Special Communication

COVID-19 and endoscopy services in intermediately affected countries: A position statement from the Saudi Gastroenterology Association

Majid A. Almadi[1,2], Abdulrahman M. Aljebreen[1], Nahla Azzam[1], Nuha Alammar[1], Emad S. Aljahdli[3], Fahad I. Alsohaibani[4], Resheed Alkhiari[5], Abdulaziz O. Almasoud[6], Mohammad S. Al Beshir[7], Suliman Alshankiti[1], Ahmad W. Alharbi[8], Mohammed Alkhathami[9], Faisal Batwa[10]

[1]Division of Gastroenterology, King Khalid University Hospital, King Saud University, [4]Department of Medicine, King Faisal Specialist Hospital and Research Center, [6]Prince Sultan Military Medical City, [9]Internal Medicine Department, Security Forces Hospital, Riyadh, [8]Department of Internal Medicine, King Faisal Specialist Hospital and Research Center, [3]Gastroenterology Division, Department of Internal Medicine, King Abdulaziz University Hospital, King Abdulaziz University, [10]King Saud Bin Abdul-Aziz University of Health Sciences, King Abdul-Aziz Medical City, Jeddah, [5]Department of Medicine, Qassim University, Buraydah, [7]Division of Gastroenterology, Department of Medicine, King Fahd Specialist Hospital Dammam, Saudi Arabia, [2]Division of Gastroenterology, McGill University Health Centre, McGill University, Montréal, Québec, Canada

Abstract

With the global pandemic due to coronavirus disease 2019 (COVID-19), there has been a significant strain on healthcare facilities. The infectivity rate, as well as the rate of healthcare workers who have fallen ill to the disease, has raised concerns globally on the proper management of patients as well as the role of safe healthcare provision utilizing personal protective equipment (PPE). Furthermore, the limited supply of PPEs has mandated rationing their use to achieve maximum utility and preservation. Multiple gastroenterology associations have issued guidance and statements that would help healthcare providers in navigating these unprecedented and difficult times, and the Saudi Gastroenterology Association has provided this statement in an effort to bring the most up to date information for the management of endoscopy units in terms of resources, manpower planning, scheduling, as well as infection control policies and leadership.

Keywords: COVID-19, endoscopy, personal protective equipment, SARS-CoV-2, Saudi Arabia

Address for correspondence: Dr. Majid A. Almadi, Division of Gastroenterology, King Khalid University Hospital, King Saud University, P.O. Box 2925 (59), Riyadh 11461, Saudi Arabia.
E-mail: maalmadi@ksu.edu.sa

Submitted: 10-Apr-2020 **Revised:** 10-Apr-2020 **Accepted:** 10-Apr-2020 **Published:** 30-Apr-2020

INTRODUCTION

The severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) and its clinical manifestation as coronavirus disease 2019 (COVID-19) pandemic has caused significant stress on healthcare systems, supply chains, governments, as well as the global economy.[1,2] The policies adopted by different countries are influenced by various factors such as the readiness of healthcare systems and its responsiveness, as well as the political will and sense of urgency to the

Access this article online	
Quick Response Code:	Website: www.saudijgastro.com
	DOI: 10.4103/sjg.SJG_161_20

How to cite this article: Almadi MA, Aljebreen AM, Azzam N, Alammar N, Aljahdli ES, Alsohaibani FI, *et al.* COVID-19 and endoscopy services in intermediately affected countries: A position statement from the Saudi Gastroenterology Association. Saudi J Gastroenterol 2020;26:240-8.

matter. The disruption to endoscopic services (which is the focus of this statement) has been huge, with units reporting a decrease in volume of up to 80%. Numerous healthcare systems have shifted from in-person outpatient visits to virtual clinics or phone communications and delivery of medications to patients' homes in an attempt to limit population mobility and public gatherings.[3,4]

The protection of health care workers (HCW) and the prevention of nosocomial infections are of importance at this time; not only is there a global shortage in supplies and facility space to cope with the anticipated surge in demand, but a loss of manpower during this period, which might be unavoidable, would create another bottleneck for the services needed.

It has been realized that aerosol-generating procedures like upper gastrointestinal endoscopy, and most probably endoscopy in general, are considered high-risk procedures that would expose HCW to the risk of infection. Numerous position statements and guidelines have recently been published to communicate to their representative constituents information for dealing with the current pandemic.[5-14] The Saudi Gastroenterology Association (SGA) realized the need for local recommendations, that were mainly adopted from other sources by a team of specialists from within the country, who reviewed it to meet the current needs of the region.

It is understood that this is an evolving situation and there is a lot of uncertainty[15] and the quality of the global publications might not be as conclusive as is desired[16] and at the same time, the literature is evolving and as such these recommendations reflect the best prevailing knowledge at the moment. In addition, this Position takes into perspective not just the medical knowledge at this point of time but also the opinions of the authors, as they understand the current situation in terms of logistics and healthcare management strategies in weathering the current pandemic.

