

A Quantitative Study of the Effect of Vagotomy on Gastric Secretion in the Dog.*

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Lim, Ivy, and McCarthy¹ described the use of a pouch of the entire stomach in studying the physiology of gastric secretion in the dog. This preparation is sometimes called a Fremont pouch, since Fremont² described this procedure in 1895.

In the total gastric pouch used by Lim, Ivy, and McCarthy, the vagus nerves to the stomach were divided when the cardia was transected. These dogs secreted 200 to 300 cc of gastric juice with a relatively low free acidity. Dragstedt and Ellis^{3,4} described the total gastric pouch prepared with the vagus nerves intact. Unlike the preparation used by Lim, Ivy, and McCarthy, such an animal secretes 600 to 2,000 cc of highly acid gastric juice daily, and will succumb to hypochloremia and alkalosis in 3 to 10 days unless given daily intravenous infusions of Ringer's solution. These animals develop large penetrating peptic ulcers in the gastric pouch,⁵ and frequently die of perforation or hemorrhage.

The present study was undertaken to determine quantitatively the effect of vagotomy on hydrochloric acid and pepsin secretion in the total pouch dog, and to determine the effect of vagotomy on secretion in response to food and other stimuli. A total of 12 dogs survived surgery. Vagotomy was performed in 9 animals by the transthoracic approach.

With the animals on a standard diet, the 24-hour gastric secretion was collected, titrated for free acidity, and the peptic power determined by a method described by LeVeen.⁶

In each animal, the integrity of the vagus nerves to the gastric pouch was established by the use of the intravenous insulin test, as described by Ihre⁷ and Jemerin, Hollander, and Weinstein.⁸ In one dog, the test was negative, and secretion remained low in volume and acidity. The response to histamine was determined by injecting one milligram subcutaneously and collecting the gastric juice over a 75-minute period. The response to food-taking was measured by feeding the fasting animal a standard meal of meat over a 15- to 30-minute period, and by collecting fractional samples of gastric juice for 12 to 16 hours. The same testing procedures were carried out following vagotomy.

Vagotomy produced a decrease in the volume and free acidity of the 24-hour gastric secretion in all of the 9 animals which were vagotomized. The decrease in volume varied from 37 to 79%, averaging 56%. The decrease in free acidity varied from 14 to 82%, averaging 54%. The decrease in milliequivalents of free hydrochloric acid secreted varied from 47 to 92%, the average reduction in hydrochloric acid output being 77%.

In 7 of 8 animals, vagotomy produced a reduction in the peptic power of the 24-hour secretion. This reduction varied from 11 to 72%, averaging 34%. In one animal, the peptic power increased by 47%.

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¹ Lim, R. K. S., Ivy, A. C., and McCarthy, J. E., *Quart. J. Exp. Physiol.*, 1925, **15**, 13.

² Fremont, *Bull. de l'Acad. de Med.*, 1895, **34**, 509.

³ Dragstedt, L. R., and Ellis, J. C., *Proc. Soc. Exp. Biol. and Med.*, 1929, **26**, 305.

⁴ Dragstedt, L. R., and Ellis, J. C., *Am. J. Physiol.*, 1930, **93**, 407.

⁵ Matthews, W. B., and Dragstedt, L. R., *Surg., Gynec., and Obst.*, 1932, **55**, 265.

⁶ LeVeen, H. H., *Proc. Soc. Exp. Biol. and Med.*, 1946, **63**, 254.

⁷ Ihre, B. J. E., *Acta Med. Scandinav.*, Suppl., 1938, **95**.

⁸ Jemerin, E. E., Hollander, F., and Weinstein, V. A., *Gastroenterology*, 1943, **1**, 500.

Vagotomy produced a marked decrease in secretion to histamine stimulation.

In 3 of 4 animals tested, secretion was high in volume and acidity in the fasting state. Within 15 minutes after feeding, there was a pronounced augmentation in secretion, followed in 15 to 30 minutes by a profound inhibition in volume, free acidity, and peptic power. After 3 to 7 hours, secretion returned to the fasting level. Following vagotomy, there was no augmentation with feeding, and the period of inhibition appeared as before.

The ineffectiveness of partial vagotomy was well demonstrated in 2 animals. In one the left, in the other the right vagus nerve was crushed in the cervical region. The secretory response to insulin hypoglycemia was unaffected, and there was no diminution in the 24-hour secretion either in volume or acidity.

Three dogs died of peptic ulcer. Two died of perforation 4 and 7 days after operation; the third died of hemorrhage 5 days after vagotomy.

Conclusions. 1. The totally isolated stom-

ach with intact blood and nerve supply secretes large amounts of gastric juice even in the absence of food-taking.

2. On the ingestion of food there occurs an immediate augmentation of secretion followed by a period of inhibition lasting 3 to 7 hours and then a period of profuse secretion.

3. Section of the vagus nerves above the diaphragm reduces the secretion of gastric juice in the isolated stomach by an average of 56% and the output of hydrochloric acid by 77%. Nervous factors are thus more important than other mechanisms in determining gastric secretion in these animals.

4. Chronic progressive peptic ulcers occur frequently in these isolated stomachs and cause death by hemorrhage or perforation. They rarely develop in such preparations that have been denervated, and following vagotomy, they tend to heal.

5. Partial vagotomy has little or no effect on gastric secretion.

6. After complete vagotomy, the secretory response to a standard dose of histamine is markedly reduced.

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Scarring and Precirrhosis of the Liver in Chronic Phosphorus Poisoning of Guinea Pigs.

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In a previous report,¹ we described the fibrous tissue in dietary cirrhosis of rats and carbon tetrachloride cirrhosis of rats and guinea pigs as forming primarily about the hepatic veins. It was suggested that at least in certain experimental cirrhoses the proliferation and condensation of fibrous tissue occur in the same part of the liver lobule as the parenchymal damage. It seemed desirable to test this concept further by repeatedly injuring the peripheral (portal) part of the

liver lobules to determine whether or not fibrous tissue would form about and connect the portal areas.

White phosphorus was selected for use in this study since it has been stated that this substance produces periportal fatty degeneration and necrosis of the liver, and since Mallory,² among others, has produced cirrhosis in rabbits with phosphorus.

We were not successful in producing frank liver cirrhosis in the animal used (guinea pig). However, other striking extensive

¹ Ashburn, L. L., Endicott, K. M., Daft, F. S., and Lillie, R. D., *Am. J. Path.*, 1947, **23**, 159.

² Mallory, F. B., *Am. J. Path.*, 1933, **9**, 557.