

in vitro studies of Cross and Taggart(1) have demonstrated that the rate of PAH accumulation by thin slices of rabbit kidney cortex is accelerated by the presence of acetate, pyruvate or lactate in the suspending medium. Under conditions of greatly decreased renal vascular resistance associated with increases in renal blood flow of 75 to 100 percent there is a small and variable change in Tm_{PAH} (3,13). The increases in renal blood flow observed under the present experimental conditions were between 10 and 15%. Even if this increase were indicative of a perfusion of previously ischemic nephrons, it would not

account for the increases in Tm_{PAH} observed.

Summary. The intravenous administration of sodium lactate causes a statistically significant increase in Tm_{PAH} in man. The average maximum increase amounted to 30% of the preinjection levels, and the effect was observed in each of 8 subjects tested twice. Neither the observed increases in pH_a and $(BHCO_3)$ nor the changes in renal blood flow appear to bear a causal relationship to the increases in Tm_{PAH} produced.

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Evaluation of Segmental Gastric Resection for Peptic Ulcer.* (18894)

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For many years surgeons have done a three-quarter gastric resection for peptic ulcer in which the entire gastrin-containing area of the stomach along with a large segment of the acid-secreting area is excised utilizing the Billroth I or Billroth II technics. In order to overcome some of the limitations of these methods, it was proposed(1) to reverse the usual procedure of gastric resection by leaving the antrum intact, excising a larger fragment of the acid-secreting area, and leaving not more than 10% nor less than 5% of the total gastric area in the fundic segment. Diminution of acid secretion is then assured, and optimal conditions afforded for neutralization and digestion by bile and pancreatic juice. Moreover, it was hoped that segmental gastric resection might obviate some of the problems

of the "dumping syndrome" observed rather commonly following the conventional types of gastric resection.

Berger(2) has mapped out the parietal cell distribution on 8 normal stomachs. He pointed out that there are virtually none of these cells in the antral area, and that there are 50% as many parietal cells in the fundic and cardiac portions of the stomach as in the corpus. Ferguson(3) showed in a dog with the stomach divided into 4 distinct pouches that the upper pouch, representing 19% of the stomach by weight, secreted half as much acid per g of stomach on histamine stimulation as the middle area of the stomach representing 60% of the stomach by weight. This finding correlates well with Berger's parietal cell counts. The present study was undertaken to ascertain how much of the acid-secreting area of the stomach needs to be removed to protect against ulcer formation when the gastric antrum is allowed to remain intact.

Present study. Six series of dogs were studied.

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1. Wangenstein, O. H., *Transactions and Studies of the College of Physicians of Philadelphia*, 1950, v18, 1.

2. Berger, E. H., *Am. J. Anat.*, 1934, v54, 87.

3. Ferguson, D. J., Unpublished data.

TABLE I. Assessment of Protection of Segmental Gastric Resection in Dogs Against Histamine-in-Beeswax Provoked Ulcer. (Daily dose 30 mg histamine base.)

Operation	No. dogs	Avg No. Histamine in je	Avg % by wt of fundic pouch		Avg % by wt of acid secreting area excised, %	Ulcers		Erosions	
			Estimated at operation, %	Weighted at autopsy, %					
Series 1						No.	%	No.	%
Resection of entire upper stomach; antrum anastomosed to esophagus	4	45	0	5	94	0	0	0	0
Series 2									
Resection of corpus; fundic-antral anastomosis	10	47	10	20	74	0	0	0	0
Series 3									
Resection of corpus; fundic-antral anastomosis; pyloroplasty	6	45	10	21	72	0	0	0	0
Series 4									
Resection of corpus; fundic-antral anastomosis; pyloroplasty	6	45	25	31	63	1	16.6	1	16.6
Series 5									
Resection of corpus; fundic-antral anastomosis; pyloroplasty, vagotomy	6	42	25	33	60	3	50	0	0
Series 6									
Controls—no operation. Dogs received same amount of histamine	6	29	—	—	0	6	100	0	0

Series 1. Excision of the entire acid-secreting area of the stomach with esophagoantral anastomosis (4 dogs).

Series 2. Excision of the corpus leaving 10% of the stomach by weight as a fundic pouch with fundic-antral anastomosis (10 dogs).

Series 3. Same as Series 2 with a pyloroplasty added to hasten gastric emptying (6 dogs).

