EFFECTS OF VARIOUS TYPES OF VAGOTOMY ON ELECTRICAL AND CONTRACTILE ACTIVITIES OF THE CANINE STOMACH

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SSUMMARY

Ten dogs equipped with four bipolar silver needle electrodes and three strain gauges on the anterior wall of their stomachs underwent three types of vagotomy: truncal vagotomy (TV)–4 dogs; selective proximal vagotomy (SPV)–3 dogs; and antral vagotomy (AV)–3 dogs.

Electrical and contractile activities of the stomach were examined before and after these vagotomies on both the fasting and postprandial states. TV caused an increased incidence of dysrhythmia and a 9% to 22% reduction of the propagation velocity of basic electrical rhythm (BER). Following feeding, the characteristic waxing and waning pattern of normal gastric contraction was altered to a monotonous steady pattern, increasing overall contraction activity of the pyloric sphincter. These changes seemed attributable to delayed gastric emptying following truncal vagotomy. SPV reduced the propagation velocity of BER slightly, preserving the inherent physiological contractile activity in the antrum and pyloric sphincter, and transforming the contractile activity in the corpus to a more monotonous steady pattern. AV effected a localized monotonous contractile activity in the antral region with no changes discernible in the body and pyloric sphincter.

Key words: stomach; truncal vagotomy; selective proximal vagotomy; antral vagotomy; electrical and contractile activity of the stomach; discharge interval; propagation velocity; waxing and waning pattern of contraction; monotonous contraction.

INTRODUCTION

Since Dragstedt and Owens1 re-introduced vagotomy for the treatment of peptic ulcer in 1943, modified vagotomies such as selective vagotomy2 and selective proximal vagotomy3 (also called partial gastric vagotomy4, parietal cell vagotomy5, and highly selective vagotomy6) have been applied in clinical practice. These have had as their primary purpose the elimination of undesirable side effects following truncal vagotomy, for example, tardiness in gastric emptying or gastric stasis and post-vagotomy diarrhea. The literature is replete with clinical and experimental studies in this field, and the information is so diverse and complex that one would find difficulty in drawing any unified conclusions about vagal effects on gastric motor...
behavior.

In reviewing the literature concerned with the effects of vagotomy on gastric motility, one can summarize their observations into three categories: 1) recovery of gastric motor activity after a certain period of time following vagotomy; 2) hypomotility or decrease in peristaltic movement; and 3) disturbance of pyloric sphincter motility. The majority of these observations were obtained by roentgenologic or intragastric balloon methods, or a combination of both.

Recent studies utilizing electromechanical techniques have yielded further valuable and promising information. Nelsen, et al and others noted definite changes in electrical and contractile activities following truncal vagotomy, such as a decrease in propagation of electrical activity, disorganized electric pattern, and decreased gastric work. They attributed these changes to delayed gastric emptying. Sakamoto and Nishi, however could not detect any electrophysiologic changes in these parameters.

Thus, the study of the effects of vagotomy on the stomach is still an unresolved and challenging subject.

Development of ideal tools for monitoring the electrical and contractile activities of the gastrointestinal tract in animal experiments has allowed the author of this paper to examine this subject under chronic physiologic conditions. The purpose of this study is to answer the following questions: Why does gastric stasis or delayed gastric emptying occur after truncal vagotomy? What kind of changes in electrical and contractile functions occur following selective proximal vagotomy and antral vagotomy (i.e. selective severing the nerve of Latarjet innervating the antrum)?

**METHOD**

Then adult mongrel dogs weighing approximately 15 kg were used. After a 24 hour fast, they were anesthetized with intravenous pentobarbital sodium, intubated and connected to a piston respirator. A midline laparotomy was then made, utilizing routine aseptic techniques. The stomach was well exposed, and four bipolar silver electrodes (200 Micron in diameter, 15 mm interpolar distance) were implanted along the greater curvature parallel to the underlying longitudinal muscle layer. The first two electrodes were implanted in the corpus, and the latter two in the antrum. The second electrode was placed proximal to the point into which the first branch of the nerve of Latarjet enters. The third electrode was positioned distal to the entry of the nerve. The fourth electrode was usually positioned at a point about 2.5 cm to 3.0 cm proximal to the pyloric sphincter. Thus the inter-electrode distance varied in individual animals ranging 3.5 cm to 6.0 cm. After electrode implantation, waterproof strain gauges (120 Ohm. 4.0 × 8.0 × 1.0 mm in size) were carefully sutured to the serosal surface of the stomach, incorporating the entire thickness of the underlying muscle layers. The first gauge was positioned in proximity to the second electrode and served as the body gauge (BG). The second gauge was positioned in similar fashion in proximity to the fourth electrode and served as the antral gauge (AG). The third gauge was positioned in the pyloric sphincter serving as the sphincter gauge (SG). All strain gauges were oriented parallel to the underlying circular muscle (Fig. 1). The lead cords of electrodes and strain gauges were guided subcutaneously to the interscapular region and brought to the surface through a small skin incision. The