Discriminant Analysis of Data in Ulcer and Nonulcer Populations

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The purpose of this study was to assess whether consideration of age and body weight measurements improved discrimination between normal subjects and duodenal ulcer subjects using the maximal acid output test. Seventy-seven male volunteers were the "normal" group, and 155 patients with surgically proven duodenal ulcers were the "ulcer" group. We found that the ratio of maximal acid output to actual weight gave the best discrimination between the two groups. Using this ratio, there were 45 hypersecretors in the ulcer group, and only 1 false-positive among the normal subjects. A graphic method is described which employs the ratio of acid to weight and can correctly classify two-thirds of the ulcer group. The disadvantage of this method, however, is that one-third of the control group in our series were misclassified as hypersecretors; therefore, the clinician must consider history and barium meal findings as well as this evaluation of the subject.

When Kay in 1953 (1) described the maximal histamine test and Card and Marks (2) discovered the relation between the maximal secretory response and the parietal cell mass, it was hoped that improved discrimination between duodenal ulcer and nonulcer populations would result. However, the degree of overlap between the two populations remained considerable, and only partial separation was possible with studies using histamine (3–7). Histalog® (Eli Lilly & Co) in varying doses (8–11), and later pentapeptide (12), were tried. Although high acid output was achieved in some of these studies, and possibly better reproducibility, the overlap remained so large that in a study of the basal and stimulated gastric secretion (dose of Histalog, 0.5 mg/kg) in 1249 control subjects and 1032 patients with duodenal ulcer, the overlap was such that no upper limit of secretion could be set which would include most patients with duodenal ulcer while excluding most persons without this disease (9). This finding was later confirmed, using a higher dose of Histalog (1.5 mg/kg), in 75 controls and 117 duodenal ulcer patients in a study showing even more overlap (10).

The practicing clinician has therefore been left without any firm guidelines in his use of the maximum secretion test. Our aims in this study were a) to test whether consideration of age and body measurements improve discrimination between our "normal" and duodenal ulcer samples, and b) to ascertain whether, using the best single discriminant, any duodenal ulcer patients have significantly higher values than the normal range (mean +2 SD of normal).

*Deceased.

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Table 1. Analysis of Data for 77 Normal Men

<table>
<thead>
<tr>
<th></th>
<th>Correlation coefficient (r)</th>
<th>Regression coefficient (b)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAO vs Age</td>
<td>-0.096</td>
<td>-0.094</td>
</tr>
<tr>
<td>MAO vs Actual wt</td>
<td>0.108</td>
<td>0.127</td>
</tr>
<tr>
<td>MAO vs Ideal wt</td>
<td>0.068</td>
<td>0.134</td>
</tr>
<tr>
<td>MAO vs Lowest wt</td>
<td>0.049</td>
<td>0.178</td>
</tr>
<tr>
<td>MAO vs Lean body mass</td>
<td>0.114</td>
<td>0.370</td>
</tr>
</tbody>
</table>

*Not significantly different from zero (limit P = 2α); therefore no relationship established (15)

Lean body mass was derived from Hume's formula for men (14) which is based on the measurement of total body water:

Leon body mass (men) = 0.32810W + 0.33929H - 29.5336

Subjects

The normal subjects were 77 male paid volunteers who had no history of past or current gastrointestinal symptomatology.

The duodenal ulcer subjects were 155 male patients who were all shown to have duodenal ulcer disease at operation within days or at most a few weeks of the time of the test.

Statistical Methods

The relationship of maximal acid output (MAO) to age, actual weight, ideal weight, lowest weight, and lean body mass was determined in each population, using simple regression analysis. If the linearity of the regression function was not disproved, the estimate of the regression coefficient was tested for a significant difference from zero (15).

The distribution of each variable in each population was tested for gaussian distribution using the X² goodness-of-fit test, the X probability being the probability that the data were normal in distribution (P > 0.05 if the data are gaussian). This was employed as a screening test to determine which variables could be meaningfully compared between the two populations after considering variances, distribution, and F ratio of each (16).

Comparison between the two populations in terms of the variables was carried out using the “d” test for large samples (17).