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ARMY MEDICAL RESEARCH LABORATORY

FORT KNOX, KENTUCKY

REPORT NO. 75
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A METHOD FOR CONTINUOUS ASPIRATION OF GASTRIC CONTENTS IN THE DOG*

*Subtask under Environmental Physiology, AMRL Project No. 6-64-12-028, Subtask, Gastrointestinal Responses to Physiological Variables.

MEDICAL RESEARCH AND DEVELOPMENT BOARD
OFFICE OF THE SURGEON GENERAL
DEPARTMENT OF THE ARMY

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A METHOD FOR CONTINUOUS ASPIRATION OF GASTRIC CONTENTS IN THE DOG*

by

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from

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ARMY MEDICAL RESEARCH LABORATORY
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Subtask AMRL, S-6
MEDEA

ABSTRACT

A METHOD FOR CONTINUOUS ASPIRATION OF GASTRIC CONTENTS IN THE DOG

OBJECT

To devise a reliable and convenient method for obtaining continuous samples of gastric contents in the trained, unanesthetized dog.

RESULTS

A double lumen gastric tube has been developed which allows complete and continuous aspiration of the stomach contents in the intact dog.

RECOMMENDATIONS

This tube is recommended for use where it is desired to focus primary attention on gastric activity in the intact animal and under conditions which are reasonably physiological in scope.

Submitted by:

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A METHOD FOR CONTINUOUS ASPIRATION OF GASTRIC CONTENTS IN THE DOG

I. INTRODUCTION

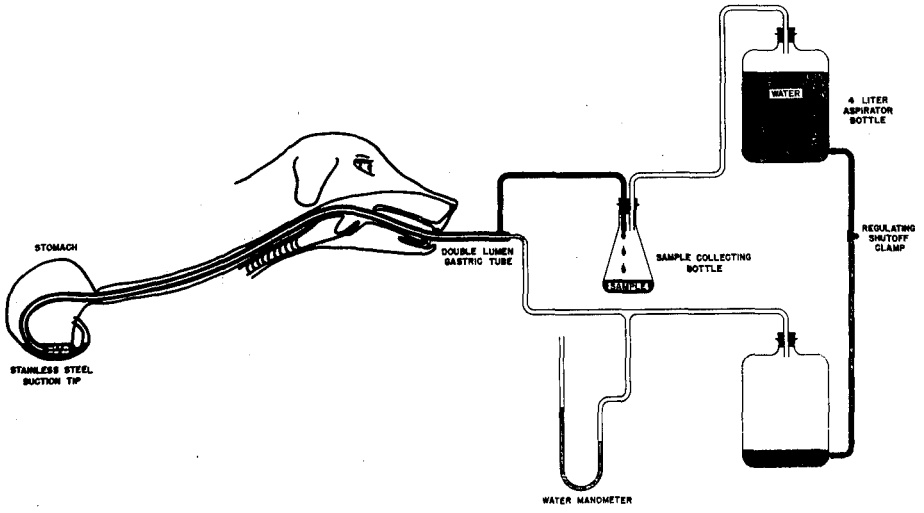
The problem of obtaining the complete gastric contents for analysis has troubled investigators for many years. Various operative procedures such as fistulae, pouches, and short circuit operations have been used with varying success but in these procedures there is always the complication of having altered anatomical and physiological relationships to a considerable degree. Also, many types of stomach tubes (1, 2) for aspirating gastric contents have been developed with differing types of tips to prevent clogging by retained food particles. Undesirable features inherent in these methods are the collapse of gastric mucosa around the tip and an inability to compete with the duodenum for a portion of the contents.

The method described in this report is the direct result of an attempt to develop a method of obtaining complete gastric contents in the unanesthetized dog both convenient and reliable enough for routine use in investigation of gastric responses under conditions which can be considered reasonably physiological in scope. The purpose of this report is to describe a method which, on the basis of preliminary tests, meets these objectives.

