

COVID-19 screening in asymptomatic patients scheduled for surgery. What is the role of rt-PCR in elective procedures during the pandemic?

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Abstract

Background: COVID-19 has changed medical practice nowadays. One of the biggest concerns has been establishing when invasive procedures such as surgery, GI endoscopy or bone marrow transplant are safe; and if it is necessary to consider screening for asymptomatic patients.

Methods: We identified asymptomatic patients that were scheduled for invasive procedures from May 2020 to April 2021 at Clínica de Marly. Patients were asked to fill a questionnaire about GI and upper respiratory symptoms and contact with possible/confirmed cases of COVID-19 in the last 15 days. Patients taken to emergency procedures, who had symptoms or contact with probable/confirmed cases in the last 15 days were excluded. rt-PCR was performed to screen COVID-19.

Results: A total of 1837 patients were included. 104 rt-PCRs tested positive for SARS-CoV-2, leading to a 5.66% of identified asymptomatic patients. Patients were followed-up on the 30th day after the procedure. 1733 negative patients responded to our follow-up, in which only 1 death and 2 complications were detected. 102 positive patients were followed-up and no complications or deaths were reported.

Conclusions: We found the presence of 5.66% of asymptomatic patients with positive rt-PCR for COVID-19. Safe screening will decide if these invasive interventions can be postponed, or, if the benefit outweighs the risks.

Keywords: COVID-19, SARS-CoV-2, rt-PCR screening, asymptomatic patients, health services, invasive procedures.

Tamizaje de COVID -19 en pacientes asintomáticos programados para cirugía. ¿Cuál es el papel de la rt-PCR en procedimientos electivos durante la pandemia?

Resumen

Contexto: El COVID-19 ha cambiado la práctica médica en la actualidad. Una de las mayores preocupaciones ha sido establecer cuándo son seguros los procedimientos invasivos como la cirugía, la endoscopia GI o el trasplante de médula ósea; y si es necesario considerar tamizaje para pacientes asintomáticos.

Métodos: Identificamos pacientes asintomáticos que fueron programados para procedimientos invasivos desde mayo de 2020 hasta abril de 2021 en la Clínica de Marly. Se solicitó a los pacientes que completaran un cuestionario sobre síntomas gastrointestinales, respiratorios superiores y contacto con casos posibles/confirmados de COVID-19 en los últimos 15 días. Se excluyeron los pacientes llevados a procedimientos de emergencia, que presentaron síntomas o contacto con casos probables/confirmados en los últimos 15 días. Se realizó rt-PCR para detectar COVID-19.

Resultados: Se incluyeron un total de 1837 pacientes. 104 rt-PCR dieron positivo para SARS-CoV-2, lo que lleva a un 5,66% de pacientes asintomáticos identificados. Los pacientes fueron seguidos a los 30 días después del procedimiento. Respondieron 1733 pacientes negativos a nuestro seguimiento, en el que solo se detectó 1 muerte y 2 complicaciones. Se dio seguimiento a 102 pacientes positivos y no se reportaron complicaciones ni muertes.

Conclusiones: Encontramos la presencia de un 5,66% de pacientes asintomáticos con rt-PCR positiva para COVID-19. La detección segura decidirá si estas intervenciones invasivas se pueden posponer o si el beneficio supera los riesgos.

Palabras clave: COVID-19, SARS-CoV-2, rt-PCR tamizaje, pacientes asintomáticos, servicios de salud, procedimientos invasivos.

Introduction

In December 2019, a novel respiratory syndrome appeared in the city of Wuhan, China. Later, the pathogen was identified as a beta-coronavirus, which was named Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), and the

disease associated with it was named Coronavirus disease 2019 (COVID-19)¹. By the end of December 2021, more than 280 million confirmed cases and more than 5.4 million deaths have been identified worldwide. In Colombia, more than 5 million cases were diagnosed and more than 129'000 lives were taken by the end of December 2021².