Modes of transmission

The most recent interim recommendation from the World Health Organization (WHO) states that the two methods of infection transmission are through respiratory droplets (generated by coughing or sneezing of an infected individual) and contact (the immediate environment of an infected individual where respiratory droplets might fall and the virus would remain viable).[17]

There have been studies that detected SARS-CoV-2 in the stools of patients and suggested a possible fecal-oral route of transmission of the virus even in the absence of diarrhea or when respiratory samples were negative.[18-22] As such a similar level of caution should be undertaken when performing lower gastrointestinal procedures, as there is a risk of aerosol generation through the biopsy channel of lower endoscopes when introducing or removing instruments through the accessory channel.[5] Past experiences with other outbreaks have emphasized the need to adhere to infection prevention policies at all times and in different areas within healthcare facilities to prevent nosocomial infections.[23] Also, diligent hand hygiene is a necessity for all HCW throughout the facility as well as in general.[24]

Personal protective equipment (PPE)

Masks

There are a variety of masks that could be used and there has been a long debate on what type, whom, and where to use masks. Surgical masks are not adequate in blocking aerosols and the WHO clearly states that the "use of a mask alone is insufficient to provide an adequate level of protection, and other measures should also be adopted."[17] The same document states that "health care workers should use a particulate respirator at least as protective as a US National Institute for Occupational Safety and Health-certified N95, European Union standard FFP2, or equivalent, when performing or working in settings where aerosol-generating procedures are performed."[17] Fitted respirator masks (N95 respirators, filtering face piece [FFP] 2, or equivalent) are designed to block aerosols (<5 μm) at least 95% of the time and droplet sizes from 5 μm to 50 μm. Elastomeric half-mask respirators are used in the construction and manufacturing industries, and their use by HCW workers has been described in the literature recently,[25] but their limited availability would not warrant its discussion in our setting.

In a meta-analysis[26] of four randomized trials, there was no difference between medical masks and N95 respirators in the prevention of laboratory-confirmed viral respiratory infections with an odds ratio (OR) of 1.06 [95% confidence interval (CI); 0.90 to 1.25] or clinical respiratory illness with an OR of 1.49 (95%CI; 0.98 to 2.28). Of note, these studies were in the setting of nonaerosol generating care, had a low level of certainty of evidence, and only one of the four was specific to the SARS-CoV-2 virus.[26] A second meta-analysis that included six randomized trials had a similar conclusion.[27] Also of note, the WHO recommended that masks be exchanged whenever they become damp and not to reuse single-use masks[17] and the Asian Pacific Society for Digestive Endoscopy (APSDE) guideline recommended that masks be only changed after

each session[10] with the aim of preserving this scarce commodity while the European Centre for Disease Prevention and Control (ECDC) recommended that masks be exchanged after performing an aerosol-generating procedure.[28]

The use of N95 respirators and/or FFP2 or equivalent masks during aerosolized procedures has been recommended in a recent guideline from the Surviving Sepsis Campaign group[29] while the ECDC went as far as recommending a FFP3 respirator (which has a minimum filter efficiency of 99%) when performing aerosol-generating procedures.[30] Thus, we recommend that HCWs in the endoscopy unit should use medical masks with a particulate respirator quality.

It is essential that all personnel get fitted with the proper mask sizes that achieve proper sealing.[24] In the BEARDS study,[31] none of the fully bearded HCW achieved a seal on the N95 filtering face piece respirators and, in these settings, either a clean shave would be advised or a powered air-purifying respirator (PAPR) should be used with newer designs that have been introduced lately.[32-34] In some institutions, the use of PAPRs has been advocated in cases with confirmed COVID-19 that require endoscopic procedures to be performed.[3]

Gowns

The types of gowns that are usually used in endoscopic procedures are reusable woven cotton gowns, disposable water-resistant nonwoven gowns, or disposable nonwoven plastic aprons, and are usually chosen based on local practices and these are by default long-sleeved. A study comparing these three types of gowns found variable properties and benefits of each. Cotton gowns have the advantage of water absorption and thus less contamination of the environment from drops that would be repelled off the other two kinds, but would at the same time risk the penetration of material to the cloth of the HCW, while disposable water-resistant nonwoven gowns would not have that downside but could contaminate the environment, especially if it is forcefully removed without untying the gown.[35] A combined approach of an outer cotton gown and an inner disposable water-resistant nonwoven gown might be the best approach in combination with the proper sequence of wearing and removing the gowns. Similarly, shoe covers should be used as these have been documented to get contaminated.[36] Although there is a lack of evidence, given the nature of endoscopic procedures, it might be worthwhile using boot covers (which extended up to the ankle and calf) when performing endoscopic procedures. The APSDE guidelines recommend that gowns be changed when contaminated.[10]

The use of coveralls (which are one-piece protective garments) has not been recommended by the WHO[37] and Public Health England has mentioned its use for ambulance trusts when performing aerosol-generating procedures.[38] It is worth noting that the use of coveralls might be associated with heat stress and dehydration but have been used extensively in Asia during the current pandemic.

