LETTER

Prevention of nosocomial SARS-CoV-2 transmission in endoscopy: international recommendations and the need for a gold standard

Over 3000 healthcare workers (HCW) in China are suspected of having coronavirus disease 2019 (COVID-19) and over 1700 tested positive.[1] These statistics underline the need for robust preventative measures against the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). Endoscopy departments are fertile grounds for viral spread because aerosolisation of bodily secretions occurs during procedures. A single viral-shedding patient with a high viral load can contaminate an entire endoscopy room with the virus that remains viable for up to 3 days, putting uninfected patients and HCWs at risk.[2 3]

Singapore previously had the largest cohort of COVID-19 patients outside China in the early phases of the outbreak. Given its novelty, the effectiveness of new preventative measures implemented within our endoscopy services was unknown. To determine best practice, we conducted systematic searches of literature and official websites for gastroenterology and endoscopy societies (n=28) in the 15 most-affected countries to scrutinise recommendations and associated evidence. Methodology is available on request.

In summary, we found careful patient selection was commonly advised but protocols for screening and triaging differed (table 1). The two most important differences observed were: (1) type of personal protective equipment (PPE) recommended and (2) postprocedure risk management (table 2). Only 32% (9/28) of all gastrointestinal (GI) related societies reviewed had provided guidance as of 16 March 2020. A universal gold standard was lacking. One article reported the effect of preventative measures on the incidence of new COVID-19 cases but the sample size was small and period of observation abrupt.[4]

Patient screening undoubtedly is the foremost step at preventing nosocomial transmission; timely detection allows postponement of non-urgent procedures

Table 1 Summary of recommendations for patient selection in GI endoscopy during the COVID-19 pandemic

