

The Practice of Gastrointestinal Motility Laboratory During COVID-19 Pandemic: Position Statements of the Asian Neurogastroenterology and Motility Association (ANMA-GML-COVID-19 Position Statements)

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During the Coronavirus Disease 2019 (COVID-19) pandemic, practices of gastrointestinal procedures within the digestive tract require special precautions due to the risk of contraction of severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) infection. Many procedures in the gastrointestinal motility laboratory may be considered moderate to high-risk for viral transmission. Healthcare staff working in gastrointestinal motility laboratories are frequently exposed to splashes, air droplets, mucus, or saliva during the procedures. Moreover, some are aerosol-generating and thus have a high risk of viral transmission. There are multiple guidelines on the practices of gastrointestinal endoscopy during this pandemic. However, such guidelines are still lacking and urgently needed for the practice of gastrointestinal motility laboratories. Hence, the Asian Neurogastroenterology and Motility Association had organized a group of gastrointestinal motility experts and infectious disease specialists to produce a position statement paper based on current available evidence and consensus opinion with aims to provide a clear guidance on the practices of gastrointestinal motility laboratories during the COVID-19 pandemic. This guideline covers a wide range of topics on gastrointestinal motility activities from scheduling a motility test, the precautions at different steps of the procedure to disinfection for the safety and well-being of the patients and the healthcare workers. These practices may vary in different countries depending on the stages of the pandemic, local or institutional policy, and the availability of healthcare resources. This guideline is useful when the transmission rate of SARS-CoV-2 is high. It may change rapidly depending on the situation of the epidemic and when new evidence becomes available.

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Key Words

COVID-19; Esophageal motility disorders; Gastrointestinal diseases; Gastrointestinal motility; Infection control

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Introduction

Since the advent of the Coronavirus Disease 2019 (COVID-19) pandemic, endoscopy of gastrointestinal (GI) tract and ear-nose-throat procedures, which perform a wide range of aerosol-generating procedures, have been the focus of significant attention with multiple guidelines and statements from different societies giving instruction and recommendation to protect both patients and medical staff from contracting severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) infection.¹⁻⁴ However, there has yet to be recommendations or guidance for safe practices in the gastrointestinal motility laboratory (GML), where aerosol-generating procedures are often performed.

The GML serves as the clinical hub of functional GI diseases related investigations such as GI manometry and pH studies. It also performs an array of other diagnostic and therapeutic procedures from the urea breath test to capsule endoscopy. GML procedures are often performed without sedation and involve repeated nasoro-pharyngeal intubation during procedures, causing the patient to cough or wretch, which increases the risk of aerosolization and contamination of healthcare environmental surfaces. Hence, appropriate precaution needs to be taken to minimize the risk of COVID-19 to healthcare workers performing these procedures.^{1,5,6}

The Asian Neurogastroenterology and Motility Association (ANMA) is the representative society for the standard of functional GI diseases care in Asia. ANMA is committed to guiding the protection and care of both patients and the medical staff during GML procedures. During the COVID-19 pandemic, ANMA aims to provide recommendations for safe and good clinical practice regarding GML activities. These statements are based on the best available evidence and expert opinions. ANMA recommends that all GML strictly adhere to institutional, local, and state advisories and guidelines for infection control.

The current guidelines made certain assumptions that the government or local authority does not limit the running of the hospital to urgent admissions through the emergency department only. We based these guidelines on the best available current evidence of COVID-19, which is rapidly evolving as well as existing practices of

disinfection for contagious respiratory diseases. These guidelines are based on current knowledge of COVID-19, which is rapidly evolving, and existing practices of disinfection in hospitals while treating viral and other contagious diseases. We hope to provide a reference point for GML staff from doctors to medical technologists to carry out procedures safely during the COVID-19 pandemic. This guideline is useful when the transmission rate of COVID-19 is still high. It may or may not apply to future respiratory viral infections because each virus has a unique disease pattern.

Methods

The ANMA president appointed the lead author to form a writing committee based on their expertise in the field. The job of the writing committee was to review current literature and regulation regarding the activities of GML around the globe during COVID-19. The writing committee was tasked to produce evidence-based statements to guide the GML staff on how to handle at-risk patients or high-risk procedures during COVID-19. Altogether, 17 experts from around Asia were invited, and all of them agreed to join the writing committee. The lead author and President of ANMA, predetermined 7 chapters for development. The writers were divided into 3 groups, with each group focusing on 2 to 3 chapters. During the writing process, several online voting and discussion processes were conducted to reach an agreement for contentious issues. The 3 group leaders would then resolve any discrepancies in the statements by reaching a consensus. The final manuscript was reviewed by 2 infectious disease experts and then finally by 2 senior ANMA council committee members.

