

Recommendations in general surgery during and after the crisis

Recomendaciones en cirugía general durante y después de la crisis

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ABSTRACT

In recent months the world has changed; now life revolves around the pandemic caused by SARS-CoV-2, this translates, above all, in uncertainty and fear. In the Mexican Association of General Surgery, we are concerned about safeguarding the integrity and health of our patients, as well as that of professionals and associates. What used to be known as Patient Safety, now also includes safety for health professionals. Major healthcare systems around the world have been overwhelmed when doctors and nurses become infected or die. Surgeons are going to be right in the middle of the problem, given that we must continue to care for the lives of our patients, as well as the need to perform emergency interventions and resolve oncology patients' issues. So, we make recommendations for emergency procedures, both surgical and endoscopic, use of personal protective equipment, and give advice for laparoscopic surgery for patients with or without COVID-19.

RESUMEN

El mundo ha cambiado en los últimos meses, ahora la vida gira alrededor de la pandemia causada por SARS-CoV-2, ésta se traduce, sobre todo, en incertidumbre y temor. En la Asociación Mexicana de Cirugía General estamos preocupados por salvaguardar la integridad y salud de nuestros pacientes, al igual que la de los profesionales de la salud y asociados. Lo que antes se manejó como Seguridad del Paciente, ahora incluye también la seguridad para los profesionales de la salud. Los principales sistemas de salud en el mundo se han visto rebasados cuando médicos y enfermeras se contagian o fallecen. Los cirujanos nos vamos a encontrar de lleno en el problema, dado que tenemos que seguir atendiendo la vida de nuestros pacientes, así como la necesidad de realizar intervenciones de urgencias y resolver pacientes oncológicos. Por lo que hacemos las recomendaciones de procedimientos de urgencia, tanto quirúrgicos como endoscópicos, uso del equipo de protección personal, consejos para cirugía laparoscópica tanto para pacientes con COVID-19 o sin éste

The world seems to have changed in recent months; it no longer revolves around the Sun, now life revolves around a viral pandemic, COVID-19, caused by SARS-CoV-2, which continues to evolve and generate damage to health and economy globally. This pandemic translates, above all, into uncertainty and fear, both among the general population and physicians.

The time will surely come when we will return to daily life. How long will it take? We do not know yet, it will depend on many variables, but it will leave its mark on us. Even more difficult times await us, and we will have

to be prepared by knowing our viral enemy, knowing our environment, with education for all and seeking to get out of the contingency in the best possible way.

In the Mexican Association of General Surgery, we are concerned about safeguarding the integrity and health of our patients, as well as that of health professionals and associates. What was previously handled as patient safety, now also includes safety for health professionals. Major healthcare systems around the world have been overwhelmed when doctors and nurses become infected. Surgeons are going to be right in the middle of the problem, given

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that we must continue to care for the lives of our patients, as well as the need to perform emergency interventions and resolve oncology patients' issues. Likewise, we are going to have to operate on COVID-19 positive patients and, if necessary, we will have to go down to the front line to work and help in services other than our usual activities are performed.

We are concerned about preventing the surgeon and health personnel in general from becoming second victims, as has happened in other countries. At the same time, we will have to provide the best possible health care, with the quality and humanism that characterize us. Concerned about taking care of the health personnel, always attending to our vocation of service and without incurring in omissions or irresponsibility.

As always, we as surgeons, are obliged to provide timely and high-quality surgical care that achieves the best results for patients. But if surgical teams are not adequately protected against transmission of the virus during the COVID-19 outbreak, the ability of our health systems to provide the necessary care will collapse as more and more physicians become ill or are forced to quarantine themselves.

THE CONSIDERATIONS OF THE AMERICAN COLLEGE OF SURGEONS ARE AS FOLLOWS:¹⁻³

- Educating surgeons and other healthcare workers about prevention.
- Social distance and hand hygiene as key preventive measures.
- Most viral infections will come to the hospital from the community.
- Test as many people as possible: healthcare professionals, surgeons, and patients.
- Cancel **all** elective procedures in patients with a functional or vital prognosis that is not significantly worse than after a two-month delay in treatment.
- Cancel **all** procedures and consultations. Implement remote counseling solutions.
- Use the hospital ethics committee to support decisions to be made during critical stages.
- Prohibit family visits. Technology can be used to keep them informed and in contact with their loved ones.