Articles grouped by country:	China*†‡	USA§¶	UK**††	Spain‡‡	Singapore
Patient selection in endoscopy	Triaging: ► Suspend elective cases and reduce active endoscopy rooms. Urgent or emergency cases only. Postpone all procedures in COVID-19 patients if unnecessary. ► Postpone procedures for abdominal pain, vomiting, bloating, diarrhoea, coffee ground vomiting or mild PR bleeding, any other mild conditions. ► Proceed if (1) ingestion of foreign bodies, for example, batteries, sharp or toxic foreign bodies, (2) GI obstruction caused by foreign bodies, and (3) endoscopic diagnosis and treatment of major gastrointestinal bleeding. For any other indication, for example, suspected cancers, endoscopist discretion is advised. Screening protocol: ► Screen all patients for fever at the 'front desk'. Refer to fever clinic and provide patients with a face mask if febrile; axillary body temperature ≥37.3°C or ear temperature ≥37.5°C. CT Lung if suspicious +/−throat swab.‡ If afebrile, continue risk assessment. ► If afebrile, screen for other COVID-19 symptoms, recent travel and close contact history. If suspected COVID-19, perform CT Lung‡ PPE recommendation (general staff): ► Desk staff to wear surgical face masks, caps, impermeable clothing. Contingency plan for high-risk patients detected in endoscopy: ► All patients found to COVID-19 positive to be quarantined in an isolation ward.	Triaging: ► Strongly consider postponing non-urgent or elective cases. ► Triage suspected or confirmed COVID-19 patient to a designated area. Carers and relatives prohibited from the endoscopy department unless necessary. Screening protocol for[6]: ► Four questions asked before endoscopy: i. Fever (>37.5°C) in last 14 days? ii. Cough/sore throat/respiratory problems? iii. Close contact with suspected or confirmed COVID-19 individual? (including family's exposure) iv. High-risk area? ► Check body temperature before entering endoscopy. Classify risk: i. Low=No symptoms, no contact risks, not from high-risk area ii. Intermediate=One of any positive iii. High risk=symptomatic with either contact risk of from the high-risk area. PPE recommendation (general staff): ► All patients to be offered surgical face masks Contingency plan for high-risk patients detected in endoscopy: ► Not stated.	Triaging: ► Three categories: (1) Need to continue, (2) defer until further notice, (3) needs discussion. Need to continue procedures: acute upper GI bleeding, oesophageal obstruction (foreign bodies, food bolus, pinhole stricture or cancer requiring urgent stenting), endoscopic vacuum therapy for perforations/leaks, acute cholangitis or jaundice secondary to biliary obstruction, acute biliary pancreatitis, cholangitis with stone and jaundice, infected pancreatic collections, walled-off pancreatic necrosis, urgent inpatient nutrition support (enteral feeding tubes), gastrointestinal obstruction needing urgent decompression or stenting. Defer until further notice procedures: All routine symptomatic referrals, planned POEM, pneumatic dilatation for achalasia, elective PEG, stricture dilatation, APC for GAVE, RFA, pneumatic dilatation, ampullectomy, bariatric endoscopy Low-risk follow-up and repeat scopes—oesophagitis healing, gastric ulcer healing, 'poor views', check post-therapy, for example, EMR, RFA, polypectomy (unless high-risk neoplasia present), and so on. Surveillance polyp check, IBD, Barrett's (unless high-risk neoplasia present), non-urgent enteroscopy, EUS for 'benign' indications—biliary dilatation, possible stones, submucosal lesions, pancreatic cysts without high-risk features. Other ERCP cases—stones where there has been no recent cholangitis and a stent is in place; therapy for chronic pancreatitis; metal stent removal or change; ampullectomy follow-up. Flexible sigmoidoscopy should stop unless discussed with local commissioners. Patients undergoing endoscopy/biopsy as part of clinical trials. Case-by-case decision: 2-week wait cancer referrals, FIT positive bowel screening colonoscopy, planned EMR/ESD for complex polyps or high-risk lesions, new suspected IBD, cancer staging EUS, small bowel endoscopy. (General guidance, non-exhaustive list). Screening protocol: i. Travel history ii. Body temperature iii. Patients are given a symptom information sheet and asked to report any symptoms at the front desk. PPE recommendation (general staff): ► None stated Contingency plan for high-risk patients detected in endoscopy: ► Not stated.	Triaging: ► Delay all procedures for 30 days if patients have respiratory symptoms or exposure to contacts regardless of a fever unless in emergencies. Screening protocol: i. Body temperature, ii. Respiratory symptoms iii. High-risk contacts Contingency plan for high-risk patients detected in endoscopy: ► Not stated. PPE recommendation (general staff): ► None stated Contingency plan for high-risk patients detected in endoscopy: ► Not stated.	Triaging ► Non-urgent indications in the following settings to be postponed: 1. Patients with acute respiratory Symptoms, 2. Exposure in high-risk countries 3. Suspect COVID-19 4. Proven COVID −19 ► All urgent indications to proceed regardless of COVID-19 status. ► The urgency of referral determined by endoscopists. Screening protocol: i. Body temperature ii. Cough iii. All other COVID-19 symptoms, (iv) Travel history iv. Contact history, All suspected and confirmed COVID-19 patients to be managed in designated isolation areas. PPE recommendation (general staff): ► None stated Contingency plan for high-risk patients detected in endoscopy: ► Not stated.

Articles grouped by the country of publication; recommendations may not necessarily reflect national guidance if any.
*Subspecialty group of Gastroenterology, the Society of Paediatrics, Chinese Medical Association. (Prevention and control program on 2019 novel coronavirus infection in children's digestive endoscopy centre). *Zhonghua Er Ke Za Zhi* 2020;58, 175–178.
†Luo *et al* (Standardised diagnosis and treatment of colorectal cancer during the outbreak of novel coronavirus pneumonia in Renji hospital). *Zhonghua Wei Chang Wai Ke Za Zhi* 23, 2020; E003.
‡Gou *et al* (Treatment of pancreatic diseases and prevention of infection during outbreak of 2019 coronavirus disease). *Zhonghua Wai Ke Za Zhi* 2020;58, E006.
§Pochapin *et al* American College of Gastroenterology COVID-19 and recommendations for gastroenterologists. 2020.
¶Repici *et al* Coronavirus (COVID-19) outbreak: what the department of endoscopy should know. Gastrointestinal Endoscopy 2020.
**British Society of Gastroenterology and British Association for the Study of the Liver. COVID-19: Advice for healthcare professionals in Gastroenterology and Hepatology. 2020.
††Public Health England. COVID-19: Guidance for infection prevention and control in healthcare settings (Version 1.0). 2020.
‡‡Sociedad Española de Patología Digestiva (SEPD) (Updated SEPD recommendations on infection by the SARS-CoV-2 coronavirus.)
APC, argon plasma coagulation; EMR, endoscopic mucosal resection; ESD, endoscopic submucosal dissection; EUS, endoscopic ultrasonography; FIT, faecal immunochemical test; GAVE, gastric antral vascular ectasia; GI, gastrointestinal; IBD, inflammatory bowel disease; PEG, percutaneous endoscopic gastrostomy; POEM, peroral endoscopic myotomy; PPE, personal protective equipment; RFA, radio frequency ablation.