ANMA-GML-COVID-19 Statements

1. Regular planning and assessment of routine GML workflow are essential during the COVID-19 outbreak.
2. Infection prevention and control measures should be strengthened.
3. Safe handling of GML inventory is mandatory.
4. All GML staff should undergo training for standard infection control and proper usage of personal protective

- equipment.
5. All patients should be triaged. GML procedures for high-risk patients should ideally be decided by a multidisciplinary team or be postponed.
 6. All elective non-urgent GML procedures should be postponed.
 7. Low-risk patients can be considered for urgent or time-sensitive GML procedures if there are no alternatives.
 8. Recovered COVID-19 patients may be considered for urgent or time-sensitive GML procedures if there are no alternative 4-6 weeks after remission.
 9. Esophageal manometry, pH-impedance monitoring, urea breath test and hydrogen/methane breath tests are high-risk procedures.
 10. Anorectal physiologic tests and treatment such as biofeedback are potentially high-risk procedures.
 11. When either a high-risk patient or high-risk procedure is involved, standard, droplet, and airborne precautions with full personal protective equipment (PPE) are highly recommended, and the procedure should be performed in negative-pressure rooms whenever possible.
 12. For low-risk patients undergoing low-risk procedures, standard precautions are highly recommended, or as determined by their respective institutions.
 13. Environmental decontamination should be performed in between cases with at least a 30-minute interval.
 14. All non-disposable and non-dedicated GML equipment should be disinfected and reprocessed between cases.
 15. GML staff should actively follow-up and advise patients to contact GML if they develop COVID-19 within 14 days of undergoing GML procedures.
 16. Stepwise resumption of non-urgent elective GML investi-

gations can be done based on international and local COVID-19 pandemic situation.

Statement 1: Regular planning and assessment of routine gastrointestinal motility laboratory workflow is essential during the COVID-19 outbreak.

Many GMLs may not be adequately equipped to handle outbreaks such as COVID-19. Most are placed next to or near to the endoscopy suite and may not have the characteristics or requirements typical of an Airborne Infection Isolation Room (AIIR). Some laboratories have separate rooms for upper GI, lower GI procedures, and breath testing. During the writing process and experts discussion, we realized that some GMLs do not perform all the core procedures (for example wireless motility capsule, hydrogen and methane breath test). Some of the core procedures are performed by other endoscopy centers or diagnostic laboratories (for example urea breath test and video capsule endoscopy). Besides, some laboratories perform research and advanced diagnostic and therapeutic procedures on top of the core tests (Table 1). All these characteristics need to be taken into consideration when planning workflow during the outbreak. It is essential to start with triaging of patients at the registration counter with risk evaluation, temperature check, provision of surgical masks and hand-sanitizers. Patients should have a safe distance of 2 meters apart in the sitting area. It may be advisable to review and revise the workflow based on new research, changing epidemiology and policies (Fig. 1). Depending on the local staffing level, only the absolute minimum number of staff that can ensure the running of the procedure safely needs to be present in the room. Splitting GML staff into 2 teams is also a good policy to avoid cross-infection and to ensure continuity of the laboratory.

Table 1. Classification of Gastrointestinal Motility Laboratory Procedures (Reproduced From Rao et al⁷)

Core procedures	Esophageal manometry, esophageal pH tests (including impedance and capsule-based), anorectal manometry, hydrogen and methane breath test, urea breath test, wireless motility capsule, video capsule endoscopy
Specialized diagnostic tests	Laryngopharyngeal pH test, antroduodenal manometry, colonic manometry, electrogastrography, barostat tests, endoanal/endorectal ultrasonography, functional luminal imaging probe system, ¹³ C octanoic breath test, esophageal balloon distension test, GI scintigraphy
Specialized therapeutic procedures	Diaphragmatic breathing and biofeedback, biofeedback therapy, sensory training, bulking agent/botulinum toxin injection
Research-based procedures	Mucosal impedance testing, cortical evoked potential, hydrogen sulphide breath test, trans-lumbosacral anorectal magnetic stimulation, trans-lumbosacral neuromodulation therapy, repetitive transcranial magnetic stimulation therapy, high-resolution pharyngeal manometry and UES strain tests, stool sampling for microbiome testing

GI, gastrointestinal; UES, upper esophageal sphincter.