Series 4. Excision of the corpus leaving 25% by weight of the stomach as a residual fundic pouch with fundic-antral anastomosis (6 dogs).

Series 5. Same as Series 4 with transthoracic vagotomy added (6 dogs).

Series 6. (Controls). Six dogs, not operated upon, receiving the same daily dose of histamine-in-beeswax, were employed as controls to test the effectiveness of the histamine-in-beeswax preparation in the production of peptic ulcer.

All operations were carried out on healthy mongrel dogs weighing from 24 to 50 lb. Anastomosis was accomplished by the closed

method, great care being taken to preserve the fibers of the vagus nerves to the antral segment along the lesser curvature in the first 4 series of animals. The pyloroplasty in Series 3, 4 and 5 was made as an open, linear pylorotomy with transverse closure of the Heinecke-Mikulicz type. It is difficult to determine exactly the area of the antrum from the external appearance of the stomach. In order to leave only antral mucosa in the lower pouch, the distal line of resection transected the stomach from a point just above the incisura on the lesser curvature almost perpendicularly downward to the greater curvature. To obtain a 25% fundic pouch, the proximal line of resection was extended from between the second and third short gastric vessels on the greater curvature to a point 2 to 2.5 cm below the esophago-gastric junction on the lesser curvature. To obtain a 10% fundic pouch only a narrow strip of stomach was left below the esophago-gastric junction. Patterns of the extent of resection were determined beforehand in preliminary trials on sacrificed dogs. The actual correlation of the

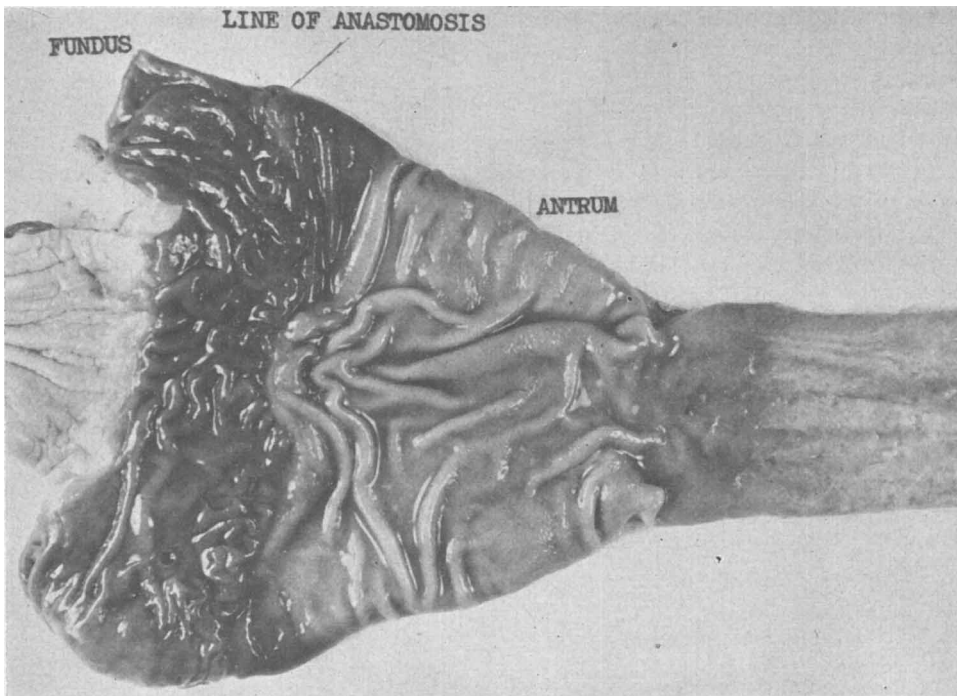


FIG. 1. 10% fundic pouch. Note small triangle of acid-secreting mucosa along the greater curvature on the antral side of the anastomosis.

extent of the excision in the various series had to await the ultimate determination of the weight of the residual gastric fragments when the dogs were sacrificed on the conclusion of the experiments.

Gastric emptying times were done by the method outlined by Lillehei *et al.* (4), and the completeness of the vagotomies in dogs in Series 5 was tested by insulin gastric analysis, using 3 units of insulin per 10 lb of body weight.

