

# Surgical procedures in the COVID-19 pandemic: integrative review

*Procedimentos cirúrgicos na pandemia de COVID-19: revisão integrativa*

*Procedimientos quirúrgicos en la pandemia de COVID-19: revisión integrativa*

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**ABSTRACT: Objective:** To summarize the scientific production on surgical procedures during the COVID-19 pandemic. **Method:** This is an integrative review conducted between September and November 2020 in the following databases: PubMed, Medical Literature Analysis and Retrieval System Online (MEDLINE), Latin American and Caribbean Health Sciences Literature (*Literatura Latino-Americana e do Caribe em Ciências da Saúde* — LILACS), and Nursing Database (*Base de Dados em Enfermagem* — BDENF); combining the descriptors: “coronavirus and perioperative care”; “coronavirus and operating room nursing”; “perioperative care and operating room nursing”, connected by the Boolean operator “AND”. We retrieved 858 articles and included 15 in the sample. The level of scientific evidence was applied. **Results:** The publications had methods such as clinical recommendations, case reports, and observational studies, with level of evidence VI, indexed in the PubMed, LILACS, and MEDLINE databases. The articles provide recommendations on the management of surgical procedures, human resources, and materials for the working of the surgical center during the pandemic. **Conclusions:** We highlight the possibility of limiting elective surgical procedures, with access to rapid tests and effectiveness in protecting professionals.

**Keywords:** Coronavirus infections. Surgicenters. Pandemics.

**RESUMO: Objetivo:** Sumarizar a produção científica sobre procedimentos cirúrgicos durante a pandemia da COVID-19. **Método:** Revisão integrativa, realizada entre setembro a novembro de 2020, nas bases de dados PubMed, Medical Literature Analysis and Retrieval System Online (MEDLINE), Literatura Latino-Americana e do Caribe em Ciências da Saúde (LILACS) e Base de Dados de Enfermagem (BDENF), por meio do cruzamento dos descritores: “*coronavirus and perioperative care*”; “*coronavirus and operating room nursing*”; “*perioperative care and operating room nursing*”, correlacionados pelo operador booleano “and”. Identificaram-se 858 artigos, 15 contemplaram a amostra. Aplicou-se o nível de evidência científica. **Resultados:** Destacam-se publicações com aplicação de métodos entre recomendações clínicas, relatos de casos e estudos observacionais, com nível de evidência VI, indexadas nas bases de dados PubMed, Literatura Latino-Americana e do Caribe em Ciências da Saúde (LILACS) e Medical Literature Analysis and Retrieval System Online (MEDLINE). As publicações trazem recomendações acerca da gestão de procedimentos cirúrgicos, recursos humanos e materiais para o funcionamento do centro cirúrgico durante a pandemia. **Conclusão:** Ressalta-se a possibilidade de limitar os procedimentos cirúrgicos eletivos, com acesso aos testes rápidos e à efetividade na proteção dos profissionais. **Palavras-chave:** Infecções por coronavírus. Centros cirúrgicos. Pandemias.

**RESUMEN: Objetivo:** Resumir la producción científica sobre procedimientos quirúrgicos durante la Pandemia del COVID-19. **Método:** Revisión integradora, realizada entre septiembre y noviembre de 2020, en las bases de datos PubMed, MEDLINE, LILACS y BDENF; mediante cruce de los descriptores “*Coronavirus y Cuidado Perioperatorio*”; “*Coronavirus y Enfermería de Quirófano*”; “*Cuidados Perioperatorios y Enfermería de Quirófano*”, correlacionado por el operador booleano “y”. Se identificaron 858 artículos, 15 en la muestra. Se aplicó el nivel de evidencia científica. **Resultados:** Se destacan las publicaciones con aplicación de métodos entre recomendaciones clínicas, reportes de casos y estudios observacionales, con nivel de evidencia VI, indexadas en bases de datos PubMed, LILACS y MEDLINE. Las publicaciones traen recomendaciones sobre el manejo de procedimientos quirúrgicos, recursos humanos y materiales para el funcionamiento del centro quirúrgico durante la Pandemia. **Conclusión:** destacamos la posibilidad de limitar los procedimientos quirúrgicos electivos, con acceso a pruebas rápidas y efectividad en la protección de los profesionales. **Palabras clave:** Infecciones por coronavirus. Centros quirúrgicos. Pandemias.

