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Editorial Board Member of *World Journal of Gastrointestinal Endoscopy*, Istvan Hritz, MD, PhD, Associate Professor, Doctor, First Department of Surgery and Interventional Gastroenterology, Semmelweis University, Budapest 1082, Hungary. istvan.hritz@gmail.com

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Vinyl bag cover method to avoid droplet-containing aerosol escape from endoscopic forceps channel caps during COVID-19 pandemic (with Video 1 and Video 2)

Kazuya Akahoshi, Shinichi Tamura, Kazuaki Akahoshi, Yoriko Kaneshiro, Reiichi Sashihara, Kento Uemura, Kenta Sato

ORCID number: Kazuya Akahoshi 0000-0002-1095-6546; Shinichi Tamura 0000-0002-4644-741X; Kazuaki Akahoshi 0000-0001-7177-3586; Yoriko Kaneshiro 0000-0002-1430-8319; Reiichi Sashihara 0000-0002-0570-1872; Kento Uemura 0000-0003-2645-3043; Kenta Sato 0000-0002-2525-0597.

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Kazuya Akahoshi, Shinichi Tamura, Kazuaki Akahoshi, Yoriko Kaneshiro, Reiichi Sashihara, Kento Uemura, Kenta Sato, Endoscopy Center, Aso Iizuka Hospital, Iizuka 820-8505, Japan

Corresponding author: Kazuya Akahoshi, MD, PhD, Chief Doctor, Director, Endoscopy Center, Aso Iizuka Hospital, 3-83 Yoshio, Iizuka 820-8505, Japan. kakahoshi2@aol.com

Abstract

Endoscopists are at high risk of allowing transmission of coronavirus disease 2019 (COVID-19) during gastrointestinal endoscopy (GIE) procedures under pandemic conditions. The main avenues of droplet-containing aerosol generated during GIE are the mouth, anus, and endoscopic forceps channel. Although the usefulness of personal protective equipment for preventing COVID-19 dissemination has been well reported, measures to address infected aerosol escaping during endoscopic forceps use have been neglected. Pathogen-contaminated aerosol from the endoscopic forceps channel, leading into the gastrointestinal lumen, has been confirmed and is a highly problematic source of infection. We developed a technique that entails covering the forceps entry/exit hole with a vinyl bag, thereby preventing contamination of the endoscopy room by the infected aerosol that escapes from this hole. The technique can be used in daily clinical endoscopic practice. Furthermore, this shielding technique is useful for all patients who undergo GIE, regardless of the purpose of the procedure such as for making a diagnosis, administering therapy, or in an urgent situation. In this letter, we introduce our novel, easily performed, inexpensive method of infection prevention by disallowing infected aerosol to escape from a COVID-19-infected patient into the air during a procedure that requires the use of endoscopic forceps.

Key Words: Vinyl bag; Droplets; Endoscopy; COVID-19; Infection; Contamination

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Core Tip: The world is experiencing a viral pandemic. The main avenues of droplet-containing aerosol generated during gastrointestinal endoscopy are the mouth, anus,

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and endoscopic forceps channel. Although the usefulness of personal protective equipment for preventing coronavirus disease 2019 dissemination has been well reported, measures to address infected aerosol escaping *via* endoscopic forceps use have been neglected. We developed a technique using a vinyl bag to cover the hole through which forceps enter the gastrointestinal lumen. It prevents endoscopy room contamination by disallowing infected aerosol to escape *via* the forceps entrance. It thus protects the endoscopy room and staff during endoscopy.

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TO THE EDITOR

Following the first reports of coronavirus disease 2019 (COVID-19) infections in December 2019 from Wuhan, China[1], the infection rapidly spread worldwide until it reached pandemic proportions. Recently, it has been reported that severe acute respiratory syndrome coronavirus 2 virus has been detected in the oral cavity and fecal samples of COVID-19-infected patients[2,3].

Gastrointestinal endoscopic procedures are performed by inflating the gastrointestinal tract with air or carbon dioxide, thereby inducing belching, vomiting, coughing, and flatus, each of which may generate virus-infected aerosol. The main sources of such aerosol generated during gastrointestinal endoscopy (GIE) are the mouth, anus, and endoscopic forceps channel. Johnston *et al*[4] reported that the endoscopist's face risks bacterial exposure during GIE and recommended the use of universal facial protection during these procedures. Furthermore, bacteria-contaminated aerosol from the endoscopic forceps channel, leading to the gastrointestinal lumen, has been confirmed and is a highly problematic source of infection[5]. The endoscopic forceps channel cap usually loses its sealing ability through repeated insertion of the forceps. Hence, endoscopists are at high risk of COVID-19 transmission while performing GIE procedures.

