



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

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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

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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

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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.

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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.

Informed 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.

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