Direct Evidence by DNA Fingerprinting that Endoscopic Cross-Infection of Helicobacter pylori Is a Cause of Postendoscopic Acute Gastritis

TOSHIRO SUGIYAMA,1* HIROJI NAKA,1 AKIRA YACHI,2 AND MASAHIRO ASAKA1

Third Department of Internal Medicine, Hokkaido University School of Medicine,1 and Sapporo Medical University,2 Sapporo, Japan

Received 4 October 1999/Returned for modification 29 January 2000/Accepted 4 April 2000

The DNA fingerprinting of Helicobacter pylori strains in two cases of acute gastritis that occurred after endoscopy was examined. H. pylori was isolated from the stomachs of two patients with acute gastritis and from the stools of the patients in whom the same gastrofiberscope had previously been used. The genomic DNA digested with HaeIII was subjected to pulsed-field gel electrophoresis. The corresponding paired electrophoretic patterns were completely identical. These findings provide direct evidence that postendoscopic acute gastritis can be caused by cross-infection with H. pylori via endoscopy.

Acute gastric mucosal lesion (AGML) is a typical clinical entity in acute gastritis, and it is characterized by severe erosion, hemorrhage, ulceration, or a combination of these. AGML is thought to be induced by nonsteroidal antiinflammatory drugs, chemicals, alcohol, and stress. In addition, AGML occasionally develops after endoscopic examination of the upper gastrointestinal tract without an evident cause. Such cases have been reported since 1982 in Japan. To elucidate the incidence, pathophysiology, and causes of AGML, a multicenter questionnaire was used by Sagenji et al. in 1989 in Japan. The incidence of AGML was found to be 0.02% (420 cases) in 1,913,939 endoscopic examinations (6, 7). It was also found that AGML never occurred immediately after an endoscopic examination; there was a time lag in onset of 4 to 7 days after the endoscopy. Moreover, it usually occurred in patients who did not show any abnormal findings in the first endoscopic examination. Although the cause of AGML was not elucidated by the results of the multicenter questionnaire, the above findings suggested that some infectious agents might be transmitted during the first endoscopy. We have therefore focused on Helicobacter pylori cross-infection as the possible cause of this unique disease. In our first publication, we reported that about half of the cases of postendoscopic AGML (PE-AGML) might be induced by an initial infection with H. pylori, on the basis of the positive conversion of H. pylori antibody in serum after onset, probably via fiberoscopic cross-infection (7). Although the possibility of patient-to-patient transmission of the organism has already been speculated on the basis of fiberoptic gastroduodenoscopy (3) and viable H. pylori has been detected in a gastrofiberscope after manual Hydroxyamine washing (2), our previous report was the first to propose that H. pylori infection could be a cause of PE-AGML. In our previous study, we investigated 23 paired serum samples collected before and after the onset of PE-AGML as well as the sera of the patients in whom the same gastrofiberscope had been used just before it was used in the AGML patients. Of 23 patients who developed PE-AGML, 19 were H. pylori negative before endoscopy, and 10 of those 19 patients showed seroconversion after onset of PE-AGML. In our previous study, however, we could not confirm a direct cross-infection with H. pylori via an endoscope on the basis of DNA analysis. Since our first publication, we have been able to isolate one H. pylori strain both from the stomach of a patient with PE-AGML and from the stomach of the preceding patient (case 1), and we stored the bacteria at −70°C. Recently, we performed DNA analysis on H. pylori isolated from a new PE-AGML patient (case 2). The second case was a 43-year-old man who underwent endoscopy for screening of gastric cancer in a clinic in which tap water and 70% ethanol solution had been used for the cleaning and disinfection of the fiberscope and the biopsy forceps. This patient had no abnormal findings in the first endoscopy. However, at 5 days after the first endoscopy, the patient complained of nausea and epigastralgia, and he visited the same clinic and underwent a second endoscopic examination. Mild erosion, hemorrhage, and shallow ulceration in the stomach, which are endoscopic findings typical of AGML, were observed. H. pylori was also detected and isolated from the stomach of the patient. The medical record of the preceding patient, a 48-year-old man, in whom the same gastrofiberscope as was used in the PE-AGML patient had been used, was investigated. After informed consent was obtained, a second endoscopic examination was performed on the 48-year-old patient. H. pylori was identified in his stomach by a rapid urease test (Pylorit; Serum Research Corp, Elkhart, Ind.), and it was isolated from the stomach. H. pylori isolates stored at −70°C were grown on 5% (vol/vol) horse blood agar, transferred to 50 ml of brucella broth supplemented with 7% (vol/vol) horse blood agar, and incubated for 36 h at 37°C with constant shaking under microaerobic conditions (CampyPak; BBL Microbiology Systems, Cockeysville, Md.). The bacteria were harvested by centrifugation, washed twice with phosphate-buffered saline, and suspended in 4 ml of 10 mM Tris hydrochloride–10 mM sodium EDTA (pH 8.5). The DNA was extracted and purified with a Sepa Gene kit (Sanko Junyaku Co., Ltd., Tokyo, Japan). Ten micrograms of DNA was digested to completion by incubation overnight at 37°C with 30 U of HaeIII (Pharmacia Biotech, Uppsala, Sweden) in a reaction buffer solution. The DNA fragments were separated in a horizontal gel containing 1% agarose (type II; Sigma Chemical Co., St. Louis, Mo.) in TBE buffer (45 mM Tris, 45 mM borate, 1.0 mM EDTA [pH 8.3]) (4, 5). The gel was run for 16 h at 60 V in a pulsed-field

