

Coronavirus pandemic and colorectal surgery: practical advice based on the Italian experience

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Abstract

Aim The current COVID-19 pandemic is challenging healthcare systems at a global level. We provide a practical strategy to reorganize pathways of emergency and elective colorectal surgery during the COVID-19 pandemic.

Method The authors, all from areas affected by the COVID-19 emergency, brainstormed remotely to define the key-points to be discussed. Tasks were assigned, concerning specific aspects of colorectal surgery during the pandemic, including the administrative management of the crisis in Italy. The recommendations (based on experience and on the limited evidence available) were collated and summarized.

Results Little is known about the transmission of COVID-19, but it has shown a rapid spread. It is prudent to stop non-cancer procedures and prioritize urgent cancer treatment. Endoscopy and proctological procedures should be performed highly selectively. When dealing with colorectal emergencies, a conservative approach is advised. Specific procedures should be followed when operating on COVID-19-patients, using dedicated personal protective equipment and adhering to specific rules. Some policies are described, including minimally-invasive surgery. These policies outline the

strict regulation of entry/ exit into theatres and operating building as well as advice on performing procedures safely to reduce risk of spreading the virus. It is likely that a reorganization of health system is required, both at central and local levels. A description of the strategy adopted in Italy is provided.

Conclusion Evidence on the management of patients needing surgery for colorectal conditions during the COVID-19 pandemic is currently lacking. Lessons learnt from healthcare professionals that have managed high volumes of surgical patients during the pandemic could be useful to mitigate some risks and reduce exposure to other patients, public and healthcare staff.

Keywords Colorectal surgery, complications, COVID-19, emergency, health policy

What does this paper add to the literature?

COVID-19 pandemic is stressing healthcare system globally and threatens the ability to offer full and adequate care to patients. Limited data is available concerning the management of colorectal patients during the emergency. This manuscript contains practical tips to face the crisis, hoping to mitigate its impact on colorectal patients and healthcare professionals.

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‘There is nothing new in the story. [...]. Want of foresight, unwillingness to act when action would be simple and effective, lack of clear thinking, confusion of counsel until the emergency comes, until self-preservation strikes its jarring gong’

Winston Churchill

Introduction

The outbreak of SARS-CoV2 infection, responsible for the clinical manifestations named Corona Virus Disease 2019 or COVID-19 by the World Health Organisation, became a pandemic on the 12th March 2020. A combination of unreadiness in containing the first cases and of the aggressiveness of the virus itself, along with an underestimation of the problem during the early phases of the outbreak, resulted in the extremely rapid diffusion of COVID-19 globally, before effective measures to contain the infection had been developed.

Italy suffered the deepest impact, and its Health System is currently being severely tested by COVID-19. After an initial attempt to contain the outbreak (which mainly involved the North of Italy) with usual methods of response to a contagious, infective disease, it became apparent that more stringent measures were needed. The Italian Government announced the forced isolation of citizens for a period of 14 days, in order to reduce social contact to the lowest level possible. This was deemed the safest action in view of the absence of a vaccine and very little data on the pathophysiology and course of the infection. Notwithstanding the stringent measures adopted, a further 69 000 individuals tested positive in Italy by the 26th March 2020 with more than 6800 deaths [1]; approximately 6% of those infected required intensive care. A similar trend has been observed later in Spain, which adopted the similar ‘strict’ strategy that Italy advocated, closing land borders to all foreigners excluding people living or working in Spain, effective of the 17th March 2020 [2]. In the United Kingdom, the Government initially decided not to restrict social contacts, based on the concept of favouring acquired immunity, a statement signed by many UK scientists criticized this policy, advocating to enforce social distancing [3]. A stricter isolation policy is now in effect in the UK. It is likely that similar decisions will follow in the next days in the other European Countries.

As the number of people positive for COVID-19 are exceeding 740 000 cases in 196 countries, of whom approximately 28% had an outcome, and have caused over 35 000 deaths (30th March 2020), and considering that the actual rate of patients affected is difficult to

be accurately predicted (due to the different policies in COVID-19 testing globally), it is necessary to plan prompt actions to be taken, in order to face the COVID-19 challenge appropriately.