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## INTRODUCTION

Coronavirus is part of a family group of viruses, such as MERS-CoV and SARS-CoV, that usually affect some animals; however, in December 2019, the SARS-CoV-2 virus, which can be transmitted from person to person by direct contact, contaminated surfaces, handshakes, or the respiratory route — through droplets and aerosols from sneezing, phlegm, and coughing —, was discovered in Wuhan, China. Thus, the disease became globally known as coronavirus disease 2019 (COVID-19)<sup>1</sup>.

In this context, COVID-19 reached a high number of people worldwide and, on March 11, 2020, was considered a pandemic by the World Health Organization (WHO). Evidence showed that older patients with respiratory and cardiovascular conditions presented severe complications. Disease manifestations range from the lack of symptoms (asymptomatic patients) to flu syndrome, pneumonia, and even acute respiratory distress syndrome (ARDS), progressing to multisystem organ failure and, consequently, death<sup>2</sup>.

According to the coronavirus disease panel of the Ministry of Health (MoH), Brazil has over 16 million confirmed cases and more than 452 thousand deaths. We stress that the case count is performed daily, based on data provided by State Health Departments. This process is complex and dynamic, taking into account the plurality and limitations of each state and municipality<sup>3</sup>.

This scenario has impacted all health areas, especially the surgical field, which requires direct contact between patient and team and cannot be replaced by remote treatment. Therefore, the surgical workforce faced several challenges compared to other specialties<sup>4</sup>.

Moreover, the inordinate repercussions of the disease have produced a series of measures that had to be implemented in health facilities, either globally or at regional or local levels, to combat the COVID-19 pandemic in order to reduce its impacts<sup>5</sup>.

Although a wide range of studies has been published relating the pandemic to several areas, including the surgical center (SC), investigations from several countries, especially from Brazil, are needed to address what happens in the SC during patient care in times of COVID-19 since each country has its particularities, and the surgical specialty has been one of the most affected during the pandemic.

## OBJECTIVE

To summarize the scientific production on surgical procedures during the COVID-19 pandemic.

## METHOD

This is an integrative literature review with a descriptive design. To this end, we carefully followed the methodological process based on these steps:

- theme identification;
- elaboration of the research guiding question;
- establishment of criteria for inclusion and exclusion of studies/sampling or literature search;
- definition of the information to be extracted from the articles selected;
- assessment of the articles included in the integrative review;
- interpretation of results and knowledge review/synthesis, which allowed the critical analysis of findings<sup>6</sup>.

This research was carried out between September and November 2020 by students from the Nursing Undergraduate Program, under the guidance of two professors, for the subject “Special Topics in Health — Theoretical Notions of Surgical Center and Sterile Processing Department Nursing”, from an expanding university in Paraíba, Brazil.

This research was guided by the question: what has been published on national and international databases about the SC and the COVID-19 pandemic?

The time frame for the articles selected was 2020, as the focus of the COVID-19 pandemic.

To build the research corpus, we searched articles indexed online in the following databases: PubMed, Medical Literature Analysis and Retrieval System Online (MEDLINE), Latin American and Caribbean Health Sciences Literature (*Literatura Latino-Americana e do Caribe em Ciências da Saúde* — LILACS), and Nursing Database (*Base de Dados em Enfermagem* — BDENF) — the last three included in the Virtual Health Library (VHL).

We used the Health Sciences Descriptors (*Descritores em Ciências da Saúde* — DeCS), with the following keywords in English and their combinations linked by the Boolean operator “AND”: “coronavirus and perioperative care”; “coronavirus

and operating room nursing”; “perioperative care and operating room nursing”, in all databases selected.

