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Effect of COVID-19 pandemic on the workflow of endoscopy units: an international survey

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Abstract

Introduction: The coronavirus disease 2019 (COVID-19) pandemic poses a challenge to healthcare. Staff and patients are at increased risk during an examination or intervention, so certain restrictions ought to be introduced. Hence, we aimed to measure the effect of the pandemic on endoscopy units in real-life settings.

Methods: This was an observational, cross-sectional, questionnaire-based study, carried out between 7 April and 15 June 2020. Responds came from many countries, and the participation was voluntary. The survey contained 40 questions, which evaluated the effect of the COVID-19 pandemic on the endoscopy units and assessed the infection control.

Results: A total of 312 questionnaires were filled, 120 from Hungary, and 192 internationally, and 54 questionnaires (17.3%) were sent from high-risk countries; 84.9% of the gastroenterologists declared that they read the European Society of Gastrointestinal Endoscopy (ESGE) statement, while only 32.1% participated in any advanced training at their workplace. Overall, 92.1% of gastroenterologists realized risk stratification, and 72.1% claimed to have enough protective equipment. In 52.6% of the endoscopy units, at least one endoscopist had to discontinue the work due to any risk factor, while 40.6% reported that the reduced staff did not affect the workflow. Gastroenterologists considered that the five most important examinations both in low and high-risk patients are the following: lower/upper gastrointestinal (GI) bleeding with hemodynamic instability, endoscopic retrograde cholangiopancreatography (ERCP) in obstructive jaundice, foreign body in the esophagus, ERCP in acute biliary pancreatitis, and iron deficiency anemia with hemodynamic instability, which correlates well with the ESGE recommendation. Significant correlation was found in the usage of the necessary protective equipment in high-risk patients depending on the countries ($p < 0.001$).

Conclusions: The survey found weak correlation in preliminary training depending on countries; nevertheless, in Hungary during the examined period, endoscopists considered the recommendations more strictly than in other countries. Although many physicians left the endoscopy lab, the workflow was not affected, probably due to the reduced number of examinations.

Keywords: coronavirus, endoscopy, pandemia, personal protective equipment, SARS-CoV-2

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Introduction

Coronavirus disease 2019 (COVID-19) is a predominantly respiratory tract infection caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) virus. Coronaviruses are single-stranded, RNA viruses that are prevalent in

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humans, mammals, and birds, and can cause respiratory, enteral, liver, and neurological infections. Six types of coronaviruses are known to cause disease in humans. Four viruses, 229E, OC43, NL63, and HKU1, cause mild, flu-like symptoms. The remaining two virus strains, namely the severe acute respiratory syndrome coronavirus (SARS-CoV) and the Middle Eastern respiratory coronavirus (MERS-CoV), could result in a more severe disease course and could have higher mortality rates.[1,2]

SARS-CoV-2 is a predominantly respiratory pathogen, the main route of human-to-human transmission is the exhaled respiratory droplets.[3,4] Besides, the virus is detectable in endoscopic biopsy and fecal specimens, thus the fecal–oral transmission could also be a route of human-to-human transmission.[5,6]

The surfaces of non-living objects could be contaminated by respiratory droplets and/or fecal specimens where the virus could survive for hours to days contributing to the indirect transmission of the infection.[3,5]

The COVID-19 pandemic was declared by the World Health Organization on 11 March 2020.[7] At that time, the government also declared an extraordinary legal order and emergency situation in Hungary for the entire territory of the country and a similar situation was reported in other countries. These restrictions significantly affected the operation of healthcare in the sprint (and unfortunately now too, during the second wave). The number of doctor–patient appointments has been dramatically decreased, hospital admissions have been limited, and specialist appointments have been suspended. However, the care of patients with serious health conditions, requiring emergency admission, radiological or endoscopic examinations, as well as surgery, continued. Thus, endoscopy units faced a great challenge. Previous studies have shown that during endoscopic examination, the face, eyes, and skin of the endoscopy staff, as well as the wall of the endoscopy room are contaminated with fecal droplets from the patient.[8,9]