All dogs were allowed to recover for at least 30 days postoperatively before starting the daily dose of 30 mg of histamine base in beeswax administered intramuscularly according to the method described by Hay and associates (5). Injections were continued for a period of 45 days unless the animal died of the complications of peptic ulcer. The effectiveness of the histamine preparation in stimulating gastric secretion was tested at periodic

intervals throughout the course of the experiment in Heidenhain pouch dogs.

Results. The results of this study are outlined in Table I. The discrepancy noted in the weights of the residual fundic pouch between the predicted values estimated at surgery, on the basis of earlier determinations on sacrificed dogs, and the weights found ultimately on completion of the experiments is explained by hypertrophy of the residual stomach pouch. Moreover, in spite of the care taken at the time of surgery, there occasionally remained a small triangular area of acid-secreting mucosa attached to the antral pouch which had not been excised at the time of the segmental resection (Fig. 1). No essential difference in gastric emptying time was noted in these experiments whether or not a pyloroplasty or a vagotomy was done in addition to the gastric resection.

In the dogs developing gastric ulcers in Series 4 and 5, 2 of the ulcers were at the esophago-gastric junction, and 2 were at the line of anastomosis between fundus and antrum.

4. Lillehei, C. W., Lewis, F. J., Wangenstein, O. H., *Gastroenterology*, 1950, v15, 487.

5. Hay, L. J., Varco, R. L., Code, C. F., Wangenstein, O. H., *S.G.O.*, 1942, v75, 170.

Comments. The present study indicates that an extensive segmental gastric resection is an adequate operation for peptic ulcer if only 10% of the stomach by weight is left as the residual fundic pouch. However, when 25% or more of the stomach is left intact as a fundic pouch, this operative procedure fails to afford protection against the histamine-in-beeswax provoked ulcer. This latter finding is not surprising since 25% of the stomach is the amount found to make a suitable residual pouch to protect against recurrent ulcer in the conventional 75% gastric resection in which the antrum is also removed. Ferguson(3) has shown that vagotomy decreases histamine stimulated secretion by 68% in total gastric pouches, as contrasted with the observed secretion values from these same pouches before

denervation. Nevertheless, a complementary vagotomy added to segmental resection when a 25% fundic pouch remains, fails to protect against the histamine-in-beeswax provoked ulcer (Series 5).

Summary. (1) An extensive segmental gastric resection in which 74% of the acid secreting portion of the stomach by weight is excised, leaving 10% of the entire stomach as the upper fundic pouch anastomosed to the antrum will protect against the histamine-in-beeswax provoked ulcer in the dog. (2) A segmental resection in which 25% of the stomach by weight is left as the fundic pouch will not protect against the histamine-in-beeswax provoked ulcer, whether or not a complementary vagotomy is done.

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Phosphocreatine in Red and White Muscle. (18895)

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The striated muscle of the turkey was reported by Krishnan and Nelson(1) to be a superior source of adenosine triphosphate as compared with that of a number of mammals. These same investigators noted that the white breast muscle provided a greater yield of this high energy phosphate than did the red muscle of the leg. Lohman(2) demonstrated that the pyrophosphate content of trichloroacetic acid extracts of white muscle of the rabbit was approximately 1.5 times that of the red muscle. These findings suggested the possibility that a difference might also be found in the phosphagen (phosphocreatine) content of these muscles which might further reveal some relationship of this constituent to muscle activity.

An experiment was designed to ascertain relative levels of the creatine phosphate in the leg and breast muscles of the common fowl, and furthermore to compare these results with

those obtained in similar muscles of "flying" birds, *i.e.* the pigeon.

Experimental. The analyses were made on samples of the anterior muscles of the thigh and the pectoral muscle of 6 White Leghorn pullets* and 6 pigeons of indefinite breed. All animals appeared to be in good flesh and health. No discrimination as to stage of the reproductive cycle was made in selecting the animals. Uniformity of experimental animals was of limited importance since the comparisons were made between the red and white muscles of each animal separately. Each pair of determinations were completed simultaneously and under identical conditions. The animals were anesthetized by the slow introduction of sodium pentobarbital intravenously, and were bled immediately prior to the removal of the muscle samples. The samples were taken alternately first from the breast or

1. Krishnan, P. S., and Nelson, W. L., *Arch. Biochem.*, 1948, v19, 65.

2. Lohman, K., *Biochem. Z.*, 1928, v203, 164.

*The birds were furnished by Dr. J. H. Bruckner, Poultry Department, Cornell University Agriculture Experimental Station.