The impact on those who have contracted COVID-19, patients with cancer or with chronic conditions, patients scheduled to undergo elective non-cancer procedures, as well as on healthcare professionals (called to work in a completely unusual and critical scenario), is enormous [4,5]. There is an urgent need to re-group and rethink the way the surgical care is being offered, especially when dealing with colorectal surgery.

The aim of the authors, who were profoundly involved in the response to the pandemic in their own country of practice, was to provide the readers with practical information and instructions on how to deal with COVID-19 from a surgeon’s perspective, with particular focus on colorectal diseases. Given the lack of high-quality evidence on the COVID-19 and the rapid evolution of the pandemic; the readers should be aware that some of the recommendations in the present article are opinions or based on expert experience of the pandemic.

COVID-19 consequences on elective management of colorectal cancer and inflammatory bowel diseases

COVID-19 pandemic is stressing every aspect of different healthcare systems worldwide. Whilst the greatest priority is currently the treatment of COVID-19 cases, the population continues to suffer from all the same diseases that existed prior to the COVID-19 outbreak. In colorectal surgery, the most affected categories of patients are those diagnosed with cancer and inflammatory bowel diseases (IBD). Whether patients with gastrointestinal cancers are more likely to be infected with COVID-19 compared with healthy individuals, remains to be elucidated. In a nationwide analysis from China, 18 (1%) of 1590 COVID-19 cases had a history of cancer; among these 18 cases, three (16.7%) had a history of colorectal cancer [4]. Patients with COVID-19 and previous or active cancers seemed to have more serious adverse events [4]. According to data coming from the Italian National Institute of Health (*Istituto Superiore di Sanità, ISS*), out of a total of 2003 COVID-19-related deaths that occurred in Italy until March 17th, 2020, 72 patients (20.3%) had a history of active cancer in the last 5 years [6]. These figures should be interpreted with caution, as they do not represent the totality of the cases, therefore it is not possible at present to establish if cancer patients are at higher risk of death from

COVID-19, but a higher rate of complications could be expected.

These considerations raise management issues, in addition to the clinical challenges. Several measures have been implemented in Italy to optimize the management of colorectal cancer patients [7]. In severely hit areas, like Lombardy and other northern Italian regions, staff shortages and overwhelming workload in emergency departments, intensive care units and COVID-19 dedicated wards required the reallocation of surgeons. All elective non-cancer procedures and outpatient clinics are suspended.

After the announcement of restrictive measures to reduce social contacts by the Italian Government, geographical location became even more relevant. Each Italian Region followed a policy, based on the actual extent of the outbreak locally. In Lombardy, some “Hub” hospitals were established, including patients with colorectal cancer, and patients were prioritized based on patient- and disease-related factors. A detailed description is reported in the “Healthcare policy and Italian Government Perspective” section.

In patients who underwent surgery and were due to receive adjuvant treatment, therapy is being postponed on a case-by-case basis, when possible. In COVID-19-positive patients, it would be prudent to defer elective surgery, even if asymptomatic, due to the presumed risk of worse outcome in the event of postoperative complications [8]. In areas with the highest infection rate, patients requiring surgery are mandatorily being screened for COVID-19 infection. Extra precautions are encouraged for each patient, including wearing a surgical mask and social distancing.

Patients with IBD have excessive immunological responses and inflammation, often requiring immune modulating or immunosuppressive drugs. Such treatments expose patients to an increased risk of infections and potentially increased susceptibility to COVID-19. It is prudent to advise all patients under biologic immunosuppressive therapies who are living in areas with high density of COVID-19 cases, to adopt enhanced protective measures such as social distancing, frequent hand washing and disinfection with hydroalcoholic gel, while maintaining their usual treatment [9]. Considering that viral infections (e.g. EBV, CMV) could worsen IBD, it might be prudent to consider reassessing patients and modulate biological treatment as required. It is of outmost importance to consider the possible implications associated with treatment withdrawal, especially in terms of IBD flares – which might have more severe consequences than COVID-19. The International Organization for the Study of Inflammatory Bowel Diseases (IOIBD) advice to maintain