II. EXPERIMENTAL PROCEDURE

A. Construction of Tube and Circuit (Figure 1).

A soft rubber tube, 1 cm. in diameter with a wall thickness of 1 mm. and 70 cm. in length, is used for the stomach tube. One end of the tubing is attached to the outer lumen of a double concentric lumen



stainless steel suction tip. The other end is attached to one of the horizontal arms of a glass "T" made from 1 cm. tubing. Within the outer tube a plastic tube, 3 mm. in diameter with a wall thickness of 0.5 mm., is attached to the inner lumen of the double lumen suction tip and is cut long enough to extend through the horizontal arms of the glass "T" where an air tight seal is made with the glass at its point of exit. The vertical arm of the "T", being continuous with the outer lumen of the stomach tube, is continued by means of flexible tubing to a trap for the collection of gastric content. Suction for the trap is supplied by water running from an aspirator bottle approximately seven feet above the floor to a second bottle on the floor. The rate of flow is regulated by a pinch cock on the tubing between the two bottles. The positive pressure from the lower aspirator bottle is vented into the inner lumen of the stomach tube thus making a completely closed circuit.

B. Testing Efficiency of System.

In testing the efficiency of this method, varying measured amounts of water were injected into the positive pressure side of this system with a complete recovery of plus or minus 0.5 cc. To further test the completeness of recovery, an excised stomach was used with the tube in place and the pylorus ligated to prevent leakage. Injection of a given volume of water into the lumen of the excised stomach at various points with a number 28 needle was found to result in complete recovery of the measured injected water.

C. Technique of Animal Preparation.

Dogs are trained to lie on their left side holding the tube in the mouth between the incisors. In this position the normal underbite of the lower jaw prevents pinching and/or puncturing of the tube. Covering the eyes facilitates training the animals.

With a dog on its left side the duodenum is above the stomach and the stainless steel tip forms a pocket in the greater curvature contralateral to the pylorus thus reducing loss of secretion to the small intestines. This loss is further minimized by partially inflating the stomach with air to decrease the effective propulsive force of stomach contractions.

It has been found that a liquid meal consisting of meat juice and sucrose given 12 hours before experiment cleans the stomach and reduces the possibility of inconsistent results due to residual food damming off pockets of secretion. Feeding time was changed from morning to afternoon because experimental procedures were done in the morning and some difficulty was encountered with psychic secretion.

D. Recording Gastric Motility.

If a recording manometer is included in the positive pressure side of the system (Figure 1), concurrent studies of gastric motility may be obtained.

III. RESULTS

The amount of gastric secretion obtained from the dog, using the described method, was quite high in comparison with the rates reported in the literature (3, 4, 5, 6). Subcutaneous injection of histamine phosphate, histamine phosphate and mecholyl chloride, and insulin hypoglycemia were used as gastric secretory stimuli.

The results obtained in a representative experiment following subcutaneous injection of histamine and histamine plus mecholyl are shown in Figure 2. Maximum volume from histamine stimulation alone was 59 cc. of .158 N HCl or 340 mgms. HCl for a 10-minute period. The second peak following stimulation by a combination of histamine and mecholyl chloride was 68 cc. of .133 N HCl or 330 mgms. for a 10-minute period.

In the unoperated dog, subcutaneous insulin (one unit per kilogram body weight injected over dorsum of neck) caused a steady increase in the secretory rate with the peak appearing in 50 to 60 minutes after injections as the blood sugar continued to fall. The results of a representative experiment are shown in Figure 3. The blood sugar (Nelson modification of the Somogyi method) initially was 57 mgm.% and decreased progressively to 28 mgm. % during the subsequent 2-1/2 hours. The volume began increasing 30 minutes after injection of insulin and reached the peak at 50 minutes after injection when 53 cc. of .1275 N HCl or 246 mgms. HCl was secreted in a 10-minute period.

