The Impact of Face Shields on the Quality of Colonoscopy During the COVID-19 Pandemic

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Abstract

Background: The coronavirus disease 2019 (COVID-19) has become a global pandemic. Healthcare workers are at a higher risk for exposure to COVID-19 infection than the general population. During the COVID-19 pandemic, endoscopists are recommended to wear personal protective equipment (PPE), including face shields, to prevent COVID-19 transmission. However, to the best of our knowledge, there are no reports on the impact of face shields on the quality of colonoscopy. This study aimed to determine whether the use of PPE, including face shields, affects the quality of colonoscopy during the COVID-19 pandemic.

Methods: We retrospectively reviewed the medical records of patients who underwent screening or surveillance colonoscopy performed at Dong-A University Hospital between June 2020 and March 2021 during the COVID-19 pandemic. Endoscopists wore isolation gowns, disposable gloves, and KF94 masks from June 2020 to October 2020. From November 2020, endoscopists additionally wore face shields. Therefore, we compared the colonoscopy quality indicators during the 5 months without the use of face shields and the 5 months with the use of face shields. We calculated the overall adenoma detection rates (ADRs) of the group using face shields and the group not using face shields. Further, the polyp detection rate (PDR), sessile serrated lesion detection rate (SSLDR), advanced neoplasia detection rate (ANDR), polyp per colonoscopy, and adenoma per colonoscopy were calculated for each group.

Results: In total, 1,359 patients were included in the study; the face shield and non-face shield groups comprised 679 and 680 patients, respectively. We found no statistically significant differences in the PDR (49.04 vs. 52.50%, $p=0.202$), ADR (38.59 vs. 38.97%, $p=0.884$) SSPDR (1.91 vs. 1.32%, $p=0.388$), and ANDR (3.98 vs. 3.97%, $p=0.991$) between the groups. In both the experienced endoscopist group and trainee endoscopist group, there was no difference in the colonoscopy quality indicators between the groups of patients examined by endoscopists with and without face shields.

Conclusions: The quality indicators of colonoscopy were not affected by face shields during the COVID-19 pandemic.

Background

An outbreak of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) was detected in a cluster of patients with respiratory tract infection of unknown etiology in Wuhan, Hubei Province, China, in December 2019.[1] The World Health Organization named the disease caused by the SARS-CoV-2 infection as the coronavirus disease 2019 (COVID-19) in February 2020 and declared it a pandemic in March 2020.[2] Because COVID-19 is mainly transmitted through droplets, aerosols, and direct contact, healthcare workers are at a higher risk of being exposed to COVID-19 than the general population.[3, 4] Fecal-to-oral transmission may also be a route of COVID-19 infection.[5] Therefore, endoscopic procedures, such as colonoscopy, increase the risk of COVID-19 transmission. Medical societies, such as the World Endoscopy Organization, American Society for Gastrointestinal Endoscopy, American

Gastroenterological Association, European Society of Gastrointestinal Endoscopy, and Asian Pacific Society for Digestive Endoscopy, have made recommendations for clinicians to follow during the COVID-19 period. The common recommendations of these were to assess the risk of COVID-19 to determine when to perform an endoscopy and that all endoscopists wear appropriate personal protective equipment (PPE) to prevent COVID-19 transmission.[6–10] PPE includes an isolation gown, disposable gloves, a mask, and face shield or goggles. A face shield is used for protection of the facial area from exposure to infectious agents. Many protective devices have previously been used during endoscopy, but face shields have not been used before the COVID-19 pandemic.

Colonoscopy is the gold standard for the screening and diagnosis of colorectal cancer (CRC).[11, 12] However, poor-quality colonoscopy can lead to post-colonoscopy CRC (PCCRC).[13] An increased adenoma detection rate (ADR) has reduced the risk of PCCRC and CRC-related mortality.[14, 15] ADR is affected by the resolution of the colonoscope.[16, 17] High resolution provides clear images, making it easy to detect abnormalities in the colonic mucosa. The sharpness of the screen is an important factor influencing the ADR during colonoscopy.[18] Since the face shield is a device worn in front of the eyes, it may affect the visual field of the user observing the screen. However, there are no reports on the impact of the use of a face shield on the quality of colonoscopy including ADR. Therefore, it is necessary to determine whether the use of a face shield affects the ADR or other colonoscopy quality indicators.