- Create two separate COVID-negative and COVID-positive areas in the Intensive Care Unit (ICU), operating rooms, and hospitalization areas.
- Personal protective equipment (PPE) should be used by all healthcare personnel in positive and suspected patients going to surgery, bearing in mind that at some point supplies will be in short supply.
- When the virus is very prevalent in the community, it will be ideal to have patients sampled before surgery.
- There is insufficient data on the surgical outcome of COVID-positive patients.
- Move quickly and act before you see the virus in your hospital. If you don't, it will be too late.

RECOMMENDATIONS OF THE MEXICAN ASSOCIATION OF GENERAL SURGERY (AMCG)⁴⁻⁸

The information provided should not be considered as rigid guidelines and is not intended to supplant clinical judgment. Nor is the information intended to preclude consensus regarding institutional and local approaches to treatment guidelines. There is great uncertainty surrounding this evolving pandemic and a great deal of regional variability. In this highly variable environment, information changes rapidly. As such, the AMCG recommends:

1. **Defer all elective surgical procedures (non-urgent surgeries):** Hospitals and surgical centers should assess the medical needs of their patients and their real-time logistical and infrastructural capacity. The risk to the patient should include an additional assessment of the actual risk of proceeding, versus delay, including the possibility that a delay of 8 weeks or more may be necessary to exit the acute contagious phase, although not the COVID-19 setting. It is important to recognize that the decision to cancel or proceed with a surgical procedure must be made in the context of strict medical considerations, but also according to local and national logistics.

2. **Defer non-urgent endoscopy:** there may be an increased risk of viral exposure during airway endoscopic procedures. When necessary, strict use of PPE should be considered for all equipment, against gross droplets, and aerosols. This includes, at a minimum, N95 masks and face shields.
3. **For emergency surgery** that must be performed, we recommend taking into consideration the possibility of contamination of instruments.

It should be considered that viral dispersion in aerosols occurs both in open and laparoscopic surgery. Even though it may produce more aerosol in laparoscopic surgery, in open surgery it may be more difficult to control by aspiration.

The greatest aerosol production occurs during intubation and extubation of the patient.

Ideally, every patient brought to the operating room should have preoperative COVID-19 testing, if available and practical; especially if it is accessible in your hospitals. Since there can be false negative results, it is suggested that "every patient in the OR should be considered COVID-19 positive until proven otherwise".

It is advisable to perform a CT scan of the abdomen and thorax on all patients who are taken to the operating room, especially if there is abdominal pain, and that this study should not take more than 24 hours to be performed.

Additional Guidelines for the Management of Non-Emergent Surgery During the COVID-19 Pandemic

4. **Outpatient consultation: all non-urgent consultations** should be cancelled, it is necessary to consider that our patients will be forced to break isolation, move around the city, reach hospitals, be in contact with others, are probably infected but asymptomatic, and that the consultation itself represents a health risk for doctors and patients, even if contamination prevention measures are considered. As an attention to the staff of their work teams, it is also advisable to send home those who are not indispensable, to reduce their presence to a

minimum and to establish rotations. Patients with neoplastic pathology (oncology) cases shall be assessed individually and they will be attended considering all preventive measures. The physician/surgeon should wear a mask. Increase the distance with the patient and family for the interview. Recommend that only one family member accompany the patient and proceed to clean and disinfect the consultation areas.

5. **Personal protective equipment (PPE):** this is recommended for all surgical procedures, and especially for all laparotomies, unless they have been shown to be COVID-19 negative (again considering that there may be false negative results), including eye protection. The use of full PPE underneath the surgical garment is mandatory for the protection of health personnel; as it is a little known and complicated procedure it should be preceded by intensive training, thus avoiding exposing health personnel to unnecessary risks. The recommendation at this time is that even two people are needed to carry out the placement and removal of this equipment following a strict list of steps (checklist).