treatment with mesalamine and taper steroids whenever possible. For patients under thiopurines or JAK inhibitors treatment, due to the long-standing immunomodulator effect, their discontinuation would not be beneficial in the short term. There is also no indication to stop biologic therapies, provided that patients adhere to enhanced recommendations [9,10]. According to data coming from the seven largest IBD referral centres in China with more than 20 000 IBD cases, currently no patients with IBD tested positive for SARS-CoV-2. Furthermore, no patients with IBD and COVID-19 have been reported from the three largest tertiary IBD centres in Wuhan [4]. Furthermore, in a recent report from Wuhan, 318 patients were recently contacted and provided with self-preventative measures and had their treatment adjusted to reduce the risk of COVID-19 infection [11]. By doing so, none of the patients reported symptoms suggestive of COVID-19 and no one tested positive for the virus, suggesting that such pro-active strategies were effective in the short-term.

International collaborations and big data analysis could provide a more comprehensive picture. A promising initiative of an international registry including paediatric and adult IBD cases with SARS-CoV-2 infection has been recently launched: the SECURE-IBD Coronavirus reporting registry (<https://covidibd.org>). The aim is to help define the impact of COVID-19 on IBD and how factors such as age, comorbidities, and IBD treatments impact COVID-19 outcomes. All cases of confirmed COVID-19 in IBD patients, are reported in this registry, regardless of severity. Seven cases of COVID-19 have been reported to the registry so far (only one requiring hospitalization but no ventilator support).

COVID-19 consequences on endoscopic procedures

Endoscopy implies a high risk of COVID-19 transmission. Short physical distance among patients and healthcare providers, aerosolization and aspiration of digestive fluids, may contribute to the unrecognized spread of the disease, especially from asymptomatic patients [12]. In addition, ACE-2 receptor, binding site for SARS-CoV-2, is highly expressed in the digestive system [13] and viral RNA has been detected in saliva [14] and stools [15,16], suggesting oral-faecal transmission as a potential alternative route of contagion.

Patients infected with COVID-19 can also develop GI symptoms [17]. In a recent study [17], among 73 patients hospitalized for COVID-19 pneumonia, 39 (53.4%) tested positive for viral-RNA in the stools, with

results still positive in 17 (23.3%) patients after virus clearance in the respiratory samples. Zhang *et al.* [16] suggested that the virus is detectable in the faecal samples of all positive patients, regardless of the severity of illness and remains much longer in the stool than in other specimens such as nasopharyngeal swabs and deep throat saliva. Therefore, the authors conclude that stool sample analysis may be useful in identifying asymptomatic COVID-19-positive individuals. However, knowledge of the disease is still limited, and many recommendations are based on assumptions derived from previous SARS or MERS outbreaks [18].

After the detection of first coronavirus clusters in Italy and the declaration of Italian Government of national outbreak on 11 March 2020, firm recommendations have been released, supported by the Italian Society of Digestive Endoscopy (SIED) [19] with similar advice released by international societies in the following days. Figure 1 shows a potential reaction to outbreak by an endoscopy department.

All routine endoscopies have been postponed and will be rescheduled. Outpatient and follow-up visits have been deferred or done by telemedicine or telephone consultation [12,20]. We suggest avoiding any rescheduling until a clear perspective about outbreak escalation is known. Each case needs to be tracked and periodically evaluated, in the light of pandemic

evolution, to decide if any further delay may increase the risk for the patient.

Personnel should be strategically assigned, in the perspective of an infection spread among hospital staff. The minimum staff level strictly necessary to perform urgent or undeferrable procedures should attend the department. Students and trainees should not be allowed to access the department to avoid unnecessary risks [21] and overuse of personal protective equipment (PPE).

Concomitant exposure of individuals with specialist set skills needs to be avoided to preserve service continuity [22]. In low-resource settings, endoscopy procedures may be reduced to only life-threatening GI bleeding, foreign body removal, food bolus obstruction, and ascending cholangitis [23].

