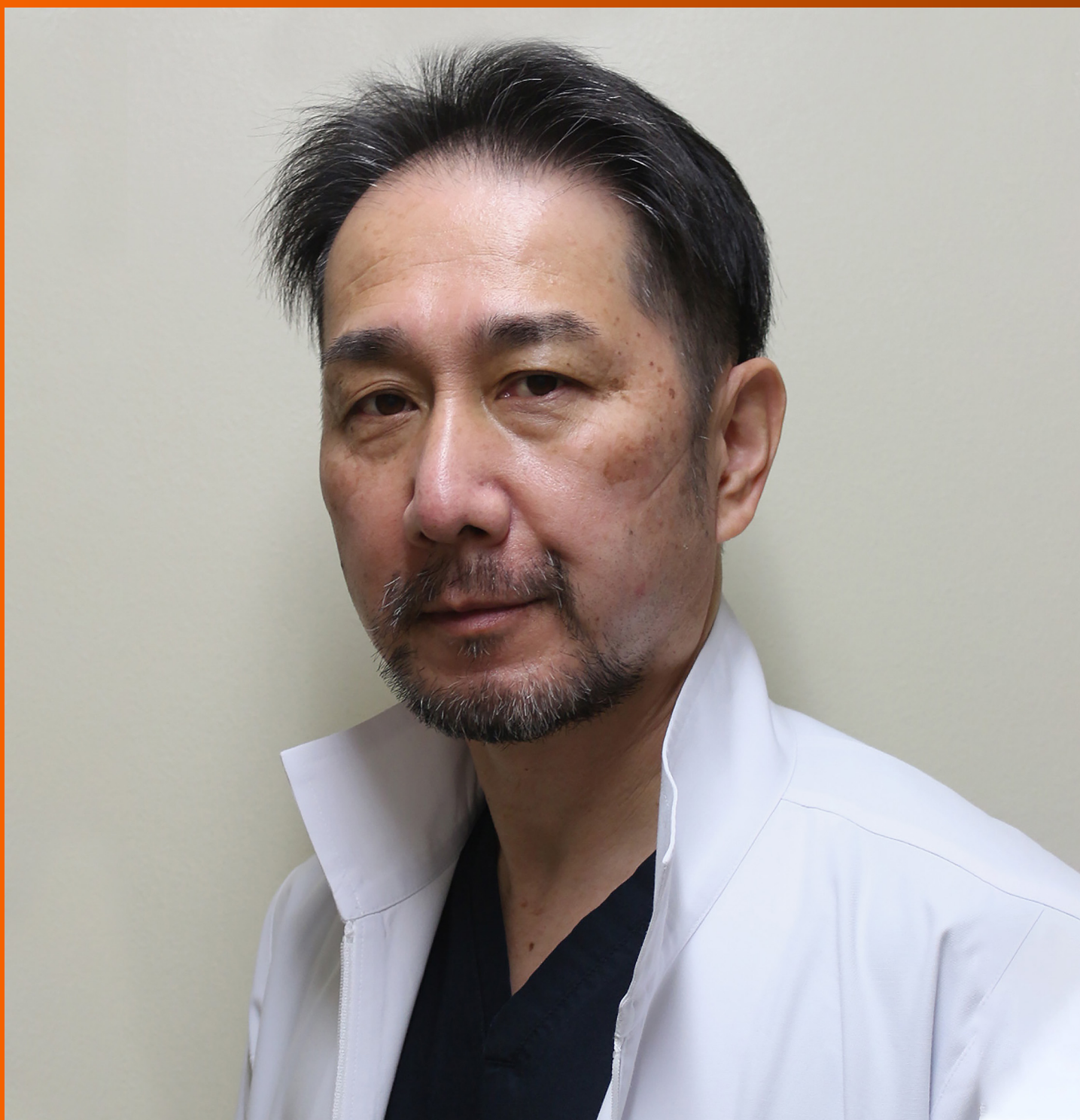


World Journal of *Gastrointestinal Surgery*

World J Gastrointest Surg 2021 June 27; 13(6): 516-619



Contents

Monthly Volume 13 Number 6 June 27, 2021

OPINION REVIEW

- 516 Borderline resectable pancreatic cancer: Certainties and controversies
Nappo G, Donisi G, Zerbi A

MINIREVIEWS

- 529 Special surgical approaches during peri-COVID-19 pandemic: Robotic and transanal minimally invasive surgery
Sánchez-Guillén L, Jimenez-Rodriguez RM
- 537 Therapeutic interventional endoscopic ultrasound in pancreato-biliary disorders: Does it really replace the surgical/percutaneous approach?
Lesmana CRA, Paramitha MS, Gani RA
- 548 Association between acute pancreatitis and COVID-19 infection: What do we know?
Jabłońska B, Olakowski M, Mrowiec S

ORIGINAL ARTICLE

Basic Study

- 563 Efficacy of hybrid endoscopic submucosal dissection with SOUTEN in gastric lesions: An *ex vivo* porcine model basic study
Esaki M, Ihara E, Hashimoto N, Abe S, Aratono C, Shiga N, Sumida Y, Fujii H, Haraguchi K, Takahashi S, Iwasa T, Nakano K, Wada M, Somada S, Nishioka K, Minoda Y, Ogino H, Ogawa Y

