

How to get away with COVID-19: endoscopy during post-peak pandemic. A perspective review

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Abstract: The SARS-CoV-2 pandemic has changed the way we work, and health care services have to adapt. The use of personal protective equipment (PPE) and the delay of non-urgent procedures were the immediate measures adopted by Gastrointestinal (GI) Endoscopy Units at the time of crisis. As the peak has now passed in most countries, GI facilities are facing the next challenge of this pandemic: service providers must adapt their routine work to a 'new normal'. Routine casework must resume, and waiting lists must be addressed: all in the awareness of the ongoing potential risks of COVID-19, and the threat of a second wave. In this review, we discuss strategies to manage the workload by improving procedure appropriateness and prioritization, whilst maintaining a 'COVID-free' environment. This includes monitoring of an adequate stock of PPE and the implications for the staff's workload, and the GI trainees' need of training.

Keywords: public health, endoscopy, prevention, clinical practice, SARS-CoV-2, coronavirus

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Introduction

Coronavirus disease (COVID-19) is a respiratory illness caused by the SARS-CoV-2 virus, first identified in Wuhan, the capital city of China's Hubei Province, in December 2019.¹ The virus then spread to Europe, with the most severe outbreak in five provinces in Northern Italy (Lombardy and Emilia-Romagna regions),² and thereafter all over the world, having caused by the end of April 2020 more than 3,000,000 infections and over 200,000 deaths worldwide.³

Even if the disease primarily and more severely involves the respiratory tract,¹ presence of gastrointestinal (GI) symptoms has been recorded in up to 20% of these patients.⁴ As SARS-CoV-2 viral RNA has been detected in faecal samples of COVID-19 patients,^{5,6} it has been speculated that an oro-faecal transmission is possible.⁶ Moreover, viral RNA has been found in stools of affected patients with negative naso-pharyngeal swab⁷ and, possibly more relevant, in stools of patients recovered from infection during convalescence.^{8–10}

Therefore, international digestive endoscopy societies recommended high-level protection measures during procedures in COVID-19 patients or in areas with high disease incidence.^{11–13} Indeed, although the World Health Organization (WHO) did not include digestive endoscopy among the procedures at high infection risk, it has been reported that endoscopic procedures can result in aerosolization of viral particles, either during endoscope intubation or by the use of accessories through the endoscope channel.¹⁴ Finally, colonoscopies can theoretically expose to the risk of spread through non-aerosol-related particles if a faecal-oral route will be proved.^{10,15} Clinical practice of endoscopic facilities has, therefore, been significantly affected, with an extensive reduction of non-urgent examinations to limit the potential infective spread. In high-volume centres, only inpatient and urgent outpatient examinations, including cancer patients, have been performed, with a 70% volume reduction.¹⁶

In a disease without proven specific treatment or available prophylaxis, health policy interventions

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mainly consist of prevention with cases identification, notification and social distancing, whose duration will depend on the evolution of the pandemic wave and subsequent transmission dynamics.¹⁷ Along an initial flattening of infection curves, many countries are now gradually easing lockdown measures. The WHO designate this phase as a 'post-peak' period when disease spread in most countries has dropped below the peak and a rest/restock/rebuild policy is allowed.¹⁸ Endoscopy departments in affected areas will therefore soon be required to prepare a strategic plan to compound the ongoing assistance of COVID-19 patients (C+) with a gradual and safe re-establishment of non-COVID (NoC) patients' care.

Methodology

A literature search was done on *PubMed*, *Scopus*, *Embase*, *Cochrane database* and *Google Scholar* using the terms 'Post-pandemic period and endoscopy', 'Post-COVID and endoscopy', 'Endoscopy and post-peak pandemic'. Only one paper was found on endoscopy in inflammatory bowel diseases during the pandemic and post-pandemic periods.¹⁹ We therefore aimed at providing a set of shared proposals after discussion among physicians working at two high-volume endoscopy departments to safely face this transition to phase II endoscopy in the COVID-19 era.