There are many reports on the effectiveness of personal protective equipment for preventing COVID-19 infection during GIE[6,7]. In addition, several useful protective shielding methods against the infected aerosol escaping from the patient's mouth have been developed, such as aerosol chambers[8] and face shields for the patients[9,10]. However, little attention has been paid to infection control measures against infected aerosols escaping *via* the endoscopic forceps channel[5] that communicates with the lumen of the gastrointestinal tract.

We therefore developed a technique for covering the forceps entrance hole cap with a vinyl bag ([Figure 1](#)) to prevent contamination of the endoscopy staff and endoscopy room by aerosols escaping from the "relaxed" forceps cap of the endoscope. We have been using the technique during GIE procedures in our daily practice since May 2020. The materials required include a vinyl bag, a round reinforcement label for marking, transparent adhesive tape, medical tape, and a toothpick, which are inexpensive and easily obtained worldwide ([Figure 2](#)).

The first step in preparing the apparatus is to make a small hole at the bottom of a small vinyl bag through which a device such as forceps can be inserted ([Video 1](#)). The second step is to cover the endoscopic forceps hole cap using the vinyl bag, which produces space in which to trap the infected droplet-containing aerosol, ultimately leading to reduced COVID-19 transmission. To obtain effective intra-vinyl bag space, there must be several centimeters of separation between the endoscopic forceps hole cap and the insertion hole of the vinyl bag. This separation ensures that the aerosol does not escape from the vinyl bag. We conducted an experiment with rapid retrograde injection of indigo carmine solution through a forceps channel, which showed that no dye-containing droplets had escaped from the vinyl bag ([Video 2](#)). Hence, it is extremely important for the endoscopists and assistants to carefully maintain the separation during GIE. [Figure 3](#) shows the liquid from the aerosol



Figure 1 Overview photograph of the vinyl bag cover technique to prevent contamination of the endoscope room by droplet-containing aerosol escaping from the forceps hole of the endoscope.

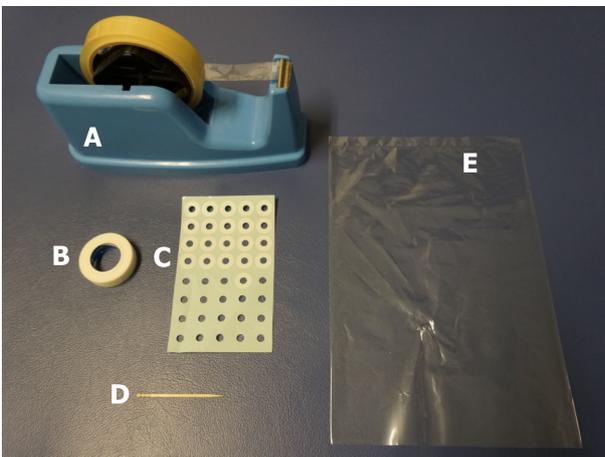


Figure 2 Materials required for constructing the apparatus. A: Transparent adhesive tape (*e.g.*, sellotape, scotch tape); B: Medical tape; C: A round seal; D: Toothpick; E: A transparent vinyl bag (27 cm × 18 cm).

trapped in a vinyl bag during colonic endoscopic submucosal dissection in a patient with a laterally spreading colonic tumor.

After the endoscopic procedure, the contaminated vinyl bag can be easily removed from the endoscope and safely discarded, making the apparatus disposable (Video 2). Furthermore, this shielding technique is useful for all patients who undergo GIE, regardless of the purpose of the procedure (*e.g.*, diagnostic, therapeutic, urgent).

Although wearing full personal protective equipment is the most basic measure of infection control in this COVID-19 pandemic era, further measures to reduce the risk of infection are urgently needed in endoscopy suites. Our newly devised shielding method is thus a promising countermeasure to prevent contamination of the endoscopy staff and room by infected aerosol escaping from the patient's gastrointestinal lumen *via* the entrance/exit hole for endoscopic forceps. The technique is inexpensive, and the apparatus is easily constructed, disposable, and practicable in endoscopy rooms worldwide. However, further aerodynamic study is needed to assess the effectiveness of the method.



Figure 3 Apparatus in use. Liquid formed from droplet-containing aerosol escaping from the endoscopic forceps entrance/exit hole is being trapped in a vinyl bag during colonic endoscopic submucosal dissection.

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