* Corresponding author. Mailing address: Third Department of Internal Medicine, Hokkaido University School of Medicine, N-15, W-7, Kita-ku, Sapporo 060-8638, Japan. Phone: 81-11-716-1161. Fax: 81-11-706-7867. E-mail: tsugi@med.hokudai.ac.jp.

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FIG. 1. Fingerprinting of _H. pylori_ DNA from the patients with PE-AGML and the patients immediately preceding them in treatment with the same gastrofiberscope (_Hae_III digest). Lanes: 1, PE-AGML patient (case 1); 2, preceding patient (case 1); 3, PE-AGML patient (case 2); 4, preceding patient (case 2); ATCC, type strain.

_gel electrophoresis system (Nippon Bio-Rad Laboratories, Yokohama, Japan) (9), dyed with ethidium bromide, and photographed with an FAS-III digital filing system (Toyobo, Tokyo, Japan). We investigated the molecular typing of two sets of paired isolates of _H. pylori_. As shown in Fig. 1, the fingerprinting patterns of the _Hae_III digest of DNA of the paired _H. pylori_ isolates from the PE-AGML patient and the preceding patient were completely identical in both case 1 and case 2.

In case 2, the _H. pylori_ antibodies in the serum of a patient with PE-AGML were measured and compared before and after the onset of PE-AGML by using an HM-CAP enzyme-linked immunosorbent assay (ELISA) kit (Enteric Products Inc., Westbury, N.Y.). The results converted from negative to positive at 2 months after the first endoscopic examination, suggesting that the patient with PE-AGML might have been infected with _H. pylori_ during the endoscopic examination. The HM-CAP ELISA kit has been commonly used worldwide and was described previously by Evans et al. (1). In brief, high-molecular-weight, cell-associated proteins from a pool of five strains of _H. pylori_ were used as antigens. Measurement was conducted according to the manufacturer’s protocol, and a value of 2.2 or greater was considered to be positive. Serological examinations, including those of the present case, showed that 11 of 20 _H. pylori_-negative patients (55.0%) showed seroconversion after the onset of PE-AGML, as determined by HM-CAP ELISA, and that none of the 4 that were _H. pylori_-positive before the onset of PE-AGML showed seroconversion. In case 1, the seroconversion of _H. pylori_ antibodies in the PE-AGML patient after the first endoscopy had already been verified in our previous study (7, 8) and was also confirmed in this study.

In conclusion, our data provide the first direct evidence that PE-AGML can be caused by cross-infection with _H. pylori_ via a fiberscope from patients in whom the fiberscope had been used previously. Our findings also indicate that cleaning and disinfection of a gastrofiberscope and other equipment are important for preventing PE-AGML and iatrogenic _H. pylori_ transmission.

**REFERENCES**