given in high doses of 15 mg/kg for at least one year. Although toxicity may be less if given in a lower dose for a short period of time, caution must be exercised when considering AHA as a suitable agent for clinical use in the treatment of *H pylori*.


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# Detection of Helicobacter pylori carriers by discriminant analysis of urea and pH levels in gastric juices

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## Abstract

**An alternative approach to the problems inherent in current methods for detecting *Helicobacter pylori* carriers—that of being generally time-consuming, expensive, and not sufficiently sensitive—was devised by using the urea concentration and pH levels of gastric juices. A linear discriminant analysis of these variables, measured in 54 patients submitted to digestive endoscopy for gastritis, provided a mathematical formula for assigning the subjects (previously classified by other standard methods) to groups of either positive or negative *H pylori* carriers. The results obtained showed a correct classification in 52 out of 54 cases with only one false negative and one false positive case.**



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Before starting treatment for *Helicobacter pylori* infection, frequently associated with dyspeptic symptoms, an early and reliable diagnosis must be made.[1 2] The urease test performed on histological specimens, considered valid because of its rapidity, low cost, and easy execution, is not very sensitive: only 62% of positive cases are detected in our laboratory compared with other tests such as culture and microscopical examination of biopsy specimens, brushings, and pellets of gastric juices.[3] This report proposes an alternative approach to the problem based on the use of the discriminant analysis of the urea concentrations and pH in gastric juices.

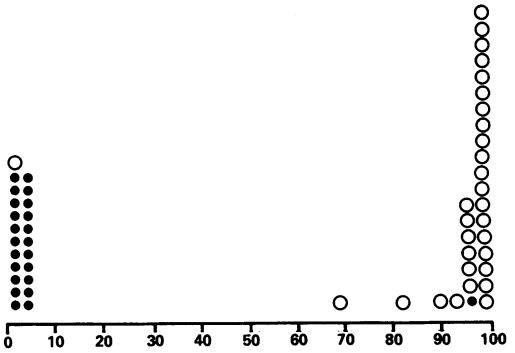
## Methods

Fifty four samples of gastric juice, obtained from patients submitted to digestive endoscopy for gastritis (29 men and 25 women, mean (SD) age 48·3 (5·7) years), were analysed by standard cultural and microscopic methods to identify the presence of *H pylori*. The same samples were tested for urea (Beckman: ASTRA 4, Automated Stat/Routine Analyzer with the urea kit from the same manufacturer) and pH concentrations (pH meter).

For the statistical analysis of the data, a discriminant analysis was used (7M module of the BMDP Statistical Package), which allows individual patients to be assigned to different groups, previously classified by another reference system.[4]

## Results

Thirty one of 54 biopsy specimens were




*Discriminant analysis performed by urea concentrations and pH from the gastric juice of patients submitted to digestive endoscopy for dyspeptic symptoms. Results are expressed as posterior probability of belonging to the H pylori positive group. ○ H pylori positive; ● H pylori negative subjects.*

positive and 23 negative; these data were used as reference for further comparisons. Samples of the gastric juices were obtained from the same patients and tested for the urea concentrations and pH for the presence of other bacteria. The presence of *H pylori* was strictly associated with a urea concentration of $\leqslant 15$ mg/dl and a pH of $< 3{\cdot}5$.[5] High pH was associated with common bacterial flora, especially Gram negative micro-organisms. The detection of these bacteria strongly decreases the probability of finding *H pylori* (only one case out of 12).

The results obtained show that the simultaneous use of urea and pH from gastric juice are powerful discriminants, providing a 96·3% rate of correct classification (two subjects were misclassified). The discriminant function is 0·66304 × pH + 0·16243 × urea − 3·94734. Patients with values of more than 0 are *H pylori* negative while the others are positive. The BMDP program calculates the posterior probability of belonging to one of the two groups (figure). The formula for calculating this probability is exp (−4·16 + 1·81 × pH + 0·41 × urea). All the patients with urea concentrations of more than 15 mg/dl were *H pylori* negative (14 out of 14). Of the remaining subjects, those with a pH of more than 3·5, or with bacterial flora in the pellets of gastric juices were also negative (eight of nine). The others were positive (30 of 31).

## Discussion

A rapid and easy method of recognising *H pylori* carriers would be extremely useful if the results were reliable and correlated with the other standard reference tests. In fact, the urease test, applied directly to biopsy specimens obtained by digestive endoscopy, is generally used because of its simplicity and rapidity. As reported widely, however, it is not considered sufficiently sensitive. Other microbiological and histological methods are available but they require a longer period of time (cultures) and experienced personnel (histology).

Two variables were chosen for this study: the urea concentrations and pH in gastric juices. This selection was initially made on the basis of the observation that *H pylori* is associated with low urea concentrations and a low pH. The localisation of this micro-organism on the gastric mucosa, although protected by the mucous film, depends on its pH tolerance. Other bacteria can only colonise the stomach cavity after an increase in gastric pH. When these variables were introduced into a computer program with a linear discriminant analysis, the results confirmed the previous biological observations, and gastric urea and pH were selected as powerful discriminating indices.

The program provides two formulas. The first differentiates the positive from negative *H pylori* carriers, assigning the best coefficient to the variables and obtaining the maximum discrimination between the groups (known to be positive or negative by means of another reference system). The second one calculates the probability of belonging to one of the two groups, considering the subjects as non-previously classified (posterior probability). A 96·3% rate of correct classification was obtained, with only two errors: one was a false negative and the other a false positive.

To conclude, the test described can be performed as easily, rapidly, and inexpensively as the urease test. The sensitivity obtained is as high as the specificity. If these results can be confirmed on a larger number of patients, this method should be preferred to those more costly, time-consuming, and less sensitive currently in use.

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