General considerations

Identify (and maintain) COVID-free environments

In the new post-peak phase community transmission will be reduced and health care authorities should identify separated facilities specifically designed for COVID care. However, in the mid-term, and probably until vaccination is available, this separation will be hardly feasible or only partially efficacious. The natural choice will, therefore, be to design this confinement at a hospital and unit level. The most likely scenario is that endoscopy facilities will continue assisting patients that require urgent endoscopy (C+ or those at high-risk, either symptomatic or waiting for test confirmation) and re-allocate dedicated spaces to the assistance of the other patients (either inpatients or outpatients) whose less urgent health needs have been postponed for months.

At the endoscopy service level, it is essential to identify a C+ or high-risk area (C+/HR), well separated from a COVID-free or low-risk area (NoC/LR) and with dedicated paths (Figure 1).

Depending on centre volume, C+/HR area deserves one or more separated endoscopy suites with negative pressure and separate waiting and recovery rooms, with easily identifiable alerts. Full personal protection equipment (PPE) is required in this area. Assistance of COVID patients must continue to fulfil the recommendations of international societies and local protocols.¹¹⁻¹³ Description of these measures, including PPE [among the others, a N95 or N99 mask respirator or a powered air-purifying respirator, double gloving etc.], appropriate donning and doffing et cetera, falls outside the scope of this paper.^{14,20}

Alongside this COVID path, a separate NoC/LR area must be organized with separate waiting room, endoscopic suite and recovery room. In a post-peak pandemic scenario, attention must be paid not to consider this as a PPE-free area (see below: *Minimal standard of protective equipment for NoC/LR areas*).

There should be no intermixing among the personnel working in these areas. The same health care personnel (HCP) team (MDs, nurses, technicians and anaesthetists) must occupy only one of the two environments and remain together for the entire schedule so as to compartmentalize and minimize personnel exposure. The personnel distribution should be rotated (e.g. on an 'every two weeks' basis) in order to reduce the physical and psychological burden of working in a high-risk environment. Assistance in the C+/HR area might be followed by a week off endoscopy-room activity, with administrative tasks or patients' navigation/triaging. Ideally, a testing strategy (see below) should then follow, before starting the 2 week period in the NoC/LR endoscopy area.

According to local realities, a space confinement might also be associated with (or replaced by if necessary) a time confinement, with NoC/LR patients (and team) attending the service in the morning and C+/HR in the afternoon. In this case, a complete disinfection of all the rooms at the end of the day and a second HCP team to perform C+/HR in the afternoon session should be provided .