Risk stratification of patients is paramount. We recommend telephone interview the day before the procedure, asking for symptoms such as fever, cough and dyspnoea. It is recommended that, before entering the endoscopy department, all patients should be scanned for fever (temperature > 37°) and undergo a triage questionnaire to stratify the risk associated with the procedure [12,24]. Repici *et al.*[12] classified “low risk” patients as those with no symptoms, no contact with COVID-19, who did not stay or travel to areas at risk during the previous 14 days. “Intermediate risk” was

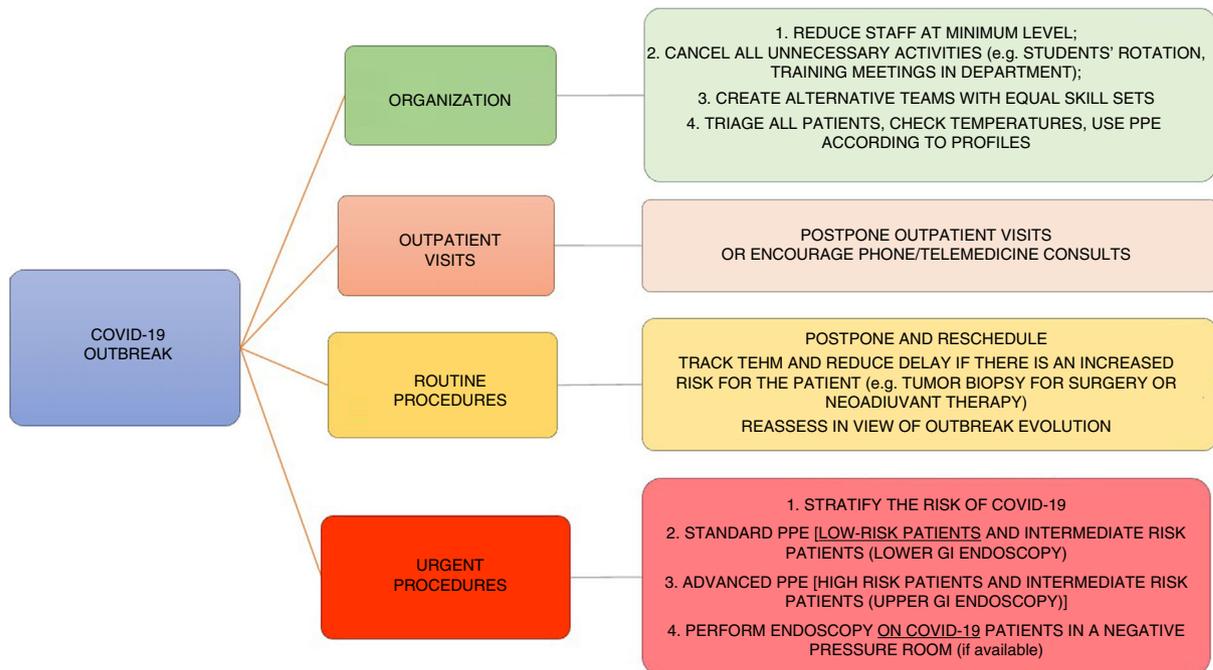


Figure 1 Endoscopy department reaction to COVID-19 outbreak. A suggested risk stratification pathway is reported in the text [12]. PPE: Personal Protective Equipment.

defined as those with symptoms (fever, cough, dyspnoea, diarrhoea) but with no contact with COVID-19 or stay in high risk areas, or without symptoms but with exposure to COVID-19 or stay in risk areas. "High risk" patients were considered those with at least one symptom and at least one of the following: contact with COVID-19; stay in areas at risk during the previous 14 days [12].

Standard precautions (surgical mask, gloves in high risk patients) are mandatory for patients and providers. Relatives/caregivers must wait outside the department. For low-risk patients (and intermediate risk patients undergoing low GI endoscopy), surgical mask, single-use gown, hairnet and eye protection (e.g. goggles) are sufficient. For high-risk patients (and intermediate risk patients undergoing upper GI endoscopy) filtering face-piece (FFP) respirators, such as N95, FFP2/FFP3, double-gloves, water-resistant gown and goggles must be used [23].

A COVID route, completely separated from non-COVID-19, must be clearly identified. A negative pressure room outside the endoscopy department for COVID or suspected COVID-19 patients needing endoscopy is desirable. Caution must be paid when disposing of PPE, scrubs and shoes used in the endoscopy ward. In a study by Ong *et al.* [25] regarding environmental contamination by SARS-CoV-2, positive samples were found on staff shoes. Therefore, dedicated endoscopy shoes or disposable shoe covers are recommended [26].