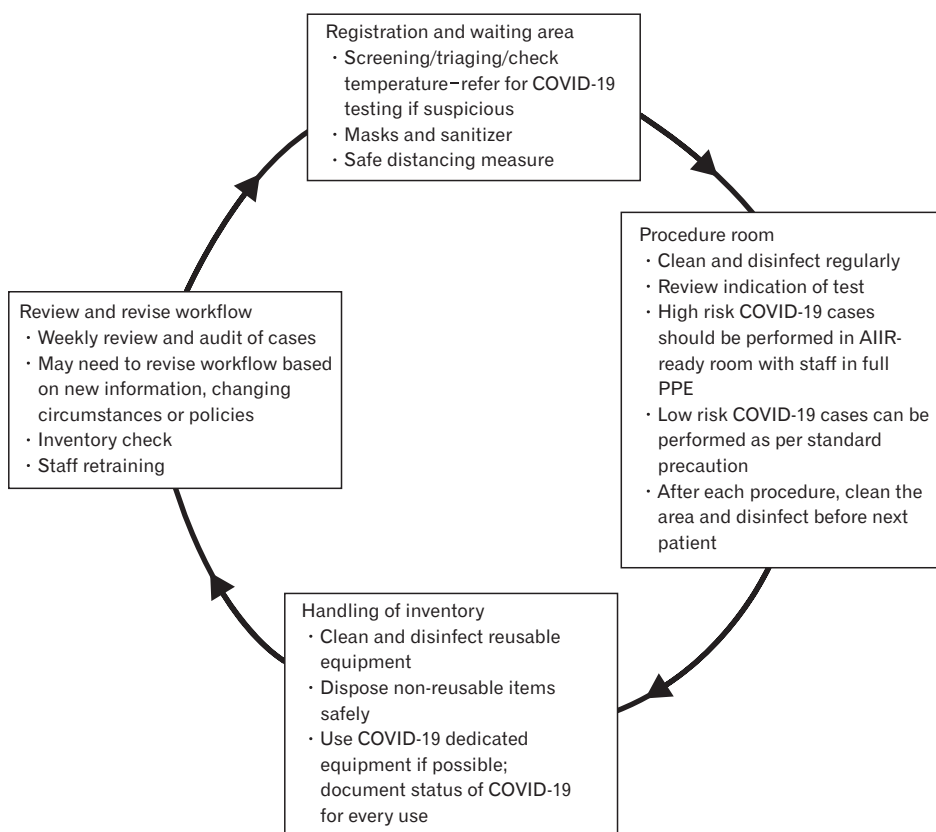


Figure 1. Gastrointestinal motility laboratory workflow during Coronavirus Disease 2019 (COVID-19) pandemic.

Statement 2: Infection prevention and control measures should be strengthened.

The SARS-CoV-2 is easily killed and vulnerable due to its lipid shell, but it may remain infectious in aerosols for hours and viable on surfaces for days.^{6,8} It is not clear if there is fecal transmission despite the finding of viral shedding in stools.^{9,10} Recommended disinfectants include 62-71% ethanol, 0.5% hydrogen peroxide, or 0.1% sodium hypochlorite that effectively inactivates the virus within 1 minute.¹¹ Procedure rooms should be regularly disinfected and thoroughly cleaned before and after routine use. For high-risk patients and motility procedures, full PPE should be available. GML staff may also consider the use of virucidal povidone-iodine 7% gargle or mouthwash.¹² At the end of the day, staff ensures the safe disposal of PPE and other disposable consumables and complete sanitization of the GML room.

Statement 3: Safe handling of gastrointestinal motility laboratory inventory is mandatory.

Inventory of a motility laboratory can be categorized into either reusable (eg, high-resolution manometer) or disposable (eg, pH catheter). For reusable items, after use, these should be disinfected



Figure 2. Components of personal protective equipment, alcohol-based hand sanitizer, and biohazard disposal bag.

and cleaned as per recommendations from the manufacturer and hospital guidelines. Typically for the high-resolution manometer, it should be immersed and wiped with an enzymatic cleaning solution, then rinsed with warm tap water and later soaked in an approved disinfectant (eg, CIDEX ortho-phthalaldehyde [Advanced Sterilization Produces, Irvine, CA, USA] or peracetic acid). Ideally, a dedicated reusable probe should be reserved for high-risk

COVID-19 patients. However, in less resourceful laboratories, it is essential to document the COVID-19 status for each patient performed with the probe. All disposable items must be disposed of safely after the procedure and not be reused.

Statement 4: All gastrointestinal motility laboratory staffs should undergo training for standard infection control and proper usage of personal protective equipment.