Hence, all types of endoscopic examinations should be considered as aerosol-generating procedures, as coughing or gagging during upper gastrointestinal (GI) endoscopy and passing flatus or contacting with liquid stool during lower GI endoscopy can happen. The general strategy for the protection of both the endoscopy staff and patients is the postponement of all non-essential endoscopic procedures, and therefore only emergency endoscopies are permitted during the pandemic according to the declaration of several endoscopy organizations all over the world. Based on the ESGE statement, published in April 2020, 'European Society of Gastrointestinal Endoscopy (ESGE) and European Society of Gastrointestinal Endoscopy Nurses and Associates (ESGENA) Position Statement on gastrointestinal endoscopy and the COVID-19 pandemic' by Gralnek *et al.*,[10] the recommended protective equipment for health professionals should be stratified by patients' risk situation. During an endoscopy of a low-risk patient, surgical mask, gloves, disposable hairnet, protective eyewear, waterproof disposable gowns should be worn, while during an examination of a high-risk or positive patient Filtering Face Piece-2/3 (FFP-2/3) mask, two pairs of gloves, disposable hairnet, protective eyewear, and waterproof disposable gowns are the adequate clothing, based on the ESGE guideline.[10–16]

Aims

The primary aim of this questionnaire-based study was to evaluate the effect of the COVID-19 pandemic on the operation of endoscopy units worldwide and to assess the impact of the regulations regarding the endoscopy units introduced to protect the patients and healthcare workers in international settings.

Our secondary aim was to determine the most important indications of endoscopic procedures that have to be performed under any circumstances and should not been postponed. In addition, we intended to compare these indications with the recently published ESGE guidelines and also between the responding countries.

Our tertiary aim was to evaluate the quality of infection prevention and control strategies in the endoscopy units of responding countries.

Methods

This was an observational, cross-sectional, online questionnaire-based study, carried out between 7 April 2020 and 15 June 2020. Gastroenterologists from the countries listed below, working in endoscopy units of primary, secondary, and tertiary

level medical centers, were invited to complete the questionnaire. Collaborators were reached by email, to distribute the questionnaires in their countries, and those who recruited 20 participants from a country qualified as a co-author. Co-workers and colleagues were selected and chosen to distribute the questionnaires due to previous collaborations. The Hungarian participants were members of the Hungarian Society of Gastroenterology (HSG). The invitation letter contained the aims of the survey, assured participants about the anonymity and strict confidentiality of data during the statistical analysis; it also emphasized that the participation was voluntary, and by completing the questionnaire, they would contribute to the usage of obtained data for scientific purposes. The survey comprised 40 questions which evaluated the effect of the COVID-19 pandemic on the endoscopy units' workflow and assessed the infection control of endoscopy units. Questionnaires which were partially completed and/or repeatedly submitted were excluded.

Countries were classified by the COVID-19 infection rate (cases per one million people, since the outbreak until 1 September), as low (0–2000 cases/million), medium (2000–5000 cases/million), and high-risk (>5000 cases/million) countries. (Table 1). The endoscopy labs were classified into three groups, based on the number of employed gastroenterologists. This way low (less than three endoscopists), medium (four to six endoscopists) and large (more than seven endoscopists) endoscopy units have been distinguished.

Countries with a minimum of 20 responders were eligible for the comparison.

The study protocol and the questionnaire were approved by the Scientific Research Ethics Committee of the Hungarian Medical Research Council. The study was carried out under the Declaration of Helsinki.

Statistical analysis was performed with the Statistical Package for the Social Sciences software version 24 (SPSS Inc., Chicago, IL, USA). Descriptive statistics were performed on all studied variables which were expressed as means and medians with ranges. During the analysis of secondary endpoints, the differences between the workflows of endoscopy units were assessed by Fisher's exact tests, a p value of <0.05 was considered to indicate statistical significance.

Table 1. The distribution of responses among countries.

