# ASSESSMENT FOR COMPLETENESS OF GASTRIC VAGOTOMY

A.K. GANGULI AND S.K. LAL

*Department of Physiology,*
*Jawaharlal Institute of Postgraduate Medical Education and Research,*
*Pondicherry-6*

**Summary:** Efficacy of the electrical stimulation test to predict the completeness of gastric vagotomy was studied in rats and dogs. The results indicate that electrical stimulation test can be effectively employed for this purpose because all the post-vagotomy animals which showed lack of rise of intragastric pressure on electrical stimulation around the lower oesphagus, also exhibited lack of acid secretion in response to insulin induced hypoglycaemia.

**Key Words** : *tests for complete vagotomy insulin test for vagotomy electrical stimulation test for vagotomy.*

## INTRODUCTION

Insulin induced hypoglycaemia increases gastric acid secretion through the secreto-motor activity of vagal fibres. Earlier, we reported the influence of changes in blood glucose on the production of experimental gastric ulcers (3, 4). For further studies on this problem, it became necessary to asses the efficacy of available techniques for predicting the completeness of gastric vagotomy.

Two techniques have been described. Hollander's insulin test (6, 7) has the disadvantage that it can be used only post-operatively and if vagotomy is incomplete, a further operation becomes necessary. A recurrent duodenal ulceration following vagotomy is well known and has been attributed to incomplete nerve section (2). The technique of electrical stimulation of the vagal fibres during the operative procedure as described by Burge and Vane (1) was criticised by Lythgoe (8), because even after employing the electrical stimulation test, 12% of his cases still showed incompleteness of vagotomy. In this paper, we report our study in which a reassessment of these two tests has been done in dogs and rats.

## MATERIALS AND METHODS

Experiments were performed on 9 mongrel dogs weighing 5-9 kg and 11 albino rats weighing 120-250 gms. The animals were fasted for 42-48 hours. After 24 hours of fasting, 15-20 *ml* of 25% Glucose however, was allowed to rats. Water was freely available to all animals. The dogs were anaesthetised with 25-30 *mg/kg* of pentobarbitone given intravenously, and rats, with 0.75—0.85 *ml*/100 gms of 25% urethane administered subcutaneously.

*Electrical stimulation test* : Pyloric end of the stomach was cannulated and connected to a water manometer for pressure recording. Oesophageal end of the stomach was occluded by an inflated balloon. The distended lower oesophagus was then mobilised below the diaphragm and a ring electode was positioned around it so that it lay in intimate contact with vagal nerve fibres. The stomach and associated tubings were filled with 150 *ml* of water in the dogs and 15 *ml* of water in the rats. Square wave pulses for stimulation were obtained from an electronic stimulator. Parameters for rats were 5-30V, 5 msec, 2-25/sec and those for dogs were 10-50V, 5 msec, 2-30/sec. Each train of pulses lasted for $\frac{1}{2}$ minute.

*Insulin test* : The stomach was drained of its fluid after the electrical stimulation test, and after one hour a gastric sample was taken before injecting insulin. Thereafter, blood and gastric juice samples were withdrawn every half hour. Free acidity in the gastric juice was determined by titrating against N/100 NaOH, using Topffer's reagent as indicator. Blood sugar was estimated according to Hagedorn & Jensen (5). Insulin (Burroughs Wellcome) was given intravenously at the dosage of 1.25 U/*Kg* in dogs, and 0.12 U in every rat.

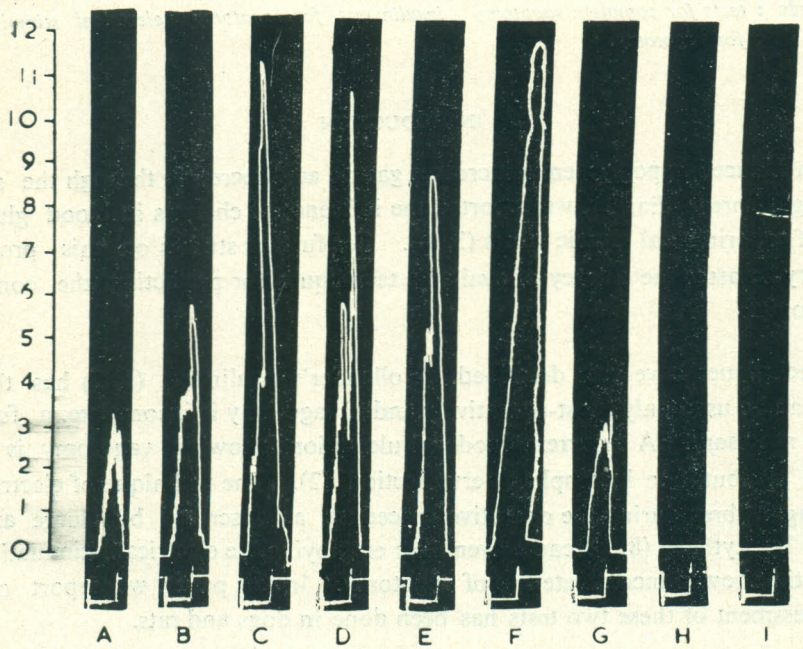


*Fig.* 1: *Electrical stimulation test for completeness of vagotomy. Kymographic records of gastric pressure changes in response to vagal stimulation in a rat have been depicted. Stimultion parameters were : A-10V, 3/sec; B-10V, 5/sec; C-01V, 10/sec; D-12V, 10/sec; E-10V, 20/sec; F-10V, 10/sec; G,H&I-10V, 10/sec.*
*First vagotomy was done between F and G, which was found to be incomplete because a small response was still obtainable. More vagal fibres were searched between G and H. Subsequent stimulation showed that vagotomy was complete. Note that maximum response was obtained with parameters 10V, 10/sec.*
*Pressure scale is in cm of water. The lowermost tracing in each record indicates stimulation signal.*