Table 2 Summary of recommendations for periprocedural, intraprocedural and postprocedural recommendations including general advice

Articles grouped by country:	China*†‡	USA§¶	UK**††	Spain‡‡	Singapore
Periprocedural and intraprocedural practices	PPE recommendations: For all patients: Mask: N95 or PAPR Clothing: Impermeable clothing wear, shoe covers, work caps, goggles and latex gloves for all procedures. ► Staff to take caution in putting on and removing PPE to avoid self- contamination. Infection control measures: ► Strict hand hygiene for staff. ► Patients to disinfect hands and must wear face masks.	PPE recommendations: Low-risk patients: Mask: Surgical masks. Clothing: Work cap, goggles, glove, disposable gowns and gloves *Lower endoscopy in patients with intermediate-risk is downgraded to low risk High-risk patients: Mask: FFP2 or FFP3 Clothing: Impermeable clothing, work cap, goggles and/or face shield, double glove, impermeable clothing *Upper endoscopy=high risk. Infection control measures: ► Strict hand hygiene for staff. ► Staff to pay attention to PPE removal techniques. ► A negative pressure ventilation room recommended. ► Essential personnel only.	PPE recommendations: Low-risk patients: Mask: Recommendation unclear Clothing: Standard infection control procedures with PPE; disposable gloves and gowns. *Lower endoscopy in COVID-19 patients considered low risk, surgical face mask recommended. High-risk patients: Masks: FFP3 Clothing: PPE with face shield or goggles if upper endoscopy. Consider advanced PPE if out-of-hours or emergency cases. Infection control measures: ► Strict hand hygiene for staff. ► Minimise non-essential staff.	PPE recommendations: For all patients: Mask: Unspecified mask Clothing: Gowns, gloves and protective goggles. Infection control measures: ► Standard measures	PPE recommendations: Low-risk patients: Mask: N95 Clothing: Face shield and standard PPE High-risk patients: Mask: PAPR Clothing: Advanced PPE including goggles, work caps, shoe covers, with required for all staff. Infection control measures: ► Strict hand hygiene for staff. ► Minimise non-essential staff numbers. ► Negative pressure ventilation room required.
Postprocedural practices	Decontamination practices: ► Decontamination staff to wear disposable impervious isolation clothing, latex gloves, shoe covers (boot covers), and strictly implement hand hygiene. ► Decontaminate endoscopy room surfaces, PPE and equipment with 2000–5000 mg/L chlorine-containing disinfectant (30 min). ► Ventilate the room, use plasma air disinfector or air disinfection spray if necessary. ► Double-bag all medical waste and spray waste bags with 1000 mg/L of chlorine-containing disinfectant. PPE for transfer: ► None stated Post-sedation management: ► None stated	Decontamination practices: ► Decontamination staff to wear surgical face masks at all times. ► Decontaminate all surfaces after each suspected or confirmed COVID-19 case. ► Bleach containing solutions in ratios of 1:100 was cited. PPE for transfer: ► - None stated Post-sedation management: ► None stated ► Phone follow-up on Day seven and Day 14 post-procedure.	Decontamination practices: ► Decontaminate surfaces with a disinfectant containing 1000 parts per million chlorine. ► Only deep clean endoscopy room after the procedure if suspected or confirmed COVID-19 patient, or pandemic area. ► Single rooms six air changes per hour, Negative pressure rooms 12 air changes per hour. PPE for transfer: ► Symptomatic patients wear a surgical face mask during transfer. Postsedation management: ► None stated	–	Decontamination practices: ► Endoscopy team will de-gown in order- 1. Gloves and gowns in the isolation room 2. PAPR and N95 masks to be left outside the patient room or anteroom. 3. Dirty equipment and scopes to be wiped down with disinfectant. 4. Dirty scopes placed in double-bagged biohazard bags and placed in a rigid container and labelled 'Dirty' for transportation back to endoscopy for washing, ► Endoscopy room to be deep cleaned after each suspected or confirmed case. PPE for transfer staff: ► Transfer staff requires standard PPE during all patient transfers. Postsedation management: ► None stated
General advice	► Staff to check personal body temperature daily and self-refer if T≥37.3°C. ► 14-day medical isolation and observation if staff comes in contact with a COVID-19 patient without protection or if febrile.	► Patients with conditions that require long term immuno-suppression should continue with immunosuppressive therapy.	► Patients to continue immuno-suppression if established and contact the medical team if unwell or exposed to COVID-19 patient	► Face-to-face evaluation for patients who are on biological treatment, immunosuppressed or if they have a chronic debilitating disease. ► Formation of stable work teams: (medical physician, anaesthetist or sedation nurse/ nurse/assistant).	► All staff to check personal body temperature twice daily. ► Endoscopic staff is segregated into isolated teams to reduce social mixing to reduce cross exposure in the event of an outbreak.