SYSTEMATIC REVIEWS

- 574 Acute pancreatitis and COVID-19: A literature review
Correia de Sá T, Soares C, Rocha M
- 585 Chylous ascites in colorectal surgery: A systematic review
Ng ZQ, Han M, Beh HN, Keelan S
- 597 2D vs 3D laparoscopic right colectomy: A propensity score-matching comparison of personal experience with systematic review and meta-analysis
Costa G, Fransvea P, Lepre L, Rondelli F, Costa A, Campanelli M, Lisi G, Mastrangeli MR, Laracca GG, Garbarino GM, Ceccarelli G

ABOUT COVER

Editorial Board Member of *World Journal of Gastrointestinal Surgery*, Kazuhiko Yoshimatsu, MD, PhD, Professor, Department of Digestive Surgery, Kawasaki Medical School, Kurashiki 7010192, Okayama, Japan.
 kyoshsu@med.kawasaki-m.ac.jp

AIMS AND SCOPE

The primary aim of *World Journal of Gastrointestinal Surgery* (WJGS, *World J Gastrointest Surg*) is to provide scholars and readers from various fields of gastrointestinal surgery with a platform to publish high-quality basic and clinical research articles and communicate their research findings online.

WJGS mainly publishes articles reporting research results and findings obtained in the field of gastrointestinal surgery and covering a wide range of topics including biliary tract surgical procedures, biliopancreatic diversion, colectomy, esophagectomy, esophagostomy, pancreas transplantation, and pancreatectomy, etc.

INDEXING/ABSTRACTING

The WJGS is now abstracted and indexed in Science Citation Index Expanded (SCIE, also known as SciSearch®), Current Contents/Clinical Medicine, Journal Citation Reports/Science Edition, PubMed, and PubMed Central. The 2020 edition of Journal Citation Reports® cites the 2019 impact factor (IF) for WJGS as 1.863; IF without journal self cites: 1.824; Ranking: 109 among 210 journals in surgery; Quartile category: Q3; Ranking: 77 among 88 journals in gastroenterology and hepatology; and Quartile category: Q4.

RESPONSIBLE EDITORS FOR THIS ISSUE

Production Editor: Jia-Hui Li; **Production Department Director:** Xiang Li; **Editorial Office Director:** Ya-Juan Ma.

NAME OF JOURNAL

World Journal of Gastrointestinal Surgery

ISSN

ISSN 1948-9366 (online)

LAUNCH DATE

November 30, 2009

FREQUENCY

Monthly

EDITORS-IN-CHIEF

Shu-You Peng, Varut Lohsiriwat, Jin Gu

EDITORIAL BOARD MEMBERS

<https://www.wjgnet.com/1948-9366/editorialboard.htm>

PUBLICATION DATE

June 27, 2021

COPYRIGHT

© 2021 Baishideng Publishing Group Inc

INSTRUCTIONS TO AUTHORS

<https://www.wjgnet.com/bpg/gerinfo/204>

GUIDELINES FOR ETHICS DOCUMENTS

<https://www.wjgnet.com/bpg/gerinfo/287>

GUIDELINES FOR NON-NATIVE SPEAKERS OF ENGLISH

<https://www.wjgnet.com/bpg/gerinfo/240>

PUBLICATION ETHICS

<https://www.wjgnet.com/bpg/gerinfo/288>

PUBLICATION MISCONDUCT

<https://www.wjgnet.com/bpg/gerinfo/208>

ARTICLE PROCESSING CHARGE

<https://www.wjgnet.com/bpg/gerinfo/242>

STEPS FOR SUBMITTING MANUSCRIPTS

<https://www.wjgnet.com/bpg/gerinfo/239>

ONLINE SUBMISSION

<https://www.f6publishing.com>



Special surgical approaches during peri-COVID-19 pandemic: Robotic and transanal minimally invasive surgery

Luis Sánchez-Guillén, Rosa M Jimenez-Rodriguez

ORCID number: Luis Sánchez-Guillén 0000-0003-0623-9074; Rosa M Jimenez-Rodriguez 0000-0001-8587-8768.

Author contributions: Sánchez-Guillén L and Jimenez Rodriguez RM were responsible for the design, analysis of the data and final review of the manuscript; Jimenez Rodriguez RM and Sánchez-Guillén L have read and approved the manuscript; Jimenez-Rodriguez R and Sánchez-Guillén L wrote the manuscript on behalf of the ESCP Guidelines committee.

Conflict-of-interest statement: Luis Sanchez-Guillen and Rosa M Jimenez-Rodriguez declare no conflicts of interest, financial relationship or financial support.

Open-Access: This article is an open-access article that was selected by an in-house editor and fully peer-reviewed by external reviewers. It is distributed in accordance with the Creative Commons Attribution NonCommercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited and the use is non-commercial. See: <http://creativecommons.org/License>

Luis Sánchez-Guillén, Department of Cirugía General, Hospital Universitario de Elche, Elche 03201, Spain

Rosa M Jimenez-Rodriguez, Department of Surgery, Hospital Universitario Virgen del Rocío, Unidad de Coloproctología, Sevilla 41013, Spain

Corresponding author: Rosa M Jimenez Rodriguez, MD, PhD, Doctor, Staff Physician, Surgeon, Department of Surgery, Hospital Universitario Virgen del Rocío, Unidad de Coloproctología, Avda Manuel Siurot S/N, Sevilla 41013, Spain. ros_j_r@hotmail.com

Abstract

During the peri-coronavirus disease 2019 pandemic, the need of special care has raised, not only for our patients but also for health care workers. These needs are different regarding the procedure and the approach performed. This is a dynamic review in the use of robotics and transanal approaches for colorectal diseases. We searched PubMed and KSREvidence.com for studies related to coronavirus disease and robotic surgery/transanal mesorectal excision/transanal surgery (primary and systematic reviews). From 147 results in PubMed, 11 were selected for full text screening, and 11 were included in this paper. From 3 results in KSREvidence, no relevant systematic reviews were identified. We also checked the references in identified papers for further relevant studies. European Society of Coloproctology guidelines were including as part of the recommendations available. Robotic and transanal MIS can be performed safely during the pandemic, but particular characteristics of these procedure need to be taken into consideration.