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The appearance of this pandemic has changed the medical practice of nowadays, raising multiple concerns in various scenarios of the medical field. Many questions have appeared when performing invasive procedures such as elective surgery in the out-patient setting³, mainly when it comes to determine if it is safe to these procedures, and if so, to determine the necessity of screening COVID-19 asymptomatic patients to avoid exposure and risk of infection to the medical team, as well as to decrease the risk of mortality and postoperative complications in the patient. Here we present our results of screening patients scheduled to undergo elective surgery with rt-PCR within 7 days prior surgery.

Methods

Here we present an observational, descriptive, retrospective study of a cohort of patients undergoing elective surgery from May 4th, 2020 to April 23th, 2021 at Clínica de Marly in Bogotá Colombia. Data collection was done under the supervision of the scientific committee Clínica de Marly. Informed consent was obtained from all individual participants included in the study prior to the invasive procedure. No identifying information is exposed in this study.

Demographic and clinical variables of patients and operative data were abstracted.

Prior to scheduling the procedure, any programmed intervention in the pandemic was supervised by a specialized committee, and the MeNTS score system was used in order to determine the necessity of the intervention⁴. If the procedure was approved, patients were asked to fill a questionnaire that inquired for the presence of upper respiratory airway symptoms (URAS), gastrointestinal (GI) symptoms or the contact with probable/confirmed COVID-19 cases in the last 15 days (table 1). If one of these questions was positive, the patient was addressed to attend to the emergency room for mandatory COVID-19 screening. Instead, if these questions were negative, a naso/oropharyngeal swab was taken to detect SARS-CoV-2 ARN with rt-PCR within 7 days prior to surgery. Patients were instructed to self-isolate until the day of surgery in order to minimize the risk of COVID-19 infection (Fig. 2). The timing of SARS-CoV-2 diagnosis was recorded as preoperative.

Patients that underwent emergency surgery or with positive symptoms/contact with probable/confirmed cases of COVID-19 were excluded from our study analysis.

Patients that underwent invasive procedures were followed up 30 days after the intervention in order to detect any adverse outcomes. If patients were positive for COVID-19, the procedure was delayed for at least 14 days and re-scheduled once the patient was free of respiratory symptoms.

The primary outcome was the incidence of COVID-19 in asymptomatic patients and without any contact with probable/confirmed COVID-19 cases. Secondary outcomes were the incidence of complications 7 days after the surgery of recovered COVID-19 patients, and death by 30 days after the procedure.

Study definitions:

Asymptomatic patient for COVID-19 was defined as a patient without any classic symptoms and no contact with probable/confirmed COVID-19 cases in the last 15 days.

Patients are considered as COVID-19 positive if there is viral RNA amplification in real time – reverse transcriptase polymerase chain reaction (rt-PCR).

Molecular screening for COVID-19:

Laboratory testing for SARS-CoV-2 was made by rt-PCR detection of viral RNA in oropharyngeal/nasopharyngeal swabs. rt-PCR was performed in different laboratories approved by the Ministry of Health of Colombia and the National Institute of Health of Colombia.

Statistical analysis:

Descriptive statistics were used to gather and summarize the data. Results are reported as means. Analysis was performed with Stata 14 software (StataCorp). Continuous variables were expressed in mean ± standard deviation (SD) or median (min-max), while categorical data were expressed in number and frequency