The search for a suitable surgical mask that offers adequate protection is a relevant issue.

Elements of personal protective equipment (PPE) (Annex I)

6. **Operating room:** the minimum number of personnel necessary should remain in the operating room. All should wear PPE and eye protection. Intubation and extubation should be done in the operating room. If necessary and possible, intubation and extubation should be performed inside a negative pressure or neutral pressure room. Keep in mind that most operating rooms have positive pressure, and this can contaminate the rest of the operating room (OR). The operating rooms should always be considered as contaminated. <https://www.asahq.org/in-the-spotlight/coronavirus-covid-19-information>, <https://icmanaesthesiacovid-19.org>.

Operating rooms for suspected, suspected or confirmed COVID-19 positive patients should be adequately filtered and ventilated and should be different from those used for other emergent surgical patients.

Only those considered essential personnel will participate in the surgical procedure (within the operating room) and, unless another emergency occurs, there should be no exchange of operating room personnel for any reason. All OR staff members should wear PPE as recommended by national or international organizations, including the World Health Organization (WHO) and Centers for Disease Control (CDC). Appropriate gowns and face shields should be worn. These measures should be taken for all surgical procedures during the pandemic, regardless of known or suspected COVID status. Donning and removal of PPE should be in accordance with CDC guidelines.

Electrosurgical units should be set at the lowest possible setting for the desired effect. The use of monopolar electrosurgery, ultrasonic dissectors, and advanced bipolar devices should be minimized, as they can produce aerosolization and dispersion of particles by vapors. If available, monopolar diathermy pencils connected to smoke evacuators should be used or have the aspirator always close to the electro-coagulated area.

It should be considered that when we perform open surgery, within 5 minutes of activation of the electrosurgical equipment, the concentration of smoke particles in an operating room can rise from 60 thousand to 1 million particles per cubic foot. This turns the operating room into a laboratory with high viral circulation; therefore, ultrafiltration of the operating room is necessary, especially in COVID-19 positive patients.

Surgical equipment used during procedures on COVID-19 positive patients or persons under investigation or suspected of COVID should be cleaned separately from other surgical equipment.

- 7. Laparoscopic surgery:** early in the pandemic, the possibility of increased

aerosol dispersion during laparoscopic and general anesthesia procedures was considered. Aerosol production by ultrasonic and electrosurgical scalpel may indeed be higher in laparoscopic surgery but may also be easier to control versus open surgery. The cost-benefit ratio of laparoscopic procedures needs to be evaluated.

There is not yet sufficient evidence that filters and improvised measures, such as closed suction circuits, are reliable. In appendicitis, the cost-benefit of laparoscopy or open appendectomy can be considered, if there is no certainty in the control of the pneumoperitoneum with a laparoscopy procedure. The same can apply for other procedures such as acute cholecystitis, also considering that it can be managed conservatively during the contingency period.

There is still no clear evidence on the relative risks of minimally invasive (laparoscopic) surgery versus the conventional open approach, specific to COVID-19. Therefore, across all surgical societies we continue to monitor emerging evidence to address this issue.

Previous research has shown that laparoscopy and pneumoperitoneum air can lead to the production of bloodborne virus aerosols. Recommendations for highly transmissible virus-associated diseases are based on studies of hepatitis B and papillomavirus, and coronavirus is respiratory transmitted and surgical aerosols have not been shown to contain the virus.

SARS-CoV-2 consists of a single-stranded RNA of about 30,000 nucleotides, ranging in size from 0.06 to 0.14 microns. The virus has been found in nasal passages, saliva, sputum, throat, blood, bile, and feces. Urine and cerebrospinal fluid (CSF) evaluations have been negative. The virus has also been found within cells lining the respiratory tract and gastrointestinal tract; it is suspected to have multiple modes of transmission.

For minimally invasive procedures, the use of devices to filter released CO₂ from aerosolized particles should be

strongly considered. The proven benefits of minimally invasive surgery, reduced length of stay and complications, should be seriously considered in these patients, in addition to ultrafiltration of most or all aerosolized particles. Aerosolized particulate filtration may be more difficult to control during open surgery.

