Real-time diagnosis of *H. pylori* infection during endoscopy: Accuracy of an innovative tool (EndoFaster)

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**Abstract**

**Background:** EndoFaster is novel device able to perform real-time ammonium measurement in gastric juice allowing *H. pylori* diagnosis during endoscopy. This large study aimed to validate the accuracy of EndoFaster for real-time *H. pylori* detection.

**Methods:** Consecutive patients who underwent upper endoscopy in two centres were prospectively enrolled. During endoscopy, 4 ml of gastric juice were aspirated to perform automatic analysis by EndoFaster within 90 seconds, and *H. pylori* was considered present (>62 ppm/ml) or absent (≤62 ppm/ml). Accuracy was measured by using histology as gold standard, and \(^13\)C-urea breath test (UBT) in discordant cases. Accuracy, sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) were calculated.

**Results:** Overall, 189 patients were enrolled, but in seven (3.4%) the aspirated gastric juice amount was insufficient to perform the test. The accuracy, sensitivity, specificity, PPV, and NPV were 87.4%, 90.3%, 85.5%, 80.2%, 93.1%, respectively, and 92.6%, 97.1%, 89.7%, 85.9%, 98.0%, respectively, when *H. pylori* status was reclassified according to the UBT result in discordant cases.

**Conclusions:** This study found a high accuracy/feasibility of EndoFaster for real-time *H. pylori* diagnosis. Use of EndoFaster may allow selecting those patients in whom routine gastric biopsies could be avoided.

**Keywords**

*Helicobacter pylori*, diagnosis, EndoFaster, histology, urea breath test, gastric juice

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**Introduction**

*Helicobacter pylori* infection invariably causes chronic active gastritis, which is the first step starting the carcinogenic cascade of gastric cancer.\(^1\) Indeed, such an infection accounts for most cases of gastric cancer, the risk being about 6-fold greater in infected than in uninfected subjects, with a population attributable fraction as high as 74.7%.\(^2\)

Similarly, *H. pylori* is the main cause of low-grade B-cell lymphoma of the stomach, and peptic ulcer disease.\(^3\)\(^-\)\(^5\)

Therefore, *H. pylori* infection is widely involved in the pathogenesis of the most relevant gastroduodenal diseases, which are distinctly infrequent when the infection is absent.

Current European guidelines suggest to search for *H. pylori* infection by using upper endoscopy with biopsies in dyspeptic patients with an increased risk of gastric cancer (over a local age cut-off point) as well as in those patients with alarm symptoms (bleeding, anaemia, weight loss, persisting vomiting, and dysphagia).\(^6\) However, the prevalence of *H. pylori* infection is decreasing in Western countries. A recent

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study. Patients were excluded when one of the following conditions was present: proton pump inhibitor or antibiotic therapies in the previous 4 weeks, previous *H. pylori* eradication therapy, gastric surgery, neoplasia, liver cirrhosis, severe renal, cardiac, or respiratory disease as well as those on anticoagulant treatment. The study was approved by the local Ethical Committees (Rome: N = P/1182/CE/2012; Milan: N = CE ICH 205). All patients gave written informed consent to participate.

**Endoscopic procedure**

All patients underwent conventional white-light upper endoscopy with video-endoscopes. Standard biopsy sampling according to updated Sydney System was performed.\(^{10}\) In detail, two biopsies were taken from the antrum (within 2 cm from the pylorus; anterior and posterior wall), two from the angularis, and two from the gastric body (anterior and posterior wall). The main endoscopic findings observed during endoscopy were reported on a standardized endoscopic report.

**EndoFaster**

The study has been conducted with EndoFaster 21-42 (NISO Biomed S.r.l, Turin; Italy), an innovative device which performs automatic gastric juice analysis during upper endoscopy and communicates the result in real time. The device is interposed between the endoscope and the suction system, utilizing 4 ml of the gastric juice aspirated at the beginning of endoscopy. *H. pylori* diagnosis is based on the determination of ammonium concentration, as a consequence of the urease activity of the bacterium within 30–90 seconds, that is during endoscopy.\(^{8,9}\) The test was considered positive for *H. pylori* infection when the ammonium concentration was 62 ppm/ml and negative when ≤62 ppm/ml. As compared with the prototype (MT 21-42) used in previous studies,\(^{8,9}\) the EndoFaster 21-42 has an improved performance since it requires a lower volume of gastric juice for performing the test. In addition, the actual cut-off 62 ppm simply depends on a new parameter – that is a corrective for the temperature – introduced in the software of the new version of device. Therefore, the 62 ppm cut-off of the device exactly corresponds to 60 ppm of the prototype. For the purpose of our study, EndoFaster analysis was performed before histological sampling.

**Methods**

**Study population**

A prospective study was conducted in two Endoscopy Units (Rome, Milan). Consecutive patients who were referred from their General Practitioners for upper endoscopy due to dyspeptic symptoms were included in the

**H. pylori assessment**

Histological assessment was performed for both detection of *H. pylori* infection and evaluation of gastritis. In detail, biopsies were stained with haematoxylin–eosin for gastritis assessment and with the modified

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**Figure 1. The EndoFaster.**

US nationwide study found that *H. pylori* prevalence is less than 15% in those patients who underwent upper endoscopy.\(^{7}\) Therefore, *H. pylori* infection is absent in the majority of patients who underwent upper endoscopy and histological examination. The availability of an accurate test able to disclose *H. pylori* presence during endoscopy could allow to select those patients deserving biopsy mapping of gastric mucosa from those in whom biopsies are most likely useless, time-consuming, and costly. A novel device (EndoFaster21-42) able to perform real-time – i.e. during endoscopy – ammonium measurement in gastric juice has been introduced (Figure 1). Some preliminary data showed that EndoFaster accurately predicts *H. pylori* presence on gastric mucosa with a sensitivity of 96.7% and specificity of 94.3%, with an accuracy equal to that of \(^{13}\)C-urea breath test (UBT).\(^{8,9}\)

This large, prospective study aimed to validate the performance of such a tool for real-time *H. pylori* detection in patients who underwent upper endoscopy.
Giemsa staining for detection of *H. pylori*. In cases of disagreement between EndoFaster and the histological examination for *H. pylori* infection, a UBT, with a cut-off value of 3.5% according to the manufacturer’s recommendations, was performed and the infection status was accordingly reclassified.