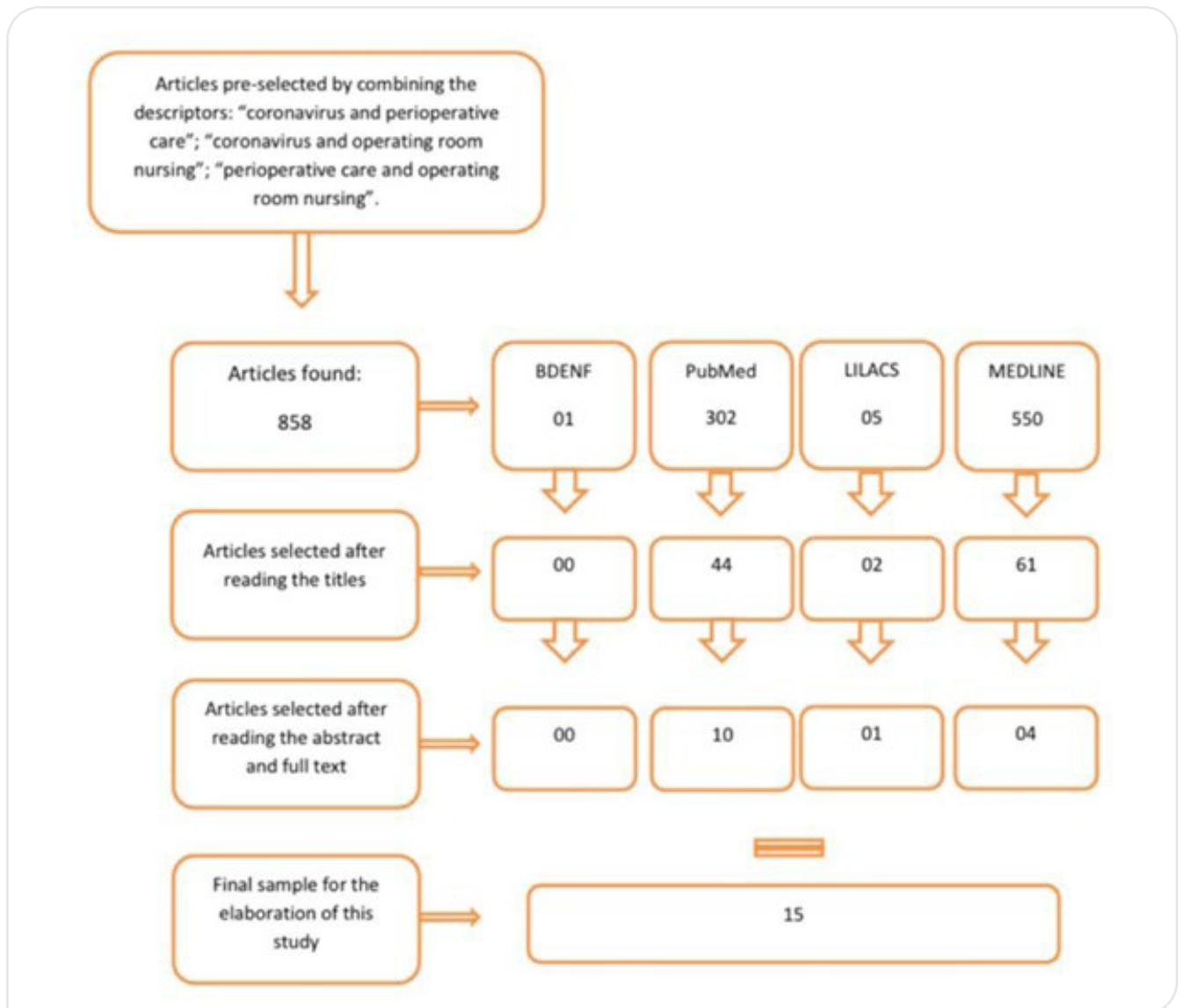
The inclusion criteria were established considering full articles available online in Portuguese, Spanish, and English, addressing the guiding question. We excluded dissertations, theses, abstracts, unavailable texts, publications in other languages, and those that did not address the proposed theme.

Thus, 858 articles indexed in the databases consulted were retrieved — 302 in PubMed, 550 in MEDLINE, five in LILACS, and one in BDENF. We selected 15 articles after screening them according to the inclusion and exclusion criteria and analysis of titles and abstracts; ten studies were

found in PubMed, four in MEDLINE, and one in LILACS, as shown in Figure 1.

The level of evidence of the summarized sample publications was adopted in the analysis according to the classification:

- Level I (systematic review or meta-analysis of multiple control studies);
- Level II (single study with experimental design);
- Level III (study with a quasi-experimental design, such as non-randomized trial with a single pre- and post-test group, time series, or case-control);
- Level IV (study with non-experimental design, such as descriptive correlational and qualitative research or case studies);



**Figure 1.** Flowchart of the identification and selection of scientific articles.

- Level V (case report or data obtained systematically with verifiable quality or program evaluation data);
- Level VI (opinion of reputable authorities based on clinical competence or opinion of expert committees, including interpretations of non-research-based information)<sup>7</sup>.