It is strongly recommended that the possibility of viral contamination be considered for personnel during open, laparoscopic, or robotic surgery, and that protective measures be strictly employed for personnel safety and to maintain a functioning workforce.

Aerosols can leave the virus virtually everywhere: plastic, metal, or cardboard, and can persist for up to several days. It should be considered that there is a risk of contagion by aerosolization during laparoscopic procedures, so the recommendation is to perform this type of surgery with face masks with high percentage of particle filtration (i.e., N95) and filters to evacuate the pneumoperitoneum.

Filtration can be an effective means of protection against virus release during minimally invasive surgery (MIS) and endoscopy. N95 masks are designed to filter 95% of particles 0.3 microns or larger. Air-purifying respirators (APRs), which are not widely available at this time, can be beneficial for intubation, extubation, bronchoscopy, endoscopy, and possibly tracheostomy. Filters are used to remove smoke and particulates, including viruses. High efficiency (HEPA) air filters have a minimum efficiency rating of 99.97% to remove particles greater than or equal to 0.3 microns in diameter. Ultra-low particulate air (ULPA) filters can remove a minimum of 99.999% of airborne particles, with a minimum particle penetration size of 0.05 microns. ULPA filters can remove 0.1-micron particles. Filtration in positive pressure operating rooms can be accomplished with HEPA filters that are placed in the ceiling and ductwork and provide adequate filtration.

Preventive measures in the production of aerosols

Consider the increased aerosol production in the operating room during intubation and extubation, upper gastrointestinal endoscopy, upper airway surgery such as oropharyngeal, intestinal, and pulmonary surgery.

- Lower the pneumoperitoneum to the minimum.
- Seal the port valves to avoid air leaks.
- Use electrocautery and ultrasonic scalpel as little as possible or not at all.

Measures to avoid transmission or contamination with aerosols

- Ultrafiltration of air with filters designed for surgical smoke, especially in pneumoperitoneum.
- CO₂ inlet filter to avoid contamination of the insufflator when the intra-abdominal pressure is higher than that of the insufflator. There should be filters at the exit of the pneumoperitoneum to avoid contamination of the room.

The pneumoperitoneum should be removed through the filter, in a closed system and completely before removing the trocars.

- Improvised filters and measures may not be reliable.
- Masks N95 or larger.
- Eye protection.

If this type of protective equipment is available, the recommendation is to perform laparoscopic procedures using low pressure (recommended 8-10 mmHg). Restrict the use of electrocautery or ultrasonic scalpel since these instruments also generate aerosols.

It is recommended not to use drains, especially if the patient is COVID positive.

The surgical approach should be the most beneficial for the patient, regardless of the COVID-19 infection status. In any case, measures to protect the airway and mucous membranes (masks and appropriate goggles) should always be taken. Likewise, although

there is no evidence in this regard, if available, it would be advisable to use smoke filters in the cannulas of the laparoscopy ports.

Practical measures for laparoscopy

The incisions for the ports should be as small as possible to allow passage of the ports, and without allowing leakage around them. CO₂ insufflation pressure should be kept to a minimum and ultrafiltration (smoke evacuation or filtration system) should be used, if available.

The pneumoperitoneum should be safely evacuated through an air filtration system prior to closure, trocar removal, specimen removal, or for conversion to open surgery.

RECOMMENDATIONS FOR MINIMALLY INVASIVE SURGERY: BEST PRACTICE

- Incisions shall be as small as possible.
- Low pneumoperitoneum pressure.
- Seal port valves.
- Filter the air coming out of the insufflator.
- Filter pneumoperitoneum air prior to closure, trocar removal, or conversion.
- Air suction/evacuation device: ultrafiltration.
- Electrocautery and ultrasonic scalpel as little as possible.
- Drains are not recommended in patients with COVID-19.

