Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.
Special article

Emergency surgery and trauma care during COVID-19 pandemic. Recommendations of the Spanish Association of Surgeons

José Manuel Aranda-Narváez, a,∗ Luis Tallón-Aguilar, b Felipe Pareja-Ciuró, b Gonzalo Martín-Martín, c Antonio Jesús González-Sánchez, d Ignacio Rey-Simó, d Gonzalo Tamayo-Medel, e Carlos Yáñez-Benítez, f David Costa-Navarro, g Soledad Montón-Condón, h Salvador Navarro-Soto, i Fernando Turégano-Fuentes, j María Dolores Pérez-Díaz, j José Ceballos-Esparragón, k José María Jover-Navalón, l José María Balibrea, m Salvador Morales-Conde b

a Servicio de Cirugía, Hospital Regional Universitario, Málaga, Spain
b Servicio de Cirugía, Hospital Universitario Virgen del Rocío, Sevilla, Spain
c Servicio de Cirugía Quirúrgica, Barcelona-Hospital CIMA, Barcelona, Spain
d Servicio de Cirugía, Complejo Hospitalario Universitario, A Coruña, Spain
e Servicio de Anestesiología, Hospital de Cruces, Bilbao, Spain
f Servicio de Cirugía, Hospital Royo Villanova, Zaragoza, Spain
g Servicio de Cirugía, Hospital Vithas, Alicante, Spain
h Servicio de Cirugía, Hospital García Orcoyen, Estella, Navarra, Spain
i Servicio de Cirugía, Hospital Parc Taulí, Sabadell, Barcelona, Spain
j Servicio de Cirugía, Hospital General Universitario Gregorio Marañón, Madrid, Spain
k Servicio de Cirugía, Hospital Vithas Santa Catalina, Las Palmas de Gran Canaria, Spain
l Servicio de Cirugía, Hospital Universitario de Getafe, Getafe, Madrid, Spain
m Servicio de Cirugía, Hospital Clínic, Barcelona, Spain

ARTICLE INFO

Article history:
Received 22 April 2020
Accepted 24 April 2020
Available online 24 September 2020

Keywords:
COVID-19
SARS-CoV-2

ABSTRACT

New coronavirus SARS-CoV-2 infection (coronavirus disease 2019 [COVID-19]) has determined the necessity of reorganization in many centers all over the world. Spain, as an epicenter of the disease, has been forced to assume health policy changes in all the territory. However, and from the beginning of the pandemic, every center attending surgical urgencies had to guarantee the continuous coverage adopting correct measures to maintain the excellence of quality of care. This document resumes general guidelines for emergency surgery and trauma care, obtained from the available bibliography and evaluated by a subgroup of professionals designated from the general group of investigators Cirugía-AEC.

∗ Please cite this article as: Aranda-Narváez JM, Tallón-Aguilar L, Pareja-Ciuró F, Martín-Martín G, González-Sánchez AJ, Rey-Simó I, et al. Atención de la urgencia quirúrgica durante la pandemia COVID-19. Recomendaciones de la Asociación Española de Cirujanos. Cir Esp. 2020;98:433–441.

∗ Corresponding author.
E-mail address: Josearanda68@telefonica.net (J.M. Aranda-Narváez).

2173-5077/ © 2020 AEC. Published by Elsevier España, S.L.U. All rights reserved.
COVID-19 from the Spanish Association of Surgeons, directed to minimize professional exposure, to contemplate pandemic implications over different urgent perioperative scenarios and to adjust decision making to the occupational pressure caused by COVID-19 patients.

© 2020 AEC. Published by Elsevier España, S.L.U. All rights reserved.

Atención de la urgencia quirúrgica durante la pandemia COVID-19. Recomendaciones de la Asociación Española de Cirujanos

Palabras clave:
COVID-19
SARS-CoV-2
Cirugía
Urgencias
Politraumatizado

Introduction

The coronavirus disease 2019 (COVID-19) caused by SARS-CoV-2 has had a colossal impact on health systems around the world. Four months after the start of the pandemic, the total number of confirmed cases in the world is close to 2 500 000 and exceeds the figure of 170 000 deaths directly attributed to the disease. In Spain, the number of infected individuals exceeds 200 000, with a mortality rate higher than 10% and a heterogeneous impact on different regions.1 It is possible that these data have been underestimated, to a greater or lesser degree, as a direct result of the different policies adopted in different territories in terms of population screening or mortality data based solely on reliable verification of the virus. Regardless, these data reflect a health crisis with global implications.

Given the spread of this pathology, several hospitals have had to reorganize their spaces, systems and even their staff to provide an adequate response, and longer or shorter decision-making times have been determined by the speed of disease progression in the local community. However, even from the beginning of the pandemic, emergency surgeries, with their volume and treatment impact, had to be continued and were prioritized at all hospitals, regardless of the alert scenario.

