Unique features of gastritis due to Helicobacter pylori infection on T2WI acquired using 3.0-Tesla MRI with negative oral contrast agent

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Aims and objectives

The highest incidence of gastric cancer can be found in Japan, representing the second most common cause of cancer death for males and the third most common cause of cancer death for women in 2014 [1]. The most important risk factors for gastric cancer are thought to be smoking, excess intake of sodium, diet and Helicobacter pylori (H. pylori) infection [2, 3]. H. pylori infection is not only a well-known cause of gastritis and ulcers, but also the most important risk factor associated with gastric cancer [4]. The prevalence of H. pylori infection, classified as a Group 1 gastric carcinogen in humans [2], is highest in eastern countries such as Japan and Korea [3].

The mechanism of gastric cancer induction by H. pylori is thought to be through inflammatory changes caused by superoxide radicals [5]. These infections typically occur at a young age, and low infection rates are correlated with gastric cancer decrease [6].

Urea breath and fecal antigen tests are more convenient screens for H. pylori infection than endoscopic examinations screens for H. pylori infection. Endoscopic findings of atrophy and mucus, due to inflammatory changes of the gastric mucosa, are possibly consistent features of H. pylori infection [7, 8]. The National Institution of Cancer Research in Japan recommended in 2015 that endoscopy surveys should be incorporated as part of health checks. In contrast, imaging findings from other modalities such as computed tomography (CT) or magnetic resonance imaging (MRI) examinations have not been considered so far.

Abdominal MRI is an established procedure for the evaluation of disease in the liver, pancreas, biliary duct, pancreatic duct and kidneys. T2 Weighted Image (T2WI) MRI examinations after the administration of a negative oral contrast agent, such as in magnetic resonance cholangiopancreatography (MRCP), show a reduction of water signal intensity in the gastric cavity. This reduction of water signal intensity is necessary to evaluate the gastric mucosa. We hypothesize that mucus adhering to the gastric mucosa may be detected using T2WI MRI with a negative oral contrast agent, which eliminates the water but not the mucus signal. Therefore, a layer of high-intensity signal on the gastric mucosa, resulting from mucus associated with H. pylori infection, may be detectable by MRI.

The purpose of this study is to clarify whether the appearance of a high-intensity layer on the gastric mucosa in T2WI acquired using a negative oral contrast agent is associated with H. pylori infection. In addition, we show the resulting changes of appearance in T2WI of the gastric mucosa before and after treatment of H. pylori infection.
Methods and materials

Study population

This study was a retrospective review of 824 patients who had undergone MRCP with a negative oral contrast agent between January 2013 and December 2015. Written informed consent for MRI and upper gastrointestinal endoscopy were routinely obtained from all patients prior to each examination by clinician. The protocol for the study was approved by the institutional review board of our hospital.

Endoscopy

Upper gastrointestinal endoscopy was performed by an experienced endoscopist according to the standard of practice at our institution. Endoscopy was performed following the administration of 20 mg of scopolamine butyl bromide (Buscopan, Boehringer Ingerheim, Berkshire, England) for all patients other than those with a history of side effects or prostatomegaly, ischemic heart disease or glaucoma, who did not receive scopolamine butyl bromide.

MRI protocol

MRI was performed using a 3.0 Tesla MR scanner (MAGNETON Skyra, Siemens Medical Solutions) following the administration of a negative oral contrast agent (250 ml of Manganese chloride tetrahydrate, Bothdel Oral Solution, Kyowa Hakko Kogyo, Tokyo, Japan).

<table>
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<th>Sequence</th>
<th>Repetition Time (msec)</th>
<th>Echo Time (msec)</th>
<th>Flip Angle</th>
<th>Matrix Size (mm)</th>
<th>Voxel Size (mm)</th>
<th>Slice Thickness (mm)</th>
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<td>90</td>
<td>384</td>
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<td>6.0</td>
<td>20</td>
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</tbody>
</table>
Image interpretation

The presence of a high-intensity layer on the gastric mucosa in T2WI was assessed by experienced radiologists using axial and coronal images.

Statistical analysis

Statistical analysis was performed using SPSS version 21.0 (IBM, Armonk, NY). The study evaluated the consistency of MRI findings with those resulting from endoscopic examination.
Results

Out of the 824 patients, 25 had positive findings of high-intensity layer on T2WI. Of these, 13 patients had no corresponding endoscopy examination. Therefore 12 patients were considered for the analysis. 9 out of the 12 patients had positive findings of *H. Pylori* infection on the endoscopic examination. The concordance rate between the MRI and endoscopic findings was 0.75 (CI; 0.428-0.945).
Fig. 1: Gastric mucosa of a 53 year-old woman. No significant high-intensity layer was found on the axial T2WI. Endoscopy confirmed that the gastric mucosa was normal.

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Fig. 2: A 56 year-old man with enlarged-fold gastritis associated with H. pylori infection. The high-intensity layer along gastric rugae on the axial T2WI (A) suggests mucus from gastritis. Endoscopic images show H. pylori-induced atrophic gastritis (B) and enlarged-fold gastritis (C).

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Fig. 3: A 70 year-old woman with atrophic gastritis due to H. pylori infection. Coronal T2WI (A) shows a high-intensity layer along gastric rugae suggesting mucus from gastritis. The endoscopic image (B) shows atrophic change in the gastric mucosa and adherent mucus secretion. Positive immune G test confirmed H. pylori infection in this patient. The high-intensity layer disappeared after H. pylori eradication (C).

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Conclusion

To the best of our knowledge, this is the first mention of a possible correlation between *H. pylori* infection and MRI and endoscopic findings. A significantly high-intensity layer on the gastric mucosa of patients on T2WI may correlate with gastritis caused by *H. pylori* infection. Detection of this layer could facilitate the diagnosis and early treatment of gastritis due to *H. pylori* infection and its eradication to prevent gastric cancer caused by *H. pylori* infection.
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