Country	Questionnaires filled (%)	COVID-19 prevalence
Belgium	2 (0.6)	High
Canada	2 (0.6)	Medium
Croatia	12 (3.8)	Medium
Czech Republic	20 (6.4)	Medium
Finland	23 (7.4)	Low
France	22 (7.1)	High
Germany	2 (0.6)	Medium
Hungary	120 (38.5)	Low
Israel	7 (2.2)	High
Italy	32 (10.3)	Medium
Romania	13 (4.2)	Medium
Slovakia	7 (2.2)	Low
Slovenia	27 (8.7)	Low
Switzerland	22 (7.1)	High
United Arabian Emirates	1 (0.3)	High
Overall	312	

COVID-19 prevalence (cases per one million people, since the outbreak until 1 September) is classified to low (0–2000 cases/million), medium (2000–5000 cases/million), and high-risk (>5000 cases/million) countries.
COVID-19, coronavirus disease 2019.

Results

A total of 312 questionnaires were filled, 120 from Hungary, and 192 internationally, mostly from Europe (Belgium, Canada, Croatia, Czech Republic, Finland, France, Germany, Israel, Italy, Romania, Slovakia, Slovenia, Switzerland, and United Arabian Emirates) (Table 1).

Fifty-four questionnaires (17.3%) were sent from high-risk, 81 from medium-risk (26%) and 177 from low-risk (56.7%) COVID-19 prevalence countries. The proportion of large, medium, and low capacity endoscopy units were 40.7% ($N=127$), 29.5% ($N=92$) and 29.8% ($N=93$).

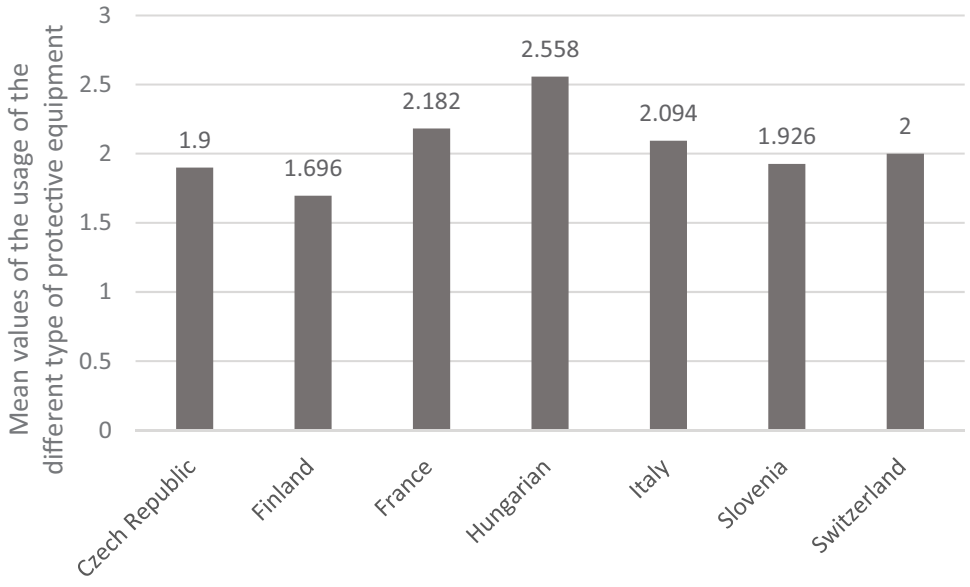

Figure 1. Usage of available necessary protective equipment [FFP2 (N95)/FFP3 (N99) (Filtering Face Piece), protective eyewear, double gloves] in endoscopy labs; 1 point when only one was used, 2 when two of them were used, and 3 when all of them were used (mean values based on countries).
FFP, Filtering Face Piece.

A total of 84.9% of the gastroenterologists declared that they had read the ESGE statement, while only 32.1% said that they attended or participated in any advanced training at their workplace on the management of the endoscopy lab during the pandemic. There was no significant difference in the participation rate between Hungary and other countries ($p = 0.701$). We also looked for correlation, whether the preliminary training depended on the countries (above 19 filled questionnaires); however, no significant difference was obtained ($p = 0.531$).