In regions with highest peaks of COVID-19 outbreak, endoscopy services have been centralized in few referral centres in order to reduce workload and to increase the local response to the ingrowing number of COVID-19 admissions.

COVID-19 consequences on proctology

Proctology and other benign disorders are a component of colorectal surgery that has almost completely ceased during the current pandemic. All outpatient proctology clinics, with the exception of oncological and urgent cases, have been postponed and are due to be rescheduled gradually.

However, several proctology disorders represent a serious psychosocial and economic burden for the patients, sometimes comparable to a malignant disease. Rectovaginal and rectourethral fistulas certainly belong to this category, as well as pre-cancerous lesions and anal malignancies. Not being able to perform diagnostic procedures (including imaging and biopsy) raises ethical concerns because their mortality rate, if not timely treated, could exceed the rate reported for COVID-19

[27,28]. Patients with sexually transmitted diseases deserve special attention; treating them during the pandemic could increase the risk of postoperative complications due to a weakened immune system.

Digital rectal examination and anoscopy are important steps of proctology examination, but the current emergency forces surgeons to use them selectively, due to the risk of contagion intrinsic to such manoeuvres.

Since elective outpatient appointments are not being carried out, most consultants are conducting telephone consultation after revising the charts of the patients, and only those who are deemed not deferrable are invited to attend the hospital. Implementation of telemedicine into everyday practice is probably something to consider after resolution of the pandemic, as it could avoid physical attendance of the hospital, unless unavoidable [8]. It has indeed been shown that telemedicine reduces healthcare costs by means of fewer hospital admissions and re-admissions [29]. The role of telemedicine during disasters has been validated [30] as well as its role in coloproctology [31,32].

Anorectal emergencies are common and include thrombosed external haemorrhoids, strangulated or bleeding haemorrhoids, anorectal abscesses, anal fissure, and Fournier's gangrene. Treatment of such conditions should be timely provided, even if surgery is not always necessary. Any attempt should be made to manage the patients conservatively, especially if the suspicion of COVID-19-positivity is high or the patient is known to be affected. Conservative measures are possible and effective for thrombosed haemorrhoids [33], whereas anorectal septic conditions should be promptly treated with surgical drainage. Fournier's gangrene has an estimated incidence below 1% of all anorectal sepsis, but its mortality rate ranges between 25% and 73% [34], thereby requiring immediate diagnosis and treatment as a priority. In the case of proctology procedures during the pandemic, outpatient procedures and local anaesthesia should be favoured.

COVID-19 and emergency colorectal surgery with perioperative practice recommendations on how to safely scrub and protective measures/equipment

Emergency surgical patient can be distinguished into COVID-19-positive confirmed cases and COVID-19 suspected cases. Either case should be handled as positive until proved otherwise. Swabs and diagnostic tests are requested as appropriate at admission but obtaining results should not delay definitive surgical management.

Within colorectal emergency surgery, only life-threatening emergencies should be treated (i.e. intestinal

perforation, obstruction and bleeding), in order to spare crucial resources for the management of the pandemic. SARS-Cov-2 might potentially be released in the form of aerosol with CO₂ circulation in the abdominal cavity, increasing the likelihood of nosocomial infections.

The use of laparoscopy in confirmed COVID-19 positive patient needing colorectal surgery should be carefully considered. The potential downsides of minimally-invasive surgery might include aerosolization of virus that might increase viral spread, favoured by intra-abdominal positive pressure during laparoscopy, while for some procedures longer operative time prolongs anaesthesia. However, laparoscopy can reduce the dissemination of aerosol compared to open surgery, especially when using electrocautery. Attention should be paid, indeed, to limit the leakage of gas from the trocars. Several methods have been suggested [8]. It is important to use trocars with self-sealing type Hasson and to make the incision as small as practicable. The trocar trephine must be connected to negative pressure suction with water seal. Before releasing the pneumoperitoneum or making an extraction incision the insufflator must be turned off and the pneumoperitoneum must be emptied by negative pressure connected to a water seal. The choice on whether to use laparoscopy should be decided on a case-by-case basis and be based on patient- and disease-related factors, as well as surgeon expertise. In COVID-19 positive emergency cases, we would suggest to adopt a selective use of laparoscopy only if the appropriate equipment is available and properly used. Pre-operative and intra-operative collaboration with the multi-disciplinary and anaesthetic team is vital.