Articles grouped by the country of publication; recommendations may not necessarily reflect national guidance if any.
*Subspecialty group of Gastroenterology, the Society of Paediatrics, Chinese Medical Association. (Prevention and control program on 2019 novel coronavirus infection in children's digestive endoscopy centre). *Zhonghua Er Ke Za Zhi* 2020;58, 175–178.
†Luo *et al* (Standardised diagnosis and treatment of colorectal cancer during the outbreak of novel coronavirus pneumonia in Renji hospital). *Zhonghua Wei Chang Wai Ke Za Zhi* 23, 2020; E003.
‡Gou *et al* (Treatment of pancreatic diseases and prevention of infection during outbreak of 2019 coronavirus disease). *Zhonghua Wai Ke Za Zhi* 2020;58, E006.
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††Public Health England. COVID-19: Guidance for infection prevention and control in healthcare settings (V.1.0). 2020.
‡‡Sociedad Española de Patología Digestiva (SEPD) (Updated SEPD recommendations on infection by the SARS-CoV-2 coronavirus).
FFP2, filtering facepiece rating 2; FFP3, filtering facepiece rating 3; PAPR, powered air-purifying respirator; PPE, personal protective equipment.

until the infection has resolved, significantly reducing transmission risk to patients and staff. However, the median incubation time of the virus is 5.1 days but can extend to 14 days (99th percentile), meanwhile patients remain asymptomatic or have subclinical symptoms and may be infectious.[5 6] This limits screening protocols reliant on symptomatology. GI symptoms of COVID-19 are also non-specific. Travel history becomes limited when COVID-19 becomes more rampant in local communities so contact screening for exposure to individuals who have symptoms of COVID-19 may be more

useful. Nonetheless, data on the accuracy of question-based screening tools were not identified.

Current limitations of screening place greater importance on risk management strategies postprocedure. Detecting 'false negatives' that slip through processes allows for the identification of HCWs and patients with infection risk after exposure to asymptomatic or subclinical carriers in the viral incubation period at the time of endoscopy. A robust contact screening programme is then necessary to contain the spread of COVID-19 among exposed staff and patient contacts. Only one guideline identified in our review has advised on postprocedure patient follow-up on day 7 and day 14 by telephone.[7]

No evidence of SARS-CoV or SARS-CoV-2 transmission through endoscopy was identified. SARS-CoV-2 has been isolated in gastric, duodenal and rectal biopsies, and faecal viral RNA is detectable in half of all COVID-19 patients although there is a poor correlation to GI symptoms.[8 9] Nonetheless, reports may surface in the future and suspicion for faecal-oral transmission should remain high. US and UK guidelines regarded lower endoscopy as low risk and therefore were less stringent with PPEs compared with China or Singapore (table 2). We have erred on the side of caution because the microbial contamination of surroundings after lower endoscopy has been reported.[10 11] Differences in recommendations may also have been influenced by resource availability and health policies.

In our experience, resource allocation for staff education, decontamination and management of the physical and mental well-being of HCWs were also crucial. In conclusion, better evidence is needed to inform current practice. A postprocedure risk management programme can help prevent the nosocomial and community spread of SARS-CoV-2 and should not be neglected.

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