Healthcare providers in the GML including nursing staff or medical technologists should undergo standard infection control training, which includes strategies concerning infection control in GML, triaging of patients, disinfection policy, and proper wearing and removing of PPE. Appropriate knowledge of infection control



Figure 3. Physician wearing complete personal protective equipment including N95 respirator in gastrointestinal motility laboratory room.

is fundamental to protect GML staff and patients. The definition of a confirmed, probable, and suspected COVID-19 case by the World Health Organization should be reviewed by healthcare providers to triage the patients. Standard infection control education must include hand hygiene and disinfection of equipment. Components of full PPE include surgical masks or N95/equivalent (filtering facepiece [FFP] 2/3) respirators, goggles or face shields or both, hair nets or hoods, isolation gowns (long-sleeved and water-resistant), and single/double gloves (Fig. 2).¹³ All GML staffs should familiarize themselves with risk stratification of different patients, level of risk of procedure, and type of patients so that the

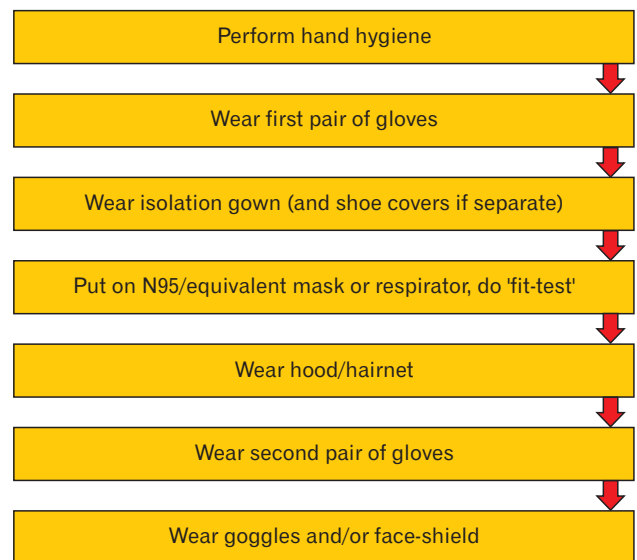


Figure 4. Sequence of putting on personal protective equipment.



Figure 5. Sequence of removal of personal protective equipment.

appropriate PPE and infection control procedures are followed.¹⁴

All staff should undergo adequate training to wear a suitable N95/equivalent respirator that has been fit-tested for the right model and size, as well as optimal training on donning and doffing of PPE.¹⁵ PPE training of GML staff shall include (1) demonstration of all individual components of PPE to the trainees along with an explanation of utility and proper wearing of each component, (2) stepwise demonstration of the complete procedure of donning and doffing by one of the trainers or refer to online sources, and (3) emphasis on critical points like performing optimal hand hygiene with alcohol-based hand sanitizer before donning of PPE and during as well as after the process of doffing (Fig. 3-5) GML staff should also be taught regarding the safe disposal of “used/doffed” N95/equivalent respirators and other components of PPE. There should be a provision of separate designated areas/cubicles for donning and doffing of GML staff. Disinfection of the GML equipment and the procedure area should be performed before and after the procedure with recommended disinfectant.¹¹ To minimize the risk of exposure to staff and to ensure fair use of PPE, only essential personnel (GML physician and trained technician/nurse) should be inside the GML procedure room with appropriate PPE. The GML patient shall be wearing a triple-layer surgical mask all the time until it is needed to be adjusted for the performance of the upper GI GML procedure as applicable.

Statement 5: All patients should be triaged. Gastro-intestinal motility laboratory procedures for high-risk patients should ideally be decided by a multidisciplinary team or be postponed.

A confirmed case of COVID-19 required laboratory evidence

Table 2. Characteristics of Patients With High-risk and Low-risk of Coronavirus Disease 2019

Low-risk patients
<ul style="list-style-type: none"> • No respiratory symptoms • No fever • No positive contact history • No travel history or stay in high-risk areas
High-risk patients
<ul style="list-style-type: none"> • Presence of respiratory symptoms OR • Presence of fever with no apparent localizing source OR • Positive contact history with suspected/confirmed COVID-19 cases OR • Travel to areas of high COVID-19 prevalence or stay in high-risk areas

COVID-19, Coronavirus Disease 2019.

according to the World Health Organization, irrespective of signs and symptoms.¹⁶ A probable case is a suspected case with the inconclusive COVID-19 test result. A suspected case fulfils the following 3 criteria: (1) patients presenting with acute respiratory signs and symptoms with no other known etiology and a history of travelling to, or a resident in, countries with local transmission of COVID-19 during 14 days before the start of any symptom; (2) patients presenting with acute respiratory signs and symptoms who have positive contacts with a confirmed or probable case of COVID-19 in the past 14 days before the start of any symptom; and (3) patients with a severe acute respiratory illness requiring hospitalization and with no other cause that fully explains the clinical presentation. COVID-19 can cause various respiratory and GI symptoms.¹⁷ Patients infected with COVID-19 often present with fever, cough, fatigue, anorexia, and breathlessness. A small proportion of patients also had diarrhea, nausea/vomiting, and abdominal pain.¹⁸