**Statistical analysis**

The EndoFaster accuracy, sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) for *H. pylori* assessment were calculated by using histology as gold standard, and with the UBT for the divergent cases. In order to assess the sample size, we assumed a 30% *H. pylori* prevalence and an unfeasibility of the EndoFaster analysis in 10% of cases (i.e. insufficient gastric juice amount). Thus, 180 patients were needed to show an EndoFaster accuracy for *H. pylori* diagnosis of 90% with a 95% confidence interval (CI) between 86% and 94%.

**Results**

Overall, 189 (Male/Female: 79/110; Mean age: 55.7 ± 8.7 years; non-ulcer dyspepsia: 185; gastric ulcer: three; duodenal ulcer: one) consecutive patients were enrolled in the study. *H. pylori* infection was detected at histology in 73 (38.6%) patients, being negative in the remaining 116 (61.4%) cases. EndoFaster was attempted in all patients, but in seven (3.4%) the aspirated gastric juice amount was insufficient for determining ammonium concentration, including one *H. pylori* positive and six negative at histology. The accuracy, sensitivity, specificity, PPV, and NPV of EndoFaster for *H. pylori* assessment as compared with histology are provided in Table 1. According to the study protocol, a UBT was proposed to the 23 patients with discordant results between histology and EndoFaster, but six patients refused the test. As shown in Table 2, the UBT result allowed re-classification of *H. pylori* status in four out of 17 patients, confirming the histology assessment in the remaining 13 patients. By considering these results, the infection was present in 69 patients and absent in 107 cases so that the accuracy, sensitivity, specificity, PPV, and NPV of EndoFaster for *H. pylori* assessment at adjusted analysis were 92.6%, 97.1%, 89.7%, 85.9%, and 98.0%, respectively (Table 3).

**Discussion**

*H. pylori* infection remains the major factor involved in both neoplastic and non-malignant gastroduodenal lesions, which are infrequent when the infection is absent.2-5 Indeed, international guidelines advise to search for and to treat the infection in dyspeptic patients.6 Luckily, the prevalence of *H. pylori* in developed countries is decreasing, so that probability of detecting the infection at endoscopy is less than 20–35% according to recent data, or even less when considering only those patients without macroscopic lesions.7,11 Therefore, the majority of gastric biopsies currently performed are negative, time-consuming, costly and, most likely, clinically worthless. This undesirable circumstance may be resolved when an accurate test is able to disclose *H. pylori* presence during endoscopy. The proposed use of a new ultra-fast rapid urease test did not solve the problem since biopsies are still required to perform the test, and an accurate result is achieved only after 5 minutes, that is, when the endoscopic examination has generally

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<th>Table 1. Accuracy of EndoFaster for <em>H. pylori</em> diagnosis with only histology as gold standard</th>
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<td>Enrolled patients <em>(N = 182)</em></td>
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<td>EndoFaster positive</td>
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<td>EndoFaster negative</td>
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<td><em>H. pylori</em> pos</td>
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<th>Table 3. Accuracy of EndoFaster for <em>H. pylori</em> diagnosis following bacterial status re-classification according to UBT</th>
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<td>Enrolled patients <em>(N = 176)</em></td>
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ended. On the contrary, EndoFaster was introduced to allow a real-time detection of *H. pylori* in the stomach. The present study clearly showed a very high accuracy of this tool for real-time diagnosis of the infection. Overall, by applying EndoFaster, biopsies would have been avoided in 94 (51.6%) patients with an EndoFaster-negative result, without significantly overlooking the infection, the NPV being as high as 98%. The risk of such a procedure is to miss precancerous conditions (atrophy/intestinal metaplasia) in uninfected patients. However, a recent meta-analysis found that diffuse intestinal metaplasia – which is the only precancerous condition deserving a 3-year interval follow-up according to current European Guidelines – was overall present in 13% (9–17%) of patients, with values widely ranging in different countries. Indeed, in a recent nationwide Italian study, diffuse intestinal metaplasia was present in only 3% of patients, and it was significantly associated with the *H. pylori*. Therefore, the use of EndoFaster would be valuable to select those patients with *H. pylori* infection deserving gastric biopsies, allowing gastric sampling to be avoided in the majority of patients who are uninfected. However, a cost-effective analysis study taking into account the prevalence of diffuse intestinal metaplasia in *H. pylori*-negative patients in different populations is needed to test the consistency of such an approach. As far as the cost is concerned, near 20 euros is the charge of a single test performed by using an EndoFaster device which is supplied on loan for use.

In conclusion, this large study established the high accuracy of EndoFaster in detecting *H. pylori* infection. Such a tool could be useful to select those patients in whom gastric biopsies are probably useless.

**Conflict of interest**

None declared.

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**References**