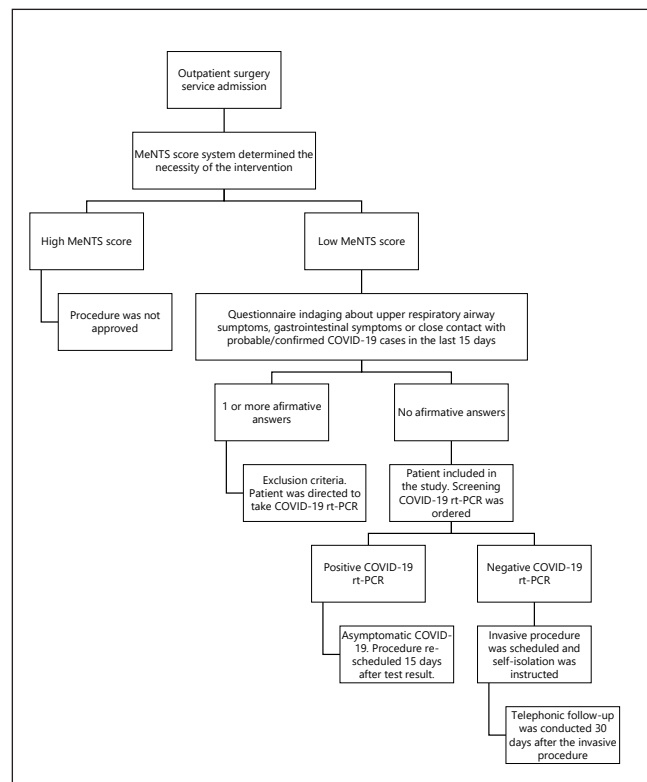


Figure 1.

Table 1. Characteristics of the population

Characteristics	Patients n=1837 N. (%)
Gender	
Female	904 (49.3%)
Male	933 (50.7%)
Age (mean)	49.5
Intervention	
Surgery	1655 (90%)
Gastro	182 (9.9%)
Rt-pcr sars-cov-2	
Positive	104 (5.66%)
Negative	1733 (94.33%)

Results

Demographic data:

A total of 1837 patients were included. From this sample, mean age was 49.5 years (range, 0-98 yr, standard deviation: 18.74), 933 (50.7%) were male and 904 (49.3%) were female. All the patients included in this sample denied having COVID-19 symptoms or contact with probable or confirmed cases in the last 15 days (Tabla 1).

From the 1837 patients, 104 rt-PCRs tested positive for SARS-CoV-2, leading to an incidence of 5.66% of identified asymptomatic patients. Mean age was 48 years (range, 3-86 yr). 52 out of the 104 patients were female (50%) and 52 patients were male (50%)(Tabla 2).

Follow-up results:

No matter if the patient was positive or negative for COVID-19, follow-up was made on the 30th day after the procedure looking for adverse outcomes by calling our patients.

Until April 23st, 2020, 1822 patients were taken to surgery and responded to our 30th day follow-up. From those 1822 patients, 29 patients reported non-respiratory complications, including 8 surgical site infections that didn't require new surgical treatment. 14 patients reported respiratory symptoms after surgery, but none of these patients reported further testing to rule out COVID-19. 1 patient passed away in our follow-up, but the cause of death wasn't attributed to the surgery nor respiratory complications. 1 patient reported respiratory symptoms with a positive COVID-19 test, although the patient stated in the follow-up close contact with a positive case of COVID-19.

From the 104 asymptomatic COVID-19 patients detected in our study, 90 patients were able to be taken to surgery. No mortality nor respiratory complications were evidenced in the 30th day follow-up in asymptomatic COVID-19 patients. 14 patients were not taken to surgery, 10 referred personal

reasons like fear of hospitalization in the pandemic and vacations, 2 have been operated in other institutions and 2 lose the follow up (Tabla 2).

Discussion

The COVID-19 pandemic has imposed many challenges to medical practice, being one of the most defiant invasive interventions and elective surgery, defined as invasive procedures that have no immediate indication due to a life-threatening emergency⁵.