Nevertheless, significant correlation was found in the numbers of usage of the necessary protective equipment [FFP2 (N95)/FFP3 (N99), protective eyewear, double gloves] used during the examination of a high-risk patient depending on the country ($p < 0.001$). Due to the significance, we compared each country in terms of protective equipment. It can be clearly seen, that based on our data, Hungarian gastroenterologists significantly used the most of the different types of necessary clothing (Figure 1 and Table 2).

The rate of institutes providing training was independent of the COVID-19 rate of the country ($p = 0.483$), in addition, it was also independent of the capacity of the endoscopy units ($p = 0.402$).

A total of 99.4% of the gastroenterologists claimed that the COVID-19 pandemic had an impact on the operation of the healthcare system and their endoscopy units. In 52.6% of the endoscopy units ($N = 164$) at least one endoscopist had to discontinue the work due to any risk factor (age over 65 years, chronic disease, for example), while 40.6% reported that the reduced staff did not affect the workflow. In addition, more than 40% of the doctors ceased the work in 10.3% of the endoscopy units ($N = 32$); 63.8% of the endoscopy labs at least halved their endoscopic capacity; moreover, in 37.5% of the labs the reduction exceeded 75%. Colonoscopy was reduced in 83% of the cases, and gastroscopic examinations were diminished to a slightly greater extent (86.2%), while ERCP and endoscopic ultrasound (EUS) was reduced in a lower proportion (63.5% and 61.9%). A possible explanation is that ERCP and EUS are performed in fewer endoscopy labs.

A total of 91.7% of the respondents claimed that they perform patients' risk stratification prior to the examination. Endoscopists considered that the five most important examinations are the following in a low-risk patient: lower/upper GI bleeding with hemodynamic instability (93.9%), ERCP in obstructive jaundice (91.0%), foreign body in the esophagus (89.7%), ERCP in acute biliary pancreatitis (79.2%), and iron deficiency

Table 2. Significance (p-values) in terms of the presence of the protective equipment during an examination of a high-risk, or COVID-19 positive patient.

	Czech Republic	Finland	France	Hungary	Italy	Slovenia
Finland	0.999	–	0.494	<0.001	0.7503	0.999
France	0.999	0.494	–	0.494	0.999	0.999
Hungary	0.0065	<0.001	0.494	–	0.03547	0.00199
Italy	0.999	0.7503	0.999	0.03547	–	0.999
Slovenia	0.999	0.999	0.999	0.00199	0.999	–
Switzerland	0.999	0.999	0.999	0.02733	0.999	0.999

The results were significant, when data were compared with Hungarian results.
COVID-19, coronavirus disease 2019.

anemia with hemodynamic instability (78.8%), which correlates well with the ESGE recommendation. Based on our results it seems to influence the indications of the necessary examinations performed, but still the five most important indications remained unchanged: lower/upper GI bleeding with hemodynamic instability (95.2%), ERCP in obstructive jaundice (69.6%), foreign body in the esophagus (76.9%), ERCP in acute biliary pancreatitis (49.4%), and iron deficiency anemia with hemodynamic instability (32.1%). Still, more than 20% of the responders stated that they would perform endoscopy in high-risk or SARS-Cov-2 positive patients in the case of lower/upper GI bleeding without hemodynamic instability (28.5%), endoscopically confirmed malignant adenoma (27.6%), and dysphagia (24.0%). Only 19.9% declared that they would perform colonoscopy in severe flare-ups of therapy-refractory inflammatory bowel disease, which is included in the ESGE statement, due to potentially permanent health damage (Figure 2).