## RESULTS

The sample includes 15 articles, characterized in Chart 1, according to the numerical order of publications, author/

year, country of origin, method, database, journal, and level of evidence.

We underline that 13 articles were written in English, two in Spanish, and all were published in 2020. Seven works were conducted in the United States, three in China, one in Chile, one in Japan, one in Portugal, one in Spain, and one in India. Articles A4 and A10 were published in the same journal, namely, the Journal of Clinical Anesthesia. Several methods were applied to the studies, especially clinical recommendations, with nine articles (A1, A2, A4, A6, A8, A9, A10, A11, A14), followed by four case reports (A3, A5, A7, A15), and two observational studies (A12 and A13). Ten publications

**Chart 1.** Characterization of the scientific articles selected to compose the sample.

No. Author/ Year	Country of origin	Method	Database	Journal	Level of evidence
Aranda et al. <sup>5</sup>	Chile	Clinical recommendations for anesthesia in the perioperative period	LILACS	<i>Revista Chilena de Anestesia</i>	VI
Krishnamoorthy et al. <sup>8</sup>	United States	Clinical recommendations for perioperative management during the pandemic	MEDLINE	<i>British Journal of Anaesthesia</i>	VI
Yek et al. <sup>9</sup>	China	Case report	PubMed	<i>Korean Journal of Anesthesiology</i>	IV
Pimentel et al. <sup>10</sup>	United States	Clinical recommendations for perioperative care	PubMed	<i>Journal of Clinical Anesthesia</i>	VI
Wen et al. <sup>11</sup>	China	Case report	MEDLINE	<i>World Neurosurgery</i>	VI
Pinto et al. <sup>12</sup>	Portugal	Clinical recommendations for orthopedic and trauma surgical procedures	PubMed	<i>Journal of Bone and Joint Surgery</i>	VI
Chen et al. <sup>13</sup>	China	Case report	MEDLINE	<i>Chinese Journal of Traumatology</i>	V
Feijoo et al. <sup>14</sup>	Spain	Clinical and practical recommendations for patient management in the perioperative period	PubMed	<i>Revista Española de Anestesiología y Reanimación</i>	VI
Wang and Ito <sup>15</sup>	Japan	Clinical recommendations for perioperative care in spine surgery	PubMed	<i>Spine Surgery and Related Research</i>	VI
Herman et al. <sup>16</sup>	United States	Clinical recommendations for obstetric care	PubMed	<i>Journal of Clinical Anesthesia</i>	VI
Diaz et al. <sup>17</sup>	United States	Clinical recommendations for elective surgery	PubMed	<i>American Journal of Surgery</i>	VI
Pai et al. <sup>18</sup>	India	Observational study	PubMed	<i>Journal of Surgical Oncology</i>	V
Singer et al. <sup>19</sup>	United States	Observational study	PubMed	<i>Surgery</i>	V
Al-Muharrariq <sup>20</sup>	United States	Clinical recommendations for types of COVID-19 tests	PubMed	<i>British Journal of Oral and Maxillofacial Surgery</i>	VI
Stucky et al. <sup>21</sup>	United States	Case report	MEDLINE	<i>Journal of PeriAnesthesia Nursing</i>	V