Methods

Study design and patients

We retrospectively reviewed the medical records of patients who underwent screening or surveillance colonoscopy at Dong-A University Hospital between June 2020 and March 2021 during the COVID-19 pandemic. All patients were aged between 30–79 years and underwent either the first screening colonoscopy of their lives or surveillance colonoscopy after 3 years since the last examination. Colonoscopies were performed by four experienced endoscopists and three gastroenterology fellows. All experienced endoscopists who participated in the study had more than 5 years of experience. All gastroenterology fellows who participated in the study were either second- or third-year fellows who could perform colonoscopies independently. The endoscopists wore isolation gowns, disposable gloves, and KF94 masks from June 2020 to October 2020; patients examined under this condition were classified as the non-face shield group. From November 2020 onward, the endoscopists additionally wore face shields, and the patients examined under this condition were classified as the face shield group (Figure 1). Therefore, we compared the colonoscopy quality indicators during 5 months without the use of face shields and 5 months with the use of face shields. Only patients with adequate bowel preparations (Boston bowel preparation scale score ≥ 2 in all segments, described as good or excellent) were included in the study. Patients with a history of colorectal surgery, CRC, inflammatory bowel disease, or active bleeding symptoms were excluded from the study.

Risk stratification and endoscopic procedures with personal protective equipment

Dong-A University Hospital is a tertiary hospital that treats patients with COVID-19. Since the COVID-19 pandemic, our hospital has classified patients' risk of COVID-19 infection into three categories. Patients showing no symptoms (e.g., cough, temperature $>37.5^{\circ}$, breathlessness, diarrhea), with no contact with COVID-19-positive patients, and who did not stay in high-risk areas in the previous 14 days were classified as low-risk patients. Patients showing symptoms, with no contact with COVID-19-positive patients, and who did not stay in high-risk areas in the previous 14 days or patients without symptoms but had contact with COVID-19-positive patients or stayed in high-risk areas in the previous 14 days were classified as intermediate-risk patients. Patients showing symptoms and meeting one of the latter two criteria were classified as high-risk patients. During the chart review, we performed screening or surveillance colonoscopy for low-risk patients. Intermediate- or high-risk patients underwent polymerase chain reaction test for COVID-19 to confirm negative results, and the necessity of colonoscopy was evaluated. Subsequently, colonoscopy was performed for patients with negative results but not for confirmed COVID-19 patients. High-definition video processor systems (i.e., CV-290 EVIS LUCERTA ELITE [Olympus Medical, Tokyo, Japan] and EPK-i7010 [Pentax, Hoya Corporation, Tokyo, Japan]) were used to all colonoscopies. Patients were prepared with 1–2 L of a polyethylene glycol solution containing ascorbic acid with an additional 1–2 L of water. For sedation, we used midazolam 2–5 mg and/or propofol 10–60 mg.

Definitions of polyp detection rate, adenoma detection rate, sessile serrated lesion detection rate, and advanced neoplasia detection rate

We defined the polyp detection rate (PDR) as the proportion of patients with at least one polyp, including adenoma and hyperplastic polyp (HP), among all the patients examined. We defined ADR as the proportion of patients with at least one adenoma among all the patients examined. We added features of clinically significant sessile serrated lesions (SSLs) to our definition of SSL. Therefore, SSL was defined as follows: (a) SSL with or without dysplasia, (b) HP measuring ≥ 5 mm in the proximal colon (proximal to the splenic flexure), or (c) HP ≥ 10 mm in the whole colon. Advanced adenoma was defined as follows: any adenoma ≥ 10 mm in size, with villous histology or with high-grade dysplasia, and any SSL ≥ 10 mm in size or with dysplasia. The sessile serrated lesion detection rate (SSLDR) and ANDR were calculated in the same way as PDR and ADR.

Endpoint

The primary endpoint was the comparison of the ADR between the groups. The secondary endpoint was the comparison of the PDR, SSPDR, ANDR, adenoma per colonoscopy (APC), intubation time, and withdrawal time.