Key Words: Robotic surgery; Transanal mesorectal excision; Pandemic

©The Author(s) 2021. Published by Baishideng Publishing Group Inc. All rights reserved.

Core Tip: Despite most European countries have already passed the first coronavirus disease 2019 (COVID-19) pandemic, new cases are now increasing and many countries in the world continue suffering this critical situation and could benefit from teaching from previous experiences. Global cooperation and shared information will help in a second wave of the pandemic which could need well-established guidance for

s/by-nc/4.0/

Manuscript source: Unsolicited manuscript

Specialty type: Surgery

Country/Territory of origin: Spain

Peer-review report's scientific quality classification

Grade A (Excellent): 0

Grade B (Very good): 0

Grade C (Good): C, C

Grade D (Fair): 0

Grade E (Poor): 0

Received: December 28, 2020

Peer-review started: December 28, 2020

First decision: January 25, 2021

Revised: January 26, 2021

Accepted: April 9, 2021

Article in press: April 9, 2021

Published online: June 27, 2021

P-Reviewer: Bhardwaj R, Dinc B

S-Editor: Zhang L

L-Editor: A

P-Editor: Li JH



better patient outcomes protecting healthcare professionals. This paper reviews and unify recommendations for robotic and transanal surgery in the peri-COVID-19 era including European Society of Coloproctology guidelines.

Citation: Sánchez-Guillén L, Jimenez-Rodriguez RM. Special surgical approaches during peri-COVID-19 pandemic: Robotic and transanal minimally invasive surgery. *World J Gastrointest Surg* 2021; 13(6): 529-536

URL: <https://www.wjgnet.com/1948-9366/full/v13/i6/529.htm>

DOI: <https://dx.doi.org/10.4240/wjgs.v13.i6.529>

INTRODUCTION

The coronavirus disease 2019 (COVID-19) pandemic impacted the management of the surgical patient on the background of reported postoperative mortality rates of up to 23.8% [1,2]. Scientific societies and regulatory bodies issued a range of varying recommendations for the pre, intra and postoperative periods. Meanwhile, emergency, urgency and oncological procedures must be carried out, and cannot wait for the normalized viral control. Delaying elective surgery is not always practical, especially not for time-critical therapies, such as surgery for cancer [3,4]. Many of those recommendations include advice on laparoscopic procedures, but little evidence has been issued on other minimally-invasive procedures.

In colorectal surgery, novel transanal minimally-invasive approaches and the use of robotic platforms are increasingly part of standard treatment options for the 21st century surgeon [5,6]. The COVID-19 pandemic triggered concerns about potential virus transmission during surgical procedures and especially during minimally invasive surgery (MIS). In theory, CO₂ used during these procedures could contain traces of COVID-19, contaminate the operating room environment and hence expose health care workers [7]. Although CO₂ is commonly used for all, laparoscopic, robotic and transanal surgery, all procedures have specific characteristics to consider when performing surgery in during this pandemic.

METHODS

We searched PubMed and KSREvidence.com for primary studies and systematic reviews (latest searches on July 21, 2020). The search strategies are presented in [Supplementary Tables 1 and 2](#). From 147 results in PubMed, 11 were selected for full text screening, and 11 were included in this paper. From 3 results in KSREvidence, no relevant systematic reviews were identified. We also checked the references in identified papers for further relevant studies.

Inform consent was not required for this study as well as internal rating-based approach approval.

GENERAL CONSIDERATIONS

Most guidelines suggest the delay of all non-essential elective surgery where the prognosis of the disease is not going to be affected [3,4,8]. During the highest level of the global health alert, European Society of Coloproctology (ESCP), European Association for Endoscopic Surgery and Society of American Gastrointestinal and Endoscopic Surgeons, in line with the World Health Organization, recommended to postpone all elective and endoscopic cases, although some suggested making this decision locally by taking into account medical, logistical and organizational considerations [9,10]. For example, the Spanish Society of Surgery designed a dynamic scale for surgical activity during pandemics to facilitate and standardize the process of decision-making when planning colorectal procedures for individual units [11]. Some of the suggested key indicators to consider for moving up the scale, are persistent downward trend of fall in number of infected patients, R0, rate of positive COVID-19 inpatients, number of available beds (intensive care/high dependency) and

availability of staff and equipment. Daily monitoring of this on-going situation and up to date information from World Health Organization, national government, local authority and statutory organization is mandatory in order to determine the phase of pandemic in the local setting. Other factors, such as an intact supply chain and repair service for essential equipment also need to be taken into consideration[12].

During the COVID-19 pandemic and transition to normalcy, all surgical procedures performed should be carried out with the highest caution, including personal protective equipment (PPE). Several levels of PPE have been described: From just wearing a work uniform for nuisance contamination only to specific protection when the type of airborne substance is known, when the highest level of respiratory protection is needed or to the highest level, when a protection of the respiratory system, skin, eye and mucous membrane is needed. When operating on patients who tested negative for Coronavirus and with a body temperature below 38° Celsius, without a travel history to areas with confirmed infection, occupational exposure, contact history with confirmed cases and clustering (Fever, Travel, Occupational, Contact, Confirmed or FTOCC) or any another suspicion for COVID-19 infection, a lower level of PPE could be used. In patients who tested positive or presented with symptoms or a history of direct exposure, the highest level of PPE is recommended [13].