**Chart 2.** Article summary according to title, objective, recommendations, and conclusion.

Article No./Title	Objectives	Recommendations	Conclusions
Aranda et al. <sup>5</sup> Recommendations for the management of COVID-19 patients in the perioperative period	To provide recommendations for anesthesia management of patients with suspected or confirmed COVID-19 infection in the perioperative period in order to reduce the risk of infection for health professionals, other patients, and the community.	Protective masks (preferably N95, FFP2, or equivalent) for the health team; goggles; surgical gowns with impermeable sleeves and cuffs; non-sterile and well-fitting gloves (latex or nitrile); use of double gloves for airway manipulation. Coordinate patient transfer with the hospital safety system to achieve optimal flow; maintenance of the surgical mask for patients submitted to local anesthesia.	Recommendations include training the multidisciplinary team, adequate disposal of contaminated waste, using personal protective equipment (PPE), and strategies for managing airways and anesthesia administration.
Krishnamoorthy et al. <sup>8</sup> Rational perioperative utilisation and management during the COVID-19 pandemic	To report the elaboration of a structure for the next steps needed to prepare perioperative teams for an outbreak of critical patients due to COVID-19.	Detailed planning for the health system.	The authors suggest detailed planning for the health system, considering local organizational factors. Important considerations include: a) what types of severely ill patients will be treated in the perioperative period?; b) how will perioperative professionals be prepared to care for critical patients?; c) what organizational infrastructure, including intensivists consultation and regionalization of care, will work best in the local environment?
Yek et al. <sup>9</sup> Perioperative considerations for COVID-19 patients: lessons learned from the pandemic	To facilitate the surgical management of patients with confirmed or suspected COVID-19 while minimizing the risk of nosocomial transmission to healthcare workers and other patients.	Considerations on the equipment and facilities in the perioperative management of COVID-19 patients: a) patient transportation with plastic cover; b) example of personal protective equipment; c) workflow of the operating room complex; powered air-purifying respirator (PAPR); PPE: N95 masks, face shield, disposable gowns, additional green cape to protect the neck and ears.	Detailed planning and coordination between departments are necessary to reduce the risk of transmission. Containment measures must be effective but practical, without compromising patient care, especially during a surgical emergency.
Pimentel et al. <sup>10</sup> Using a pre-procedure COVID-19 huddle to improve operating room safety	To establish a clear procedure plan prior to patient transportation to the operating room.	Operating room with negative pressure for aerosolizing procedures; transport plan: from the preoperative site directly to the operating room; from the operating room to the postoperative site.	Simulations to demonstrate that the huddle process has the added benefit of creating a space to clarify policies and collect feedback. This type of meeting may apply to other perioperative cases involving other communicable diseases.

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**Chart 2.** Continuation.

Article No./Title	Objectives	Recommendations	Conclusions
Wen et al. <sup>11</sup> Lessons from China when performing neurosurgical procedures during the coronavirus disease 2019 (COVID-19) pandemic	Advise the neurosurgery team on how to properly prepare and safely perform neurosurgical procedures in confirmed and suspected COVID-19 patients.	The authors recommend that men with beards shave their faces to ensure sealing between face and mask; use of protective gown covering the entire body; protective goggles and shoe covers. Avoid touching eyes, nose, or mouth after removing the mask or protective goggles at the end of the procedure. If a negative-pressure operating room is not available, a standard filtration system with high-efficiency particulate air (HEPA) filter should be implemented.	By following the proposed instructions, urgent neurosurgical procedures and surgeries can be safely performed for the benefit of critical patients with suspected or confirmed COVID-19.
Pinto et al. <sup>12</sup> Preparing to perform trauma and orthopaedic surgery on patients with COVID-19	To describe the protocol developed at the facility to treat COVID-19 patients, focusing on the specifics required for trauma and orthopedic surgical procedures.	The operative complex was divided into five zones: Zone 1 — entry, where the basic PPE is provided; Zone 2 — anteroom, where disinfection and surgical dressing are performed; Zone 3 — operating room (COVID-19 room); Zone 4 — exit, where PPE is removed; Zone 5 — exit dressing room, where the staff showers. Use of HEPA filters; suction devices should be used to remove smoke and aerosols during surgical procedures.	The protection of health workers and proper training are crucial to minimizing the transmission and the stress associated with the physical and mental exhaustion they are experiencing.
Chen et al. <sup>13</sup> Perioperative management strategy of severe traumatic brain injury during the outbreak of COVID-19	To describe the management strategy for patients with traumatic brain injury in the perioperative period during the COVID-19 outbreak based on medical and nursing practices.	PPE: N95 masks, surgical masks, sterile caps, positive-pressure headgears, protective goggles, protective screens, protective clothing, one-piece isolation gowns, disposable surgical gowns, sterile gloves, long boots.	The effective perioperative management of patients with traumatic brain injury will have a positive impact on their recovery and prognosis, improving their satisfaction.
Feijoo et al. <sup>14</sup> Practical recommendations for the perioperative management of the patient with suspicion or serious infection by coronavirus SARS-CoV	To address practical recommendations for perioperative management of patients with suspected or severe infection by SARS-CoV-2.	Negative-pressure isolation room; PPE: N95 or — preferably — FFP3 mask, tight-fitting goggles or full-face shield, impermeable gown, double gloves, and impermeable cap and boots.	There is no specific treatment for SARS-CoV-2; thus, the key aspects are establishing appropriate prevention measures and supporting the treatment and management of complications.
Wang and Ito <sup>15</sup> Spine surgery: precautions and strategies to minimize perioperative risks amid COVID-19 outbreak	To summarize some key principles from international recommendations/consensus and combined evidence- and experience-based practices from medical communities around the world.	Use, donning, and doffing of PPE, such as N95 mask; induction room and operating room with negative-pressure ventilation and high efficiency; HEPA filter.	A consensus on the best evidence-based practice can provide a perspective on how expert spinal surgeons can better handle a similar medical crisis in the future.

