and MEDLINE databases using the descriptors “Coronavirus” and “Coronavirus infections” and the qualifier “/ surgery”, in addition to recommendations from the Brazilian College of Surgeons. The most highlighted recommendations are the obligatory use of personal protective equipment, reduce medical teams to essential professionals, postpone selection processes, precise and systematized cleaning, isolate the COVID-19 positive patients in a special area and avoid sharing personal objects that can spread the virus. Special care is needed in the management of the airways due to its high association with the generation of aerosols, seeking to perform it as accurately and quickly as possible. Priority must be given to minimally invasive procedures that have a lower risk of aerosolization when their postponement is not possible, as in cases of emergency and oncological surgery. The importance of preventing the spread of the virus is emphasized, with the responsibility of health professionals and the surgical sector

being crucial in developing and complying with safety and control standards. Thus, stricter protocols are needed for the management of pandemics. Therefore, it is necessary a better applicability and consolidation of the effective protocols allied with surveillance over its implementation.

Keywords: Coronavirus; Coronavirus infections; General surgery.

RESUMO: A pandemia do coronavírus (COVID-19) tornou necessárias adaptações organizacionais e de segurança, visando impedir a contaminação de pacientes e equipes durante procedimentos cirúrgicos. O objetivo da presente revisão é apontar as principais recomendações necessárias para que os procedimentos cirúrgicos sejam realizados com segurança durante a pandemia. Foram selecionados artigos restritos ao ano de 2020 nas bases de dados PUBMED, LILACS e MEDLINE, utilizando os descritores “Coronavirus” e “Coronavirus infections” e o qualificador “/surgery”, além de recomendações do Colégio Brasileiro de Cirurgiões. Destaca-se a obrigatoriedade do uso de Equipamentos de Proteção Individual (EPIs) por toda a equipe, restringindo-se apenas aos essenciais, adiamento de procedimentos eletivos visando poupar recursos, leitos e EPIs,

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higienização minuciosa e sistematizada, restrição de espaços para pacientes COVID-positivos e evitar uso de objetos pessoais que possam propagar o vírus. É necessário cuidado especial no manejo de vias aéreas, devido sua alta associação com a geração de aerossóis, buscando realizá-lo de forma mais precisa e rápida possível. Devem-se priorizar procedimentos minimamente invasivos e que possuam menor risco de aerossolização quando não for possível o adiamento de tais procedimentos, como em casos de cirurgias de emergência e oncológicas. Ressalta-se a

importância da prevenção da disseminação do vírus, sendo crucial a responsabilidade dos profissionais de saúde e setor cirúrgico em desenvolver e cumprir as normas de segurança e controle. Diante disso, fez-se necessária maior aplicabilidade e consolidação de protocolos efetivos, aliado à fiscalização de sua implementação.

Palavras-chave: Coronavírus; Infecções por coronavírus; Cirurgia geral.

INTRODUCTION

The coronavirus pandemic (COVID-19) has been motif of great discussion, being responsible for social, economic changes and specially in the health area. Safety measures like the social isolation and incentive to the adequate sanitization practices have been applied all over the world. According to World Health Organization (WHO), until the middle of November, 2020, Brazil presented almost 6 million confirmed cases and total of death surpassed 160 thousand, getting to the mark of 800 deaths by million inhabitants. In the world scenario, almost 60 million people were infected and the numbers don't stop increasing^{1,2}.

The virus is highly transmissible by nasopharynges aerosol dispersion and contact mainly in locked places with low ventilation and hospital facilities. The health professionals are particularly susceptible to the contamination, being secluded from ones' activities due to the contagious. In Italy, 20% of the corona virus frontline professionals got infected and died due to complications^{2,3,4}.

Furthermore, the health services must be prepared and available as good as possible to face the pandemic, to attend to the sick ones and to offer support with intensive care methods in hospital for severe cases⁵. This way, the transference of non-contaminated patients can be necessary to the reusing of the intensive care rooms, reserving them for further complications of patients with COVID-19 and avoiding overloading the system.

The changes which have been done in the health area comprehend strategies to execute the surgical procedures. Following recommendations of the Brazilian College of Surgeons (BCS), Brazilian Society of Oncological Surgery (BSOS) and Brazilian Society of Orthopedics and Traumatology (BSOT), elective surgeries have been postponed for a more convenient moment, aiming on avoiding the unnecessary use of personal protective equipment (PPE), prioritizing the ones affected by the pandemic in the bed distribution, reducing the risk of contamination of those patients and the occupational exposition risk of the doctors and all the health staff^{6,7}. A similar recommendation was implanted in the United States, following the recommendations of the American College of Surgeons. (ACS)⁸.