It has been stated that taking a COVID-19 patient to surgery could accelerate and exacerbate disease progression of COVID-19, and also it could increase the risk of ICU hospitalization and mortality^{6,7}, development of renal injury and myocarditis⁸ in comparison to patients without prior SARS-CoV-2 infection, not to mention the increased risk of transmission of health care providers due to high exposure and high risk activities such as airway management⁹. A number of researchers have evaluated the ideal timing of surgical intervention following SARS-CoV-2 infection a multicenter international cohort study involving 24 countries and 1128 patients, evaluated mortality and pulmonary complications in the first 30 days after surgery in COVID-19 patients, revealing that 24.8% of patients died in the first 30 days and shockingly, more than half of the sample (51.2%) developed pulmonary complications⁷. Afterwards, in march 2021 the COVIDSurg Collaborative group published an international and multicentre study with 140.231 participants, in which 3.127 patients were diagnosed with COVID-19 prior to surgery, the outcome showed that mortality was increased in participants being subjected to surgery within the first six weeks of diagnosis, specifically 0-2 weeks OR 4.1, 3-4 weeks OR 3.9 and 5-6 weeks OR 3.6, compared to participants without COVID-19 with an OR of

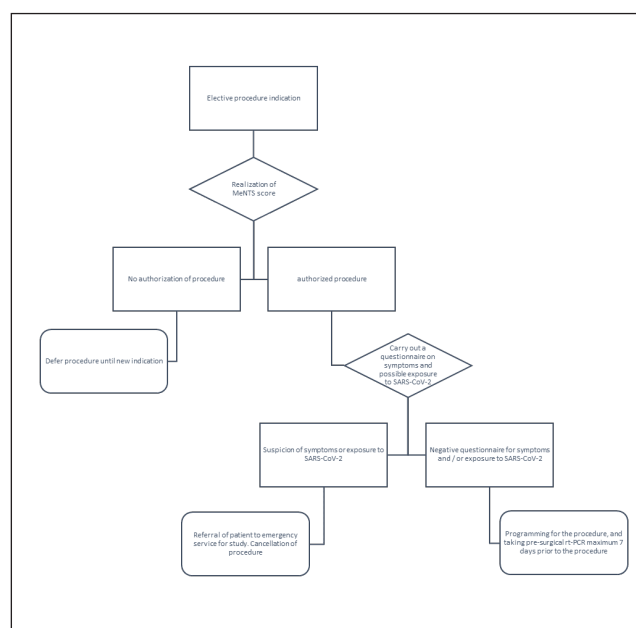


Figure 2.

Table 2. Asymptomatic participants

Asymptomatic participants	Patients n= 104
Gender	
Female	52 (50%)
Male	52 (50%)
Not operated	14 (13.4%)
Operated	90 (86.6%)
Surgery	80 (76.9%)
Gastro	10 (9.6%)
Mean days intervention	45 Days
Mode for intervention day	14
Range of intervention weeks	2-27 Weeks
Complications at 7 days	0
Mortality at 30 days	0

1.5, nevertheless after the seven weeks participants appeared to have the same mortality risk as the control group. Therefore the final recommendation was to perform any surgical intervention at least seven weeks after the diagnosis of SARS-CoV-2 infection¹⁰.

In this observational study, we found that 104 out of 1837 patients were identified as asymptomatic carriers of SARS-CoV-2 which reinforces the key role of molecular screening preceding any surgical intervention. Out of the total number of 104 patients, 90 were surgically intervened in a range of 2 to 27 weeks, within our protocol patients required at least a two-week recovery period to intervene, the predominant cause of further delay of the procedure was patient personal reasons such as holidays coming-up or fear of hospital stay in the midst of a pandemic. No complications were detected in the first 30 days after surgery in this group identified at follow-up. Nevertheless, our results are limited to our sample size.

Concerning the hematologic patients, we identified five bone marrow donors that were positive for SARS-CoV-2 rt-PCR. Malard et al reported that 52% of it's sample (18 patients) developed ARDS in the first 29 days after COVID-19 diagnosis, and from those 18 patients, 9 died¹¹, which raises the concern of performing bone marrow biopsy in the pandemic. This being said, the European Society of Bone Marrow transplantation recommends having a negative rt-PCR before performing any transplant¹².