Using laparoscopy during the pandemic has been subject to much controversy. For example, at the beginning of the COVID-19 pandemic, recommendations made by the British Intercollegiate General Surgery Guidance on COVID suggested that laparoscopy should not be used because of the risk of aerosol contamination. More recently this sentence has been changed to a “consideration only in selected patients” [4].

It remains unclear whether tissue aerosolization during laparoscopy represents a greater risk to health staff when compared to open surgery[14]. The presence of different viruses in surgical smoke, including corynebacterium, human papillomavirus, poliovirus, human immunodeficiency virus and hepatitis B have been demonstrated in previous studies[15-17]. To date, there is no evidence that COVID-19 is transmissible through surgical smoke. There remains a theoretical risk of virus aerosolization during MIS, hence recommendations about the use of MIS include the prevention of smoke leakage (minimal skin incisions, low pressure pneumoperitoneum, controlled evacuation of intraabdominal gas)[18]. However, robotic and transanal MIS may require additional risk prevention strategies[19]. Particularly important for the latter, recent data indicate the prolonged presence of viral RNA in blood, fluids and faecal samples up to 27.9 d (mean) *vs* 16.7 d in respiratory samples after contracting COVID-19[20-24]. The possibility of faecal-oral transmission has been suggested but hard evidence has not been established yet. Considering the ability of faecal excretion of viable virus for both severe acute respiratory syndrome coronavirus and Middle East respiratory syndrome coronavirus, the possibility of faecal-oral COVID-19 transmission remains critical[25].

COVID-19 AND ROBOTIC SURGERY

In principle, the same risk-mitigating measures for laparoscopic surgery apply for robotic surgery. Some scientific societies suggested robotic colorectal operations should not be carried out in phases four (high level alert scenario) and five (emergency scenario)[26-29] but also high-quality robotic surgery for colorectal cancer has been described during the COVID-19 pandemic using considered measures to mitigate risk [30]. There are significant differences between laparoscopic and robotic surgery that should be taken into consideration during the pandemic:

Staff protection

Compared to laparoscopic surgery for the main part of robotic procedures (console time) less staff is required in the immediate vicinity of the patient. The absence of visual contact with the patient during the procedure could have different consequences regarding the distance between the main surgeon and the patient. Nevertheless, minimize the number of exposed health workers; Usually only one scrub nurse and one surgical assistant should be bedside and the use of 4 robotic arms performing could help to performed the surgery with an operating surgeon and a nurse, avoiding a need of surgical assistant[31]. As in any other surgical procedure, all non-essential staff should clear the room during endotracheal intubation and extubation.

ESCP recommendation: (1) The robotic console should be placed outside of the operating room (*e.g.* side room) if infrastructure allows such a setup; (2) The scrub nurse/surgical assistant may not be required bedside during the entire procedure; (3) Bedside personnel should take level 3 precautions while the rest of the team in the operating room could take level 2 precautions (Table 1)[32]; and (4) In case of, the main surgeon and the assistant should start to perform the procedure whilst calling for more staff if needed.

Pneumoperitoneum management

The prevention of gas leakage and unnecessary ventilation pressures can be reduced by choosing lowest possible intraabdominal pressures. The use of a robotic platform and closed-circuit continuous flow insufflation systems may facilitate to reduce intraabdominal pressures to 5-10 mmHg. Skin incisions for ports should be chosen small to create an effective seal around ports. A helpful technique is to create a skin impression with the blunt end of the port and use the mark as a guide to choose the length of the incision[33,34].

ESCP recommendation: (1) Lowest pneumoperitoneum should be maintained during robotic surgery, optimal between 5-10 mmHg; and (2) Minimal skin incision to create effective seal around ports.

Smoke management

It was demonstrated in previous studies that aerosolization of blood borne virus is a realistic possibility[18]. Although unintended smoke evacuation during robotic surgery may be less than in conventional laparoscopy due to a lower frequency of instrument changes and a stable platform, this remains a viable risk. Energy instruments may create more aerosolization of particles than monopolar diathermy instruments. Filtered smoke evacuation systems should be used wherever possible[26-28].

ESCP recommendation: All recommendations provided for laparoscopic procedures in terms of gas leak, specimen extraction or evacuation should be followed such as the use of devices to filter released CO₂, controlled evacuation of pneumoperitoneum and considerate use of aerosol producing energy devices.

Handling of specimens and body fluids

Due to the presence of viral RNA in fluids and faecal samples, prevention of manipulating faeces and opening of colon and rectum is paramount[21-25]. Some data indicate a potential benefit to perform completely intraperitoneal anastomoses. Robotic assisted surgery can facilitate the creation of intraabdominal anastomosis and intraabdominal suturing. The specimen should be extracted in a plastic bag to avoid contamination[35, 36].

ESCP recommendation: (1) Robotic intraabdominal anastomosis and intraabdominal sutures when feasible; and (2) Small incisions for extraction and the use of specimen retrieval bags could help preventing unnecessary contamination of faecal material.

Maintenance of robotic equipment

Robotic devices usually have large surface areas that need to be cleaned regularly with antiviral disinfectants.