PRACTICAL TIPS FOR LAPAROSCOPY SURGERY

- Use filter in insufflator (CO₂ inlet).
- Use of filter between aspirator bottle and wall aspirator.
- Five- or 10-mm port to be used as window for mist extraction, connected to tubing with filter.
- Close trocar valve before introduction into the abdominal cavity.
- Close trocar valve before connecting or disconnecting CO₂ tubing.
- Close trocar valve when turning on or off CO₂ insufflation.
- Turn on insufflator, then open trocar valves.
- Remove CO₂ and abdominal gas before removing ports, removing parts, and making

incisions. The aspirator shall be activated on any of the 5 mm trocars (CO₂ output).

In COVID positive patients: all the above plus the following:

- Use protective measures covering all exposed skin: neck, ears.
 - Dress and, above all,
 - Remove PPE under supervision, who dictates each action to be performed.
- 8. Consent:** the discussion of consent with the patients should be made precisely informing them of the risk of exposure to COVID-19 and the possible consequences. All procedures must have informed consent, specifying the risk of in-hospital SARS-CoV-2 infection and its consequences, which have a high mortality rate during the postoperative period, all in accordance with NOM 004/SSA3/2012.
- 9. Regarding transplants,** CENATRA recommends suspending all donation and transplantation procedures. A suspected or confirmed COVID-19 case cannot be a donor or recipient.
- 10. Differentiate between COVID-19 infection and sepsis of abdominal origin:** up to 10% of patients may be preceded by digestive symptoms such as diarrhea, nausea and, in a few cases, abdominal pain. Abdominal pain may be clinically confused with pancreatitis or abdominal sepsis. Unlike bacterial sepsis, COVID-19 infection does not cause an increased white blood cell count, nor a classic neutrophilia, and is associated with lymphopenia in approximately 80% of patients and mild thrombocytopenia in the worst prognostic cases. A nonspecific elevation of D-dimer is also frequent. Procalcitonin is elevated in only 5% of cases of COVID-19 infection. However, C-reactive protein (CRP), as in the case of sepsis, can be elevated with a direct relationship with the prognosis and severity of the disease (*Table 1*). Anorexia was the most frequent digestive symptom in adults, while diarrhea and vomiting were the most common in adults

Table 1: Gastrointestinal manifestations in COVID-19.

Symptoms	Percent
Gastrointestinal	18
Diarrhea	12
Nausea and vomiting	10
Abdominal pain	9

and especially in children. **Abdominal pain** is more frequent in severe patients.

Gastrointestinal symptoms appear to be frequent and may occur even without respiratory data. **Diarrhea and vomiting** may be the cause of consultation and not be quickly suspected as part of COVID-19. Abdominal pain seems to be related to decreased systemic oxygenation, and can produce intestinal ischemia, gastrointestinal tract bleeding and pain, ileus, and pancreatitis, among other abdominal alterations.

REFERENCES

1. COVID-19: Guidance for triage of non-emergent surgical procedures. Available in: <https://www.facs.org/about-acs/covid-19/information-for-surgeons/triage>.
2. SAGES Recommendations regarding surgical response to COVID-19 crisis. Available in: <https://www.sages.org/recommendations-surgical-response-covid-19/>.
3. COVID-19-Elective surgical procedure guidance. Available in: <http://www.dph.illinois.gov/topics-services/diseases-and-conditions/diseases-a-z-list/coronavirus/health-care-providers/elective-procedures-guidance>.
4. Information for Healthcare Professionals. Available in: <https://www.cdc.gov/coronavirus/2019-nCoV/hcp/index.html>.
5. Strategies for Optimizing the Supply of PPE. Available in: <https://www.cdc.gov/coronavirus/2019-ncov/hcp/ppe-strategy/index.html>.
6. Hua ZM, Boni L, Fingerhut A. Minimally invasive surgery and the novel coronavirus outbreak: lessons learned in China and Italy. *Ann Surg.* 2020; 272: e5-e6.
7. Alp E, Bijl D, Bleichrodt RP, Hansson B, Voss A. Surgical smoke and infection control. *J Hosp Infect.* 2006; 62: 1-5.
8. COVID 19: Considerations for optimum surgeon protection before, during, and after operation. American College of Surgeons 2020. Available

in: https://www.facs.org/-/media/files/covid19/considerations_optimum_surgeon_protection.ashx.