Eye and face protection equipment

Face shields and/or safety goggles should be used by personnel when performing endoscopic procedures to prevent the exposure of the face and eyes from aerosolized material[24] and those that are reusable, or when supply is short, should be cleaned with disinfectants before storage and reuse.[3] When goggles are used, they should be fit to the facial features of the HCW and compatible with the respirator mask being used.[30]

The use of hairnets is also advised. Figure 1 displays an endoscopic retrograde cholangiopancreatography (ERCP) being performed using PPEs.

Double vs. single gloving

The use of gloves and the proper technique of taking them off are key in preventing contamination. It was suggested that having double gloves worn above and below the sleeves of long gowns and removed in a sequence where the outer glove was removed first and the inner glove was removed last demonstrated that the risk of contamination was lower when compared to a single glove strategy[39] similar to the findings in a Cochrane review.[40] Of note, most of the studies were in simulated situations with small numbers of volunteers and whether this strategy would result in a true reduction in infection is not clear. Nonetheless, such a strategy would be recommended especially in high-risk

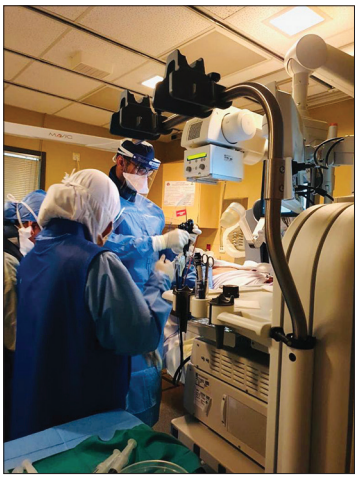

Figure 1: Personal protective equipment being used during an endoscopic retrograde cholangiopancreatography

procedures provided that the supplies of PPEs permit such a practice. Gloves should be changed after every procedure.[10]

Donning and doffing

Training on putting on (donning) and taking off (doffing) PPEs is of utmost importance as these would become sources of infection if not dealt with properly. For further information on this practice, we refer the readers to the US Center for Disease Control and prevention (CDC).[41] In a Cochrane review, the CDC doffing guidance appeared to decrease the risk of contamination. In addition, a more active face-to-face training process for PPE use might reduce doffing errors more than passive training (video or folder based).[40] A common finding is that there were failure points in doffing of high-level PPEs when removing the outermost garment, boot covers, and respirator hoods as well as hand hygiene.[42] In addition, designated areas of donning and doffing should be made known to staff, and deal with the bins that contain used PPEs in a proper and timely fashion to avoid overflow.[24] It has been recommended that HCWs be observed during donning and doffing with the aim of improving the technique as well as identifying gaps and mistakes.[5]

Suspected cases vs. confirmed cases or a single strategy?

The literature has reflected a differing approach in dealing with patients, with the idea that stratifying patients to risk categories would enable rationing in PPEs and saving precious resources to those who pose a higher risk. Although such an approach is understandable, we would recommend that each procedure be dealt with as an infected patient which is in line with the recommendation of the American Gastroenterology Association (AGA).[5] The rationale for such a recommendation stems from the high risk of transmission inherited in the case of upper endoscopy, as it is an aerosol-generating procedure. Furthermore, during the incubation period, which could be as long as 14 days, where an individual is asymptomatic but could be contagious, the simple screening questionnaires that are implied would not be able to detect a person as a possible source of infection.[17,43,44] In addition, an endoscopist's skills as well as those of the endoscopy personnel are a precious commodity that cannot be undertaken by other HCWs, and as such, the provision of this service would be interrupted should they fall ill.

If and when rapid point-of-care testing for SARS-CoV-2 becomes available with acceptable sensitivity, then a "testing first strategy" might help better triaging patients with the aim of hopefully preserving PPEs.

Use of negative pressure rooms or high-efficiency particulate air (HEPA) filters

The use of negative pressure rooms was not found to be associated with decreased exposure or infection in a review by the AGA. However, we recommend its use based on indirect evidence that the SARS-CoV-2 virus could remain viable in an aerosol form till at least 3 h.[45] In addition, the ECDC recommended performing aerosol-generating procedures in negative pressure rooms.[46] It would be reasonable that negative pressure rooms be used, when available, as endoscopy is an aerosol-generating procedure. In settings where negative pressure rooms are not available, the use of rooms that have portable HEPA filters is advised.[29]

Communication with family and caregivers

In addition, caregivers and relatives of the patients should not be allowed to the endoscopy area except in special situations in which patients require specific assistance. Also, it is recommended that if a family member is accompanying the patient, he/she should be in a waiting area, wearing a surgical mask and should abide by the recommendations of social distancing in the waiting area.[3] Also, as some centers have adopted in their policies and procedures, the informed consent process should be taken by the physician in charge in a verbal form and would sign in place of the patient with the aim of limiting the exchange of material between individuals as these surfaces might be a source of infection.

Patient flow inside the endoscopy unit

As it is anticipated that the majority of procedures would be performed for inpatients, it is reasonable that once the patient arrives at the unit, he/she should be directed to the procedure room immediately. If for any reason, the patient arrives at the unit and the endoscopy procedure room is not ready, the patient should be kept in a holding bay applying the rules of safe distancing. It is recognized that wearing masks by infected individuals limits the spread of infectious droplets from an individual to surfaces and the environment and would decrease the probability of infecting others;[17,46] thus, we recommend that all patients undergoing endoscopy wear a surgical mask throughout the whole process from the transfer to the endoscopy unit till leaving apart from the period when the procedure is performed.