ESCP recommendation: (1) All robotic components including the console and the cart should be cleaned; and (2) The robot should be sanitized regularly after each use using a pre-moistened disinfection wipe product or a lint-free cloth that has been sprayed with one of the following products as suggested by industry (Intuitive Surgical Ltd®, Sunnyvale CA, United States): 70% isopropyl alcohol, Metrex CaviCide®/CaviWipes® (Metrex Research Corp. MI, United States), PDI Sanicloth® Prime (PDI, NJ, United States), Bleach up to 10%[5] or with any of the products approved by the Environmental Protection Agency[37].

COVID-19 AND TRANSANAL MINIMALLY INVASIVE SURGERY

There is no current evidence on COVID-10-related risks of transanal MIS in COVID patients including total mesorectal excision (TEM), Transanal minimally invasive

Table 1 Level of protection and equipment in robotic surgery

Surgical staff	Level of protection	Equipment
Robotic surgery		
Bedside assistant	Level III	PPE; Full face respirators or PARL; Disposable latex gloves
Console surgeon	Level II	Disposable surgical cap; Mask (FFP3); Work uniform; Disposable latex gloves.
Transanal minimally invasive surgery		
Perineal surgeon and assistant	Level III	PPE; Full face respirators or PARL; Disposable latex gloves
Laparoscopic surgeon and assistant	Level II	Disposable surgical cap; Mask (FFP3); Goggles/visor; Work uniform; Disposable medical protective uniform; Disposable latex gloves

PPE: Personal protective equipment; FFP3: Filtering facepiece respirators 3.

surgery (TAMIS) and Transanal mesorectal excision (TaTME). Given this limited information, one has to rely on data from endoscopic procedures and other minimally invasive approaches. In principle the same recommendations as for laparoscopy and robotic surgery apply, specific recommendations are outlined below.

Prioritization

TEM and TAMIS are currently mostly recommended with curative intent for patients with T1 rectal cancers; or small T2 rectal cancers usually when in the setting of clinical trials and TaTME for low and rectal tumors > T2[38].

ESCP recommendation: (1) Always following medical judgment and depending on the local situation of each center, TEM/TAMIS procedures could be avoided because is indicated for non-emergent and deferrable surgery (both benign and malignant); (2) In TaTME, consider assessing case by case the risk of immunosuppression secondary to neoadjuvant therapy, the risk of symptoms due to cancer and the individual oncological prognosis; and (3) For emergent operations, where COVID screening might be deficient, the transanal approach is not recommended.

Staff protection

The transanal approach poses a potentially higher risk of severe acute respiratory syndrome coronavirus 2 transmission due to the short physical distance between patient and surgeon and the potential oral-faecal transmission[21-25,39]. Hence, the highest level of PPE is required. Recent data from Italy indicate that using appropriate PPE can prevent transmission effectively during gastrointestinal endoscopy[40]. Even in low risk patients, strict policies and staff education should be promoted and all emergent procedures performed should be considered as high risk. Placement and removal of PPE should be done according to Centers for Disease Control guidelines as recommended for all surgical procedures[41]. Negative pressure for operation room ventilation is preferred if not available for all rooms.

ESCP recommendation: During transanal approach, as well as for all surgical procedures, surgeons should wear appropriate PPE such as double gloves, filtering facepiece respirators 2 or filtering facepiece respirators 3, water-resistant gowns, goggles, and shoe covers.

Management of pneumoperitoneum, smoke and specimen management

The additional gas insufflation to create a pneumorectum and the larger amount of smoke discharge, increase the exposure risk for surgical personnel[7-10,12,26,42].

ESCP recommendation: (1) Pneumorectum should be maintained throughout the procedure at the lowest possible pressure; (2) A two-way insufflator seems to be appropriate at least in the transanal approach; (3) All surgical energy should be minimized and Ultralow particulate air filters which retain 99.9 per cent of particles at 0.1 µm should be used; (4) The pneumorectum should be removed in a controlled fashion (preferably passed through a filter mechanism at the end of the procedure; and (5) Special caution when covering or specimen extraction and removing surgical platforms which could release fluid and/or air.

Equipment maintenance

Due to the special difficulties of the transanal minimally invasive surgeries even in daily practice, only expert colorectal surgeons with extensive transanal experience should perform TEM, TAMIS or TaTME surgery during COVID outbreak, always following all the previous recommendations[43,44].

CONCLUSION

Robotic and transanal MIS can be performed safely during the pandemic, but particular characteristics of these procedure need to be taken into consideration. Robotic surgery may offer some advantages over laparoscopy in terms of theatre staff safety due to additional physical distance from the patient and the improved ergonomics to perform intraabdominal anastomoses. Transanal MIS may expose the operating surgeon to a higher exposure of evacuated gas, but appropriate PPE and controlled gas evacuation can reduce the risk appropriately.

ACKNOWLEDGEMENTS

Authors would like to thank Jos Kleijnen for his helpful advice on research strategy.