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Chart 2. Continuation.

Article No./Title	Objectives	Recommendations	Conclusions
Herman et al. <sup>16</sup> COVID-19: obstetric anesthesia care considerations	To gather obstetric anesthesia care considerations related to COVID-19.	Donning and doffing of appropriate PPE, including eye/face protection, N95 surgical mask or powered air-purifying respirator (PAPR), HEPA filter; given the potential aerosolization, patients should be extubated to nasal cannulas or oxygen masks with low flows.	Pre-hospital COVID-19 screening should be implemented for all pregnant patients; limit the number of professionals in the delivery room or operating rooms, when feasible; encourage the use of video messages with other members of the patient's support system.
Diaz et al. <sup>17</sup> Elective surgery in the time of COVID-19	To provide a brief review of publicly available statements from federal, state, and general surgery societies on elective surgery during COVID-19.	Does not apply.	The hospital leadership and department/division heads are responsible for adapting their policies to the dynamic local environment, taking into account current and designed PPE, personnel, beds, and the required equipment.
Pai et al. <sup>18</sup> Continuing surgical care in cancer patients during the nationwide lockdown in the COVID-19 pandemic: perioperative outcomes from a tertiary care cancer center in India	To report the experience with major surgical procedures performed at the Homi Bhabha Cancer Hospital, Varanasi, during the nationwide lockdown.	Does not apply.	Experience with surgical procedures performed at the facility during the nationwide lockdown.
Singer et al. <sup>19</sup> Low prevalence (0.13%) of COVID-19 infection in asymptomatic pre-operative/pre-procedure patients at a large, academic medical center informs approaches to perioperative care	To determine the prevalence of COVID-19 infection in asymptomatic patients scheduled for surgeries and procedures.	Does not apply.	Low levels (0.13% prevalence) of COVID-19 infection in an asymptomatic population of patients undergoing scheduled surgeries and procedures in a large urban area helped construct perioperative protocols during the COVID-19 pandemic.
Al-Muharraqi <sup>20</sup> Testing recommendation for COVID-19 (SARS-CoV-2) in patients planned for surgery: continuing the service and 'suppressing' the pandemic	To explain the types of tests available and suggest a possible recommendation for surgeons to follow when requesting these tests in pre-booked surgical cases.	There are two categories of SARS-CoV-2 tests: those that detect the virus itself (viral ribonucleic acid [RNA]) and those that detect the host's response to the virus (serological antibodies).	When performed in all surgical units, these tests can also be part of a pandemic suppression campaign leveraged to move the current crisis closer to an optimal situation, especially in the absence of therapeutics or vaccines.

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**Chart 2.** Continuation.

Article No./Title	Objectives	Recommendations	Conclusions
Stucky et al. <sup>21</sup> COVID-19: initial perioperative and perianesthesia nursing response in a military medical center	To describe the initial changing roles and contributions of perioperative and perianesthesia nurses during the COVID-19 pandemic and share recent experiences from a military medical center.	Does not apply.	Perioperative and perianesthesia nurses contributed to the overall response through planning and influencing policy, expanding critical services/bed capacity, training the staff, introducing new methods to reduce PPE burn rates, avoiding cross-training to other clinical areas, leveraging technology for communication with family members, and continuing to provide expert surgical patient care.

had level of evidence VI (A1, A2, A4, A5, A6, A8, A9, A10, A11, A14), four had level V (A7, A12, A13, A15), and only one had level IV (A3).

Chart 2 summarizes the articles that comprise the sample, according to title, objectives, recommendations, and conclusions.

Chart 2 shows that the words surgery, perioperative, and COVID-19 were prevalent in the titles of publications that composed this integrative review and that the recommendations highlighted the use of personal protective equipment (PPE) to reduce the risk of infection among patients and professionals.