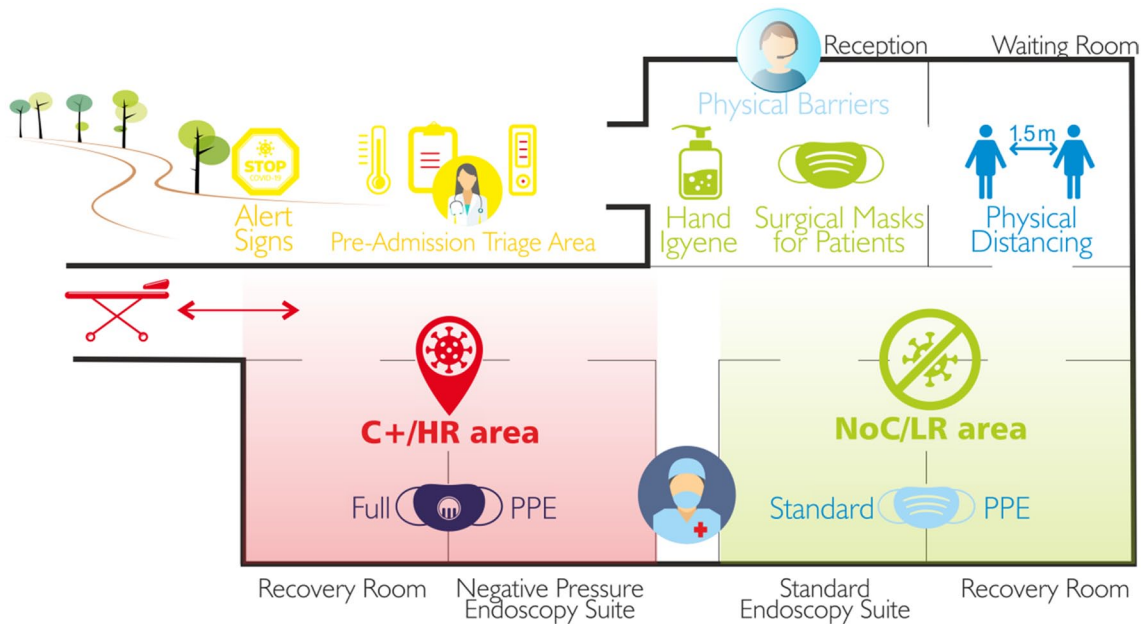


Figure 1. Endoscopy Unit. Separated areas and well-identifiable paths must be designed for COVID (C+)/high-risk (HR) patients and non-COVID (NoC)/low-risk (LR) patients, including separated waiting/recovery rooms. Every patient will be screened before entering the Unit. Eventually, HR patients detected through the pre-admission screening will be deferred or will have their examination performed as an inpatient through the C+/HR area. High-protection ('full') personal protection equipment (PPE) must be worn in the C+/HR area. Conversely, screening and triaging will let only LR patients be admitted into the Unit. These patients must anyway perform hand hygiene, maintain physical distancing and wear appropriate PPE, and must never cross the HR environment at any time during admission. HR, high risk; T, temperature

As it concerns the waiting/recovery rooms, in both areas (C+ and NoC) seats should have a distance between them (Figure 1) of at least 1 m, and preferably 1.82 m,²¹ in the NoC areas, and more strict distancing in the C+/HR areas, and all patients must wear PPE.

Pros and cons of testing in decision making

Even if availability of testing has reduced the risk of exposure of health care workers compared with in the outbreak phase, current laboratory markers are far from a perfect stratification of general population into susceptible, affected, recovered and immune cases.

False negative results of the real-time reverse transcription-polymerase chain reaction (RT-PCR) on naso-pharyngeal swabs are not infrequent (around 30% of cases), mainly due to collection methods, site and timing.^{22,23}

Serological testing is gaining increasing interest, even if most newly proposed platforms suffer

from the absence of high-quality clinical data regarding accuracy. Moreover, cross-reactions with antigens from other coronaviruses is a concern²⁴ and data about the immunity conferred by an IgG positivity are lacking (as, for example, for other coronaviruses, immunity wanes over time¹⁷). Therefore, a testing strategy to select potentially immune individuals is debatable and putting these tests at the centre of decisional algorithms may lead to a false sense of security, and a tendency to release the use of protective equipment, which is to date the safest option to rely on.

A US economic analysis of screening strategies has led to the conclusion that the economic burden of universal screening (through RT-PCR) would be adequately repaid by reimbursements derived from the increased procedure volume; however, this was associated with an increased HCP infection due to procedures executed on 'false negative' patients with reduced PPE, expected to be higher with increased infection prevalence.²⁵