REFERENCES

- 1 **Lei S, Jiang F, Su W, Chen C, Chen J, Mei W, Zhan LY, Jia Y, Zhang L, Liu D, Xia ZY, Xia Z.** Clinical characteristics and outcomes of patients undergoing surgeries during the incubation period of COVID-19 infection. *EClinicalMedicine* 2020; **21**: 100331 [PMID: 32292899 DOI: 10.1016/j.eclinm.2020.100331]
- 2 **COVIDSurg Collaborative.** Mortality and pulmonary complications in patients undergoing surgery with perioperative SARS-CoV-2 infection: an international cohort study. *Lancet* 2020; **396**: 27-38 [PMID: 32479829 DOI: 10.1016/S0140-6736(20)31182-X]
- 3 **American Association of Gynecologic Laparoscopists (AAGL).** Joint statement on minimally invasive gynecologic surgery during the COVID-19 pandemic [Internet]. Cypress: AAGL, 2020 [cited 10 March 2021]. Available from: <https://www.aagl.org/news/covid-19-joint-statement-on-minimally-invasive-gynecologic-surgery/>
- 4 **Association of Surgeons of Great Britain & Ireland;** Association of Coloproctology of Great Britain & Ireland; Association of Upper Gastrointestinal Surgeons; Royal College of Surgeons of Edinburgh; Royal College of Surgeons of England; Royal College of Physicians and Surgeons of Glasgow; Royal College of Surgeons in Ireland. Intercollegiate general surgery guidance on COVID-19 update [Internet]. Edinburgh: Royal College of Surgeons of Edinburgh 2020 [cited 10 March 2021]. Available from: <https://www.rcsed.ac.uk/news-public-affairs/news/2020/march/intercollegiate-general-surgery-guidance-on-covid-19-update>.
- 5 **Banapour P, Yuh B, Chenam A, Shen JK, Ruel N, Han ES, Kim JY, Maghami EG, Pigazzi A, Raz DJ, Singh GP, Wakabayashi M, Woo Y, Fong Y, Lau CS.** Readmission and complications after robotic surgery: experience of 10,000 operations at a comprehensive cancer center. *J Robot Surg* 2021; **15**: 37-44 [PMID: 32277400 DOI: 10.1007/s11701-020-01077-4]
- 6 **Konstantinidis IT, Ituarte P, Woo Y, Warner SG, Melstrom K, Kim J, Singh G, Lee B, Fong Y, Melstrom LG.** Trends and outcomes of robotic surgery for gastrointestinal (GI) cancers in the USA: maintaining perioperative and oncologic safety. *Surg Endosc* 2020; **34**: 4932-4942 [PMID: 31820161 DOI: 10.1007/s00464-019-07284-x]
- 7 **Felsenreich DM, Gachabayov M, Dong XD, Cianchi F, Bergamaschi R.** Considerations on robotic colorectal surgery during a COVID-19 pandemic. *Minerva Chir* 2020; **75**: 213-215 [PMID: 32329322 DOI: 10.23736/S0026-4733.20.08348-0]
- 8 **Ren X, Chen B, Hong Y, Liu W, Jiang Q, Yang J, Qian Q, Jiang C.** The challenges in colorectal cancer management during COVID-19 epidemic. *Ann Transl Med* 2020; **8**: 498 [PMID: 32395542 DOI: 10.21037/atm.2020.03.158]
- 9 **ESCP Guideline Committee.** ESCP Recommendations regarding COVID-19. In: European Society of Coloproctology 2020 [cited 10 March 2021]. Available from: <https://www.escp.eu.com/guidelines/covid-19-recommendations>
- 10 **European Association for Endoscopic Surgery and other Interventional Techniques.** EAES and SAGES Recommendations Regarding Surgical Response to COVID-19 Crisis. In: COVID-19 Statements 2020 [cited 10 March 2021]. Available from: <https://eaes.eu/covid-19-statements/eaes-and-sages-recommendations-regarding-surgical-response-to-covid-19-crisis>
- 11 **Balibrea JM, Badia JM, Rubio Pérez I, Martín Antona E, Álvarez Peña E, García Botella S, Álvarez**