In order to establish guidelines that would allow surgeons to base actions on guidelines developed and supported by a central organization, the Spanish Association of Surgeons (AEC) created the Surgery-AEC-COVID-19 Group, whose function covers different aspects of the pandemic that influence the activity of surgeons. After an exhaustive bibliographic review, the Group issued consensus recommendations, which were not able to surpass the level of evidence of expert opinion. Due to the importance of maintaining appropriate management policies for urgent surgical pathologies using the same working methodology, a parallel group of professionals has developed the specific document below, which is summarized on the Association’s website.7,8

General thoughts

Coronaviruses are viruses with an RNA genome capable of synthesizing about twenty proteins, including one that projects like a crown around its surface, giving them their name. Since the last century, these viruses have been known to cause mild respiratory infections. However, in 2002 in China (SARS-CoV coronavirus) and in 2012 in Saudi Arabia (MERS-CoV coronavirus), we witnessed two serious epidemics that caused approximately two thousand deaths.9 Although SARS-CoV-2 is of animal origin, no coronavirus identical to the one that is causing the global epidemic of 2020 has been identified in any species. Certain bats have similar viruses, but there is no solid evidence about the origin of the COVID-19 disease in
humans. Transmission appears to be by person-to-person aerosols, where it can remain for hours, and it has also demonstrated stability for days when deposited on surfaces. The virus is sensitive to ultraviolet rays and heat, becoming inactivated at 56 °C for 30 min. It also appears to be inactivated with lipid solvents, ethanol, and chlorine disinfectants. Fecal-oral, urine and blood transmission also seem possible, although there is less evidence in this regard.5

The mean incubation period is 5 days.1 In 80% of cases, symptoms are mild-moderate and include fever, dry cough and fatigue. Less frequently, it is associated with congestion, anosmia, myalgia, headache and diarrhea. In severe cases, dyspnea and/or hypoxemia appear one week after infection, and can rapidly progress to acute respiratory failure, septic shock, metabolic acidosis, coagulopathy, and multiple organ failure in 50%.7,8 The mortality rate reported in Spain is 10%, although this is probably an underestimated figure. In the initial stages, laboratory findings show a normal or decreased leukocyte count with lymphopenia, thrombocytopenia, increased liver enzymes, lactate dehydrogenase, creatine kinase, myoglobin, C-reactive protein (maintaining normal procalcitonin), and erythrocyte sedimentation rate. In more advanced stages, elevated D-dimer, troponin and ferritin have been observed as well as laboratory data compatible with renal failure and acute-phase inflammatory markers.9

In this pandemic situation with a very high number of infected patients, symptomatic or asymptomatic, urgent surgical pathologies continue to exist and are the only surgeries that cannot be delayed or cancelled when there is no other medical alternative. Thus, our main objective must be aimed at preserving life-saving medical activities, protecting healthcare workers and, consequently, protecting the general population.

According to a Chinese study carried out in 72,000 patients, digestive involvement due to SARS-CoV-2 caused gastrointestinal symptoms in 10% of cases. Symptoms included diarrhea (2%-10%) and vomiting (1%-10%) one or two days before the onset of fever and respiratory symptoms.10 Another article from the same source reported that 3% of infected patients presented digestive symptoms without associated respiratory symptoms.11 These data lead us to estimate that the digestive involvement is higher than reported, as there are probably many patients with exclusively digestive symptoms who are not tested, so gastrointestinal symptoms could be close to 20%-25% globally. Clinically differentiating this viral involvement from signs of an abdominal surgical emergency is not always easy. It is therefore necessary to be very systematic when taking the clinical history, in which an epidemiological anamnesis should be included, and to use the previously mentioned analytical considerations and the radiological diagnosis.

Organizational factors for urgent surgery in the COVID era: Safety of healthcare workers

Urgent care must be guaranteed by adapting general recommendations to the specific framework of each medical center in accordance with the alert scenarios communicated by the AEC.2,3 It is recommended to have an exclusive operating room for COVID-19 patients who have either confirmed or highly suspected infection that cannot be confirmed due to pathologies requiring immediate treatment. It is necessary to create a specific patient transfer route that must be as direct and short as possible, adopting specific prevention and safety measures: use of specific elevators and areas, cleared corridors, areas, placing cloths with bleach along passageways, and adequate disinfection afterwards.

The staff who are in the operating room should be minimized and limited to as few as possible, depending on the complexity of the procedure. Surgeons will only access the operating room at the precise moment to begin the surgery, avoiding being present for other activities in which they do not take part and could be potentially contagious, such as the intubation process. Procedures should be performed by the most trained and skilled staff available in order to minimize the surgical time and any potential complications.