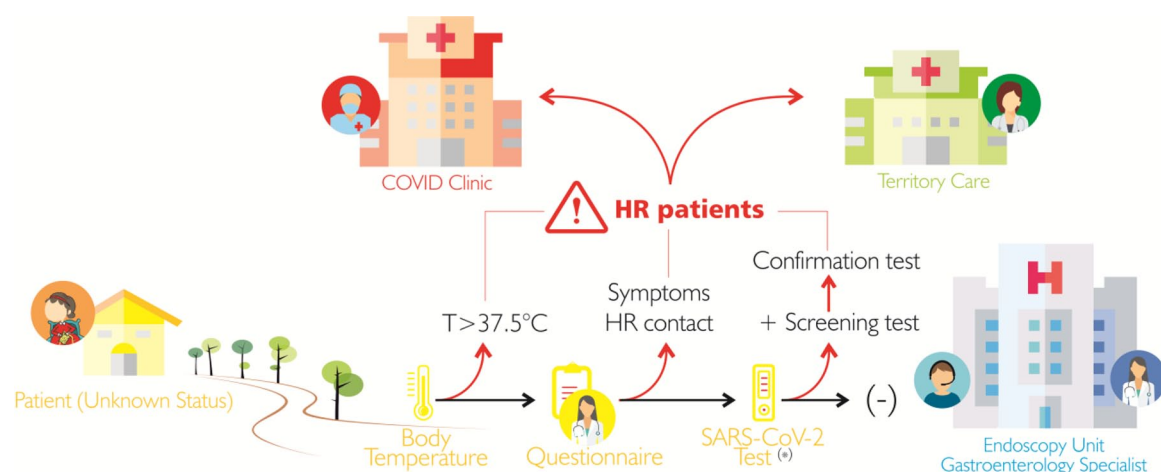


Figure 2. Screening process. After a first-round telephonic screening the day before the procedure, on the day of the procedure before entering the Unit the patient will be further evaluated: body temperature will be checked, the questionnaire updated and confirmed, and COVID testing performed with the best available technology. [*This will be preferably carried out through a point of care (POC) test and eventual confirmation test; in the case of a reliable POC test not being available yet, a timely pre-procedure test must be performed [e.g. naso-pharyngeal swab 24/48 h before the procedure].] Positivity in any of these steps should lead to a procedure deferral and to a definite workflow for patient referral to the most appropriate health service. HR, high risk; T, temperature

However, large cohort studies are now being planned to evaluate performances of serological tests. Accuracy and positive and negative predictive values will also drive the strategy for their most appropriate use, especially if rapid lateral flow immunoassays will prove to have a low false negative rate.

Isolated IgM positivity is rarely reported (probably due to low concentrations or short duration), while isolated IgG can be also found in patients with positive nucleic acid detection. It can therefore be hypothesized that all individuals with any serological positivity should be referred for a confirmation test (e.g. RT-PCR on naso-pharyngeal swabs or newly identified cost-effective tests).²⁴ Given these premises, and the to-be-clarified aspects, a serological certification of the HCP and a screening of each patient before admission could further help to reduce the likelihood of an undetected case in the NoC/LR area (Figure 2).

Maintaining an adequate workload through appropriateness and prioritization

Even if some elective procedures may be restarted in a post-peak phase, an open access system should be discouraged. Endoscopy services which have postponed elective procedures for months are expected to be burdened by a long waiting list.

A strict medical re-evaluation of the appropriateness of each procedure must be first carried out, contacting the referring physician or interviewing the patient through telephone call or telemedicine¹⁴ (Figure 3). Examinations that are clearly inappropriate but frequently requested in open-access systems, such as post polypectomy surveillance or repeated investigation of mild symptoms,^{26–28} should be cancelled. Also, when alternative examinations are available for the same diagnostic question, the exam less likely to expose to an increased risk of contagion must be chosen. For example, if an endoscopic ultrasound (EUS) is requested to exclude a choledocholithiasis, the referring physician should be contacted to discuss whether a non-aerosol-generating procedure like magnetic resonance cholangiopancreatography would be more appropriate. Pre-endoscopy diagnostics must be adequately covered, in order to increase or reduce the pre-test probability of relevant findings (e.g. a chronic diarrhoea with significantly elevated faecal calprotectin is most likely to benefit from a colonoscopy than a patient with positive transglutaminase antibodies). However, viral RNA detection in stools must also be kept in mind when considering prescribing stool analyses,¹⁰ theoretically carrying a somehow increased transmission risk if laboratory personnel are not aware of this issue nor adequately equipped. In an era where also elective specialist consultations have