- Gallego M, Martín Pérez E, Martínez Cortijo S, Pascual Miguelañez I, Pérez Díaz L, Ramos Rodríguez JL, Espin Basany E, Sánchez Santos R, Soria Aledo V, López Barrachina R, Morales-Conde S. Surgical Management of Patients With COVID-19 Infection. Recommendations of the Spanish Association of Surgeons. *Cir Esp* 2020; **98**: 251-259 [PMID: [32252979](#) DOI: [10.1016/j.ciresp.2020.03.001](#)]
- 12 **Liu Z**, Ding Z, Guan X, Zhang Y, Wang X, Khan JS. Optimizing response in surgical systems during and after COVID-19 pandemic: Lessons from China and the UK - Perspective. *Int J Surg* 2020; **78**: 156-159 [PMID: [32376240](#) DOI: [10.1016/j.ijssu.2020.04.062](#)]
- 13 **Maeda Y**, Dunlop MG, Din FVN. Risk mitigation for suspected colorectal cancer diagnostic pathway during COVID-19 pandemic. *Br J Surg* 2020; **107**: e361-e362 [PMID: [32700778](#) DOI: [10.1002/bjs.11798](#)]
- 14 **Porter J**, Blau E, Gharagozloo F, Martino M, Cerfolio R, Duvvuri U, Caceres A, Badani K, Bhayani S, Collins J, Coelho R, Rocco B, Wiklund P, Nathan S, Parra-Davila E, Ortiz-Ortiz C, Maes K, Dasgupta P, Patel V. Society of Robotic Surgery review: recommendations regarding the risk of COVID-19 transmission during minimally invasive surgery. *BJU Int* 2020; **126**: 225-234 [PMID: [32383520](#) DOI: [10.1111/bju.15105](#)]
- 15 **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 [PMID: [27484956](#) DOI: [10.1136/oemed-2016-103724](#)]
- 16 **Capizzi PJ**, Clay RP, Battey MJ. Microbiologic activity in laser resurfacing plume and debris. *Lasers Surg Med* 1998; **23**: 172-174 [PMID: [9779652](#) DOI: [10.1002/\(sici\)1096-9101\(1998\)23:3<172::aid-lsm7>3.0.co;2-m](#)]
- 17 **Rioux M**, Garland A, Webster D, Reardon E. HPV positive tonsillar cancer in two laser surgeons: case reports. *J Otolaryngol Head Neck Surg* 2013; **42**: 54 [PMID: [24246045](#) DOI: [10.1186/1916-0216-42-54](#)]
- 18 **Mowbray NG**, Ansell J, Horwood J, Cornish J, Rizkallah P, Parker A, Wall P, Spinelli A, Torkington J. Safe management of surgical smoke in the age of COVID-19. *Br J Surg* 2020; **107**: 1406-1413 [PMID: [32363596](#) DOI: [10.1002/bjs.11679](#)]
- 19 **Zheng MH**, Boni L, Fingerhut A. Minimally Invasive Surgery and the Novel Coronavirus Outbreak: Lessons Learned in China and Italy. *Ann Surg* 2020; **272**: e5-e6 [PMID: [32221118](#) DOI: [10.1097/SLA.0000000000003924](#)]
- 20 **Goh GK**, Dunker AK, Foster JA, Uversky VN. Shell disorder analysis predicts greater resilience of the SARS-CoV-2 (COVID-19) outside the body and in body fluids. *Microb Pathog* 2020; **144**: 104177 [PMID: [32244041](#) DOI: [10.1016/j.micpath.2020.104177](#)]
- 21 **Coccolini F**, Tartaglia D, Puglisi A, Giordano C, Pistello M, Lodato M, Chiarugi M. SARS-CoV-2 is present in peritoneal fluid in COVID-19 patients. *Annals of Surgery* 2020; **272**: e240-e242 [DOI: [10.1097/SLA.0000000000004030](#)]
- 22 **Gu J**, Han B, Wang J. COVID-19: Gastrointestinal Manifestations and Potential Fecal-Oral Transmission. *Gastroenterology* 2020; **158**: 1518-1519 [PMID: [32142785](#) DOI: [10.1053/j.gastro.2020.02.054](#)]
- 23 **Wu Y**, Guo C, Tang L, Hong Z, Zhou J, Dong X, Yin H, Xiao Q, Tang Y, Qu X, Kuang L, Fang X, Mishra N, Lu J, Shan H, Jiang G, Huang X. Prolonged presence of SARS-CoV-2 viral RNA in faecal samples. *Lancet Gastroenterol Hepatol* 2020; **5**: 434-435 [PMID: [32199469](#) DOI: [10.1016/S2468-1253\(20\)30083-2](#)]
- 24 **Bonato G**, Dioscoridi L, Mutignani M. Fecal-Oral Transmission of SARS-COV-2: Practical Implications. *Gastroenterology* 2020; **159**: 1621-1622 [PMID: [32247692](#) DOI: [10.1053/j.gastro.2020.03.066](#)]
- 25 **Yeo C**, Kaushal S, Yeo D. Enteric involvement of coronaviruses: is faecal-oral transmission of SARS-CoV-2 possible? *Lancet Gastroenterol Hepatol* 2020; **5**: 335-337 [PMID: [32087098](#) DOI: [10.1016/S2468-1253\(20\)30048-0](#)]
- 26 **European Society for Endoscopic Surgery and other Interventional Techniques**. What should surgeons know in cases of oncological pathology in the context of covid-19 pandemic (sars cov-2)? In: COVID-19 Statements 2020 [cited 10 March 2021]. Available from: <https://eas.eu/8797-2/>
- 27 **Morrell ALG**, Tustumi F, Morrell-Junior AC, Morrell AG, Ribeiro DMFR, Corsi PR, Morrell AC. Laparoscopic or robotic intraoperative management to minimize aerosol dispersion: Adaptations to the context of the COVID-19 pandemic. *Rev Col Bras Cir* 2020; **47**: e20202558 [PMID: [32578821](#) DOI: [10.1590/0100-6991e-20202558](#)]
- 28 **Ouzzane A**, Colin P. Cost-Effective Filtrating Suction to Evacuate Surgical Smoke in Laparoscopic and Robotic Surgery During the COVID-19 Pandemic. *Surg Laparosc Endosc Percutan Tech* 2020; **30**: e28-e29 [PMID: [32487856](#) DOI: [10.1097/SLE.0000000000000811](#)]
- 29 **Wölfel R**, Corman VM, Guggemos W, Seilmaier M, Zange S, Müller MA, Niemeyer D, Jones TC, Vollmar P, Rothe C, Hoelscher M, Bleicker T, Brünink S, Schneider J, Ehmann R, Zwirgmaier K, Drosten C, Wendtner C. Virological assessment of hospitalized patients with COVID-2019. *Nature* 2020; **581**: 465-469 [PMID: [32235945](#) DOI: [10.1038/s41586-020-2196-x](#)]
- 30 **Liang T**. Handbook of COVID-19 prevention and treatment [Internet]. Hangzhou: Zhejiang University School of Medicine; 2020 [cited 10 March 2021]. Available from: <http://covid-19.chinadaily.com.cn/a/202004/02/WS5e85823ca310128217283ed9.html>
- 31 **EAU Robotic Urology Section (ERUS)**. ERUS (EAU Robotic Urology Section) guidelines during COVID-19 emergency [Internet]. Arnhem: ERUS; 2020 [cited 10 March 2021]. Available from:

- <https://uroweb.org/wp-content/uploads/ERUS-guidelines-for-COVID-def.pdf>.
- 32 **Evans S**, Taylor C, Antoniou A, Agarwal T, Burns E, Jenkins JT, Miskovic D. Implementation of a clinical pathway for the surgical treatment of colorectal cancer during the COVID-19 pandemic. *Colorectal Dis* 2020; **22**: 1002-1005 [PMID: 32654417 DOI: 10.1111/codi.15247]
 - 33 **Samalavicius NE**, Siauly R, Janusonis V, Klimasauskiene V, Dulskas A. Use of 4 robotic arms performing Senhance® robotic surgery may reduce the risk of coronavirus infection to medical professionals during COVID-19. *Eur J Obstet Gynecol Reprod Biol* 2020; **251**: 274-275 [PMID: 32536465 DOI: 10.1016/j.ejogrb.2020.06.014]
 - 34 **Kimmig R**, Verheijen RHM, Rudnicki M; for SERGS Council. Robot assisted surgery during the COVID-19 pandemic, especially for gynecological cancer: a statement of the Society of European Robotic Gynaecological Surgery (SERGS). *J Gynecol Oncol* 2020; **31**: e59 [PMID: 32242340 DOI: 10.3802/jgo.2020.31.e59]
 - 35 **Brindle ME**, Gawande A. Managing COVID-19 in Surgical Systems. *Ann Surg* 2020; **272**: e1-e2 [PMID: 32209891 DOI: 10.1097/SLA.0000000000003923]
 - 36 **Angioli R**, Terranova C, Plotti F, Cafà EV, Gennari P, Ricciardi R, Aloisi A, Miranda A, Montera R, De Cicco Nardone C. Influence of pneumoperitoneum pressure on surgical field during robotic and laparoscopic surgery: a comparative study. *Arch Gynecol Obstet* 2015; **291**: 865-868 [PMID: 25260990 DOI: 10.1007/s00404-014-3494-z]
 - 37 **United States Environmental Protection Agency**. List N: Disinfectants for Use against SARS-CoV-2. In: Pesticide Registration [cited 10 March 2021]. Available from: <https://www.epa.gov/pesticide-registration/List-n-disinfectants-use-against-sars-cov>
 - 38 **TaTME Guidance Group representing the ESCP (European Society of Coloproctology)**, in collaboration with the ASCRS (American Society of Colon and Rectal Surgeons); ACPGBI (Association of Coloproctology of Great Britain and Ireland), ECCO (European Crohn's and Colitis Organisation); EAES (European Association of Endoscopic Surgeons), ESSO (European Society of Surgical Oncology), CSCRS (Canadian Society of Colorectal Surgery), CNSCRS (Chinese Society of Colorectal Surgery), CSLES (Chinese Society of Laparo-Endoscopic Surgery), CSSANZ (Colorectal Surgical Society of Australia and New Zealand), JSES (Japanese Society of Endoscopic Surgery), SACP (Argentinian Society of Coloproctology), SAGES (Society of American Gastrointestinal and Endoscopic Surgeons), SBCP (Brazilian Society of Coloproctology); Swiss-MIS (Swiss Association for Minimally Invasive Surgery). International expert consensus guidance on indications, implementation and quality measures for transanal total mesorectal excision. *Colorectal Dis* 2020; **22**: 749-755 [PMID: 32441803 DOI: 10.1111/codi.15147]
 - 39 **Yu GY**, Lou Z, Zhang W. [Several suggestion of operation for colorectal cancer under the outbreak of Corona Virus Disease 19 in China]. *Zhonghua Wei Chang Wai Ke Za Zhi* 2020; **23**: 9-11 [PMID: 32074719 DOI: 10.3760/cma.j.issn.1671-0274.2020.03.002]
 - 40 **Repici A**, Aragona G, Cengia G, Cantù P, Spadaccini M, Maselli R, Carrara S, Anderloni A, Fugazza A, Pace F, Rösch T; ITALIAN GI-COVID19 Working Group. Low risk of COVID-19 transmission in GI endoscopy. *Gut* 2020; **69**: 1925-1927 [PMID: 32321857 DOI: 10.1136/gutjnl-2020-321341]
 - 41 **Centers for Disease Control and Prevention**, National Center for Emerging and Zoonotic Infectious Diseases (NCEZID), Division of Healthcare. Protecting Healthcare Personnel. In: Healthcare-associated Infections [cited 10 March 2021]. Available from: <https://www.cdc.gov/hai/prevent/ppe.html>
 - 42 **Kulkarni P**, Baron PA. Aerosol measurement : principles, techniques, and applications [Internet]. Wiley; 2011 [cited 10 March 2021]. Available from: <https://www.wiley.com/en-us/Aerosol+Measurement%3A+Principles%2C+Techniques%2C+and+Applications%2C+3rd+Edition-p-9780470387412>
 - 43 **Adamina M**, Buchs NC, Penna M, Hompes R; St. Gallen Colorectal Consensus Expert Group. St.Gallen consensus on safe implementation of transanal total mesorectal excision. *Surg Endosc* 2018; **32**: 1091-1103 [PMID: 29234940 DOI: 10.1007/s00464-017-5990-2]
 - 44 **Lacy AM**, De Lacy FB, Balibrea JM. Considerations for transanal total mesorectal excision (TaTME) use during the COVID-19 pandemic. *Br J Surg* 2020; **107**: e203 [PMID: 32383490 DOI: 10.1002/bjs.11685]



Published by **Baishideng Publishing Group Inc**
7041 Koll Center Parkway, Suite 160, Pleasanton, CA 94566, USA

Telephone: +1-925-3991568

E-mail: bpgoffice@wjgnet.com

Help Desk: <https://www.f6publishing.com/helpdesk>

<https://www.wjgnet.com>