During the procedure, precautionary measures should be taken with the utmost care, following the recommendations below:12,13

- Keep doors closed at all times.
- Designate a single entry and exit area for surgical staff.
- Entry areas should be designated with signs prohibiting the entry of others.
- Use class III waste containers.
- Remove all non-essential material from the operating room, using protectors for the surfaces to be used.
- Avoid entering with personal objects: mobile phones, IDs, etc.
- Cloths impregnated with bleach should be placed in the access areas.
- Adequate and specific cleaning should follow a specific protocol.
- Surgical protocol should follow the general recommendations previously issued by the Association.2,3

All hospitals must guarantee the availability of personal protective equipment (PPE), including all elements. In the current context of a pandemic with an unacceptable percentage of infected medical professionals (currently close to 30,000 healthcare workers), personnel protection protocols must be strictly complied with. In urgent care, there is no standard time interval in which the existence of a viral coinfection is determined, so these protection measures must be extended with permissiveness. However, given the importance of maintaining equipment availability, rational use of protective equipment is necessary. PPE must be worn in all diagnostic, therapeutic or exploratory procedures that are considered ‘close contact’, but one type of protection or another is used depending on whether the procedure produces aerosolization and the positive, negative or undetermined COVID-19 infection.

In the case of a procedure that does not produce aerosolization, such as a simple physical examination or a patient interview, it should be sufficient to maintain a minimum distance for safety and some basic measures based on the patient’s COVID-19 status.

For procedures that produce aerosolization (otracheal intubation, surgical intervention, etc.), the measures should
be stepped up, regardless of the patient’s status, given the high numbers of asymptomatic and false negatives reported by the available tests.

Table 1 shows the minimum measures that must be taken in each case.\cite{14}

It is essential for all staff to have undergone training on the donning and doffing of PPE, have a checklist of the steps to take, and be supervised to avoid mistakes. The donning/doffing steps are listed in the general recommendations document of the AEC.\cite{2,3}

### Preoperative determination of viral coinfection

In the current context, it is recommended to determine the COVID-19 status of all patients with surgical urgency, regardless of whether they present symptoms of viral coinfection. The following tools are available:

- Real-time polymerase chain reaction (RT-PCR)
- Serological tests
- Radiology tests (chest radiograph/thoracic computed tomography [CT]/Point-Of-Care UltraSound [POCUS]).

Sampling nasal and pharyngeal secretions to determine viral RNA using the RT-PCR technique is the standard diagnostic test, but its ability to detect positives can be as low as 57%, even in patients with fever.\cite{15} Although the procedure requires an approximate time of 4 h, in actual clinical practice it requires a time of no less than 6 h between taking the sample and obtaining the results.

Serological tests, based on the determination in serum of SARS-CoV-2 Ag or secretory immunoglobulins (Ig) A (more theoretical than practical), M and G, are complemented with the information provided by the RT-PCR. Rapid tests are based on immunochromatography and have a sensitivity greater than 75% after the 7th day of disease progression, with a positive predictive value above 95%. ELISA techniques have a sensitivity close to 100% when IgM and IgG detection are combined after 35 days of evolution of the process, but this sensitivity is lower closer to the onset of infection and depends on the protein used for antibody determination.\cite{16} Both techniques can be performed quickly in healthcare facilities, they do not require complex material and no difficulty is involved with handling the samples.\cite{17}

Figs. 1 and 2 summarize the evolutionary profile of the infection and immune response for the correct interpretation of the different tests.

The appearance of ground glass infiltrates on chest radiology studies (simple chest X-ray or chest CT — whichever offers better diagnostic capacity) in the epidemiological context of high incidence and high clinical suspicion of SARS-CoV-2 infection can virtually diagnose the disease, even with negative RT-PCR.\cite{18} In cases with mild disease, up to 18% of patients may not have alterations on chest X-ray or thoracic CT at the onset of symptoms,\cite{19} but they are present in practically 100% of cases from day 6 on.\cite{20}

Based on the well-known capacity of ultrasound to detect interstitial lung disease, subpleural consolidations and acute respiratory distress syndrome (ARDS) of any etiology, POCUS has proven very useful both in the early diagnosis of paucisymptomatic patients and in the follow-up of COVID-19. It is a “bedside” tool, repeatable as many times as necessary. Protection measures must always be observed so the equipment does not become fomites for disease transmission. Fourteen areas (3 posterior, 2 lateral and 2 anterior, in each lung) are scanned through the intercostal spaces to cover as much area as possible. The objective is to observe the morphology (integrity) of the pleural line, both with the linear and convex probes. The implementation of an ultrasound score to standardize the findings is currently being studied.\cite{21}