After the procedure and if permissible, given the demand on endoscopic procedures, patients should recover in the endoscopy room and then shifted out of the unit from the endoscopy room directly.

If and when outpatient procedures are reinstated, we stress that patients should be managed as potentially being positive patients. It is anticipated that this would be a gradual process and the volumes would be much lower than the usual for any unit. As such, this would permit the application of social distancing as well as immediate triaging and admission to the endoscopy room and use it as a pre-procedure area. This would limit the exposure between patients. Again, minimal staff exposure is encouraged. Recovery would also be similar to the process described for inpatients.

When a patient is in a setting where he/she is either in a critical care area (whether ventilated or not) and the procedure is emergent, then it would be better performed as a mobile procedure outside the endoscopy unit. In addition, if and when an endoscopic procedure requires general anesthesia, it should be performed with all HCWs utilizing PPEs and the minimum number of HCWs should be in the room during intubation.

Manpower management of endoscopy units

The minimum number of HCWs needed to perform the procedure should be exposed to patients during endoscopy. In addition, the number of handovers for each patient during the flow through the endoscopy unit should be limited so that the number of HCW that are exposed to any one patient are reduced.[6]

It has also been recommended to have the care delivered in teams that would change over time and even those who would be considered at risk be removed from the endoscopy performing teams and shifted to other areas.[3,10] This would decrease the contact points, and if there was any concern at a later point that a patient was found to be infected, this strategy would decrease the number of HCW exposed and would ease the tracing process and limit the number of individuals that would need to be self/home isolated. If a HCW gets in contact with a positive COVID-19 case without the proper PPE or if a staff member is febrile or developed symptoms, it is advised that he/she get screened and should self-isolate for 14 days.[46] Also, as endoscopy units are high-risk areas, it would be advised that medical students, interns, or residents should avoid entering endoscopy units during this period. HCWs within the endoscopy unit should always practice safe distancing and proper hand washing and standard PPEs throughout the day, as well as wearing medical mask during presence inside endoscopy unit all day.[46]

Procedure scheduling

All nonurgent procedures should be postponed to a later date, while those that are emergencies should not be unnecessarily postponed so that care to patients would not be compromised. Also, cases and indications should be reviewed by the staff and be re-evaluated on a regular basis. A nonexhaustive list of procedures as well as the suggested action is shown in Table 1. As the duration of this pandemic is unclear and so as not to jeopardize the care of patients in need of urgent endoscopic procedures, this should be regularly reviewed by the staff and institution leadership and in the context of other healthcare resources available (operating theater and intensive care capacity for patients requiring surgery as part of the spectrum of care). It is not uncommon that the care of these urgent endoscopies usually requires coordinated care between different services and other diagnostic procedures and, as such, should be looked at from a system-wide perspective rather than just an indication for a procedure. These recommendations are inline with the position of numerous gastrointestinal associations.[8-10,47]

Reprocessing of endoscopes and disinfection

There is no reason to deviate from the reprocessing of endoscopes from the standard methods[5,8,48,49] but it is worthwhile to emphasize that infection control methods be adhered to at all times. In addition, as the endoscopy unit is a high-risk area, cleaning of surfaces including stretchers, floors, office tables, doorknobs, and workstations with computers is important and should be performed regularly.[49-51] Also, single-use accessories should not be reused[8] and should be disposed of in accordance with institution protocols as biological hazards.[6]

It has also been recommended by a group that there would be at least 30 min between procedures when negative pressure rooms are used and to increase that time to at least an hour when a regular room is used to decrease the probability of exposure to aerosolized particles.[51] The ECDC has suggested that when an aerosol-generating procedure is performed in a room without negative pressure ventilation, the room should be ventilated with fresh air (if there are windows in the room) for 1 to 3 h.[52]

The cleaning process should include all surfaces in the procedure room in order to remove soil and/or biofilm, followed by proper disinfection. The ECDC recommends using neutral detergents initially then using disinfectants with an activity against viruses (virucidal activity).[52] An alternative would be to use 0.05% sodium hypochlorite (NaClO) or if household bleach is used (which has a usual concentration of 5%) to dilute it to a 1:100 concentration.[52]