COVID-19-positive patients with upper gastrointestinal bleeding with haemodynamic stability should have all conservative management options exhausted first prior endoscopy due to the high risk of aerosol generating procedures. The requirement for such procedures should be risk-assessed and deferred or delayed if possible. If deemed essential, then full PPE are required. Non-endoscopic interventions in the stable patient with lower GI bleeding include angiography, with or without angioembolization. Unstable patients or ongoing bleeding patients should be considered for laparotomy; however, outcomes are likely to be poor.

The management of large bowel perforations during the pandemic should follow basic surgical principles, however, open approach is recommended.

The management algorithm of complicated diverticulitis should also not change [35], with a focus on maximising conservative options e.g. antibiotics where possible. Procedures such as percutaneous drainage should be risk-assessed. Laparoscopic lavage should be

strongly avoided preferring definitive surgery and source control whenever required. Open abdomen should be avoided, preferring one stage definitive procedures and end stomas. Sigmoidectomy in emergency should be performed as an open procedure and Hartmann preferred over an anastomosis in this particular situation.

It is recommended to be cautious when performing anastomosis in the emergency setting in patients with suspected or confirmed COVID-19, both because of the high risk of complications (e.g. anastomotic leaks, intra-abdominal collections) and for the subsequent consumption of healthcare resources following an anastomotic leak. Patients with COVID-19 infection might be at increased risk of post-operative morbidity and mortality [36].

Appendicitis management should be tailored to a simple algorithm:

Perforated appendicitis needs urgent surgery which should be performed via an open approach in proven COVID-19 positive patients. Laparoscopy may be considered if the above mentioned precautions and devices are available and properly installed in theatre.

Patients with image-proven non-perforated appendicitis should be consented regarding an initial non-operative approach with antibiotics and ambulatory care where appropriate. Outpatient management of uncomplicated appendicitis with regular telephone (or remote) follow up is ideal and has already been proven to be safe and effective previous to this COVID-19 epidemic [37]. Patients can be re-assessed in telephone clinics at any time during follow up if symptoms are not resolving and readmission considered if deteriorating.

All emergency general surgery patients should be tested for COVID-19 without delay. However, emergency surgical management should not be delayed whilst awaiting results with the rationale that all patients during the pandemic should be considered to be COVID-19 positive and precautions taken appropriately.

In this context, the surgical theatre staff must be correctly trained to use personal protection equipment (PPE) and all the procedures must be clearly defined and standardized. The pandemic does not eliminate the need to adhere to the perioperative surgical checklist and should be prioritised to improve communication in a high stress environment. Patients should be reviewed, intubated and recovered within the theatre to restrict contamination to just one room; the pathway to the theatres must be the shortest possible on a previously defined route, involving minimal contact with others. The number of staff involved in the surgery should be limited and the traffic in theatres should be restricted [38].

Table 1 Preventive and protective measures being adopted.