Nevertheless, urgency and emergency surgeries,

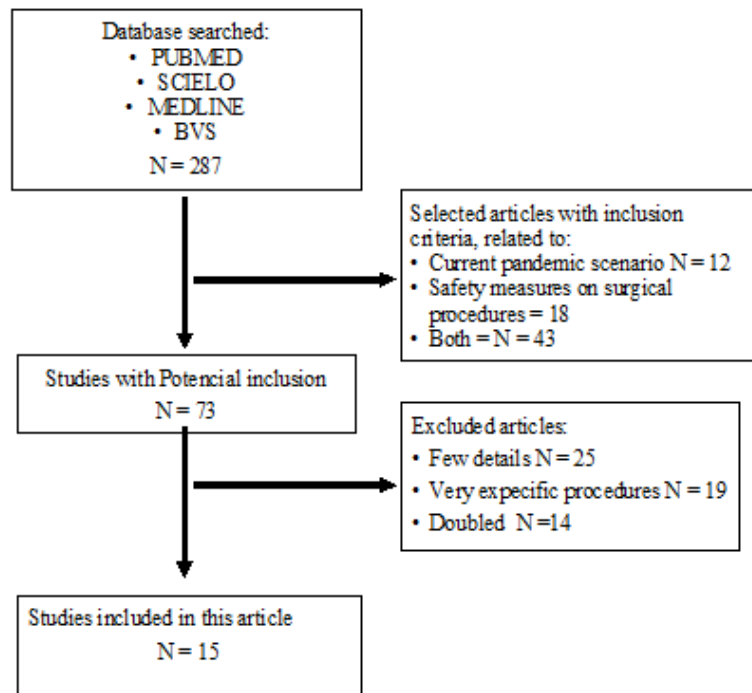
such as trauma, oncological surgeries and digestive hemorrhage, need immediate intervention. Toward this, strategies are necessary to the preparations and orientation of those involved in the assistance of these procedures (doctors, nurses and auxiliaries), so they can protect themselves in an effective way from a possible contamination⁷.

In this context, the purpose of this review is to point out the main recommendations necessary for surgical procedures to be performed safely, aiming the well-fare of the patient and the health professionals.

METHODS

It's a systematic review paper without metanalysis, performed in the period from June to September, 2020. To this review, searches in the database of PUBMED, MEDLINE, SciELO and BVS were made, using the descriptors "coronavirus", "Coronavirus infections" and "General Surgery". Articles restricted to the year 2020 were selected, being 6 of them in Portuguese, 8 of them in English and 1 of them in Spanish. The following inclusion criteria were defined: epidemiology detailing and the pandemic scenario nowadays, general and specific measure to be taken by the staff and hospital management, including procedures commonly performed in the urgency and emergency department and associated with a higher risk of aerosolization, besides being available in a complete form in the databases. Articles which were about specific procedures, with few protocol details, by title and duplicated ones were excluded. Additionally, the recommendation emitted by the Brazilian School of Surgeons was reviewed with the purpose of knowing the necessary cares in this period related to surgical procedures.

The search strategy was developed by three authors, according to the criteria of pre-defined eligibility, reviewed independently by another author. The selected articles were entirely read and the following data were extracted: author, publishing date, general and specific recommendations and main results obtained. The study results included were presented on a descriptive way, aiming to inform scientifically and unbiasedly, besides influencing on the health decision-making of managers in the context of emergency in the public health.



Picture 1: Flowchart of the articles' selection.

RESULTS

General recommendations

Surgical centers are high-risk areas of respiratory infections transmission, involving many times emergency cases which demand big staff and high-risk actions of aerosols spread, such as airway management. Normally, hospitals own protocols and preparations to deal with such cases with the due caution and reduced chances of transmission of some pathogen. Yet, the apprehension about COVID-19 and the overload of the hospital demand has made the pressure over employees grow because of the fear of the contamination with the virus⁹.