By unifying all these statements, some general considerations arise on how to proceed in the diagnosis of COVID-19 status in patients requiring urgent surgery. For patients whose treatment cannot be delayed, it is virtually impossible to use the RT-PCR test for SARS-CoV-2 virus. In these patients, we must base our actions on the clinical history, if possible, of both patients and their relations (recent acute respiratory history in the patient or family/cohabitants), analytical parameters (lymphopenia, since the elevation of C-reactive protein will be of little value due to the usual elevation in the

| Procedure | No aerosolization | Aerosolization |
|-----------|-------------------|----------------|
| COVID – or low suspicion | Surgical mask Gloves | Conventional surgical gown Mask (N95/FFP2/FFP3)* Goggles (optional) Gloves Scrub hat Shoe coverings |
| COVID + or high suspicion | Gown Mask (N95/FFP2/FFP3) Goggles or face shield (optional) Non-sterile gloves Scrub hat | Waterproof ± surgical gown Mask (N95/FFP2/FFP3)* Goggles Face shield or hood (recommended) Gloves Scrub hat Waterproof shoes/bootees/boots |

* If the mask has a valve, a conventional surgical mask should be placed over it.
context of acute abdominal pathology) and radiology, either a simple chest radiograph or thoracic CT scan and abdominal CT scan if the patient’s condition allows, which could show in both cases the characteristic pattern of predominantly subpleural ground glass infiltrates. If the hospital allows, it is advisable to establish a specific radiological circuit for confirmed patients or those with high suspicion of COVID positivity.22 If available, rapid kits that detect antibodies by immunochromatography are useful. However, given the characteristics of the tests, negativity does not exclude diagnosis.

When surgery can be delayed, it is possible to perform RT-PCR to detect viral load, which should be complemented with chest radiology, preferably thoracic CT scan. In usual clinical practice, these patients will have undergone CT of the abdomen as part of the diagnosis; it is indicated to extend this examination to the thorax and even consider the need for CT scans in processes diagnosed exclusively by ultrasound. When available, SARS-CoV-2 serological techniques can be used. In these patients, it would be preferable to perform ELISA over rapid tests due to the better sensitivity of the former and since the time factor is not as important.

For patients who are admitted for conservative management of any urgent pathology, while the pandemic situation remains active, it is recommended to also proceed with ruling out infection by the novel coronavirus.

### Implications in the standard indications for urgent surgery

In general terms, surgical indications themselves should not change during the pandemic, so an attempt will be made to offer the patient the most appropriate treatment at all times.3 But, as under normal conditions, the surgical indication is influenced by factors dependent on the patient’s general condition, inherent risk of the procedure or pre-existing diseases. During the COVID-19 pandemic, a series of cofactors are added that, beyond changing the indication, lead us to consider alternative options in a very anomalous context. Hence, three circumstances can influence the final therapeutic decision: the possibility of infection of the patient and/or healthcare workers, the existence of SARS-CoV-2 infection, and the impact on the hospital structure, especially regarding the availability of intensive care beds.22

Likewise, the weight of each of these factors is in turn determined by the so-called ‘phases’ or ‘scenarios’ during the pandemic, which the dynamic scale proposed by the AEC...
refers to. Logically, the number of COVID-19 hospitalizations and the impact on hospital resources are fundamental concerns. Urgent surgical activity is maintained in all scenarios until phases IV (high alert) and V (emergency; more than 75% of conventional and ICU beds occupied by COVID-19 patients). In phase V, however, surgery is contemplated in patients who would not survive if surgery is delayed for a few hours, requiring preoperative triage in collaboration with local ethics committees. Thus, in phases I-III, urgent surgical indications could remain unchanged. However, in phases IV and V, conservative treatments could be considered in some patients in whom the benefit of considering a less resolute option clearly outweighs the risk of infection, transmission, worsening of pre-existing COVID-19 disease or the unjustified consumption of resources. The fundamental question is to weigh the impact of the intervention itself on the patient’s condition due to COVID-19 versus the clinical result of not treating an urgent process. Poor postoperative results have been reported in patients scheduled for surgery, although the extrapolation to urgent patients is complex. In contrast, short series have described acceptable results in complicated emergent cases in which the surgical indication was maintained. The aggressiveness of surgery itself could be a trigger for a disproportionate immediate inflammatory response, which could be deleterious in infected patients. Nonetheless, this nonspecific response is already present in urgent patients, and intervention is (especially in infectious conditions) the best way to begin to mitigate it. On the other hand, in phase IV, only the surgical resolution of vital emergencies is contemplated. The justification for proposing conservative treatments is based on the results of studies indicating that these options offer an acceptable margin of safety, but in no case have they been shown to be more effective. Likewise, the vast majority of conditions in which these alternatives could be considered all require a confirmed diagnosis, almost always by abdominopelvic CT scan, which, in the current context must inexorably be extended to the thorax in order to rule out a SARS-CoV-2 concomitant infection.