Table 1: A nonexhaustive list of procedures and the recommended approach

Type of procedure	Example	Recommendation
Screening	Screening colonoscopies for colorectal cancer	Should be postponed
	Screening gastroscopies for varices in cirrhotic patients	
Surveillance	Colonoscopies after colon cancer resection with stable CEA level and a negative CT scan	
	History of previous adenomas in the gastrointestinal tract	
	Stable IBD patients to assess for mucosal healing/colon cancer.	
Diagnostic	Abdominal pain, constipation or heartburn with no alarm symptoms.	
	Motility procedures	
	Urea breath test	
Emergency	Significant gastrointestinal bleeding with a drop in the hemoglobin level	Should be performed as soon as would be done during regular conditions and with the precautions that are described
	Caustic ingestions	
	Foreign body impaction	
	Cholangitis	
	Gastric leak or biliary leak	
	Volvulus	
	Luminal obstruction requiring stenting	
	Biliary obstruction requiring stenting	
	Infected pancreatic fluid collection	
Urgent	Workup for iron deficiency anemia	The physician in charge should review these cases and should be scheduled in a timeframe that would most probably not affect the health of the patients
	Workup for weight loss	
	Slow gastrointestinal bleeding with a stable hemoglobin level	
	Symptomatic IBD patients, if procedure will change their management	
	Colonoscopies in patients after colon cancer resection with increasing CEA level or a positive CT scan	
	Diagnostic gastroscopy or colonoscopy for pain, heartburn, constipation with alarm symptoms	
	Dysphagia	

If NaClO might damage certain surfaces, then an ethanol-based product (at least 70%) can be used for decontamination after cleaning.[52]

Also, it would be advisable to limit the workstations to areas where there is no possibility of contamination, which would include staff areas where reporting and documentation as well as communication with other healthcare providers would be performed in these "safe zones." If these clean areas were not taken into consideration in the design of these units,[53] then the flow of patients should be repurposed and planned as soon as possible with the assistance of experts in infection control and facility engineers.[54] Also, the toilets of staff and patients should be separate in principle and frequently cleaned to limit contamination.[3,46]

Supply chain constraints and inventory management

Even in centers where there is what appears to be an adequate supply of PPEs and materials required for the functioning of an endoscopy unit (e.g., accessories, gowns for patients, disinfection material for endoscopes), these should be rationed wisely. There has been a disruption in numerous industries that could effect the manufacturing of material that we have taken for granted over the years but in the current time would affect the sourcing of material. In addition, there is an uncertainty associated with regards to the duration of this pandemic. This is associated with significant global, as well as local, constraints on supply chains for these materials and the deficiency in any of these would create a bottleneck for the provision of services.[2] As such, we suggest that nonessential procedures be delayed, and in situations where other methods of evaluation could be used to answer immediate important questions, these be utilized rather than endoscopy (e.g., barium swallow for dysphagia or calprotectin for inflammatory bowel disease activity monitoring).

It is prudent that endoscopy units keep track of their supplies for endoscopic procedures and PPEs that are available and manage their procedure loads accordingly. They should also take into account the uncertainty associated with the duration of this pandemic. It would also be worthwhile that coordination between units within each area be instituted for the sharing of resources as well as the patient loads based on the expertise, personnel available, and available operational material required for running their services. Such collaboration would be essential, if for any reason there is a surge in demand in one or several institutes.

Reinstating care after the pandemic

After the pandemic resolves, services of endoscopy units should attempt to compensate for the time when procedures were suspended in phases where cases are prioritized based on the urgency of procedures. A practical staged pathway of resuming endoscopy services has been published by the Asian Pacific Society for Digestive Endoscopy where services are reinstated based on the trend of newly infected cases in the community as well as the supply reserve of PPEs.[10] Endoscopy units should also

take the opportunity for replenishing of inventory as well as restocking supplies and PPEs; this is in the case that there would be any subsequent waves of the pandemic. It would also be prudent for units to reflect on their policies and procedures and update them.

Factors affecting the services that would be provided

External factors to the healthcare system will dictate the scope of the services that are provided. Countrywide policies will affect the mobility of patients and even if elective or semi-elective procedures would be re-instated, their volumes would be affected. In addition, the availability of PPEs and the uncertainty associated with the duration of the pandemic, supply chain resilience, coordination between healthcare providers in the sharing of resources, and, coordination of health services that would be provided might also affect the type and volume of procedures that will be performed by healthcare institutions.[2] All of these factors have been realized in countries like Hong Kong, South Korea, Singapore, and Japan and their navigation was essential in mitigating this pandemic.[55]

Leadership during this period

In an article by Thompson *et al.*[3] it was pointed out, correctly, that there is a role for endoscopy unit leaders and teams in the planning and coordinating of care. This is in addition to updating policies and procedures in their units to reflect the most up-to-date recommendations from international societies as well as local and hospital-based protocols in this evolving pandemic. Keeping clear lines of communication in teams and debriefing about any issues that are tackled as well as monitoring of adherence to these policies and procedures is important. For example, a number of institutions in the Kingdom have mandated that all HCWs always wear masks within their facilities with an attempt to avoid infections,[46,56] as well as daily self-reporting of any symptoms that might suggest any flu-like illness. In addition, presenteeism where an individual reports to work despite the fact he/she should not, could be a source of outbreaks in healthcare institutions and would result in a shortage in manpower. To combat this phenomenon, frequent reminders and trust between team members as well as leadership are a must with the ultimate aim of maintaining a safe environment for staff and patients. In addition, being transparent at these times will increase engagement as well as gain the trust of team members. Also, it should not be forgotten that HCWs are under strain and it is the role of leaders to look after them and support them during this crisis, and after it hopefully settles.[57] The strict implementation of infection control measures is of utmost importance[58,59] and management in some institutes have centralized the distribution of PPEs with the aim of preserving them[3,60] and to monitor the "burn rate" and predict future needs.