Statistical and data analyses

The data were divided into two groups: data from procedures performed with the use of face shields and data from procedures performed without the use of face shields. Continuous data were analyzed by Student's *t*-test and are represented as mean $\pm$ standard deviation. Categorical data were analyzed using Pearson's chi-squared or Fisher's exact test. All analyses were performed using the Statistical Package for the Social Sciences software version 26.0 (IBM, Armonk, New York, USA). Statistical significance was set at $p < 0.05$.

Ethics statement

Our research protocol was approved by the ethics committee in accordance with international agreements (World Medical Association Declaration of Helsinki: Ethical principles for medical research involving human subjects). Due to the retrospective characteristics of the study, informed consent was waived and the study was approved by the Institutional Review Board of Dong-A University College of Medicine (DAUHIRB-21-110).

Results

Demographic and clinical characteristics

In total, 1,359 patients were included in this study; 680 and 679 procedures were performed without and with face shields, respectively. The demographic and clinical characteristics of the patients are summarized in Table 1. There were no significant differences between the two groups (face shield vs. non-face shield) regarding patient's age and sex, bowel preparation, sedation, use of antiplatelet or anticoagulation, time of examination, indication for examination, type of colonoscope, and endoscopist's experience (Table 1).

Table 1
Demographic and clinical characteristics

	Face shield (n=679)	Non-face shield (n=680)	P value
Age	61.56±11.32	62.68±11.07	0.067
Gender			0.803
Male	381	377	
Female	298	303	
Bowel preparation			0.565
BBPS 8, 9	377	367	
BBPS 6, 7	302	313	
Sedation			0.705
Yes	666	665	
No	13	15	
Antiplatelet or anticoagulation use			0.937
Yes	71	72	
No	608	608	
Examination of day			0.487
Morning	183	172	
Afternoon	496	508	
Reason of examination			0.461
Screening	516	505	
Surveillance	163	175	
Type of colonoscope			0.846
CV-290	300	304	
EPK-i7010	379	376	
Endoscopist's experience			0.683
Experienced	317	325	
Trainee	362	355	
Abbreviation: BPPS=Boston bowel preparation score			

Quality indicators between the groups

There were no significant differences in insertion time (431.94 ± 199.08 vs. 431.71 ± 209.18 , $p=0.983$) and withdrawal time (524.97 ± 164.55 vs. 537.54 ± 164.20 , $p=0.159$) between the two groups. There were no significant differences in the PDR (49.04 vs. 52.50%, $p=0.202$), ADR (38.59 vs. 38.97%, $p=0.884$), SSLDR (1.91 vs. 1.32%, $p=0.388$), ANDR (3.98 vs. 3.97%, $p=0.991$), polyp per colonoscopy (1.11 ± 1.83 vs. 1.10 ± 1.57 , $p=0.897$), and APC (0.73 ± 1.34 vs. 0.69 ± 1.12 , $p=0.471$) between the groups (Table 2).

Table 2
Quality indicators between the groups

	Face shield (n=679)	Non-face shield (n=680)	P value
Cecal intubation time (Second)	431.94 ± 199.08	431.71 ± 209.18	0.983
Withdrawal time (Second)	524.97 ± 164.55	537.54 ± 164.20	0.159
PDR (%)	49.04 (333/679)	52.50 (357/680)	0.202
ADR (%)	38.59 (262/679)	38.97 (265/680)	0.884
SSLDR (%)	1.91 (13/679)	1.32 (9/680)	0.388
ANDR (%)	3.98 (27/679)	3.97 (27/680)	0.991
PPC	1.11 ± 1.83	1.10 ± 1.57	0.159
APC	0.73 ± 1.34	0.69 ± 1.12	0.471
PPB, %	0/333	0/357	1.000
Abbreviation: PDR=Polyp detection rate, ADR=Adenoma detection rate, SSPDR=Sessile serrated polyp detection rate, ANDR=Advanced neoplasm detection rate, PPC= Polyp per colonoscopy, APC=Adenoma per colonoscopy, PPB=post polypectomy bleeding			

Adenomas per colonoscopy by endoscopic feature and size

Adenomas were divided into two categories according to their endoscopic features: polypoid and flat. APC, according to endoscopic features, was not significant between the face shield and non-face shield groups (polypoid: 0.05 vs. 0.05, $p=0.933$; flat: 0.68 vs. 0.64, $p=0.457$). Adenomas were divided into three categories according to their size: <5 mm, 5–10 mm, and >10 mm. APC, according to size, was not

significant between the face shield and non-face shield groups (<5 mm: 0.66 vs. 0.58, $p=0.199$; 5–10 mm: 0.05 vs. 0.08, $p=0.171$; >10 mm: 0.03 vs. 0.03, $p=0.997$) (Table 3).