## DISCUSSION

Analysis of the selected articles revealed that the publications presented the main difficulties for the multidisciplinary team to keep the SC working during the COVID-19 pandemic. Due to the high infectivity and transmissibility of SARS-CoV-2, hospitals, intensive care units, and operating rooms in several countries were faced with high bed occupancy, which is a concern for professionals and forces them to reflect on new techniques and effective strategies to reverse the overwhelming scenario of the COVID-19 pandemic<sup>8</sup>.

Therefore, the hospital staff should plan, coordinate, and provide training to minimize the risk of infection for professionals, particularly the perioperative care team, since they

are most likely to come into contact with droplets, aerosols, and body fluids during their practice, needing to postpone elective surgeries<sup>9,10,22</sup>.

We highlight an example of this susceptibility in the SC, involving the treatment of the first identified case of a patient with COVID-19 submitted to surgery in Wuhan, China, as all 14 professionals in the surgical block were infected because they did not take the proper precautions<sup>11</sup>.

Thus, researchers inferred that huddles allow them to share information about the risk of aerosolization. Discussions about the use of PPE, the preparation of procedures in advance, patient transportation to the operating room, and the location of post-procedure recovery were beneficial, helping to coordinate the multidisciplinary team and improving planning, decision-making, and perioperative safety<sup>10</sup>.

In addition, safety measures should be reinforced during the pandemic period. The use of PPE in the presence of a surgical patient infected with COVID-19 is imperative for the safety of professionals. Studies describe PPE as: protective mask (N95), goggle, face shield, surgical gown with impermeable sleeves and cuffs, non-sterile well-fitting glove, double gloves for airway manipulation, shoe covers, additional cape to protect the neck and ears<sup>5,9-11</sup>.

Corroborating this finding, researchers added the use of “special surgical garments”, helmets, PPE, among others, in orthopedic surgical positioning. They also detailed the

division of the sector into zones to avoid spreading the virus to other environments and other professionals<sup>12</sup>.

A clean environment proved to be crucial in this scenario so as to avoid cross-contamination. Removing the clothes used by the patient must be done carefully, and special attention should be paid to the disinfection of beds, stretchers, and other transport equipment. The team can also cover materials and equipment with plastics and clean them with proper detergents/decontaminating products<sup>5,13</sup>.

Other precautions should also be taken, such as washing hands with water and soap or chlorhexidine before and after contact with the patient and during the change of clothes. The operating room should have negative-pressure ventilation and high-efficiency particulate air (HEPA) filters<sup>15</sup>.

We emphasize that the risk of infection in the hospital environment increases while donning, doffing, and disposing of the equipment at the end of the procedure, so training and preparing the team for this practice is crucial<sup>5,15</sup>.

Patient transportation should be done with caution, given the risk of aerosolization; therefore, the N95 mask should be used to avoid spreading infected droplets. Communication between professionals during this transportation and instructions to leave the transport route free are considered essential<sup>11</sup>.

Other studies recommend that, in addition to using a mask, the patient be fully pre-oxygenated before anesthetic induction and that tracheal intubation be performed quickly, using a laryngoscope after the induction of fast-acting muscle relaxants, in order to avoid coughing, with monitoring of vital signs. Extubation and post-anesthesia recovery should also be performed in the operating room to expose the lowest number of professionals<sup>11,13,14</sup>.

Researchers listed some precautions in the surgical preparation of patients with suspected COVID-19, namely: signage specifying the patient transport route; transporting the patient with supplemental oxygen through a face mask in a trolley covered by plastic that should be removed upon entering the operating room; mechanical ventilation and intubation to support the airway through videolaparoscopy, and general anesthesia maintained with desflurane<sup>9</sup>.

Other recommendations include controlling the patient's hemostasis during surgery so as to prevent blood around

the surgical incision, as well as reducing irrigation and drainage to avoid the splashing of blood and body fluids. In addition, tracheal intubation, sputum aspiration, and the use of other electrosurgical equipment should be performed with extreme caution since aerosols can remain in the air for a long time<sup>13</sup>.

Some studies emphasize that the excessive number of professionals in the same site increases the exposure and risk of coronavirus infection, leading to the disproportionate use of PPE<sup>10,14,16</sup>. An investigation estimates that the operating room should have no more than two surgeons, one anesthesiologist, two nursing professionals, and one surgical technologist<sup>9</sup>.

Researchers have published guidelines regulating surgical procedures and showing the great concern of professionals regarding the postponement of elective surgeries. Therefore, its risk-benefit should be assessed, as it involves the patient's health, safety, and well-being. Logistic factors should also be considered, including the lack of hospital beds, availability of intensive care, adequacy of labor, and availability of material resources<sup>8,15,16</sup>.