Overall, 72.1% of the participants claimed to have enough protective equipment (Figure 3). Based on our results, there is a significant correlation between the COVID-19 infection rate of a country and the usage of the protective equipment in accordance with the ESGE statement (i.e. when a gastroenterologist wears all the necessary gear during an endoscopy of a high-risk or SARS-CoV-2 positive patient; $p < 0.001$). FFP2 (N95) or FFP3 (N99) masks are provided in 83.0% of the labs, protective eyewear in 69.2%, plexiglass face-shield in 63.5%, double gloves in 69.9%, while 22.1% of the respondents still use a surgical mask during an examination of a SARS-CoV-2 positive or high-risk patient (Figure 4).

A total of 85.3% of the responding endoscopists think that the endoscopy staff is at elevated risk, but there was no clear consensus as to which procedure poses the highest risk. Most of them (46.5%) claimed that gastroscopy carries the highest risk, while 27.9% assigned ERCP to be the most hazardous. Overall, 26.6% consider that each examination poses the staff the same level of risk, while nearly everyone agreed (except 0.6%) that colonoscopy is not the most hazardous procedure.

A negative pressure room was available in 10.6% of the endoscopy units. Based on our results, adequate ventilation and/or air purification was provided in 80.1% of the cases by natural ventilation through opened windows (50.6%), ventilation on the outside (9.3%) or by air filter (19.9%).

Discussion

COVID-19 has challenged healthcare worldwide. Both healthcare professionals and patients are at increased risk during any medical intervention, but even during doctor–patient contact. For this reason, efforts should be made to perform examinations and interventions only in the case of certain indications. This is especially true for endoscopies, because they should be considered as aerosol-generating procedures, which promote the spreading of the virus. As we learn more about the pandemic, international recommendations are changing as well,