Thus, conservative treatment of uncomplicated appendicitis could be considered with at least 3–5 days of intravenous antibiotic treatment, and assuming a recurrence rate in the first year close to 30%. Likewise, acute uncomplicated cholecystitis could be treated conservatively, again assuming readmission rates, therapeutic failure and more complex surgeries, which are not negligible. Finally, the spectrum of conservative management could be broadened to an out-of-hospital regime (in combination with eventual percutaneous drainage, if necessary) in more advanced stages of acute diverticulitis, always with a local inflammatory focus, although there is no solid scientific evidence to support this statement. Expanded indications for percutaneous cholecystostomies could be justified in COVID-19 patients during the pandemic due to the potential of worsening the respiratory condition as well as the possibility of receiving antiplatelet treatment due to the high incidence of pulmonary thromboembolism in these patients.

One of the most complex aspects in the current situation is decision-making in extreme scenarios. There are many factors involved when deciding whether a patient is operated on, especially when the prognosis is uncertain or unequivocally poor. These include the severity of the urgent/emergency process, COVID-19 infection, and the possible absence of resources depending on the hospital bed occupancy predictions that guarantee appropriate postoperative care, especially in critical care units. The evaluation of each patient must be extremely thorough and carried out jointly by a multidisciplinary team that includes anesthesiologists as well as an intensive care unit (ICU) coordinator. Furthermore, ethical considerations are key in these cases. While in some hospitals there are documents to explicitly establish ‘ceiling of treatment’ protocols, this recommended measure is not widely available. Thus, it seems reasonable to involve the local ethics committee for decisions when logistics allow for their participation. Also, medical professionals should be authorized to make those decisions that, due to their necessary immediacy, do not allow for consultations. It is especially important to establish adequate communication channels, which currently can be extremely complex. In many cases, direct communication with the patient is carried out using protective measures that can depersonalize the doctor-patient interaction, while communication with family members is very likely to be by telephone.

**Choice of approach, technique and postoperative results**

The technique and approach chosen for surgery must be agreed upon by the team, taking in account the pathology, available resources, comorbidities, and suspicion or confirmation of COVID-19 infection. During surgery, the use of electrocautery and tissue dissection with ultrasonic energy sources can generate aerosol particles measuring 0.1μm and 0.35–6.5μm, respectively. Thus, it is essential to use PFE with FFP2/FFP3 masks during all procedures and to use watertight smoke aspiration systems. One recommendation is to use low-intensity energy sources to minimize the generation of vapors during tissue dissection and cautery.

Especially at the beginning of the pandemic, certain publications issued a cautionary message regarding the use of laparoscopic procedures, arguing there was a greater potential for aerosolization. As progress has been made, other considerations have confirmed that laparoscopy, with strict safety protocol compliance, continues to provide the inherent advantages of the approach without constituting an added danger for surgeons. Minimally invasive approaches involve the interposition of a physical barrier between the surgeon and the possible source of infection, thereby avoiding occupational exposure and cross infection. Other advantages of the minimally invasive approach are that it minimizes accidents with sharp instruments to members of the surgical team, minimizes the respiratory impact in the postoperative period, and requires shorter hospital stays. In laparoscopic procedures, low insufflation pressures (8–11mmHg) are recommended using constant pressure insufflation systems instead of dual devices. To evacuate the pneumoperitoneum, it is necessary to have a closed system (commercial or DIY) before making an incision to assist the extraction of the piece or to finalize the intervention. The capacity of the High-
COVID-19 patient admissions have been experiencing for
weeks now may force them to reconsider the treatment of
trauma patients with minimal chances of survival under
normal conditions, even with optimal perioperative care
(inevitable mortality criteria according to the American
College of Surgeons classification, especially in geriatric
patients with a probability of death >90%–95%). Polytrauma
patients should be received in a specific module designed
for this purpose. Due to the epidemiological context, and
especially in hospitals in the most affected autonomous
communities, all multiple trauma patients should be consi-
dered potentially infected, and therefore individual protection
measures are required, such as waterproof gowns, goggles,
high-protection masks, waterproof boots and gloves, which will be
used throughout the patient’s care: transfer to CT, interven-
tional radiology, operating room or ICU. In the current
situation, the staff who are part of the trauma team providing
initial care must be minimized, and maximum caution must
be maintained in the management of the airway and in the
placement of chest tubes due to the potential for generating
aerosols, especially in the presence of hemodynamic instabili-
ty that precludes COVID-19 screening. When it is necessary
to place chest drains or perform thoracotomies for either
pneumothorax or hemothorax, all protective measures should
be taken. For other trauma pathologies, the necessary
technique will be applied, depending on the findings. When
an operating room is required for multiple trauma patients
with uncertain COVID-19 status, the one reserved for this
circumstance should be used.