Given this context, professionals should pay attention to the screening process before an emergency surgical procedure, as in cases of patients victims of severe traumatic brain injury. Some authors indicate the need to investigate epidemic contact and for prompt preoperative tests in order to rule out the possibility of coronavirus infection since some symptoms that manifest after traumatic brain injury can be mistaken for those of COVID-19<sup>13</sup>.

The preoperative screening process performed in patients undergoing spinal surgery stands out, taking into account the severity of the condition, the screening for hyperthermia, the X-ray result and the chest computed tomography in 24 hours to detect lung abnormalities, the reverse transcription test followed by polymerase chain reaction (RT-PCR), and the serology. The use of large equipment was also considered, as it is difficult to disinfect after the procedure. In addition, electric-powered devices that generate surgical smoke, such as burrs, drills, and oscillating saws, are often used, favoring the circulation of aerosol particles<sup>15</sup>.

In line with the information above, researchers reported that, by adopting the standard precautions of proper distancing, careful screening, surface cleaning, and use of N95 mask, they did not need to suspend surgical procedures

for cancer patients during the pandemic, preventing these cases from becoming inoperable<sup>18</sup>.

A study drew attention to the very low prevalence of asymptomatic positive patients in a large population that needed to undergo a surgical procedure<sup>20</sup>. To this end, all patients scheduled for surgery and who circulated in perioperative areas underwent a preoperative RT-PCR test with results available in no more than two days, reducing the exposure time. Researchers reason that surgeons and other professionals must know and interpret the types of tests available and how the results influence their practice<sup>14,20</sup>.

One study suggested a COVID-19 test protocol for patients with scheduled surgeries. In addition to patient screening, professionals can also be tested, ensuring more safety in the contact between professionals and patients<sup>20</sup>.

So far, there is no specific treatment to combat SARS-CoV-2. However, care should be directed to managing signs, symptoms, and complications, such as: respiratory support, septic shock treatment, and antimicrobial treatment in cases of acquired pneumonia, according to clinical guidelines specific to each facility<sup>14</sup>.

Researchers emphasize that the nursing team has adapted to changes in standards and routines as the need arose due to intensive care training and improvement in the use of PPE<sup>21</sup>. Two studies underlined that routine follow-ups and drug prescriptions could be performed by e-mail, telephone, videoconference, and other portals created by each establishment<sup>15,16</sup>.

This scenario benefits the reorganization of policies and promotes changes in the physical structure, management training, perioperative and intensive care of the work environment. Authors defend the calculation and evaluation of epidemiological data to balance the supply of services with the demand of each site<sup>8</sup>.

Thus, the articles analyzed provide effective knowledge and experiences related to the maintenance of surgeries in hospital facilities during the COVID-19 pandemic in 2020. Such findings can be used by scholars and professionals. The defined time frame and the lack of articles in Portuguese are considered study limitations.

## CONCLUSION

By analyzing the 15 publications, we found that the COVID-19 pandemic has been a major challenge for

health professionals, the population, and public policies, given the impactful and novel nature of the disease, with many complications to the patient, and the knowledge changes brought by something new. The implementation of short-term strategies was considered, with few alternatives that could ensure the lowest number of people infected. The research addressed the main safety measures used in the surgical block, in addition to administrative recommendations that could guide the planning of the work process, justifying the importance of this integrative review.

Therefore, we suggest that managers, health professionals, and students assimilate this theme, consider the possibility of limiting elective surgical procedures, and, above all, facilitate access to COVID-19 tests and the use of PPE, as well as support professionals by providing update training courses, simulations, etc. We stress that each country has its limitations and specificities and, therefore, protocols should be adapted according to the context of each location, taking into account epidemiological data, financial transfer, culture, among other aspects.

## FUNDING

None.

## CONFLICT OF INTERESTS

The authors declare there is no conflict of interests.

## AUTHORS' CONTRIBUTION

Silva MP: Investigation, Methodology, Project management, Supervision, Validation, Visualization, Writing — review & editing. Lucena JGS: Investigation, Project management, Validation. Albuquerque AM: Conceptualization, Project management, Resources, Supervision, Validation, Writing — review & editing. Pinto MAS: Conceptualization, Project management, Resources, Validation.

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