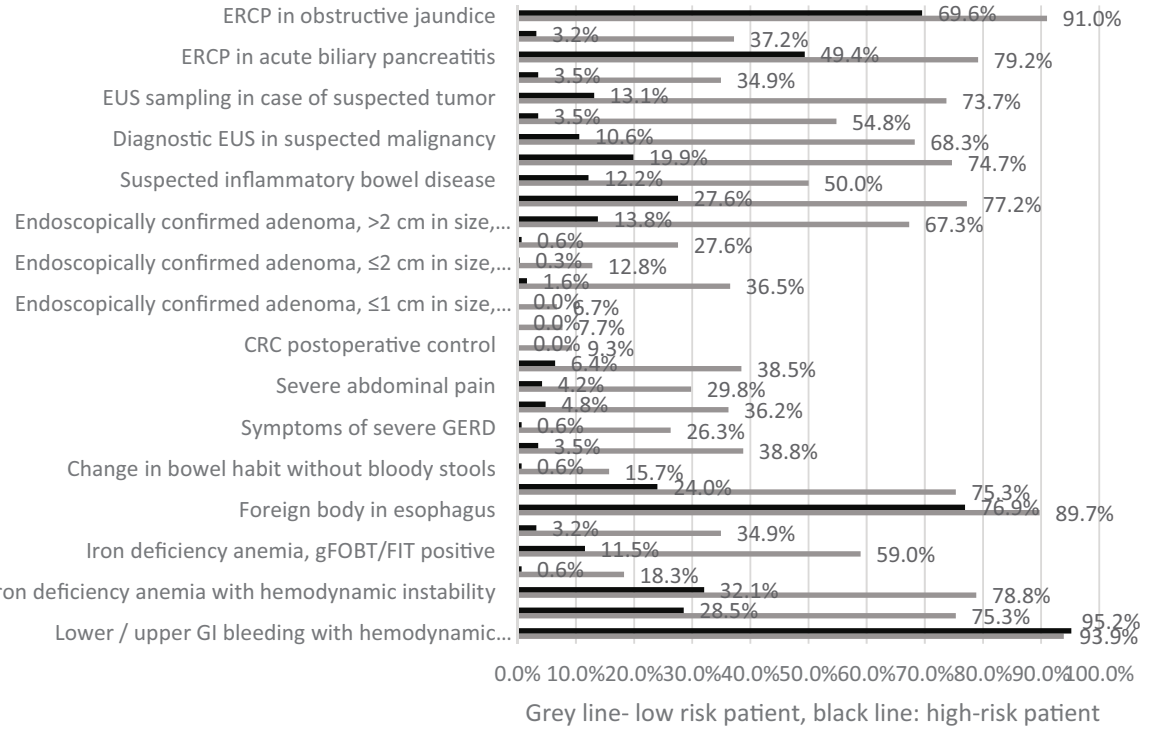

Figure 2. Indications for endoscopic procedures (divided into low and high-risk group) in which endoscopy cannot be postponed after the pandemic based on the opinion of our cohort.

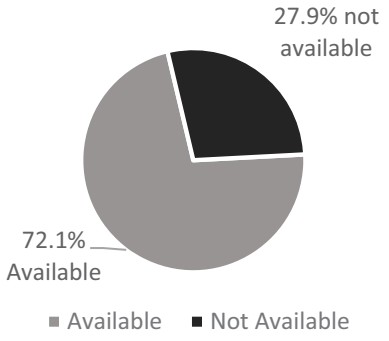

Figure 3. Availablity of appropriate amount of personal protective equipment.

and guidelines vary depending on the country, due to the different incidence of COVID-19 infections, and the resources. Nevertheless, the adherence to these regulations is still questionable; therefore, there is a need to see things clearly, and to get the proper feedback. Our study attempted to fulfil this gap, as it was an anonymous questionnaire, which examined the infection prevention and control strategies of endoscopy units, as well as the workflow, the indications for examinations, the protective equipment, and the disinfection techniques of labs. In our view, feedback is relevant during this extraordinary period, in order to set up possibly the best regulations.

Based on our results, the vast majority of gastroenterologists made certain efforts to apply changes in their laboratories, and intended to read, or be informed about the recommendations, although only a few of the responders participated in preliminary training. Although a lot of gastroenterologists had to leave the labs, the workflow did not seem to be affected that much. This can be explained by the decreased number of examinations performed since the outbreak of the pandemic.

Based on our results, despite the regulations and guidelines, there is a great variability among gastroenterologists regarding the indications for endoscopic procedures, the protective equipment, and the country as well. The most urgent indications for an endoscopic examination/

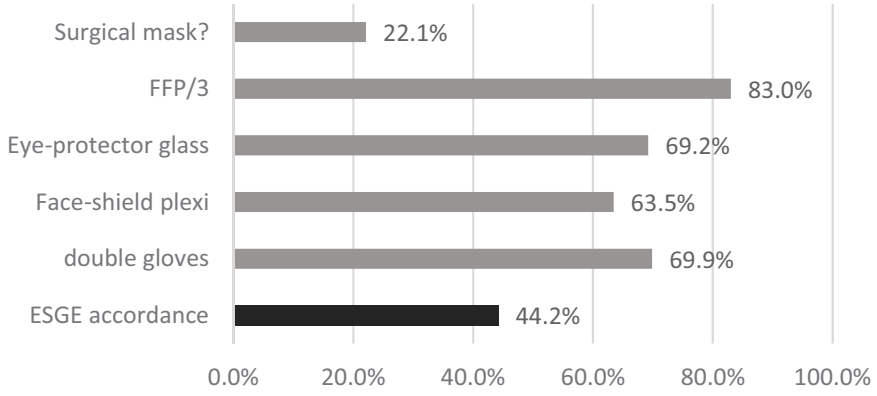

Figure 4. Personal protective equipment (PPE) used in high-risk or positive cases.

intervention during the pandemic coincided with the ESGE statement (however, not everyone agreed on it) regarding acute life-threatening gastrointestinal diseases; nevertheless, the accordance was lower about clinical conditions with a risk of potentially permanent health damage (if endoscopy was postponed). Surprisingly, in the case of a potential malignancy, still a high proportion of gastroenterologists would perform an endoscopic examination during the pandemic in patients with a low risk of SARS-CoV-2 infection (including also a change in bowel habits without hematochezia, as more than 15% of the participants would perform endoscopy in this scenario), and more than one-third of the endoscopists would continue the Faecal Occult Blood Test-based Colorectal Cancer screening programme.