SETTING OF COVID SURGICAL THEATRE
<ul style="list-style-type: none"> • 2 teams: 1 inside, 1 outside the theatre • team out: anaesthetic nurse/ ODP, scrub nurse, HCW • team in: anaesthetic nurse/ ODP, scrub nurse, HCW, anaesthetist, surgical team
<p>Level 2 Personal PPE in the theatre:</p> <p>Pre-room: double hair cap, FFP 3 mask, overshoes, neck guard or surgical balaclava, use goggles or a silicone whole face mask/ face shield if using eyeglasses, sterile gown and gloves</p>
<p>ENTRANCE ORDER IN THEATRE</p> <ol style="list-style-type: none"> 1 Scrub nurse/ HCW 2 Anaesthetist/ anaesthetic nurse 3 Patient (accompanied by the Surgical Ward staff from the area of origin who helps transfer the patient directly to the room on the surgical bed, through dedicated and marked COVID path) entrance in the Theatres Block from the emergency door adjacent to the Operating Theatre 4 Surgical team
<p>Once Inside the Theatre:</p> <p>Second sterile gown, second pair of gloves</p>
<p>EXIT FROM SURGICAL THEATRE</p> <ul style="list-style-type: none"> • The department (ward or ICU) of destination is alerted via Phone and prepares the bed; OUTSIDE staff physically goes to take the bed in the ward and brings it to the Operating Block • INSIDE staff take the bed inside the operating room, and transfer the patient from the table to the bed
<p>Procedure to leave the theatre</p> <p>When leaving the theatre, the staff undresses in the filter area, then following a dedicated path. It is important to take off the theatre gown with great care so as not to spread the virus and to remove the face mask as the last procedure and immediately put on a clean one. The team goes to the changing room (the one closest to the operating room), there takes a whole-body shower and then changes uniform before exiting.</p>
<p>EXIT ORDER</p> <ol style="list-style-type: none"> 1 Surgical team 2 Scrub nurse 3 Anaesthetist + Anaesthetic Nurse without changing wear, they take the patient to the ward of destination (or ICU) following the COVID dedicated path (which is then fully sanitized after operations are completed) together with the OUTSIDE HCW and Nurse who precede them and act as "forerunners" opening the doors, pushing for the lift and making sure that the path is isolated. 4 INSIDE HCW sanitizes the operating room, then exit and change their scrubs following the same rules as above <p><i>HCW: Health Care Workers (porters - cleaners - assistants i.e. non nursing theatre staff)</i> <i>ODP: Operating Department Practitioners</i> <i>PPE: personal protective equipment</i></p>

The preventing and protective measures adopted in Northern Italian surgical departments are summarized in Table 1.

Healthcare policy and Italian Government Perspective

During an emergency, it is necessary to reframe and reset the priorities, and the "yardsticks" that one would use in everyday practice. During the COVID-19

outbreak, before it was declared pandemic, the Italian Government promptly reacted with a timely planning strategy to face the situation.

At the time of developing guidance suitable during the COVID-19 crisis, the priority of the Government was to protect the citizens, healthcare providers, patients with COVID-19 and not patients with other treatable conditions and those requiring emergency treatment for acute diseases and trauma [4,7]. Due to the lack of solid evidence regarding the pattern of

infection, as well as the course of the disease and specific treatment for COVID-19, several strategic meetings were scheduled, in order to dynamically adapt the normative to the rapidly evolving scenario.

The Italian Government chose to establish hospitals dedicated to treating COVID-19 patients and other hospitals suitable as referral centres to deal with surgical emergencies and elective surgical procedures. These centres were identified at a local level and established after meetings of the Regional Council of each Italian Region. The directives of the Central Government required the local institution to identify several hospitals per each region that would have been used for the treatment of COVID-19 only, thereby better distributing the amount of work between centres, and allowing a better allocation of resources. Redistributing and reducing the workload during COVID-19 pandemic is a necessary measure, given the reduced number of working units available during the working shifts, due, on the one hand, to strategies aimed at reducing the social contacts and maintaining ward attendance to the strictly necessary personnel, and, on the other hand, to the contagion of healthcare professional, which require 14-day isolation. The reduced availability of instrumentation and demand for intensive care beds further highlights the importance of adequately distributing tasks/resources between centres.

The specific pathways that were adopted differed in each Italian Region were based on the local extent of outbreak. In Lombardy, a “Hub-and-Spoke” system was designed with specific hubs identified corresponding to their local expertise e.g. colorectal cancer.

Specific pathways of referrals were agreed e.g. patients requiring surgery for cancer were regarded as high priority. However, further sub-classification of priority was required in order to identify those needing expedited surgical treatment and those in whom a watchful waiting approach might be acceptable. During the early phases of the crisis, a document was circulated among the Health Directors of all hospitals of the Region Lombardy, drafted by a panel of oncologists, that reported a classification of priority suitable for patients with colorectal cancer during the COVID-19 outbreak. Cancer patients were prioritized based on tumour features and patient-associated factors (age and comorbidities, graded by means of the American Society of Anaesthesiologists’ [ASA] score). Three different categories of priorities were hence established, each identified with a colour:

- High priority (Red), including cancer-associated emergencies, not amenable to endoscopic or non-surgical treatment, with any ASA score if the patient is < 80-year-of-age, or in ASA 1-2 in case of older

patients (patients > 80 year-of-age with ASA 3-4 graded as “intermediate priority”); surgery should be performed within 2 weeks.