RESULTS

*Optimal stimulation* : After testing various permutations of the parameters of stimulation, it was found that in the rats, the maximum change in stomach pressure occurred with 10V, 5 msec, 10/sec pulses, while in dogs it occurred with 10V, 5 msec, 30/sec pulses. At these frequencies and voltages, pulse duration seemed to be relatively unimportant. Fig. 1 demonstrates that the electrical stimulation of vagus in the rat produced a most pronounced effect with 10V, 5 msec, and 10/sec stimulation (panel C and F). Similar graphs were obtained in the dogs.

*Electrical stimulation test* : Following vagotomy, electrical stimulation in some animals of both series produced a rise in gastric pressure (fig. 1, panel G.) After further searching and sectioning of vagal fibres in these animals, the intragastric pressure rise was no longer obtained when stimulated with the same parmeters (fig. 1, panel H, and I). In all other animals post-vagotomy electrical stimulation test was negative.

*Insulin test* : In the animals which showed completeness of gastric vagotomy by electrical stimulation test the insulin induced hypoglycaemia failed to cause any secretion of the

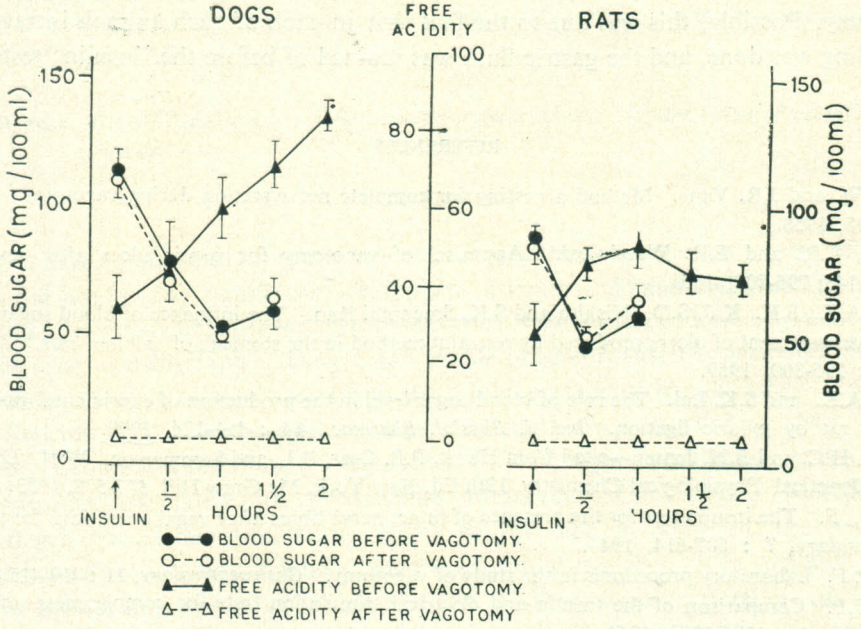


*Fig.* 2: *Insulin test for completeness of vagotomy. Data obtained from rats and dogs has been plotted. Note that after gastric vagotomy, though insulin still affects the blood sugar level in the same way as before vagotomy, the free acidity response is no longer obtainable.*

free acids as sampled from the gastric contents (fig. 2). Also, the animals already subjected to post-vagotomy electrical stimulation test, did not reveal any free acidity in their gastric contents, even before the insulin injection.

## DISCUSSION

The results of this study show that the insulin test and the electrical stimulation test are equally effective in predicting the completeness of gastric vagotomy. In experimental preparations in which complete gastric vagotomy is planned, it would be advisable to do the electrical stimulation test as recommended by Burge and Vane (1) before closing the abdomen. These animals however, should not be given atropine for blocking the secretions during anaesthesia because it will also simultaneously block the vagal nerve endings. Though Lythgoe (8) considered the elimination of atropine as the anaesthetic adjuvant to be hazardous in his patients, in the experimental preparations it did not pose any problems for the survival of chronic preparations in our hands. Some animals in this series showed a small increase in the intragastric pressure even after complete vagotomy as assessed later by the insulin test. This could be due to the spread of stimulating current directly to the gastric musculature. Nevertheless these animals did not show the full-fledged response as indicated in figure 1 even when the stimulation went beyond the supra-optimal strength.

In all the animals of this study free acidity in the gastric contents was completely absent after vagotomy. Possibly, this was due to the fact that in each of such animals intragastric pressure recording was done, and the gastric fluid was drained of before the insulin test was conducted.

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