Some publications recommend postponing evaluation
procedures for trauma patients, such as exploratory laparos-
copy of the diaphragm in wounds with a thoracoabdominal
tract, which should be planned after the respiratory infection
has been resolved in patients with COVID-19. Within the
polytrauma patient context, it also seems reasonable to delay
procedures, such as internal fixation of pelvic or other
fractures after placement of external fixation, in patients
with confirmed infection and radiological evidence of pulmo-

Funding

None.

Conflict of interests

The authors have no conflict of interests to declare related
with this article.

Members of the Surgery-AEC-COVID-19
Collaborative Group

Salvador Morales Conde (coordinator), Estibaliz Álvarez Peña,
Mario Álvarez Gallego, José Manuel Aranda Narváez, Josep
María Badía Pérez, José María Balibrea del Castillo, Sandra
García Botella, Xavier Guirao Garriga, Eloy Espín Basany, Esteban Martín Antona, Elena Martín Pérez, Sagarro Martinez Cortijo, Isabel Fascul Migueláñez, María Dolores Pérez Díaz, José Luis Ramos Rodríguez, Inés Rubio Pérez, Raquel Sánchez Santos

REFERENCES

1. Gobierno de España. Enfermedad por nuevo coronavirus covid-19. Situación actual. https://www.mscbs.gob.es/profesionales/saludPublica/ccayes/alertasActual/nCoV-China/situacionActual.htm [accessed 17 Apr 2020].

2. Baibrea JM, Badía JM, Rubio I, Martín E, Álvarez E, García S, et al. Manejo quirúrgico de pacientes con infección por COVID-19. Recomendaciones de la Asociación Española de Cirujanos. Cir Esp. 2020 (en prensa). https://doi.org/10.1016/j.ciresp.2020.03.001.

3. Documentos de posicionamiento y recomendaciones de la AEC en relación con la cirugía y COVID-19. https://www.aecircirujanos.es/Documents-de-posicionamiento-y-recomendaciones-de-la-AEC-en-relacion-con-la-cirugia-y-COVID-19_es_1.152.html [accessed 17 Apr 2020].

4. Lu R, Zhao X, Li J, Niu P, Yang B, Wu H, et al. Genomic characterisation and epidemiology of 2019 novel coronavirus: implications for virus origins and receptor binding. Lancet. 2020;395(10224):565–74. http://dx.doi.org/10.1016/S0140-6736(20)30251-8.

5. Zou L, Ruan F, Huang M, Liang H, Huang H, Gong Z, et al. SARS-CoV-2 Viral Load in Upper Respiratory Specimens of Infected Patients. N Engl J Med. 2020;382(12):1177–9. http://dx.doi.org/10.1056/NEJMoa2001373.

6. Lauer SA, Grantz KH, Bi Q, Jones FK, Zheng Q, Meredith HR, et al. The Incubation Period of Coronavirus Disease 2019 (COVID-19) From Publicly Reported Confirmed Cases: Estimation and Application. Ann Intern Med. 2020 (en prensa). https://doi.org/10.7326/M20-0504.

7. Wang D, Hu B, Hu C, Zhu F, Liu X, Zhang J, et al. Clinical Characteristics of 138 Hospitalized Patients With 2019 Novel Coronavirus-Infected Pneumonia in Wuhan, China. JAMA. 2020 (en prensa). https://doi.org/10.1001/jama.2020.1585.

8. Chen N, Zhou M, Dong X, Qu J, Gong F, Han Y, et al. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. Lancet. 2020;395(10223):507–13. http://dx.doi.org/10.1016/S0140-6736(20)30211-7.

9. Guan WJ, Ni ZY, Hu Y, Liang WH, Ou CQ, He JX, et al. Clinical Characteristics of Coronavirus Disease 2019 in China. N Engl J Med. 2020 (en prensa). https://doi.org/10.1056/NEJMoa2002022.

10. Novel Coronavirus Pneumonia Emergency Response Epidemiology Team. The epidemiological characteristics of an outbreak of 2019 novel coronavirus diseases (COVID-19) in China. Chin J Epidemiol. 2020;41(2):145–51. http://dx.doi.org/10.3760/cjma.j.issn.0254-6450.2020.02.003.

11. 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 (en prensa). https://doi.org/10.1111/apt.15731.

12. Ti LH, Ang LS, Foong TW, Ng BSW. What we do when a COVID-19 patient needs an operation: operating room preparation and guidance. Can J Anaesth. 2020 (en prensa). http://dx.doi.org/10.1007/s12630-020-01617-4.