Future lessons

It is clear that our current healthcare systems globally have not been prepared for the stress that this pandemic has caused.[61] Numerous areas that need improvement have been exposed especially supply chain management as well as the great potential in digital transformation,[62] and the importance of care integration between the various healthcare providers where the units of care delivery are healthcare networks rather than individual institutions. We have seen a recent shift with the healthcare transformation plans in the Kingdom and the development of various governing, provision, and payer models that have started to be implemented, as well as the recent shift to group purchasing organization as a strategy for procurement of supplies. We believe the recent pandemic should be used as a catalyst to implement and root these changes and should be looked at as an experience and lesson to be learned. We have already been through a prior epidemic from the Middle East Respiratory Syndrome coronavirus (MERS-CoV) a few years ago,[63] and we should be ready for any future events.[64]

In conclusion, to our knowledge, this document has the most up-to-date practices that should be implemented in endoscopy units, and is a compilation of the evidence available from various sources. Nonetheless, this is an area that is evolving with great speed and we would advise HCWs to use it and adopt new practices as new evidence emerges. We remain confident that we will weather these circumstances and emerge better than before.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Fauci AS, Lane HC, Redfield RR. Covid-19-Navigating the uncharted. N Engl J Med 2020;382:1268-9.

2. Ranney ML, Griffeth V, Jha AK. Critical supply shortages-The need for ventilators and personal protective equipment during the Covid-19 pandemic. N Engl J Med 2020;382:e41.
3. Thompson CC, Shen L, Lee LS. COVID-19 in endoscopy: Time to do more? Gastrointest Endosc 2020;92:435-39.
4. Hollander JE, Carr BG. Virtually perfect? Telemedicine for Covid-19. N Engl J Med 2020;382:1679-81.
5. Sultan S, Lim JK, Altayar O, Davitkov P, Feuerstein JD, Siddique SM, *et al.* AGA Institute Rapid Recommendations for gastrointestinal procedures during the COVID-19 pandemic. Gastroenterology 2020;159:739-58.e4.
6. Lui RN, Wong SH, Sanchez-Luna SA, Pellino G, Bollipo S, Wong MY, *et al.* Overview of guidance for endoscopy during the coronavirus disease 2019 (COVID-19) pandemic. J Gastroenterol Hepatol 2020;35:749-59.
7. Ang TL, Li JW, Vu CK, Ho GH, Chang JPE, Chong CH, *et al.* Chapter of Gastroenterologists professional guidance on risk mitigation for gastrointestinal endoscopy during COVID-19 pandemic in Singapore. Singapore Med J 2020;61:345-49.
8. ESGE and ESGENA Position Statement on gastrointestinal endoscopy and the COVID-19 pandemic. Update 1. [2020 Mar 18].
9. Tse F, Borgaonkar M, Leontiadis GI. COVID-19: Advice from the Canadian Association of Gastroenterology for Endoscopy Facilities, as of March 16, 2020. J Can Assoc Gastroenterol 2020;3:147-49.
10. Chiu PWY, Ng SC, Inoue H, Reddy DN, Ling Hu E, Cho JY, *et al.* Practice of endoscopy during COVID-19 pandemic: Position statements of the Asian Pacific Society for Digestive Endoscopy (APSDE-COVID statements). Gut 2020;69:991-96.
11. The Gastroenterological Society of Australia considerations for Australian endoscopy units during the COVID-19 pandemuc. [2020 Mar 20].
12. Joint GI society message: COVID-19 clinical insights for our community of gastroenterologists and gastroenterology care providers. [2020 Mar 16].
13. Castro Filho EC, Castro R, Fernandes FF, Pereira G, Perazzo H. Gastrointestinal endoscopy during COVID-19 pandemic: An updated review of guidelines and statements from international and national societies. Gastrointest Endosc 2020;92:440-45.e6.
14. Ong J, Cross GB, Dan YY. Prevention of nosocomial SARS-CoV-2 transmission in endoscopy: International recommendations and the need for a gold standard. Gut 2020;69:1145-48.
15. Lipsitch M, Swerdlow DL, Finelli L. Defining the epidemiology of Covid-19-Studies needed. N Engl J Med 2020;382:1194-6.
16. Peyrin-Biroulet L. Will the quality of research remain the same during the COVID-19 pandemic? Clin Gastroenterol Hepatol 2020;18:2142.
17. World Health Organization (2020)Advice on the use of masks in the context of COVID-19: Interim guidance, 6 April 2020. World Health Organization. Available from: https://apps.who.int/iris/handle/10665/331693. License: CC BY-NC-SA 3.0 IGO. [Last accessed on 2020 Apr 10].
18. Cheung KS, Hung IF, Chan PP, Lung KC, Tso E, Liu R, *et al.* Gastrointestinal manifestations of SARS-CoV-2 infection and virus load in fecal samples from the Hong Kong cohort and systematic review and meta-analysis. Gastroenterology 2020;159:81-95.