As consequence of the fact presented, new measures were taken by the Brazilian School of Surgeons in order to decrease the propagation chance of the virus in the surgical yard, such as:

- Better preparation for possible complications, increasing the previous study about the plans and actions that need to be taken, considering the necessary resources to perform them⁹;

- Postponing the elective operations, fact that decreases the traffic of people in the hospital and the dissemination of deceases for both the patients and the health staff, besides saving some resources, beds and personal protective equipment (PPE) essential in the pandemic scenario^{8,9};

- Plan to perform essential surgical procedures, making the emergency/urgency cases and limb salvage

easier¹⁰;

- Mandatory use of PPE and COVID-19 management in all the staff which participates in the surgery, it means, a person responsible for supervising if everything was done. When it's possible, minimize the number of participants inside the surgical center and provide orientation about the right management of PPE for all the staff, aiming the misinformation in order to get the best efficiency^{8,9,11};

- Personal protective equipment needed: facial mask FF (filtering facepiece) 2/3 or N95 mask, whose studies have proved protections against SARS-CoV-2 since there's the adequate training, impermeable disposable coats, surgical gown, a pair of disposable nitrile gloves, protective glasses or face shield and alcoholic solution for hand cleanness¹¹;

- The track where the patients and the staff pass must be minimized and sterilized, rigorously, before and after they've been through it. All the non-COVID-19 patients must wear PPE in order to minimize the risk of infection, in case they get close to infected patients. And, whenever it's possible, recover the patient in the operation room until the direct transfer to the isolation room or to the intensive care unit. This transport must be done with minimum number of professional possible;

- Reserve a Covid-19 operational space, supervised by a responsible professional, preferentially out of the intensive traffic areas, composed by essential and/or disposable materials only. Personal objects which can propagate the virus must be avoided. Signage with instructions must be highlighted and are necessary, along

with an anteroom for the team to get dressed and to take off the PPE^{9,11};

- During the surgery, use electronic equipment to communicate with the staff in and out of the surgery center, aiming to decrease door openings, the circulation of people and, consequently, the number of people potentially exposed¹²;

- Complete and meticulous cleaning of the surgery room and materials is crucial, specially, if the patient has confirmed diagnosis or has been under investigation of COVID-19, given that the virus can stay in the air a long period and on surfaces for hours and even days. It's estimated that a single air exchange in the surgical center removes 63% of the aerial contaminant. This way, the begging of the environment cleaning, after the release of the aerosol, last at least 20 minutes¹².

Establishment of defined airway

The establishment of a defined airway is associated directly with the generation of aerosol, and it means a great risk of virus propagation. The maximum caution in the conduction of the procedures must be taken⁸.

The airway handling must follow the acronym SPF: safe, to the patient and to the professional; precise, to prevent techniques which are not reliable, unknown or repeated, decreasing the risk of postoperative complications and long hospitalization; and fast, to avoid delays and virus exposure¹³.

In all the procedures, the recommendation previously mentioned by the Brazilian School of Surgeons must be taken into account, such recommendations include checking the availability of equipment and medicine that can be necessary, staff restriction only the essential ones (patient, doctors and auxiliary technician) and the adequate use of PPE.

Endotracheal intubation (ETI)

- ETI should be always considered as a first-choice option;

- The procedure must be performed by the most qualified doctor, to optimize the success in the first attempt;

- If it's possible, perform the procedure in a respiratory isolation room with negative pressure. Nevertheless, the surgical centers are usually projected to have positive pressure airflow. A high rate of air exchange cycles (≥ 25 cycles/hour) contribute to decrease effectively the viral load in the surgery rooms;

- The use of HEPA filter (High Efficiency Particulate Arrestance), whose efficiency is of 99,97% in the particle remotion $> 0,03 \mu\text{m}$ of diameter;

- Perform rapid sequence intubation, using neuromuscular blockers and sedatives to minimize the production of aerosol resulting from the airway irritation, cough and secretion. Avoid the awake tracheal intubation and the preoxygenation with AMBU;

- Avoid: the use of high flow oxygen, jet ventilation or positive pressure ventilation without a tracheal tube;

- The tube must be sealed with strong clamps when

the change of circuits/ventilator is necessary, to minimize the production of aerosol;

- Use a capnograph to confirm the intubation;

- Seal all the used equipment in the airways in a double seal Ziploc bag to be discarded or cleaned thoroughly^{12,13,14}.