13. Protocolo de circuito para pacientes COVID-19 que precisen intervención quirúrgica en el Hospital Universitario Virgen del Rocío – Hospital General y medidas de actuación para sus empleados. Versión 4. 11 abril 2020. https://www.hospitalvirocuero.es/wp-content/uploads/2020/04/PROTOCOLO-CIRUGIA-DE-URGENCIAS-COVID-19.pdf [accessed 18 Apr 2020].

14. Reguera Rosal J, Gómez Rosado J.C. Protocolo clínico Cirugía de Urgencias SARS – CoV-2. Versión 1. 1 abril 2020. https://www.hospitalmacarena.es/wp-content/uploads/2020/04/1-Prot_Gral_UrQuig_Covid_V1.0-2.pdf [accessed 17 Apr 2020].

15. Liu R, Han H, Liu F, Lv Z, Wu K, Liu Y, et al. Positive rate of RT-PCR detection of SARS-CoV-2 infection in 4880 cases from one hospital in Wuhan, China, from Jan to Feb 2020. Clin Chim Acta. 2020;505:172–5. http://dx.doi.org/10.1016/j.cca.2020.03.009.

16. Liu W, Liu L, Kou G, Zheng Y, Ding Y, Ni W, et al. Evaluation of Nucleocapsid and Spike Protein-based ELISAs for detecting antibodies against SARS-CoV-2. J Clin Microbiol. 2020 (en prensa). https://doi.org/10.1128/JCM.00461-20..

17. Xiao S, Wu Y, Liu H. Evolving status of the 2019 novel coronavirus infection: Proposal of conventional serologic assays for disease diagnosis and infection monitoring. J Med Virol. 2020;92(5):464–7. http://dx.doi.org/10.1002/jmv.25702.

18. Dai H, Zhang X, Xia J, Zhang T, Shang Y, Huang R, et al. High-resolution Chest CT Features and Clinical Characteristics of Patients Infected with COVID-19 in Jiangsu. China Int J Infect Dis. 2020 (en prensa). https://doi.org/10.1016/j.ijid.2020.04.003..

19. Guan W, Ni Z, Hu Y, Liang W, Ou C, He J, et al. Clinical Characteristics of Coronavirus Disease 2019 in China. N Engl J Med. 2020 (en prensa). https://doi.org/10.1056/NEJMoa200232..

20. Bernheim A, Mei X, Huang M, Yang Y, Fayad ZA, Zhang N, et al. Chest CT Findings in Coronavirus Disease-19 (COVID-19): Relationship to Duration of Infection. Radiology. 2020 (en prensa). https://doi.org/10.1148/radiol.2020200463..

21. Soldati G, Smargiassi A, Inchinochio R. Proposal for International Standardization of the Use of Lung Ultrasound for Patients With Covid-19: a simple, quantitative, reproducible method. J Ultrasound Med. 2020 (en prensa). https://doi.org/10.1002/jum.15285..

22. Plan de contingencias COVID-19. Implementación de TC Torácico complementario en pacientes quirúrgicos. Servicios de Radiología y Cirugía General. Hospital Universitario Virgen del Rocío. Marzo 2020. https://www.hospitalvirocuero.es/wp-content/uploads/2020/04/SCREENING-RADIOLOGICO-COVID-19-CIRUGIA-GENERAL.pdf [accessed 17 Apr 2020].

23. Prachand V, Milner R, Angelos F, Posner MC, Fung JJ, Agrawal N, et al. Medically-Necessary, Time-Sensitive Procedures: A Scoring System to Ethically and Efficiently Manage Resource Scarcity and Provider Risk During the COVID-19 Pandemic. J Am Coll Surg. 2020 (en prensa). https://doi.org/10.1016/j.jamcollsurg.2020.04.011.

24. Aminian A, Safari S, Razeghian-Jahromi A, Ghorbani M, Delaney CP. COVID-19 Outbreak and Surgical Practice: Unexpected Fatality in Perioperative Period. Ann Surg. 2020 (en prensa). https://doi.org/10.1097/SLA.0000000000003925..

25. Gao Y, Xi H, Chen L. Emergency surgery in suspected COVID-19 patients with acute abdomen: case series and perspectives. Ann Surg. 2020 (en prensa). https://doi.org/10.1097/SLA.0000000000003961..

26. Chen G, Wu D, Guo W, Cao Y, Huang D, Wang H, et al. Clinical and immunological features of severe and moderate coronavirus disease 2019. J Clin Invest. 2020 (en prensa). https://doi.org/10.1172/JCI137244..