To finalize, there is no clearness on viral shedding in the GI tract, although it has been shown viral shedding in stool specimens both in asymptomatic and symptomatic COVID-19 patients¹³, raising the question of possible transmission of COVID-19 when intervening the GI tract. Besides that, endoscopy has direct contact with the oropharyngeal mucosa, increasing the risk of inhalation of airborne droplets, making endoscopies a high risk procedure in the pandemic¹⁴. This is why various authors strongly suggest assessing COVID-19 status with both clinical and molecular testing¹⁵.

In Colombia, as of October 6th 2020, 862'158 patients have been diagnosed for COVID-19, including an astonishing 12.83% asymptomatic cases¹⁶, and according to our findings there is a 5.66% of asymptomatic participants, even so these statistics may not evidence reality due to the lack of diagnostic and surveillance capacity¹⁷.

As described before, there is a significant population of asymptomatic patients in Colombia without any contact with possible/confirmed COVID-19 patients, which raises the question of the necessity to perform screening tests in order to reduce exposure and risk of infection to health-care providers as well to reduce the risk of complications and mortality of patients. Performing rt-PCR for SARS-CoV-2 detection in non-urgent, elective surgeries and invasive procedures has been suggested by many organizations and authors such as Spanish Association of Surgeons, the Italian Society of Oncologic Surgeons, the American College of Surgeons, the European Society of Bone Marrow Transplantation and the Intercollegiate General Surgery Guidance on COVID-19^{8,12,18-22}. With accordance to our results, we also strongly suggest performing preoperative rt-PCR screening in asymptomatic patients undergoing invasive interventions, as well as consider that the minimum period required to reduce the possibility of complications and mortality rates after SARS-CoV-2 infection is two weeks, in contrast to the outcome of COVIDSurg Collaborative group.

Limitations

Samples for rt-PCR for SARS-CoV-2 were processed and analyzed in multiple laboratories, even though they are approved by the Colombian Ministry of Health and National Health Institute, generating a possible lack of uniformity in the results.

Conclusions

We present our findings regarding the key role of molecular SARS-CoV-2 diagnosis prior to any surgical intervention, even in asymptomatic patients due to a 5.66% prevalence of positive rt-PCR participants without manifestations of COVID-19. These findings are extremely relevant in order to make the most responsible decisions in patient care. Asking for symptoms and close contact in the questionnaire does not replace rt-PCR screening, and safe screening will eventually decide if these invasive interventions can be postponed, or, if the benefit outweighs the risk. Also, We conclude that there needs to be further research regarding timing to invasive surgical intervention in patients with diagnosis of COVID-19, in order to consider reduce the waiting times of patients in need of a invasive procedure in context of asymptomatic SARS-CoV-2 infection, considering that, the minimum planned delay in our protocol was two weeks and we found no complications or mortality in the first 30 days afterwards.

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Ethic disclosures: This article was authorized by the ethical committee of Clínica de Marly, Bogotá, Colombia. Informed consent was obtained from all individual participants included in the study prior to the invasive procedure. No identifying information is exposed in this study.