According to our questionnaire, as the SARS-CoV-2 virus spreads by droplet infection, the participants think that upper gastrointestinal endoscopy (including gastroscopy and ERCP) poses a much higher risk than colonoscopy; nevertheless, as we mentioned above, the indications were principally acute life-threatening or potential health damage-causing conditions. Depending on the patient's risk of infection, the protective equipment varies. During an examination of a low-risk patient, surgical mask, gloves, disposable hairnet, protective eyewear and waterproof disposable gowns are sufficient during an examination, but in the case of a high-risk or SARS-CoV-2 positive patient, the necessary equipment contains a FFP-2/3 mask, two pairs of gloves, disposable hairnet, protective eyewear and waterproof disposable gowns (Table 3).[5] According to our results, the presence/usage of the necessary equipment during an examination of a high-risk patient differs based on the country, and in Hungary significantly more endoscopy labs use the prescribed protective clothing. However, the number of participants differs from country to country, and nearly one-third of the respondents were Hungarian. As it was an online questionnaire, in which gastroenterologists were reached by emails, our possibilities were limited.

Conclusions

As our study was an anonymous questionnaire, presumably the answers cover reality, although the number of responses received varied greatly from country to country, so due to that, we performed the comparison among countries with more than 20 participants. Our survey found a great variability in the usage/presence of protective equipment and the preliminary training depending on the COVID-19 infection rate of the countries, or the size of the endoscopy units. Although there was a significant difference between Hungary and other countries regarding the personal protective equipment, due to the big difference in the number of participants from each country, further investigations could clarify this result. As there was also a great variability regarding the indications for endoscopic examinations, we would suggest keeping more training, and occasional forums, in order to get relevant feedback from the endoscopists, because regulations should reflect the real-life problems.

Table 3. Results of survey regarding workflow and infection prevention and control strategies of endoscopy unit during the COVID-19 pandemic.

Indications for endoscopic procedures during COVID-19 pandemic	
Acute life-threatening gastrointestinal disease	• Severe cholangitis, acute biliary pancreatitis with cholangitis, biliary leakage • Foreign body in the upper gastrointestinal tract • Acute gastrointestinal bleeding
Clinical conditions causing potentially permanent health damage if endoscopy is postponed	• Suspicion of gastrointestinal malignancy (based on the results of laboratory tests, clinical status and/or cross-sectional imaging) • Endoscopic intervention to ensure enteral feeding of patients if no other therapeutic option is possible (malignant stricture stenting, percutaneous endoscopic gastrostomy) • Endoscopic staging of cancers if the results are necessary for oncological or surgical treatment and not replaceable with other imaging modality • Severe active ulcerative colitis
Health professional personal protective equipment	
Low-risk patient	• Surgical mask • Gloves • Disposable hairnet • Protective eyewear • Waterproof disposable gowns
High-risk or SARS-CoV2 positive patient	• FFP-2/3 mask • Two pairs of gloves • Disposable hairnet • Protective eyewear • Waterproof disposable gowns

COVID-19, coronavirus disease 2019; FFP, Filtering Face Piece; SARS-CoV-2, severe acute respiratory syndrome coronavirus 2.

Conflict of interest statement

Davide Giuseppe Ribaldone: paid consultancies, lecture fees for the past 2 years: Janssen, Ferring, Errekappa

Pauliina Molander: Lecture and consultancy fees, and advisory board member fees from Abbvie, Janssen-Cilag, MSD, Orion Pharma, Pfizer, Roche, Takeda, Tillotts Pharma

Stephane Nancey: Lecture and consultancy fees and advisory board member of/from Novartis, Takeda, Abbvie, Janssen-Cilag, Amgen, Biogen, Sandoz, Lilly, Tillots Pharma, HAC Pharma

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