19. Wang W, Xu Y, Gao R, Lu R, Han K, Wu G, *et al.* Detection of SARS-CoV-2 in different types of clinical specimens. JAMA 2020;323:1843-44.
20. Chen L, Lou J, Bai Y, Wang M. COVID-19 Disease with positive fecal and negative pharyngeal and sputum viral tests. Am J Gastroenterol 2020;115:790.
21. Hindson J. COVID-19: Faecal-oral transmission? Nat Rev Gastroenterol Hepatol 2020;17:259.
22. Gu J, Han B, Wang J. COVID-19: Gastrointestinal manifestations and potential fecal-oral transmission. Gastroenterology 2020;158:1518-19.
23. Ki HK, Han SK, Son JS, Park SO. Risk of transmission via medical employees and importance of routine infection-prevention policy in a nosocomial outbreak of Middle East respiratory syndrome (MERS): A descriptive analysis from a tertiary care hospital in South Korea. BMC Pulm Med 2019;19:190.
24. Soetikno R, Teoh AY, Kaltenbach T, Lau JY, Asokkumar R, Cabral-Prodigalidad P, *et al.* Considerations in performing endoscopy during the COVID-19 pandemic. Gastrointest Endosc 2020;92:176-83.
25. Pompeii LA, Kraft CS, Brownsword EA, Lane MA, Benavides E, Rios J, *et al.* Training and fit testing of health care personnel for reusable elastomeric half-mask respirators compared with disposable N95 respirators. JAMA 2020;323:1849-52.
26. Bartoszko JJ, Farooqi MAM, Alhazzani W, Loeb M. Medical masks vs N95 respirators for preventing COVID-19 in health care workers a systematic review and meta-analysis of randomized trials. Influenza Other Respir Viruses 2020;14:365-73.
27. Long Y, Hu T, Liu L, Chen R, Guo Q, Yang L, *et al.* Effectiveness of N95 respirators versus surgical masks against influenza: A systematic review and meta-analysis. J Evid Based Med 2020;13:93-101.
28. Cloth masks and mask sterilisation as options in case of shortage of surgical masks and respirators. The European Centre for Disease Prevention and Control. Available from: https://www.ecdc.europa.eu/en/publications-data/cloth-masks-sterilisation-options-shortage-surgical-masks-respirators. [Last accessed on 2020 Apr 10].
29. Alhazzani W, Moller MH, Arabi YM, Loeb M, Gong MN, Fan E, *et al.* Surviving Sepsis Campaign: Guidelines on the management of critically ill adults with Coronavirus Disease 2019 (COVID-19). Intensive Care Med 2020;46:854-87.
30. Guidance for wearing and removing personal protective equipment in healthcare settings for the care of patients with suspected or confirmed COVID-19. European Centre for Disease Prevention and Control.
31. Sandaradura I, Goeman E, Pontivivo G, Fine E, Gray H, Kerr S, *et al.* A close shave? Performance of P2/N95 respirators in healthcare workers with facial hair: Results of the BEARDS (BEnchmarking Adequate Respiratory DefenceS) study. J Hosp Infect 2020;104:529-33.
32. Brosseau LM. Are powered air purifying respirators a solution for protecting healthcare workers from emerging aerosol-transmissible diseases? Ann Work Expo Health 2020;64:339-41.
33. Bischoff WE, Turner J, Russell G, Blevins M, Missaiel E, Stehle J. How well do N95 respirators protect healthcare providers against aerosolized influenza virus? Infect Control Hosp Epidemiol 2018:1-3. doi: 10.1017/ice. 2018.326.
34. Chughtai AA, Seale H, Rawlinson WD, Kunasekaran M, Macintyre CR. Selection and use of respiratory protection by healthcare workers to protect from infectious diseases in hospital settings. Ann Work Expo Health 2020;64:368-77.
35. Guo YP, Li Y, Wong PL. Environment and body contamination: A comparison of two different removal methods in three types of personal protective clothing. Am J Infect Control 2014;42:e39-45.
36. Ong SW, Tan YK, Chia PY, Lee TH, Ng OT, Wong MSY, *et al.* Air, surface environmental, and personal protective equipment contamination by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) from a symptomatic patient. JAMA 2020;323:1610-12.
37. Q and A on infection prevention and control for health care workers caring for patients with suspected or confirmed 2019-nCoV. World Health Organization.
38. COVID-19: Guidance for Ambulance Trusts. Public Health England.
39. Casanova LM, Rutala WA, Weber DJ, Sobsey MD. Effect of single- versus double-gloving on virus transfer to health care workers' skin and clothing during removal of personal protective equipment. Am J Infect Control 2012;40:369-74.
40. Verbeek JH, Rajamaki B, Ijaz S, Tikka C, Ruotsalainen JH, Edmond MB, *et al.* Personal protective equipment for preventing highly infectious diseases due to exposure to contaminated body fluids in healthcare staff. Cochrane Database Syst Rev 2019;7:CD011621.
41. Sequence for putting on personal protective equipment (PPE), USA CDC.