On the day before or day of the GML procedure, all patients need to undergo pre-screening, and patients classified (Table 2) based on the following information collected:

- Presence of respiratory symptoms (cough, sore throat, runny nose, dyspnea, and anosmia)
- Body temperature above 37.5°C
- Close contact with the confirmed or suspected patients of COVID-19 within the past 14 days
- History of travel or residence in an area of high COVID-19 prevalence within the last 14 days

Any decision to provide GML procedures for high-risk patients should be based on the urgency of procedures ideally involving a multidisciplinary team, including infectious disease specialists.

There may also be issues around patient distress and medico-legal concerns in any decision to defer investigations; thus, decisions on complex cases should also be made by a multidisciplinary team. For patients whose referral to tertiary care centers for GI motility study have been deferred or canceled, systems need to be in place to keep records of this so that either alternative arrangements (eg, clinic follow-up, radiological imaging) can be made, or proactively prioritize rebooking when deemed safe to resume normal activities.¹⁹

Statement 6: All elective non-urgent gastrointestinal motility laboratory procedures should be postponed.

Most GI motility disorders follow a benign and chronic course, and GI motility procedures are generally considered as elective procedures and deferment is strongly recommended until further notice during COVID-19 outbreak.¹⁹ SARS-CoV-2 is presumed

to spread mainly via respiratory droplets from coughing, sneezing, talking, and being in close contact with symptomatic COVID-19 patients.²⁰ Transmission can also occur from asymptomatic carriers and from infected individuals with virus shedding during the pre-incubation period before symptoms develop.²¹ Furthermore, GI motility disorders are often manifested by non-specific symptoms that may be confused with GI manifestations of COVID-19.²² The 4 American GI organizations recommended that all elective non-urgent endoscopic procedures be rescheduled to stop COVID-19 spread, and preserve PPE and availability of healthcare workers.¹ This should be adhered to similarly for GML investigations, given the risks of transmission mentioned above.

Statement 7: Low-risk patients can be considered for urgent or time-sensitive gastrointestinal motility laboratory investigations if there are no alternatives.

Most GI motility disorders also have a relatively benign prognosis. Data on the rationale of which GML investigations are to be performed urgently are lacking. In conditions where there is a significant impact in delays of diagnosis such as pseudoachalasia²³ or achalasia,²⁴ alternative methods of evaluation have to be considered first (eg, timed barium esophagogram for achalasia)²⁵ before deciding on the necessity of GML investigations. Also, in the presence of alarm symptoms, radiologic investigations, or endoscopy should have been performed first to exclude malignancy or other time-sensitive diagnoses. Clinching a diagnosis in a condition such as achalasia is time-sensitive as there are implications to management, as some patients can present with severe malnutrition from dysphagia and pulmonary complications from aspiration of retained esophageal content; thus treatment cannot be delayed for long periods. Another relatively common example of a time-sensitive diagnosis are patients with overt obscure GI bleeding. In such situations, video capsule endoscopy is suggested to be performed as soon as possible, optimally within 14 days.^{26,27} Otherwise, the diagnostic yield and therapeutic intervention rate decreases with longer waiting times.²⁸ Also, video capsule endoscopy does not involve close contact between healthcare staff and the patients, so transmission of COVID-19 is less likely.

Statement 8: Recovered COVID-19 patients may be considered for urgent or time-sensitive gastrointestinal motility laboratory procedures if there are no alternative 4-6 weeks after remission.

Previous researches have reported that the median duration of viral shedding is 20 days, with the shedding duration extending

at times even up to 37 days.²⁹ Additionally, SARS-CoV-2 RNA was detected in fecal samples for a mean of 27.9 days.³⁰ Therefore, GML testing should not be performed for at least 4-6 weeks after clearance from COVID-19 infection, with clearance being defined by the Center for Disease Control and Prevention as 2 separate respiratory swabs are negative for COVID-19 over 24 hours. For patients whose GML investigations have been deferred or canceled, systems need to be in place to keep records so that alternative arrangements (eg, clinic follow-up, radiological imaging) can be made.

Statement 9: Esophageal manometry, pH-impedance monitoring, urea breath test, and hydrogen/methane breath tests are high-risk procedures.