27. Sippola S, Hajaian J, Viinikainen L, Grönroos J, Paajanen H, Rautio T, et al. Quality of Life and Patient Satisfaction at 7-Year Follow-up of Antibiotic Therapy vs Appendectomy for Uncomplicated Acute Appendicitis: A Secondary Analysis of
a Randomized Clinical Trial. JAMA Surg. 2020 (en prensa). https://doi.org/10.1001/jamasurg.2019.6028.
28. van Dijk AH, de Reuver PR, Tasma TN, van Dieren S, Hugh TJ, Boermeester MA. Systematic review of antibiotic treatment for acute calculous cholecystitis. Br J Surg. 2016;103(7):797–811. http://dx.doi.org/10.1002/bjs.10146.
29. Loosen CS, Oor JE, van Ramhorst B, van Santvoort HC, Boerma D. Conservative treatment of acute calculous cholecystitis: a systematic review and pooled analysis. Surg Endosc. 2017;31(2):504–15. http://dx.doi.org/10.1007/s00464-016-5011-x.
30. You K, Bendl R, Taut C, Sullivan R, Gachabayov M, Bergamaschi R, et al. Randomized clinical trial of elective resection versus observation in diverticulitis with extraluminal air or abscess initially managed conservatively. Br J Surg. 2018;105(8):971–9. http://dx.doi.org/10.1002/bjs.10868.
31. Elsharif M, Forouzanfar A, Osakhinan K, Khetan N. Percutaneous cholecystostomy… why, when, what next? A systematic review of past decade. Ann R Coll Surg Engl. 2018;1–14. http://dx.doi.org/10.1308/rcsann.2018.0150.
32. Cui S, Chen S, Li X, Liu S, Wang F. Prevalence of venous thromboembolism in patients with severe novel coronavirus pneumonia. J Thromb Haemost. 2020. http://dx.doi.org/10.1111/jth.14830.
33. Bryan F, Milner R, Roggin KK, Angelos P, Matthews JB. Unknown unknowns: Surgical consent during the COVID-19 pandemic. Ann Surg. 2020 (en prensa). https://journals.lww.com/annalsofsurgery/Documents/Unknown%20unknowns%20.pdf [accessed 18 Apr 2020].
34. Alp E, Bijl D, Bleichrodt RP, Hansson B, Voss A. Surgical smoke and infection control. J Hosp Infect. 2006;62(1):1–5. http://dx.doi.org/10.1016/j.jhin.2005.01.014.
35. Li Y, Qin JJ, Wang Z, Yu Y, Wen YY, Chen XK, et al. [Surgical treatment for esophageal cancer during the outbreak of COVID-19]. Zhonghua Zhong Liu Za Zhi. 2020;42(0):E003. http://dx.doi.org/10.3760/cma.j.cn112152-20200226-00128.
36. Tsuch J-J, Gangloff A, Di Fiore F, Michel P, Brigand C, Slim K, et al. Strategy for the practice of digestive and oncological surgery during the Covid-19 epidemic. J Visc Surg. 2020. pii: S1878-7886(20)30070-3. https://doi.org/10.1016/j.jviscsurg.2020.03.008.
37. Kawk HD, Kim SH, Seo YS, Song KJ. Detecting hepatitis B virus in surgical smoke emitted during laparoscopic surgery. Occup Environ Med. 2016;73(12):857–63. http://dx.doi.org/10.1136/oemed-2016-103724.
38. Resources for smoke & gas evacuation during open, laparoscopic and endoscopic procedures. https://www.sages.org/resources-smoke-gas-evacuation-during-open-laparoscopic-endoscopic-procedures/ [accessed 18 Apr 2020].
39. United States Environmental Protection Agency. Disinfectants for Use against SARS-CoV-2. https://www.epa.gov/pesticide-registration/list-n-disinfectants-use-against-sars-cov-2. [accessed 18 Apr 2020].
40. Productos virucidos autorizados en España. Ministerio de Sanidad. https://www.mscbs.gob.es/profesionales/saludPublica/ccayes/alertasActual/nCov-China/documentos/Listado_virucidas_PT2_ambiental.pdf [accessed 18 Apr 2020].
41. Lei S, Jiang F, Su W, et al. Clinical characteristics and outcomes of patients undergoing surgeries during the incubation period of COVID-19 infection. EClinicalMedicine. 2020 [en prensa]. https://doi.org/10.1016/j.eclinm.2020.100331.42.
42. Christian MD, Sprung CL, King MA, Dichter JR, Kissoon N, Devereaux AV, et al. Triage. Care of the critically ill and injured during pandemics and disasters: CHEST consensus statement. CHEST. 2014;146(4_Suppl):e615–74S. https://doi.org/10.1378/chest.14-0736.
43. Guía médica de atención al paciente quirúrgico durante la pandemia de COVID19. Fundación Valle del Lili, Cali, Colombia. https://valledellili.org/ [accessed 18 Apr 2020].