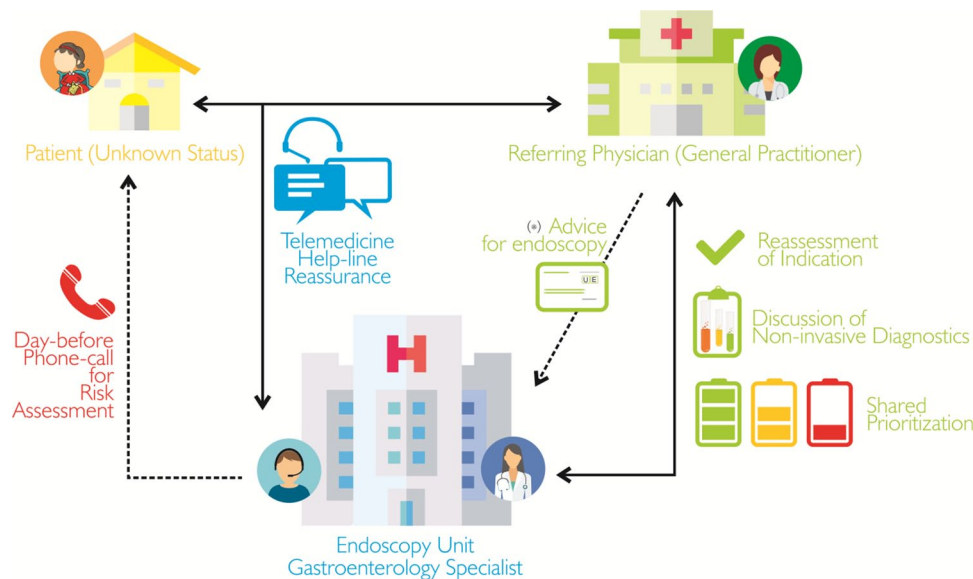


Figure 3. Healthcare network. After the referring physician has requested an endoscopic procedure, the gastroenterologist should offer his specialist consultation to verify the appropriateness. The gastroenterologist/endoscopist and the referring physician must also agree on prioritization of the procedure, taking also into account the patient's clinical history. The patients will be contacted by the Endoscopy Unit for a telephonic pre-screening of their health status. A consultation through phone call or telemedicine platforms can be offered if needed.

been reduced, this referring physician–gastroenterologist dialogue needs to be implemented.

After appropriateness is ascertained, prioritization of procedures must then be pursued using transparent criteria (Figure 3). Some procedures, despite not being urgent, could bear a psychological distress for the patient (e.g. the endoscopic resection of a large colonic lesion or EUS evaluation of a new worrisome feature on a pancreatic intraductal papillary mucinous neoplasm). Examinations requested for severely 'symptomatic' patients who would benefit from an accurate diagnosis as it would affect their specific treatment must also be performed (e.g. exclusion of inflammatory bowel disease (IBD) in chronic diarrhoea patients, after adequate non-invasive testing, or evaluation of mucosal damage in IBD patients with poor clinical response to a treatment). In the post-peak phase, some surveillance examinations might still be safely postponed (e.g. colonoscopy aimed at detecting metachronous lesions after a former resection; surveillance of atrophic gastritis, etc.), but a clearly defined date should be provided considering the capacity of the system. Even screening colonoscopies after a positive faecal immunochemical test may be relatively postponed: in one large retrospective study,










postponing these exams for up to 6 months did not have an influence on the rate of 'any' or 'advanced' cancer.²⁹

The loss of opportunity of an adequate treatment must be taken into account when postponing a procedure.³⁰ However, a significant variability among gastroenterologists in the perception of urgency of single indication has been reported.³¹ A shared (if not multidisciplinary) agreement on procedures to be postponed should be sought.¹⁴ A more general position of international societies and local health authorities could further help physicians and units to reduce the burden of medico-legal issues,³⁰ especially regarding colorectal cancer screening. Patients with postponed procedures must be adequately reassured about the safety of this conduct, using telephone calls or telemedicine. A list of deferred procedures needs to be maintained, and their urgency systematically reassessed at least every 8 weeks should the lockdown be longer than expected.¹⁴

Practical considerations (Table 1)

1. *Rest and recuperation of health care workers.*
Coping with the physical and psychological

Table 1. Flowchart of practical considerations to be taken into account when resuming a post-peak endoscopy practice.

