ON THE EXCRETORY FUNCTION OF THE STOMACH

A. N. Kuznetsova

From the Physiology Laboratory (Head—Prof. P. K. Anokhin, Active Member of the
Academy of Medical Sciences, USSR), the A. V. Vishnevsky Surgical Institute
(Director—Prof. A. A. Vishnevsky, Corresponding Member of the Acad. Med. Sci. USSR),
Academy of Medical Sciences, USSR

(Received December 23, 1956. Presented by Prof. P. K. Anokhin, Active Member of the
Academy of Medical Sciences, USSR)

The excretory function of the stomach is the least studied of all its many different physiological functions.

Researchers from the I. P. Razenkov Laboratory [2, 3, 6, 7, 10] and the M. P. Kouchalovsky [4, 8] and R. A.
Lurija [1, 5, 9] Clinics have shown the importance and role of the gastrointestinal tract in the excretion process.

The excretory function of the stomach is most evident and most intense during kidney diseases and other
diseases where the body is threatened by the accumulation in the blood and organs of waste substances which
are sometimes extremely toxic.

It has also been experimentally shown that artificial increase of these or other substances in the blood is attended by an intensified excretion of them in the stomach.

The purpose of our work was to find whether the excretory function is separate and independent of gastric
secretion or if secretion and excretion is a single and united function of the gastric glands.

EXPERIMENTAL METHODS

The experiments were conducted on healthy dogs of about the same age and weight (12-15 kg) with a
permanent Basov fistula (10 dogs) or with a Pavlov pouch (2 dogs).

The excretory function was studied on an empty stomach during the action of a food stimulus (meat
bouillon) and histamine. To evaluate the excretory function, the dynamics of gastric gland excretion of urea,
ammonia and neutral red dye (chromoscopy method) was studied.

Ammonia was determined by Conway's method, urea by the urease method. The animals were kept on
a fixed food ration during the whole observation period. The gastric contents were examined for five hours
after each hour.

After a "background" excretion of the above products had been established, the animals were intravenously
injected with 5-10 ml of 50% urea, prepared in a physiological solution (0.2-0.4 g of urea per 1 kg of animal
weight). Neutral red was injected intramuscularly. The threshold concentration of neutral red in the blood, with
which the dye, regardless of gastric gland secretion, begins to be excreted by the mucous membrane, can be at-
tained with a 4 ml injection of a 1% (40 mg), freshly prepared, solution of neutral red. The rate of neutral red
dye excretion was determined by the time from the moment of parenteral injection to its appearance in the
stomach contents.

Neutralized dye concentration in the gastric contents was determined colorimetrically.
The gastric contents were collected through a fistula tube for 4-6 hours, and the amount calculated every 15 minutes. If the contents of the duodenum were observed to reflux into the stomach, examination ceased.

**EXPERIMENTAL RESULTS**

The stomach began to excrete neutral red dye 5-10 minutes after the dye had been intramuscularly injected. The concentration of the dye in the stomach increased rapidly, reaching maximum concentration (3-4 mg%) after 30-45 minutes. The duration of the excretory period varied in different dogs from 3 hours, 30 minutes to 5 hours. In individual experiments, fluctuations in the excretory process were observed in some dogs, but they were weakly expressed (Table 1). As the amount of dye injected increased, its concentration in the blood increased, and the period of excretion became longer. One such curve for gastric dye excretion is shown in Fig. 1. The maximal concentration of dye in this experiment (3 mg%) was observed 3/4 of an hour after the beginning of excretion. Then the amount of dye excreted began to decrease, and, after 5 hours, only traces of dye could be found in the gastric contents. The total amount of dye excreted was 691y.

### TABLE 1

Neutral Red Dye Excretion by the Gastric Glands on an Empty Stomach

<table>
<thead>
<tr>
<th>Name of animal</th>
<th>Time in minutes of dye appearance</th>
<th>Time in minutes of maximal dye concentration appeared</th>
<th>Maximal concentration in mg%</th>
<th>Total amount of dye excreted in y</th>
<th>Total amount of gastric contents in ml</th>
<th>Duration of dye excretion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ryzhukha</td>
<td>5</td>
<td>30</td>
<td>4.0</td>
<td>334</td>
<td>22.5</td>
<td>4 Hrs. 15 Min.</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>15</td>
<td>3.0</td>
<td>360</td>
<td>18.0</td>
<td>4</td>
</tr>
<tr>
<td>Alma</td>
<td>10</td>
<td>45</td>
<td>2.0</td>
<td>222</td>
<td>25.0</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>30</td>
<td>2.0</td>
<td>316</td>
<td>24.5</td>
<td>3</td>
</tr>
<tr>
<td>Pishok</td>
<td>5</td>
<td>45</td>
<td>2.0</td>
<td>611</td>
<td>44.5</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>45</td>
<td>3.0</td>
<td>691</td>
<td>49.5</td>
<td>5</td>
</tr>
<tr>
<td>Bobik</td>
<td>10</td>
<td>30</td>
<td>2.0</td>
<td>408</td>
<td>35.5</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>30</td>
<td>2.0</td>
<td>511</td>
<td>36.0</td>
<td>3</td>
</tr>
<tr>
<td>Ryzhik</td>
<td>5</td>
<td>30</td>
<td>2.0</td>
<td>540</td>
<td>36.0</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>15</td>
<td>2.0</td>
<td>508</td>
<td>38.3</td>
<td>4</td>
</tr>
<tr>
<td>Verny</td>
<td>5</td>
<td>30</td>
<td>3.0</td>
<td>367</td>
<td>26.5</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>45</td>
<td>2.0</td>
<td>324</td>
<td>27.0</td>
<td>4</td>
</tr>
</tbody>
</table>

In the experiments studying the effect of the food stimulus and histamine on the excretory function, our purpose was to determine the changes in neutral red excretion during the intensified gastric secretion caused by a single feeding of the dog with meat bouillon (150-200 ml). The results of the experiment showed that the course of dye excretion did not change much during intensified gastric gland secretion. The latent period was unchanged. In separate experiments, excretion was prolonged 30-40 minutes. The dye concentration in the gastric contents hardly changed at all with the increased rate of secretion (almost double) (Table 2).

The dye concentration did not always depend on the amount of gastric juice secreted. A high concentration of the dye was observed both with a large and with a small amount of juice. This, of course, does not negate the fact that the total amount of the substance excreted depends on the amount of juice secreted.

With the parenteral injection of histamine (0.5-1 ml of a 0.1% solution), the excretion of dye with the gastric contents began 3-5 minutes after the injection, but its concentration in each batch did not increase. Under these conditions, the duration of the excretory period was lengthened an average of 15-30 minutes. The total amount of dye excreted increased 2-2 1/2 times in comparison with the total amount of dye excreted on an empty stomach.

In the given case, the amount of dye increased due to the increase in the amount of gastric juice.