Tracheotomy

- After 14 days of orotracheal intubation treatment, it's recommended the doing of the tracheotomy, when the patient isn't adequate for the extubation yet and after the acute phase of the illness. This wait helps to assure that the indication of the tracheotomy is to treat the ongoing lung injury and not the effects of the infection itself, minimizing unnecessary interventions. Nevertheless, there is no clinical test data which indicate a consensual moment to perform the procedure;

- The ideal place is a surgery center or an isolated room with negative pressure system;

- Use the standard tracheotomy surgical material, ideally using the conventional tracheostomy tube instead of the fenestrated ones;

- Avoid electrocautery, ultrasonic harmonical scalpel, lasers or any other kind of system used to tissue ablation which may disseminate aerosols;

- Perform the procedure under deep sedation and total neuromuscular block, to avoid cough and aerosolization;

- It's advisable the ventilation suspension while the tracheal incision is done and before the tracheostomy tube incision. After the incision, put quickly and precisely the tracheostomy tube with the immediate insufflation of the balloon;

- Before reinstate the ventilation, check if the balloon is insufflated;

- If it's available, conform the adequate position with a capnography ideally;

- Ascertain possible leaks and the correct fixation if the tracheostomy tube;

- Use closed aspiration systems with HME (heat and moisture exchanger) filter type;

- On the percutaneous tracheostomy, anchor the endotracheal tube before the main steps of the procedure, avoid the use of bronchoscope and the interruption of the ventilation in the final exhalation;

- On the elective tracheostomy, with the patient intubated, initially, the mechanical ventilation must be interrupted, deflate the balloon and remove the endotracheal tube until the cannula can be placed. Afterwards, perform the tracheostomy inflate the balloon of the tracheostomy tube, connect the ventilator and, when the correct ventilation was established, remove completely the endotracheal tube and anchor the tracheostomy cannula^{13, 14, 15, 16};

Cricothyrotomy

In emergency cases with patients with ventilatory deterioration, it must be done a definitive airway, as a cricothyrotomy in case a tracheostomy is impossible¹⁵.

When it's necessary a surgical cricothyrotomy, it's recommended, ideally, the use of cricothyrotomy by needle (QuickTrack), because of the advantage of its efficiency and the reduction of aerosols propagation, reserving the puncture technique to exceptional cases¹³.

Laparotomy and laparoscopy

Emergency and oncological surgeries cannot be postponed as it was done with the elective surgeries. So, the attention and the security must be directed to the generation of aerosols of the Pneumoperitoneum during the laparoscopy procedure, even if there aren't sources which indicate the virus transmission by this way. Even though the open laparotomy presents many disadvantages, it's recommended its performance instead of laparoscopy, but the choice of the best way must consider the variables of each case. It's not possible to evacuate completely the smoke produced by the electrocautery used in the laparotomy, therefore the laparoscopy must not be abandoned in detriment of the open procedure^{7,17}.

All the professionals who are to the indispensable performance of the procedure must use the PPE, including N95 mask. This way, some measures were advised to decrease the risk of dissemination of the virus, highlighting: incision size as small as possible, with seals all around it, keep the pressure of the pneumoperitoneum as lower as possible (between 10 to 12 mmHg, being 12 mmHg the inferior limit normally applied in the procedure); use filter

mechanism in both the insufflation and the exsufflation of the pneumoperitoneum; take off all the trocars only after the complete emptiness of the pneumoperitoneum; caution with the carbonic gas leak; decrease the time in the Trendelenburg position as much as possible; try to minimize its effects in the pulmonary and circulatory functions; and use the cautery in the lowest potency level, in order to decrease the smoke productions.

Combined surgeries

Combined surgeries are designated when more than one surgical procedure is performed at the same time. As some examples of this technique, we have the video-laparoscopic vaginal hysterectomy associated with the intra and extra facial, where there's the finalization with a colpotomy, or a colectomy with intracorporeal anastomosis, ending with a laparotomy^{20, 21}. It's about procedures in which, initially, there's the establishment of pneumoperitoneum and, to at the end, they cause the release of abdominal aerosols due to the positive pressure consequent of the incision.

With the purpose of avoiding possible contaminations among the professionals exposed to these procedures, it's recommended to perform the complete deflation of the pneumoperitoneum before going on with the incisional surgical time.