42. Mumma JM, Durso FT, Casanova LM, Erukunuakpor K, Kraft CS, Ray SM, *et al.* Common behaviors and faults when doffing personal protective equipment for patients with serious communicable diseases. Clin Infect Dis 2019;69(Suppl 3):S214-20.
43. Tong ZD, Tang A, Li KF, Li P, Wang HL, Yi JP, *et al.* Potential presymptomatic transmission of SARS-CoV-2, Zhejiang Province, China, 2020. Emerg Infect Dis 2020;26:1052-4.
44. Wei WE, Li Z, Chiew CJ, Yong SE, Toh MP, Lee VJ. Presymptomatic Transmission of SARS-CoV-2 — Singapore, January 23–March 16, 2020. MMWR Morb Mortal Wkly Rep. 2020;69:411-5.
45. van Doremalen N, Bushmaker T, Morris DH, Holbrook MG, Gamble A, Williamson BN, *et al.* Aerosol and surface stability of SARS-CoV-2 as compared with SARS-CoV-1. N Engl J Med 2020;382:1564-7.
46. Infection prevention and control and preparedness for COVID-19 in healthcare settings - second update. European Centre for Disease Prevention and Control.
47. The Gastroenterological Society of Australia guide for triage of endoscopic procedures during the COVID-19 pandemic. [2020 Mar 26].
48. Beilenhoff U, Biering H, Blum R, Brljak J, Cimbro M, Dumonceau JM, *et al.* Reprocessing of flexible endoscopes and endoscopic accessories used in gastrointestinal endoscopy: Position Statement of the European Society of Gastrointestinal Endoscopy (ESGE) and European Society of Gastroenterology Nurses and Associates (ESGENA)-Update 2018. Endoscopy 2018;50:1205-34.
49. Zhang Y, Zhang X, Liu L, Wang H, Zhao Q. Suggestions for infection prevention and control in digestive endoscopy during current 2019-nCoV pneumonia outbreak in Wuhan, Hubei province, China. Endoscopy 2020;52:312-4.
50. Committee AQAiE, Calderwood AH, Day LW, Muthusamy VR, Collins J, Hambrick RD 3rd, *et al.* ASGE guideline for infection control during GI endoscopy. Gastrointest Endosc 2018;87:1167-79.
51. Repici A, Maselli R, Colombo M, Gabbiadini R, Spadaccini M, Anderloni A, *et al.* Coronavirus (COVID-19) outbreak: What the department of endoscopy should know. Gastrointest Endosc 2020;92:192-7.
52. Disinfection of environments in healthcare and non-healthcare settings potentially contaminated with SARS-CoV-2. European Centre for Disease Prevention and Control.
53. Mulder CJ, Jacobs MA, Leicester RJ, Nageshwar Reddy D, Shepherd LE, Axon AT, *et al.* Guidelines for designing a digestive disease endoscopy unit: Report of the World Endoscopy Organization. Dig Endosc 2013;25:365-75.
54. Valdivia PC, le Grazie M, Gaiani F, Decembrino F, Luigi de'Angelis G. Separated pathways in the endoscopy unit for COVID-19 patients. Gastrointest Endosc 2020;92:239.
55. Legido-Quigley H, Asgari N, Teo YY, Leung GM, Oshitani H, Fukuda K, *et al.* Are high-performing health systems resilient against the COVID-19 epidemic? Lancet 2020;395:848-50.
56. Klompas M, Morris CA, Sinclair J, Pearson M, Shenoy ES. Universal masking in hospitals in the Covid-19 era. N Engl J Med 2020;382:e63.
57. Greenberg N, Docherty M, Gnanapragasam S, Wessely S. Managing mental health challenges faced by healthcare workers during covid-19 pandemic. BMJ 2020;368:m1211.
58. Bedford J, Enria D, Giesecke J, Heymann DL, Ihekweazu C, Kobinger G, *et al.* COVID-19: Towards controlling of a pandemic. Lancet 2020;395:1015-8.
59. Wong J, Goh QY, Tan Z, Lie SA, Tay YC, Ng SY, *et al.* Preparing for a COVID-19 pandemic: A review of operating room outbreak response measures in a large tertiary hospital in Singapore. Can J Anaesth 2020;67:732-45.
60. Livingston E, Desai A, Berkwits M. Sourcing personal protective equipment during the COVID-19 pandemic. JAMA 2020;323:1912-14.
61. Grasselli G, Pesenti A, Cecconi M. Critical care utilization for the COVID-19 outbreak in Lombardy, Italy: Early experience and forecast during an emergency response. JAMA 2020;323:1545-46.
62. Wang CJ, Ng CY, Brook RH. Response to COVID-19 in Taiwan: Big data analytics, new technology, and proactive testing. JAMA 2020;323:1341-2.
63. Arabi YM, Balkhy HH, Hayden FG, Bouchama A, Luke T, Baillie JK, *et al.* Middle east respiratory syndrome. N Engl J Med 2017;376:584-94.
64. Gates B. Responding to Covid-19-A once-in-a-century pandemic? N Engl J Med 2020;382:1677-9.