Endoscopic procedures can lead to aerosolization and permit the subsequent airborne transmission of SARS COV-1 coronavirus. While there is little evidence to support the transmissibility of COVID-19 during motility testing, these recommendations and statements are based on indirect evidence, expert opinion and consensus within the working group.¹ There was complete agreement amongst all members in the working group that these procedures are deemed as high-risk. Although esophageal manometry and pH-impedance monitoring do not involve positive insufflation like in upper GI endoscopy, these tests potentially increase the risk of generating aerosols, especially during the intubation process, which often induces intense gagging, sneezing, and coughing by the patient. An earlier study on the SARS COV-1 coronavirus has demonstrated that aerosol generation increases the risk of infection among the healthcare workers by 4.66 times (95% CI, 3.13-6.94) for those who are exposed to such procedures compared to non-exposed.³¹ Moreover, during the procedures, healthcare providers have to remain physically within a 1-meter distance from patients, and this close exposure may permit transmission. A study during colonoscopy found that microbial spread can be found up to 6 feet away from the patient.³² Breath tests, including hydrogen/methane breath tests and urea breath test, requires repeated long exhalation into multiple breath bags, at various intervals up to a 3- to 4-hour testing period. Even though breath samples are collected in sealed breath bags, there is concurrent exhaled air through the nose during the process of expiration. Studies showed that an increased expiratory flow rate was associated with smaller emitted particles, which possibly less than 5 μm in diameter.³³ Various sizes of droplets can find their way into the eyes, noses, or mouths of people who are within proximity or possibly be inhaled into the lungs of those who are nearby. Therefore, we propose that esophageal manometry, pH-

impedance monitoring, hydrogen/methane, and urea breath tests have a high-risk potential of transmitting COVID-19.

Statement 10: Anorectal physiologic tests and treatment such as biofeedback are potentially high-risk procedures.

Though plausible, there is little evidence to dictate the risk of fecal transmission of COVID-19 during anorectal physiologic tests, (eg, anorectal manometry and balloon expulsion test) and treatment such as biofeedback. The majority (7 out of 11) of the members in the working group believed that these procedures are nevertheless potentially high-risk for transmission of COVID-19. Viral shedding in feces had been reported in 38-58% of patients with COVID-19 infection and can even be detected in recovered patients after hospital discharge and whose nasopharyngeal swab has become negative.¹⁷ Although these procedures do not involve air suctioning or insufflation, aerosolization of viral particles may still occur during flatulent situations such as during straining or when rapidly increased abdominal pressure is applied. These situations may result in an increased risk of COVID-19 transmission through fecal-oral transmission or mucosal contact. SARS-CoV-2 RNA can be found in the tissue samples obtained from upper GI tracts (the esophagus, stomach, and duodenum) down to the rectum of COVID-19 patients.⁹ Wireless motility capsule and colonic transit marker studies

involve trans-nasal or trans-anal catheter insertions. They are not aerosol-generating procedures and have minimal patient contact. All members of the working group agree that procedures such as wireless motility capsule and colonic transit marker studies pose a low potential of COVID-19 transmission (Table 3).

Statement 11: When either a high-risk patient or high-risk procedure is involved, standard, droplet, and airborne precautions with full personal protective equipment are highly recommended, and the procedure should be performed in negative-pressure rooms whenever possible.

PPE recommendations for healthcare workers and patients as dictated by local hospital protocols should be adhered to whenever possible. Recommendations made in this section are based on the perceived risk of the procedure matched with the patient risk profile and expert opinions. PPE and work environment recommendations for the GML personnel during the COVID-19 pandemic period, as stratified by the risk of patients and procedures, are summarized in Table 4. Both low-risk and high-risk patients need to follow their respective local hospital guidelines and workflows during transfer and when in the waiting areas. In the waiting lobby, to minimize patient and caregiver exposure or potential transmission of COVID-19, patients and accompanying persons should wear a surgical mask and keep an appropriate distance from each other. The patient should wear a surgical mask until the procedure begins.

If either high-risk or low-risk procedures need to be performed in high-risk patients under particular circumstances, we would suggest the GML staff, including the doctors, technician, or nurses, to follow the standardized precautions and wear full PPE, including masks with N95 or equivalent filtering facepiece respirator, hairnet/hood, isolation gowns, double gloves, goggles, or face shields. N95 respirator could achieve a much better facial fit and filtration of airborne particles coming from the open airways of the patients during the whole procedure in the work environment.³⁴ After washing hands thoroughly with water and an alcohol-based sanitizer, we

Table 3. Risk of Coronavirus Disease 2019 Transmission From Gastrointestinal Motility Laboratory Procedures

High-risk	Low-risk
Esophageal manometry	Wireless motility capsule
Ambulatory pH-impedance monitoring	Colonic transit marker study
Urea breath tests	
Hydrogen/methane breath tests	
Anorectal manometry	
Biofeedback therapy	
Balloon expulsion test	