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References

- Lai CC, Shih TP, Ko WC, Tang HJ, Hsueh PR. Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and coronavirus disease-2019 (COVID-19): The epidemic and the challenges. *Int J Antimicrob Agents*. 2020 Mar;55(3):105924. doi: 10.1016/j.ijantimicag.2020.105924. Epub 2020 Feb 17. PMID: 32081636; PMCID: PMC7127800.
- Situación actual: Nuevo coronavirus(COVID-19). Ministerio de Salud y Protección Social. Instituto Nacional de Salud, Colombia. 26 de diciembre 2021. Available from: https://www.minsalud.gov.co/salud/publica/PET/Paginas/Covid-19_copia.aspx
- Flemming S, Hankir M, Ernestus RI, Seyfried F, Germer CT, Meybohm P, Wurmb T, Vogel U, Wiegner A. Surgery in times of COVID-19: recommendations for hospital and patient management. *Langenbecks Arch Surg*. 2020 May;405(3):359-364. doi: 10.1007/s00423-020-01888-x. Epub 2020 May 8. PMID: 32385568; PMCID: PMC7205906.
- Prachand VN, Milner R, Angelos P, Posner MC, Fung JJ, Agrawal N, et al. Medically Necessary, Time-Sensitive Procedures: Scoring System to Ethically and Efficiently Manage Resource Scarcity and Provider Risk During the COVID-19 Pandemic. *J Am Coll Surg*. 2020 Aug;231(2):281-288. doi: 10.1016/j.jamcollsurg.2020.04.011. Epub 2020 Apr 9. PMID: 32278725; PMCID: PMC7195575.
- Stahel PF. How to risk-stratify elective surgery during the COVID-19 pandemic? *Patient Saf Surg*. 2020 Mar 31;14:8. doi: 10.1186/s13037-020-00235-9. PMID: 32288785; PMCID: PMC7107008.
- Lei S, Jiang F, Su W, Chen C, Chen J, Mei W, et al. Clinical characteristics and outcomes of patients undergoing surgeries during the incubation period of COVID-19 infection. *EClinicalMedicine*. 2020 Apr 5;21:100331. doi: 10.1016/j.eclinm.2020.100331. PMID: 32292899; PMCID: PMC7128617.
- COVIDSurg Collaborative. Mortality and pulmonary complications in patients undergoing surgery with perioperative SARS-CoV-2 infection: an international cohort study. *Lancet*. 2020 Jul 4;396(10243):27-38. doi: 10.1016/S0140-6736(20)31182-X. Epub 2020 May 29. Erratum in: *Lancet*. 2020 Jun 9; PMID: 32479829; PMCID: PMC7259900.
- Al-Omar K, Bakkar S, Khasawneh L, Donatini G, Miccoli P. Resuming elective surgery in the time of COVID-19: a safe and comprehensive strategy. *Updates Surg*. 2020 Jun;72(2):291-295. doi: 10.1007/s13304-020-00822-6. Epub 2020 Jun 3. PMID: 32495280; PMCID: PMC7267759.
- Brindle ME, Gawande A. Managing COVID-19 in Surgical Systems. *Ann Surg*. 2020 Jul;272(1):e1-e2. doi: 10.1097/SLA.0000000000003923. PMID: 32209891; PMCID: PMC7188040.
- COVIDSurg Collaborative, GlobalSurg Collaborative. Timing of surgery following SARS-CoV-2 infection: an international prospective cohort study. *Anaesthesia*. 2021 Jun;76(6):748-758. doi: 10.1111/anae.15458. Epub 2021 Mar 9. PMID: 33690889; PMCID: PMC8206995
- Malard F, Genthon A, Brissot E, van de Wyngaert Z, Marjanovic Z, Ikhlef S, et al. COVID-19 outcomes in patients with hematologic disease. *Bone Marrow Transplant*. 2020 Nov;55(11):2180-2184. doi: 10.1038/s41409-020-0931-4. Epub 2020 May 6. PMID: 32376969; PMCID: PMC7201203.
