Evaluation of a Rapid Urease Test To Detect *Campylobacter pylori* Infection

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Seventy-five consecutive patients referred for upper gastrointestinal tract endoscopy were evaluated for *Campylobacter pylori* infection by pathology, culture, and a biochemical test to detect bacterial urease. Forty-eight patients (64%) had *C. pylori* present based on pathology or culture or both. Thirty-two urease tests were positive after 1 h, all in patients with *C. pylori* detected by the two other methods (specificity, 100%; sensitivity, 67%). After 24 h, 47 urease tests were positive, but only 40 had *C. pylori* present (specificity, 74%; sensitivity, 83%). When read after 1 h, the urease test was highly specific and led to rapid presumptive diagnosis.

A distinct form of spiral-shaped bacilli has been identified as a potential etiologic agent in the pathogenesis of gastritis and ulcers (2, 7). This organism is currently called *Campylobacter pylori*, but may belong to a distinct new genus (16). *C. pylori* can be identified in gastric tissue specimens by culture and histologic staining techniques. Both of these are time-consuming, and a rapid test that can accurately identify *C. pylori*-infected patients would expedite therapeutic decisions. Several investigators have tried to use the strong urease reaction of *C. pylori* by placing fresh antral tissue in Christensen’s urea broth and observing it for a change in color, which would indicate the presence of urease (1, 3, 4, 14). However, there are several reports of false-positive results with this technique (4, 5). In some of these studies, the indicator broth was incubated at room temperature (4, 14) and read after 24 h (4, 5, 14). To improve the specificity of the urease test, we investigated a method of combining incubation at 37°C with a 1-h cutoff time for reading.

(This study was presented in part at the 27th Interscience Conference on Antimicrobial Agents and Chemotherapy [T. U. Westblom, J. R. L. Moore, E. Madan, M. A. Subik, J. Tseng, J. Kemp, and M. S. Josowitz, Program Abstr. 27th Intersci. Conf. Antimicrob. Agents Chemother., abstr. no. 1173, 1987].)

Seventy-five consecutive patients referred for upper gastrointestinal tract endoscopy were studied. All patients were symptomatic, mostly with upper abdominal discomfort or pain. Clinical endoscopy diagnoses included peptic ulcer disease, gastritis, and nonulcer dyspepsia. Two antral biopsies were obtained from each patient for culture and histology. Biopsies were cultured on brain heart infusion agar containing 7% horse blood and 1% IsoVitalex and incubated in a 10% CO2 atmosphere (9). Histopathologic specimens were stained with Giemsa stain (10) and observed for presence of characteristic 2.5-μm-long, spiral-shaped organisms as originally described by Marshall (12). An additional fresh biopsy was placed in 0.5 ml of urea broth (Remel, Lenexa, Kans.) containing 2% urea and 0.001% phenol red and was immediately incubated at 37°C. After 1 h, the broth was inspected for a change in color. Yellow was interpreted as negative, indicating absence of urease. Red or pink was interpreted as positive. For comparison, a similar reading of each biopsy was also performed after 24 h. Results of the urease test were compared with culture results and histology. *C. pylori* was considered present if organisms with the previously described characteristic appearance (12) were seen after Giemsa staining or if *C. pylori* was cultured from the biopsy. All positive cultures had oxidase-positive, catalase-positive, and urease-positive organisms with characteristic morphology after Gram staining (9). Tissue sections were interpreted by two independent pathologists who were unaware of the results of the urease test.

Of the 75 patients, 48 (64%) were found to have *C. pylori* in their antral biopsies by either culture (23 of 75 [31%]) or Giemsa staining (47 of 75 [63%]). Of the 23 culture-positive biopsies, 22 were also positive by pathology. One biopsy was positive by culture alone, but it was from a tissue sample with a low number of organisms, which produced only six colonies on the original culture plate. An additional 25 biopsies were positive by pathology alone. There was full agreement between the readings of the two pathologists for all 75 patients. The lack of culture confirmation in 25 of the pathology-positive cases was primarily due to overgrowth of contaminants, which occurred in 16 of these 25 biopsies (64%).

Thirty-two patients had positive urease tests when read after 1 h. All of these 32 patients were among the 48 with *C. pylori* identified by biopsy or culture or both. There were no false-positive urease reactions (Table 1). The urease test specificity was 100%, and the positive predictive value was 100%. The sensitivity after 1 h was 67%, and the negative predictive value was 63%.

When the same urease tests were read after 24 h of incubation, false-positive readings occurred, as previously described by other investigators. Out of 75 patients, 47 had positive tests after 24 h, but only 40 actually had *C. pylori* present according to either culture or Giemsa staining (Table 1). Specificity after 24 h fell to 74% with a positive predictive

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TABLE 1. Urease test results after incubation of antral mucosal biopsies at 37°C for 1 and 24 h

<table>
<thead>
<tr>
<th>Result of culture or histologic examination or both</th>
<th>No. of results of urease test after incubation for:</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>1 h</td>
</tr>
<tr>
<td></td>
<td>Positive</td>
</tr>
<tr>
<td>C. pylori present*</td>
<td>32</td>
</tr>
<tr>
<td>C. pylori absent</td>
<td>0</td>
</tr>
</tbody>
</table>

*One positive by culture alone, 25 positive by histology alone, and 22 positive by both methods.

The advantage of a rapid diagnostic test with 100% specificity is obvious, and it was very satisfactory to find that the urease test performed so well at 1 h. This means that patients infected with C. pylori can be identified and given adequate information and instructions before they leave the endoscopy suite. Such instructions may include therapy aimed at eradicating the organism. Bismuth preparations, such as bismuth subsalicylate (Pepto-Bismol), have been shown to be active against C. pylori (8, 13, 17). Optimal therapy may, however, be the combination of a bismuth salt and an antibiotic (6, 17). With the help of the rapid urease test, such therapeutic modalities can be quickly and accurately instituted.

LITERATURE CITED