Table 3
Adenomas per colonoscopy by endoscopic feature and size

	Face shield (n=679)	Non-face shield (n=680)	<i>P</i> value
Endoscopic feature			
Polypoid	0.05 (31/679)	0.05 (34/680)	<i>0.933</i>
Flat	0.68 (465/679)	0.64 (435/680)	<i>0.457</i>
Size			
<5mm	0.66 (445/679)	0.58 (394/680)	<i>0.199</i>
5-10mm	0.05 (31/679)	0.08 (54/680)	<i>0.171</i>
>10mm	0.03 (20/679)	0.03 (21/680)	<i>0.997</i>
Overall	0.73 (496/679)	0.69±1.12	<i>0.471</i>
Abbreviation: APC=Adenoma per colonoscopy			

Quality indicators according to endoscopists' experience

The data of the face shield and non-face shield groups were further compared according to the endoscopists' experience. Regarding trainee endoscopists, there were no significant differences in cecal intubation time (455.02 ± 199.81 vs. 464.22 ± 185.30 , $p=0.523$), withdrawal time (522.68 ± 172.04 vs. 544.33 ± 172.97 , $p=0.093$), PDR (46.69 vs. 51.55, $p=0.193$), ADR (35.36 vs. 37.46, $p=0.558$), and APC (0.61 ± 1.23 vs. 0.63 ± 1.10 , $p=0.789$) between the face shield groups. Similarly, regarding experienced endoscopists, there were no statistically significant differences in cecal intubation time (405.58 ± 195.25 vs. 396.19 ± 227.50 , $p=0.575$), withdrawal time (527.58 ± 155.78 vs. 530.13 ± 153.98 , $p=0.835$), PDR (52.29 vs. 53.53, $p=0.647$), ADR (42.22 vs. 40.61, $p=0.670$), and APC (0.88 ± 1.44 vs. 0.74 ± 1.14 , $p=0.198$) (Table 4).

Table 4
Quality indicators according to endoscopists' experience

	Face shield	Non-face shield	P value
Trainee endoscopes			
Cecal intubation time, Second	455.02 ± 199.81	464.22 ± 185.30	0.523
Withdrawal time, Second	522.68 ± 172.04	544.33 ± 172.97	0.093
PDR, %	46.69	51.55	0.193
ADR, %	35.36	37.46	0.558
APC	0.61 ± 1.23	0.63 ± 1.10	0.789
Experienced endoscopists			
Cecal intubation time, Second	405.58 ± 195.25	396.19 ± 227.50	0.575
Withdrawal time, Second	527.58 ± 155.78	530.13 ± 153.98	0.835
PDR, %	52.29	53.53	0.647
ADR, %	42.22	40.61	0.670
APC	0.88 ± 1.44	0.74 ± 1.14	0.198
Abbreviation: PDR=Polyp detection rate, ADR=Adenoma detection rate, APC=Adenoma per colonoscopy			

Discussion

This was a single-center retrospective study that aimed to determine whether the use of a face shield affected the quality of colonoscopy during the COVID-19 pandemic. We found that performing colonoscopy while wearing a face shield did not affect the quality indicators of colonoscopy, including the ADR. In addition, the proficiency of both experienced endoscopists and trainee endoscopists was not affected by the use of face shields.

Endoscopists are at increased risk of contracting COVID-19 infection from airborne droplets and conjunctival contact. Upper gastrointestinal endoscopy is a procedure with a high risk of infection due to a patient's cough during examination. The live virus is also found in the patient's stool, and fecal-oral transmission of COVID-19 is also possible.[5, 19] Therefore, colonoscopy may be a procedure that increases the risk of COVID-19 infection. One study quantified the rate of unrecognized exposure to potentially infectious biologic samples during endoscopy via the endoscopist's face. According to the result, facial exposure may result in transmission of infectious diseases.[20] According to previous studies conducted in the early phase of the COVID-19 pandemic, 19% of healthcare workers who wore masks and gloves and performed hand hygiene without additional facial protection were infected with

COVID-19, but those who used additional facial protection were not infected.[21, 22] For these reasons, it is important that endoscopists wear a face shield along with isolation gowns, gloves, and a mask during colonoscopy procedures in this COVID-19 pandemic.