Chart 1: syntheses of the found recommendations

General recommendations	Previous plan and preparation for surgeries and its possible complications; Postponement of selective surgeries; Provision and obligation of wearing the PPE and inspection of its correct use; Minimize the staff inside the surgery center and avoid the circulation of people; Avoid wearing personal objects which may spread the virus; The path taken by the staff must be minimized and rigorously sterilized; Reserve a operational space for COVID-19; Complete and thorough clean of the operation room.	Quoted in 13 articles, in the references 4-12, 15, 17-19.
Airway management	Follow the SPF: safe, precise and fast; Procedures performed by the most qualified doctor, in a respiratory isolation room with negative pressure and HEPA filter; Consider ETI as a first option; Perform the fast sequence intubation, using neuromuscular blockers and sedatives; Avoid: awake intubation, the use of high flow oxygen, jet ventilation or ventilation by positive pressure without tracheal tube; When the tracheostomy is recommended, ideally to the conventional tracheostomy tube instead of the fenestrated ones; Suspend the ventilation during the tracheal incision and before the insertion of the tracheostomy tube; Avoid using electrocautery, ultrasonic harmonical scalpel or lasers; If it's necessary to perform cricothyroidotomy, perform ideally the technique by needle (QuickTrack).	Quoted in 8 articles, in the references 7, 9, 12-15, 16, 19.
Laparotomy and laparoscopy	Prioritize minimum invasive procedures; Incision as small as possible, with seals; Keep the pressure of the pneumoperitoneum as lower as possible and use filtering mechanism in the insufflation and deflation of it; Be careful with carbonic gas leaks; Decrease the time on the Trendelenburg position; Use the cautery in the lowest level of potency.	Quoted in 6 articles, in the references 7, 8, 12, 17-19.
Combined surgery	Perform the complete deflation of the pneumoperitoneum before going on with the incisional surgical time.	Quoted in 4 articles, in the references 13, 19-21.

General considerations

The most adopted recommendations by the protocols were the use of PPE and postponing elective surgeries, a common understanding in all the articles. The restriction on the number of professionals, systematic hygiene of the places and the equipment, avoid the use of personal objects and the traffic limitation of patients inside the hospital environment were quoted in average 70% of the times.

In the articles which approached the airway management, more than 90% prioritize the fast sequence intubation and less evasive methods. Yet, isolations with negative pressure and HEPA filters were quoted few times. Finally, around 50% of the articles expatiated on laparoscopy procedures, focused on the pneumoperitoneum management.

DISCUSSION

The new corona virus is shaping new habits in many different contexts all around the world. It's due its extreme impact on the health area, related to a big quantity of infected and expressive number of deaths. This scenario has brought an apprehensive era and uncertainties about the future, besides the fear of the contagious itself by the person and the ones close to them, especially family members. This, along with a highly intensive work and physical fatigue, leads to possible psychological crises which need the adequate support.

It's necessary to protect the patient and the health professionals who are in the front line against the virus, coming across inevitable and inheriting situations from the profession that may expose them to the risk of contamination.

Most of the results found were based on safety measure consolidations previously established, oriented not only to the actual pandemic. Furthermore, the articles lack from scientific evidences about the efficiency of each recommendation toward the corona virus dissemination.

When it comes to surgical practices, many procedures need immediate treatment, like in the cases where it's necessary establish the definitive airways or

emergency surgeries. It's necessary the systematization of such procedures, in order to avoid the virus propagation and occupational illness of the professionals involved.

Many recommendations have been sent out, being advised the postponement of elective surgeries. When it's not possible, it's advisable the individual and collective safety in the health centers, including the adequate use of personal protective equipment (PPE) and rigorous hygiene of the procedure room and the surgical centers.

When it comes to the procedures, less evasive techniques must be prioritized due to they have a lower risk of aerosolization, they must be performed by most qualified professional seeking maximum effectiveness and speed. The staff involved must be minimized only to the essential ones, in addition to avoiding the people flow in order to decrease the chances of exposition to the pathogen.

It was observed the absence of dissemination and the consolidation of the information in the health centers. The staff is not ready to manage positive-COVID patients, and the lack of meticulousness in the following of protocols result in the contamination of professionals and, consequently, in the increasing of the exposure risk of patients and others.

In addition, there are divergencies of resources and experiences in different health centers of the country. Not all the units that will be able to follow strictly the recommendations available in consequence of the lack of resources.

CONCLUSION

Considering the impact of the pandemic nowadays, it's necessary the implementation of adaptations such as: modification in the infrastructure and the processes, staff and patients management, strategies of prevention from infections, clinical recommendations and management of physical resources and materials to avoid the abandon of patients with surgical pathologies. It's uncertain what the future pattern of COVID-19 activity will be. Further investigations will show the effectiveness of these recommended measures and they will allow the perfecting of the prophylaxis protocols.

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