SUGGESTED READING

- Audio interview: what clinicians need to know in diagnosing and treating Covid-19. Available in: <https://www.nejm.org/doi/10.1056/NEJMe2004244>.
- Covid-19: GP surgeries close for two weeks after staff test positive. Available in: En: <https://www.bmj.com/content/368/bmj.m936>.
- Alert: We have 15 critical days to slow the spread of coronavirus. See the latest guidelines from the president and the CDC. Available in: <https://www.coronavirus.gov/>.
- Recomendaciones generales de actuación y organización básica a servicios de cirugía en zonas con alta afectación por la pandemia por COVID-19 (SARS-CoV-2). Disponible en: <https://sites.google.com/view/covid19-porespecialidades/cirug%C3%ADa?authuser=0>.
- Kwak HD, Kim SH, Seo YS, Song KJ. Detecting hepatitis B virus in surgical smoke emitted during laparoscopic surgery. *Occup Environ Med.* 2016; 73: 857-863.
- Rubin EJ, Baden LR, Morrissey S. Audio interview: what clinicians need to know in diagnosing and treating COVID-19. *N Engl J Med.* 2020; 382: e19.
- Gloster HM Jr, Roenigk RK. Risk of acquiring human papilloma-virus from the plume produced by the carbon dioxide laser in the treatment of warts. *J Am Acad Dermatol.* 1995; 32: 436-441.
- Resources for smoke and gas evacuation during open, laparoscopic, and endoscopic procedures. [Mar 29, 2020 by SAGES Webmaster] Available in: <https://www.sages.org/resources-smoke-gas-evacuation-during-open-laparoscopic-endoscopic-procedures/>.
- Aminian A, Safari Saeed, Razeghian A. COVID-19 outbreak and surgical practice: unexpected fatality in perioperative period. *Ann Surg.* 2020; 272: e27-e29. Available in: <https://journals.lww.com/annalsurgery/Documents/COVID19%20Outbreak%20and%20Surgical%20Practice%20-%20Unexpected%20Fatality%20in%20Perioperative%20Period.pdf>.
- NOM004/SSA3/2012 Expediente Clínico. Available in: <https://www.cndh.org.mx/sites/default/files/doc/Programas/VIH/Leyes%20y%20normas%20y%20reglamentos/Norma%20Oficial%20Mexicana/NOM-004-SSA3-2012.pdf>.
- Updated Intercollegiate General Surgery Guidance on COVID-19. Royal College of Surgeons 2020. <https://www.rcseng.ac.uk/coronavirus/joint-guidance-for-surgeons-v2/>.
- Steege AL. Secondhand smoke in the operating room? Precautionary practices lacking for surgical smoke. *Am J Ind Med.* 2016; 59: 1020-1031. Available in: <http://dx.doi.org/10.1002/ajim.22614>.
- Cheung KS, Hung IF, Chan PP, Lung KC, Tso E, Liu R, et al. Gastrointestinal manifestations of SARS-CoV-2 infection and virus load in fecal samples from the Hong Kong cohort and systematic review

and meta-analysis. *Gastroenterology*. 2020; 159: 81-95. Available in: <https://doi.org/10.1053/j.gastro.2020.03.065>.

- Tian Y, Rong L, Nian W, He Y. Review article: gastrointestinal features in COVID-19 and the possibility of faecal transmission. *Aliment Pharmacol*

Ther. 2020; 51: 843-851. Available in: <https://doi.org/10.1111/apt.15731>.

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ANNEX 1: ELEMENTS OF PERSONAL PROTECTIVE EQUIPMENT (PPE).

PPE will be required in any procedure considered as “close contact”, which includes surgical intervention, as well as other operating room procedures (intubation, regional anesthesia, IV cannulation, etc.).