General considerations	
	<ul style="list-style-type: none"> • Rest and recuperation of health care workers
	<ul style="list-style-type: none"> • Awareness of potential new waves
(Figure 3)	<ul style="list-style-type: none"> • Maintaining an adequate workload through appropriateness and prioritization
Organizational changes	
	<ul style="list-style-type: none"> • Restock of protective equipment and supplies
(Figure 1)	<ul style="list-style-type: none"> • Identify (and maintain) COVID-free environments
Pre-procedural changes	
	<ul style="list-style-type: none"> • Day-before call for risk assessment (symptoms and contact)
(Figure 2)	<ul style="list-style-type: none"> • Same-day triage of patients
	<ul style="list-style-type: none"> • Point of care testing
(Figure 1)	<ul style="list-style-type: none"> • Reception of patients and waiting rooms
Intra-procedural changes	
	<ul style="list-style-type: none"> • Enhanced protection for C+/HR areas
	<ul style="list-style-type: none"> • Minimal standard of protective equipment for NoC/LR areas
	<ul style="list-style-type: none"> • Re-evaluation of trainee involvement in procedures
Post-procedural changes	
	<ul style="list-style-type: none"> • Separate track for C+ endoscopes but standard reprocessing
C+/HR, COVID/high-risk; NoC/LR, non-COVID/low-risk	

distress of a pandemic can be exhausting.³² Personnel who have been involved in continuous and long-lasting assistance of COVID patients should be offered an adequate period of rest or switched to

low-intensity tasks not involving the use of full C+ PPE.¹⁸ Hospitals should also offer psychological support.

2. *Awareness of potential new waves.* Because of the loosening of some restrictions,³³ and

until an adequate vaccination programme has been established, new viral waves are likely to occur.¹⁷ Therefore, PPE (masks) should be worn by all the personnel in addition to other personal hygiene measures.

3. *Restock of protective equipment and supplies.* For the aforementioned reasons, services need to restore their stock of PPE and revise the service preparedness for a new event.¹⁸ Moreover, supplies of particular devices required for advanced, non-conventional procedures may have diminished during the pandemic due to restrictions of the distribution chain: it is time for inventory!
4. *Triage of patients.* Notwithstanding the possibility of performing rapid on-site testing in the future, outpatients at risk must be identified and treated with appropriate precautions before they reach the hospital. We suggest systematic telephone contact with scheduled patients the day before the exam.²⁰ A trained operator (with a senior physician in the back office) should ask about respiratory symptoms (e.g. fever, cough, shortness of breath) or contact with an affected individual during the previous 14 days. The questionnaire must be updated and confirmed the day of the procedure before entering the service.²⁰ In the case of high-risk patients referred for a non-urgent procedure the exam should be postponed, and patients eventually addressed by the appropriate territory service for screen-and-treat. The personnel must also be screened daily for symptoms and temperature $>37.5^{\circ}\text{C}$ before starting duties.²⁰ In our hospitals, this is automatically checked through thermal cameras placed before badging access points (preventing access in the case of temperature).
5. *Reception of patients and waiting rooms.* Clear signs at the entrance to the service must advise of the need to wear a surgical mask. No caregiver must be admitted unless strictly necessary. Surgical masks and hand hygiene stations (with alcohol-based hand rubs) must be available on site. Apart from PPE, physical barriers (e.g. glass or plastic screens) for registration desks are suggested.³⁴ Visual alerts must advise of the need to maintain social distancing. Appropriate signing can be provided of specific seats which can be used and those which need to be left to maintain an interpersonal distance of at least 1.5 m. Temperature must be measured at the entrance to the service of any patient and caregivers and the above mentioned telephonic triage questionnaire be verified. Administrative personnel must be trained on providing information on how to maintain appropriate distance and the use of facemasks.³⁴
6. *Minimal standard of protective equipment for NoC/LR areas.* Due to the aforementioned limitations of testing, in every patient with a low risk of infection (even a negative testing) a minimal standard prudential protection must be guaranteed, according to updated indications of authorities. Experiences in influenza prevention have sustained the absence of significant differences among surgical masks and N95 respirators in preventing viral transmission.³⁵ We believe that, also due to the described long-lasting persistence of viral detection in stools, at least a surgical mask, goggles, a single-use gown and double gloves need to be maintained in the NoC/LR environment, even in areas with limited community transmission. Due to the high rate of detection of viral particles in stools of recovered COVID patients, even long after a negative naso-pharyngeal swab,¹⁰ we suggest extremely high caution even in the NoC/LR environment to prevent contamination during donning and doffing, especially until a faecal–oral way of transmission is excluded.
7. *Standard reprocessing of instruments.* Current indications for instrument reprocessing include mechanical and detergent cleaning, high-level disinfection, rinsing and drying and have demonstrated a very low risk of viral pathogens transmission.¹⁴
8. *Re-evaluation of trainee involvement in procedures.* Trainees and Fellows in gastroenterology and digestive endoscopy have experienced a deep contraction of their learning opportunities, when not being re-allocated to COVID patients' care³⁶ This has to do not only with personal ambition, but also with law requirements for their certified trainings. In a scenario of PPE sparing and exposure risk reduction, Fellows have been usually withdrawn from endoscopy suites. About half of endoscopy training programmes had been suspended in