- Ljungman P, Mikulska M, de la Camara R, Basak GW, Chabannon C, Corbacioglu S, et al; European Society for Blood and Marrow Transplantation. The challenge of COVID-19 and hematopoietic cell transplantation; EBMT recommendations for management of hematopoietic cell transplant recipients, their donors, and patients undergoing CAR T-cell therapy. *Bone Marrow Transplant*. 2020 Nov;55(11):2071-2076. doi: 10.1038/s41409-020-0919-0. Epub 2020 May 13. Erratum in: *Bone Marrow Transplant*. 2020 Jun 8; PMID: 32404975; PMCID: PMC7220575.
- Perisetti A, Gajendran M, Boregowda U, Bansal P, Goyal H. COVID-19 and gastrointestinal endoscopies: Current insights and emergent strategies. *Dig Endosc*. 2020 Jul;32(5):715-722. doi: 10.1111/den.13693. Epub 2020 Jun 3. PMID: 32281689; PMCID: PMC7262209.
- Gralnek IM, Hassan C, Beilenhoff U, Antonelli G, Ebigbo A, Pellisè M, et al. ESGE and ESGENA Position Statement on gastrointestinal endoscopy and the COVID-19 pandemic. *Endoscopy*. 2020 Jun;52(6):483-490. doi: 10.1055/a-1155-6229. Epub 2020 Apr 17. PMID: 32303090; PMCID: PMC7295280.
- Sinonquel P, Roelandt P, Demedts I, Van Gerven L, Vandenbrielle C, Wilmer A, et al. COVID-19 and gastrointestinal endoscopy: What should be taken into account? *Dig Endosc*. 2020 Jul;32(5):723-731. doi: 10.1111/den.13706. Epub 2020 Jun 3. PMID: 32335962; PMCID: PMC7267439.
- Coronavirus Colombia [Internet]. Instituto Nacional de Salud;2021 [cited 2021 DEC 26]. Available from: <https://www.ins.gov.co/Noticias/Paginas/Coronavirus.aspx>
- Ortiz-Martínez Y, García-Robledo JE, Vásquez-Castañeda DL, Bonilla-Aldana DK, Rodríguez-Morales AJ. Can Google® trends predict COVID-19 incidence and help preparedness? The situation in Colombia. *Travel Med Infect Dis*. 2020 Sep-Oct;37:101703. doi: 10.1016/j.tmaid.2020.101703. Epub 2020 Apr 28. PMID: 32360323; PMCID: PMC7187809.
- Balibrea JM, Badia JM, Rubio Pérez I, Martín Antona E, Álvarez Peña E, García Botella S, et al. Surgical Management of Patients With COVID-19 Infection. Recommendations of the Spanish Association of Surgeons. *Cir Esp (Engl Ed)*. 2020 May;98(5):251-259. English, Spanish. doi: 10.1016/j.ciresp.2020.03.001. Epub 2020 Apr 3. PMID: 32252979; PMCID: PMC7270428.
- Restivo A, De Luca R, Spolverato G, Delrio P, Lorenzon L, D'Ugo D, Gronchi A; Italian Society of Surgical Oncology (SICO). The need of COVID19 free hospitals to maintain cancer care. *Eur J Surg Oncol*. 2020 Jun;46(6):1186-1187. doi: 10.1016/j.ejso.2020.04.003. Epub 2020 Apr 22. PMID: 32336627; PMCID: PMC7175900.
- Kaye K, Paprottka F, Escudero R, Casabona G, Montes J, Fakin R, et al. Elective, Non-urgent Procedures and Aesthetic Surgery in the Wake of SARS-COVID-19: Considerations Regarding Safety, Feasibility and Impact on Clinical Management. *Aesthetic Plast Surg*. 2020 Jun;44(3):1014-1042. doi: 10.1007/s00266-020-01752-9. Epub 2020 May 14. PMID: 32410196; PMCID: PMC7224128.
- Joint Statement: Roadmap for Resuming Elective Surgery after COVID-19 Pandemic [Internet]. American College of Surgeons; American Society of Anesthesiologists; Association of periOperative Registered Nurses; American Hospital Association, 2020 [cited 2021 Dec 27]. Available from: <https://www.facs.org/covid-19/clinical-guidance/roadmap-elective-surgery>
- Intercollegiate General Surgery Guidance on COVID-19 UPDATE [Internet]. The Royal College of Surgeons of Edinburgh [cited 2021 Dec 27]. Available from: <https://www.rcsed.ac.uk/news-public-affairs/news/2020/march/intercollegiate-general-surgery-guidance-on-covid-19-update>