- Intermediate priority (yellow): cancers that are potentially curable with surgery, without any pharmacological, endoscopic, radiotherapy alternatives, in patients of any age, with ASA 1 or 2 (patients above 80 year-of-age with ASA 3-4 assigned to “low priority”); surgery should be performed within 2 months
- Low priority (green): cancers amenable to pharmacological, endoscopic, radiotherapy AND early cancers (i.e. T1N0) or with low aggressiveness; surgery can be deferred over 2 months.

Specific tumour features associated with prognosis were provided for each category, in order to aid the decision-making.

It is not possible at the moment to draw any conclusions about the performance of such measures, as the decision of which specific elective procedures and the number of procedures to be performed was not strictly regulated. Speculating on data about the procedures performed in each hospital or in each Region is of limited value at this stage and could be misleading, due to the fact that most documents of discharge and clinical charts might not be available.

Lastly, dedicated monitoring measures were put in place, in order to detect any shortages in instrumentations or deficiencies which might jeopardize the adequate provision of care or expose the healthcare professionals to unacceptable working conditions, and to identify the critical areas needing immediate action.

Discussions are in place on how to plan the post-pandemic phase, which would need a careful reassessment of the situation and might need the development of a dedicated plan, which could probably require International aids and collaboration.

Conclusions

COVID-19 pandemic is seriously threatening the structure of healthcare systems globally, and many interventions will be needed to deal with the new scenario after the crisis has been controlled. Hopefully, the necessity will drive innovation [39]. The present manuscript was designed to provide an overview on how some areas of colorectal surgery can be reorganized during the emergency. Far from being a definitive and authoritative guideline, the contents of this document are to be regarded as advice and guidance during a time of unprecedented demand on global healthcare systems.

For those facing the crisis, it would be helpful to consider an in-depth reorganization of the colorectal service at a central and local level. The limited

availability of surgical theatres, the reduced number of staff members, the limited hospital beds and resources, make it necessary to perform only prioritized elective colorectal procedures. The conservative management of COVID-19-positive patients with diseases of surgical interest should be as conservative as possible, without exposing the patients to unnecessary risks.

The surgical staff must adhere to strict perioperative pathways and must receive adequate training and instructions. Adherence to rules should be accompanied by common sense and decisions should be taken swiftly but based on efficient team-working and cross-specialty collaboration.

Author contributions

SDS: Conception and design; drafting of sections Healthcare policy and Italian Government Perspective and COVID-19 and Emergency Colorectal Surgery with perioperative practice recommendations on how to safely scrub and protective measures/equipment; revision of the manuscript for important scientific content; approval of the final version of the manuscript. FP: drafting of COVID-19 consequences on endoscopic procedures; revision of the manuscript for important scientific content; approval of the final version of the manuscript. GG: drafting of section COVID-19 consequences on proctology; revision of the manuscript for important scientific content; approval of the final version of the manuscript. FC: drafting of section COVID-19 consequences on elective management of Colorectal Cancer and Inflammatory Bowel Diseases; approval of the final version of the manuscript. AS: drafting of section COVID-19 and Emergency Colorectal Surgery with perioperative practice recommendations on how to safely scrub and protective measures/equipment; approval of the final version of the manuscript. PS: drafting of section Healthcare policy and Italian Government Perspective; revision of the manuscript for important scientific content; approval of the final version of the manuscript. NS: conception and design; draft writing and revision of the manuscript for important scientific content; approval of the final version of the manuscript. AnSp: conception and design; drafting of section COVID-19 consequences on elective management of Colorectal Cancer and Inflammatory Bowel Diseases; revision of the manuscript for important scientific content; approval of the final version of the manuscript. GP: drafting of introduction and conclusions; editing and drafting of the manuscript; approval of the final version of the manuscript.

SD, FP, GG, AS and GP shared first author position.

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