Table 4. Recommendations on the Personal Protective Equipment and Work Environment for the Gastrointestinal Motility Laboratory Personnel During the Coronavirus Disease 2019 Pandemic Period

PPE recommendation	High-risk procedure	Low-risk procedure
High-risk patient	N95 or its equivalents, isolation gown, double gloves, goggles or face shield, hairnet/hood, negative pressure room	N95, isolation gown, double gloves, goggles or face shield, hairnet/hood, negative pressure room
Low-risk patient	N95, isolation gown, double gloves, goggles or face shield, hairnet/hood, negative pressure room	Surgical mask, isolation gown, gloves, hairnet/hood, standard endoscopy room

PPE, personal protective equipment.

recommend all the GML staff to wear 2 layers of gloves for all the procedures and change the outer gloves whenever contaminated by the patients' saliva or secretions.

Procedures that are high-risk for COVID-19 transmission should be performed with caution, even in relatively low-risk patients. GML staff should also follow standard precautions and wear adequate PPE, including a mask with N95 or equivalent filtering facepiece respirator, isolation gowns, hairnet/hood, double gloves, and goggles, or face shields. To minimize COVID-19 transmission risk, we recommend all high-risk motility procedures or procedures involving high-risk patients to be performed in AIIRs with dedicated medical equipment during the COVID-19 pandemic period whenever possible or filtered with a high-efficiency particulate air (HEPA) filter. The procedure room should be equipped with a double basin sink for washing and a safe disposal area. AIIRs are single-patient rooms with negative pressure relative to the surrounding areas and at least 6 air changes per hour. All room doors should be kept closed during the whole GI motility procedure with minimized staff entry and exit. The number of personnel inside the examination room should be limited to only those necessary for essential care and procedure support. Once the motility procedures have finished, all GML staff should not enter the vacated room until sufficient time has elapsed so that enough air changes have occurred to remove potentially infectious aerosols or droplets. Then, the room after use should undergo thorough cleaning and surface disinfection before the next use. Environmental surveillance should also be conducted regularly to assess the effectiveness of cleaning and disinfection.³⁵

Statement 12: For low-risk patients undergoing low-risk procedures, standard precautions are highly recommended, or as determined by their respective institutions.

For low-risk patients who are undergoing a low-risk motility procedure, which is clinically indicated after carefully evaluating the risks and benefits and where deferment is not possible, it is still imperative for GML staff to take the necessary precautions, to avoid potential viral transmission in the GML. This has to be balanced with the local availability of medical resources and protective equipment, as well as adherence to hospital protocol. We recommend the GML personnel to wear a surgical mask, isolation gown, and gloves for personal protection while preserving the valuable and limited medical resources. For low-risk procedures performed in low-risk patients, a well-ventilated standard GML or endoscopy room would be adequate.

Statement 13: Environmental decontamination should be performed in between cases with at least a 30-minute interval.

A recent study showed that SARS-CoV-2 virus particles could be found on surfaces where they may remain viable and detectable for up to 72 hours.⁶ The possibility of fecal-oral transmission of the SARS-CoV-2 virus also exists,^{17,36} as the virus has been found to remain stable in feces and urine for at least 1 to 2 days.¹³ For high-risk patients who require motility testing, the procedure should be arranged at the end of the session. The GML should have a detailed post-procedure disinfection plan.

For gastro-motility procedures performed on high-risk patients in negative pressure room, a waiting time of 30 minutes is recommended for an isolation room with 10 to 12 air changes per hour (ACH); in rooms with 6 ACH, 1 hour may be required before anyone including the physician, staff, or new patient enters the room, so that sufficient air changes have taken place to remove potentially infectious particles.³⁷ However, not every GML will have access to a negative-pressure rooms, and hence alternative measures such as diluting the air with cleaner air from the outdoors should be considered and the room kept empty for at least 1 hour because small particles remain airborne for some time.¹³

At the end of each procedure, the cleaning process of the procedure room should begin with a thorough surface cleaning to remove all soil and biofilm, as reported in the American Society for Gastrointestinal Endoscopy guideline.³⁸ Then, thorough disinfection of all noncritical surfaces frequently touched by hands (eg, bed rails and bedside tables), procedure room furniture and floor should be performed with standard techniques by staff using appropriate PPE.^{13,35}

Data on the viricidal efficacy of chemical agents against SARS-CoV-2 are not available; therefore, recommendations of the major endoscopic societies are based on studies done for other coronaviruses.^{13,38} For surface and noncritical patient-care equipment disinfection, 1:100 dilution of household bleach (sodium hypochlorite) or alcohol-based solutions are reported to be effective.^{13,39,40}

Statement 14: All non-disposable and non-dedicated gastrointestinal motility laboratory equipment should be disinfected and reprocessed between cases.