However, wearing a face shield may affect the observation capacity of the endoscopists during colonoscopy. In previous studies, the ADR was affected by the resolution and visual field of the colonoscopy.[16–18] When the screen is clear and the visual field is wide, it is easy to observe the adenomas. Therefore, there may be concerns about whether the wearing of a face shield affects the clarity or visual field during colonoscopy and thus reduces the ADR. In addition, it was worth checking whether this change made the endoscopists uncomfortable and increased the insertion time or reduced the withdrawal time. However, we confirmed that the wearing of a face shield did not affect the quality indicators of colonoscopy, including the ADR.

This study has some limitations. When a face shield is worn, lights may be reflected on the face shield and interfere with the endoscopist's visual field. In our hospital's endoscopic room, the lights were turned off, only the screen of the video processor was turned on, and there was no direct sunlight in the endoscopic room. However, the lighting or brightness of the endoscopic room and the position of the screen may reflect the light on the face shield, but this may indicate various differences in each endoscopic room. In this study, the impact of these differences on the colonoscopy quality indicators was not analyzed. Moreover, in this study, only one type of face shield was analyzed. Because there are various face shields, the impact on the quality indicators of colonoscopy may be different. Since this was a retrospective study based on medical records, it had inherent limitations. In our hospital, colonoscopy was performed while strictly following the recommendations, but as this was a retrospective study, we could not confirm whether the recommendations were followed or not in a few patients. However, according to our investigation of our hospital staff, compliance with facial protection was greater than 95% during the period; thus, it is estimated that our uncertainty did not significantly affect the results. Therefore, our results obtained by analyzing several patients' medical records in a short period of time in which the current recommendations for facial protection were strictly followed are valuable. In addition, it is meaningful to study the changes that occur due to the unprecedented pandemic that is a threat to the global population. Experts and medical societies have provided guidelines for the management of COVID-19 infection, and medical workers have strict management guidelines to prevent droplet or air transmission. The same management guidelines are also applied in the endoscopic room, and the wearing of PPE, including facial protection, is crucial for endoscopists.[6–10] Further studies will be needed to determine whether wearing a face shield is necessary for the prevention of other infections without degrading the quality indicators of the colonoscopy even when COVID-19 is over.

Conclusions

In conclusion, the quality indicators of colonoscopy were not affected by face shields during the COVID-19 pandemic. Thus, the use of face shields to prevent COVID-19 transmission will not deteriorate the quality of the colonoscopy during the COVID-19 pandemic.

List Of Abbreviations

ADRs adenoma detection rates

ANDR advanced neoplasia detection rate

APC adenoma per colonoscopy

COVID-19 coronavirus disease 2019

CRC colorectal cancer

PCCRC post-colonoscopy colorectal cancer

PDR polyp detection rate

PPE personal protective equipment

SARS-CoV-2 severe acute respiratory syndrome coronavirus 2

SSLDR sessile serrated lesion detection rate

Declarations

Ethics approval and consent to participate

Our research protocol was approved by the ethics committee in accordance with international agreements (World Medical Association Declaration of Helsinki: Ethical principles for medical research involving human subjects). Due to the retrospective characteristics of the study, informed consent was waived and the study was approved by the Institutional Review Board of Dong-A University College of Medicine (DAUHIRB-21-110).

Consent for publication

Informed consent for publication was obtained from the endoscopist wearing the protective equipment in figure 1.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

Study conception (LJY, LJH), Data acquisition, analysis (LJY, KYW), Data interpretation (LJY, KYW, LJH), Manuscript drafting (LJY), Manuscript revisions (LJH), Agree to be personally accountable for contributions and ensure that questions related to the accuracy or integrity of any part of the work are appropriately investigated, resolved, and documented (LJY, KYW, LJH). All authors read and approved the final manuscript.

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Figures

Figure 1

Endoscopists wore isolation gowns, disposable gloves, and KF94 masks from June 2020 to October 2020. From November 2020, endoscopists additionally wore face shields.