Sham Feeding as a Test of Gastric Acid Response: usefulness and limitations

Sham feeding as a test of gastric acid secretion has been a subject of interest for many years. Vagal stimulation of gastric secretion can be achieved physiologically by sham feeding, or pharmacologically by using insulin and 2-deoxy-D-glucose administration. Insulin infusion produces hypoglycemia which presumably stimulates glucose-sensitive neurons in the hypothalamus resulting in stimulation of cells in the dorsal motor nucleus of the vagus. Administration of 2-deoxy-D-glucose causes vagal stimulation by producing a block in the metabolism of glucose inside the cells. Since adverse effects are not uncommon with the use of insulin and 2-deoxy-D-glucose, sham feeding has been used more commonly than the pharmacological stimulation. In this issue of the journal, Abraham et al. have reported the effect of modified sham feeding (MSF) on gastric acid output in healthy volunteers. The increase in gastric acid output by MSF was 6.91 ± 2.72 times the basal value and was 22.8 ± 5.4 of the increase produced by histamine. Since this report is likely to be followed by further studies using this test in diseased states, some discussion on sham feeding and its scope would be in order.

Seeing, smelling, chewing and tasting food (without allowing it to reach the stomach), lead to activation of different vagal pathways which result in increased gastric acid secretion. Two techniques have been employed to study this response: (a) adequate sham feeding (ASF) is obtained in patients having gastrectomy by placing a tube through the stoma in the lower part of the esophagus. A plastic sling around the esophagus is used to tighten the esophagus over the tube. The swallowed food is passed out through the esophageal tube and gastric secretions are collected through the gastrostomy tube. ASF has only limited application in human studies; (b) in modified sham feeding (MSF), the subject chews and swallows food without swallowing it. Gastric juice is collected with the help of a nasogastric tube. The disadvantages are (i) there is pharyngeal irritation caused by the nasogastric tube, and (ii) small amounts of food may enter the stomach. However, MSF is a simple and safe procedure. Stimulation of gastric acid secretion using these two techniques has been comparable. MSF is therefore commonly employed to test the physiological vagal activation of gastric acid secretion.

What are the applications and scope of MSF in clinical practice? The test has been used in duodenal ulcer patients to assess the (i) basal vagal tone and (ii) completeness of surgical vagotomy. Duodenal ulcer patients, as a group, have increased basal acid secretion and this has been attributed to increased vagal activity. If this were true, there should be either no increase or only a small increase in gastric acid secretion with MSF in these patients. To test this hypothesis, Feldman et al. measured the basal acid output (BAO), sham feeding stimulated acid output (SAO) and pentagastrin stimulated peak acid output (PAO) in 22 healthy subjects and 29 duodenal ulcer patients. All normal subjects showed an increase over BAO with MSF. In the duodenal ulcer group, however, 4 patients who had a markedly high BAO (BAO/PAO > 0.3) did not show any further increase of their acid secretion in response to MSF. They concluded that in some duodenal ulcer patients, BAO was increased due to increased vagal tone.

Similarly, after an adequate vagotomy, sham feeding does not stimulate acid secretion. Feldman et al. in another study reported that SAO was approximately 49% of PAO in nonvagotomised subjects. The lower limit of normal for SAO was 10% of PAO, further decrease suggesting that vagotomy was incomplete. About 70% of patients with a recurrent ulcer following vagotomy had SAO greater than 10% of PAO which suggested an incomplete vagotomy. Seven of these patients had revagotomy. BAO, SAO and PAO decreased in all of them, which further suggested that the earlier vagotomy was not complete. However, certain points need to be remembered while carrying out MSF and in its interpretation. (i) It is important to ensure that the subject does not swallow the food at all during the test. In case gastric aspirate shows food particles, the test should be repeated, although in some studies, swallowing of small amounts of food did not significantly alter the results of acid secretion. (ii) While evaluating patients of recurrent ulcer having high BAO for completeness of vagotomy, serum gastrin levels should also be measured, since patients having gastrinoma and retained antrum as the cause of recurrent ulcer will frequently have a high BAO (>10% of PAO). Such patients will have a SAO higher than 10% of PAO even if MSF does not increase their acid output above the basal levels.
(iii) While sham feeding appears to be a satisfactory
test to determine the completeness of vagotomy, critical
review of some of the reports indicates that the test
has limitations in predicting ulcer recurrence.

In conclusion, MSF, a simple and safe technique,
has become increasingly popular with gastric physi-
ologists. For a clinician, it is a useful test to assess the
completeness of vagotomy. The test, however, cannot be
used to accurately predict ulcer recurrence. It is hoped
that the preliminary observations of Abraham et al
would lead to a wider application of this test in the
country to establish more precisely its usefulness in
diseased states.

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