The disinfection and reprocessing of all non-disposable, non-dedicated medical equipment used in a procedure involving confirmed or suspected COVID-19 patient should follow the standard practice, as per the manufacturer's instructions and local facilities available. There is currently no report that current disinfection tech-

niques are insufficient.^{37,38,41}

The majority of equipment used during GI endoscopy or motility testing are semi-critical devices that require cleaning and disinfection with agents that have viricidal, bactericidal, mycobactericidal, and fungicidal activity.^{4,41} A previous study conducted after the SARS outbreak reported that SARS-CoV-1 was readily inactivated by all disinfectants tested (4 hand rubs, 3 surface disinfectants, and a glutaraldehyde-based medical instrument disinfectant),⁴² suggesting that current disinfectants and reprocessing protocols are adequate.⁴³ The reprocessing work should preferably be done by experienced staff with documented competency (trainees and novices should not be included).³⁵

However, some points need special consideration:

- If possible, all GML procedures involving known or suspected COVID-19 patients should use a set of dedicated medical equipment.
- No disposable devices used for a patient with COVID-19 should be reused.
- There should be minimal possible furniture and equipment in the procedure room.
- After the procedure, the equipment should be cleaned separately from other materials.
- The detachment of manometry catheters from the device should be done with caution, as it could release fluid or air or both.
- There should be a separate/isolated recovery room for high-risk or infected cases.

Reprocessing staff should be donning PPE that includes gloves, gowns, face shields, and a surgical mask.⁴⁴ While there is no data to support a requirement for the use of N95 respirators or its equivalent in the reprocessing room, their use should be considered, especially in confirmed COVID-19 cases.⁴⁵

Contaminated waste and disposables, such as breath bags, should be disposed of using the specific local regulations related to high-risk waste.^{4,45} A separate record for collection, treatment, and disposal of COVID-19 waste should be maintained and reported to concerned authorities. There should be dedicated vehicles to collect COVID-19 waste from different areas of the hospital, and these vehicles should be sanitized after every trip. COVID-19 waste should be disposed of immediately upon receipt at facilities. Regular sanitization of workers involved in handling and collection of COVID-19 waste should be done, and they should be provided with adequate personal protective equipment including 3-layer surgical masks, splash-proof aprons/gowns, gloves, gumboots, and safety goggles.⁴⁶ Any worker showing symptoms of COVID-19 illness

should not be allowed to work at the facility.

Statement 15: Gastrointestinal motility laboratory staff should actively follow-up and advise patients to contact the gastrointestinal motility laboratory if they develop COVID-19 within 14 days of undergoing gastrointestinal motility laboratory procedures.

The patients who were not suspected/confirmed COVID-19 cases when they visited the GML should be followed up. They should be contacted preferably by phone at 7 and 14 days to ask about the development of COVID-19 symptoms or any new diagnosis.^{4,13,44,45} If any patient is suspected of having COVID-19 symptoms on follow-up, she/he should be guided to seek medical opinion urgently. Also, contact tracing of possible staff who have been exposed should be done according to hospital infection prevention and control policies. Telehealth for follow-up may be helpful if the expertise and infrastructure is available.^{4,45}

Statement 16: Stepwise resumption of non-urgent elective gastrointestinal motility laboratory investigations based on international and local COVID-19 pandemic situation.

Resumption of partial or full elective GML services are likely to be done in time-bound approach depending on the following conditions: (1) the number and epidemiological trend of local transmission, (2) the availability of medical equipment and infectious control gears including appropriate PPE, and (3) the volume of postponed GML cases.³⁷ To date, unfortunately there is no sign of abatement of COVID-19 worldwide, so it remains an almost impossible task to predict the most appropriate time to resume regular GML services.

Conclusion

The major international GI societies have recommended performing the emergent or urgent and suspended the elective GI endoscopic procedures because of a shortage of health care resources and the risk of contracting COVID-19. Many GML activities, similar to GI endoscopy, are aerosol-generating and high-risk procedures for the contraction of SARS-CoV-2 infection among the health care workers can be triaged. The indications of emergent or urgent GI motility tests are limited. Despite limited evidence, the ANMA-GML-COVID-19 position statement provided evidence-based consensus guidance on GML activities during this pandemic. The shortage of PPE and testing kits may change man-

agement decisions in many areas. The position statements may need to be updated due to rapid changes in the COVID-19 pandemic and the availability of new evidence.

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