REQUIRED EQUIPMENT:

1. Impermeable gown.
2. Mask: conventional surgical masks do not offer protection if aerosols are present. N95 or FFP2/FFP3 type masks are necessary (filtering 96 and 99%, respectively).
3. Glasses: if aerosols are produced in the procedure (we assume that this may be the case, depending on the type of surgery), full-screen eye coverage is essential.
4. Face shield: does not protect from aerosols but is necessary when there is a risk of splashes (blood, vomit, or other biological liquids).
5. Long nitrile gloves.
6. It is advisable for all personnel with long hair to tie it up completely in a low bun and secure it properly. It is also recommended to shave the beard to favor the proper fixation and functioning of the masks.
7. Once the PPE equipment has been put on, the sterile equipment necessary for the surgical intervention will be placed on it: the surgical wash with alcoholic gel will be performed on the basic gloves and the usual sterile gown and gloves will be put on.

STEP-BY-STEP INSTRUCTIONS FOR EPP (DONNING) PLACEMENT

It is essential that the entire surgical team has undergone prior training in PPE donning and doffing before performing an actual procedure. The collaboration of all members of the surgical team with each other is very important.

STEPS:

1. Remove ALL personal items from pajama pockets, as well as any accessories (watch, earrings, jewelry, etc.) before donning PPE.
2. Wash hands with hydroalcoholic solution.
3. Unfold the waterproof gown and put on the sleeves.
4. Then, the mask is put on. For proper fixation, the ideal is to hold it by the convexity, apply it to the chin and pass the straps behind the head, it is recommended to cross them for a better grip. Subsequently, the metal piece is adapted on the bridge of the nose.
5. Putting on goggles or protective screen. The straps of the goggles should be adjusted approximately to the size of the head before putting them on to avoid later manipulation. First, goggles are placed on the face, then the straps are pulled over the back of the head.
6. Put on a pair of nitrile gloves (appropriate size) on the outside of the suit, covering the sleeves of the suit at the cuffs.
7. Put on a surgical cap (if it has not previously done put on another one).
8. Mask: it is enough with the one that has already been placed if the level of protection is adequate.
9. Washing (surgical) with alcohol gel on the gloves.
10. Put on the usual surgical gown.
11. Put on usual sterile gloves.

STEP-BY-STEP INSTRUCTIONS FOR EPP REMOVAL (DOFFING)

It is essential to remove the equipment calmly, slowly, avoiding abrupt movements and under the supervision of a trained colleague. Ideally, the personnel who have been in the operating

room should remove the PPE one at a time. This should be done as far away as possible from the patient and close to the door.

1. Remove surgical gown and gloves as usual, avoid touching it, fold it with the outside (where blood contamination, splashes, etc.) facing inward, and the gloves turned back on themselves. Discard in the container.
2. Wash the base gloves with disinfectant.
3. Remove the protective screen, holding it from behind, bending the head down.
4. Wash with hydroalcoholic solution.
5. Removal of the base gloves. Remove the first one by the external part with one finger, and the second one by the internal part (putting the "clean" finger between the glove and the suit). Discard in the bucket being careful not to touch them, that they do not touch anything or fall out.
6. Wash hands with hydroalcoholic solution.
7. Removal of the protective gown. First, loosen the side knot, then, without touching the skin on the neck, pull the gown from the top to undo the Velcro. When removing the gown, it is essential not to touch more than the inner side of it and fold it over itself so that the outer part is wrapped and covered. It should be lifted carefully to prevent the ribbons from touching anything and placed in the container.
8. Wash hands with hydroalcoholic solution.
9. Removal of the goggles: bend the head forward, closing the eyes and mouth. Grasp the straps at the back and remove them carefully.
10. Wash hands with hydroalcoholic solution.
11. Removal of the mask: again, bending the head down and closing the eyes and mouth, grasp the head straps from behind, and remove it forward and downward. DO NOT touch the front of the mask, as it may be contaminated.
12. Wash hands with hydroalcoholic solution.
13. Exit from the operating room.
14. Disinfection of footwear, either by introduction in a disinfectant (stepping on filters) solution or carefully removal and disinfection by immersion.
15. Complete hand washing up to the elbows.
16. Showering is recommended after completion of the process.