one North-American survey.³⁷ While Fellows have probably profited from this time for research purposes and for e-learning (i.e. webinars), hands-on is an irreplaceable part of endoscopic training, and cannot be contracted for long periods. In this post-peak phase, adequate PPE stocks should be available, and institutions must rethink their policies for a safe and gradual reintroduction of trainees in the NoC/LR area first.³⁸ The COVID era might furthermore have changed epidemiology of endoscopy procedures (e.g. more treatments for GI bleeding rather than elective colonic endoscopic resections), and this can further limit the possibility of achieving a complete endoscopy training. We believe that an accurate tracing of what each trainee/Fellow has already done (list of procedures performed as first operator), what they are able to do (previous learning, e-videos, courses, hands-on) and what he/she still needs to learn (core curricula of international societies^{39,40} or aims of local fellowships) must be central in rationalizing trainees' allocation to procedures.

9. *Speculations on an 'exposure'-effectiveness ratio for endoscopic procedures.* Risk of aerosolization of particles is time-dependent. It is diffuse opinion that in a peak or post-peak pandemic the endoscopist should abandon 'heroic' attempts of treatments that can be safely postponed. The classic example is the management of complex choledocholithiasis (i.e. multiple or large stones). If simple ancillary methods (such as large balloon dilation assisted extraction) fail, plastic stenting and deferral must be considered as an option to reduce personnel exposure in C+/HR patients. In parallel, procedures (e.g. EUS-guided gallbladder drainage⁴¹ or EUS-guided gastroenteric anastomosis) aimed at sparing surgical spaces (and surgery-derived intensive care requirements) can be favoured when evidence and expertise make them a safe option for patients.

Conclusion

The post-peak pandemic will represent a new challenge for health care providers, as the need for maintaining adequate safety measures must be merged with a gradual re-establishment of a

quite-normal practice. Even if we barely know what the model of viral transmission would be, and how it will be affected by seasonality, immunity, diffuse testing and eventually by vaccination, efforts to reduce some restraints must be pursued, while keeping high the awareness that new peaks may happen. Results of ongoing studies on the accuracy of screening tests and, hopefully, the development of efficacious prophylactic options will further help to plan this transition. The right to rest of health workers, chronic patients' care and the training desire of GI Fellows cannot be sacrificed for too long, and this will require the most clever and brilliant efforts in planning and resource allocation. Every single health care professional is now called to a new task: be a lantern, defining the darkness before defying it.

Conflict of interest statement

GCo is consultant for Cook Medical, Boston Scientific and Olympus and had General payments/Minor Food and Beverage from Cook Medical, Boston Scientific and Olympus. IB is consultant for Apollo Endosurgery, Cook Medical, Boston Scientific and Endo Tools, is Apollo Endosurgery Research Grant Holder, is Endo Tools scientific board member, and had General payments/Minor Food and Beverage from Apollo Endosurgery, Cook Medical, Boston Scientific and Endo Tools. All other authors declare no conflict of interests relevant to this paper.

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