IV. DISCUSSION

There are certain disadvantages in the use of any stomach tube. Babkin (7) states, "The possible sources of error are numerous: e.g., admixture of saliva with gastric juice; escape of juice through the pylorus; the admixture of duodenal juices which often regurgitate into the stomach; the time interval between separate aspirations of gastric juice if continuous aspiration is not applied because the longer the gastric juice remains in the stomach the more its acidity changes; contamination with blood if the suction of gastric juice is roughly performed, and so on". These disadvantages are minimized or completely eliminated by the tube described in this report: 1) the high

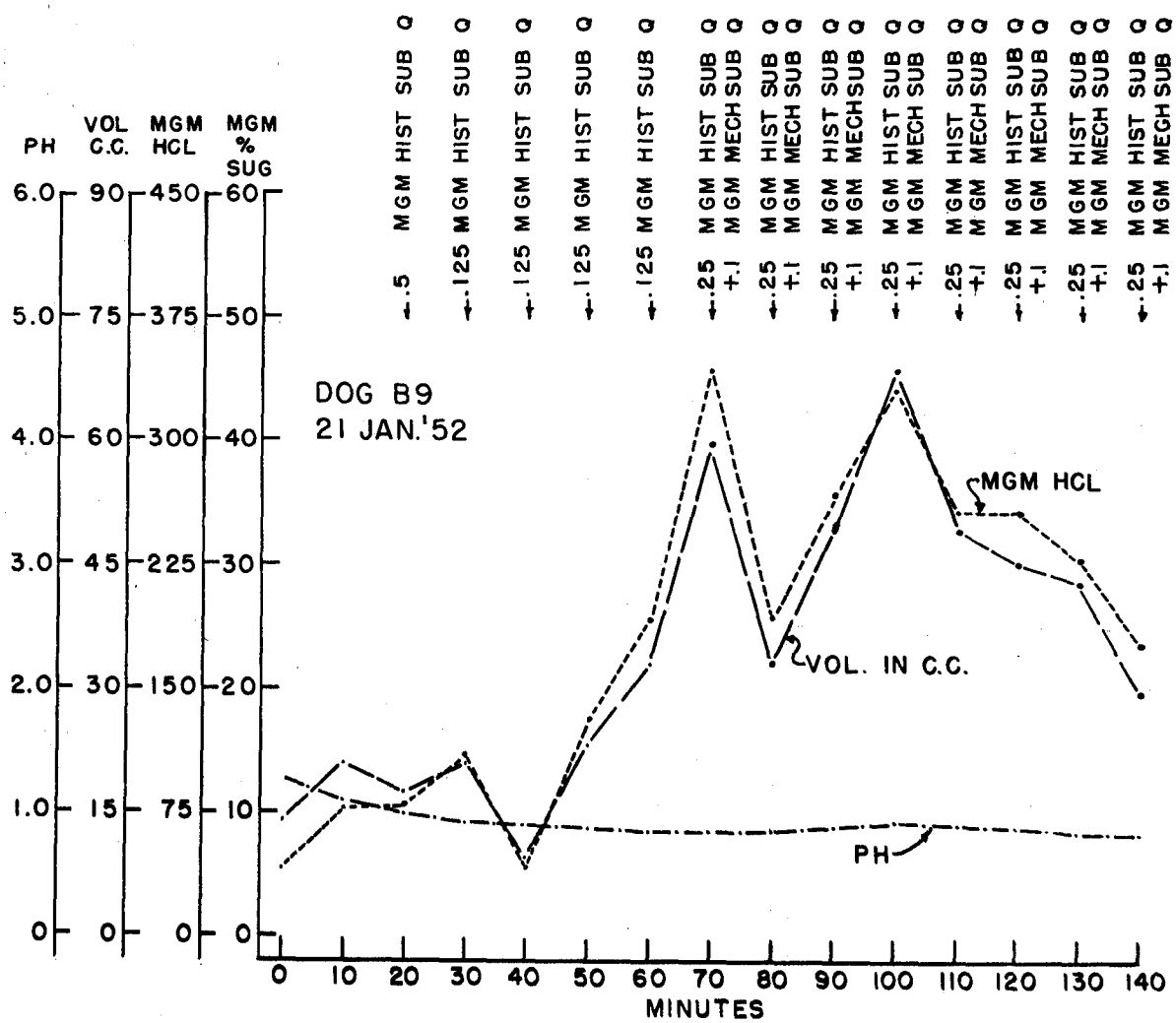


FIG. 2 GASTRIC SECRETORY EXPERIMENT-HISTAMINE & MECHOLYL STIMULUS

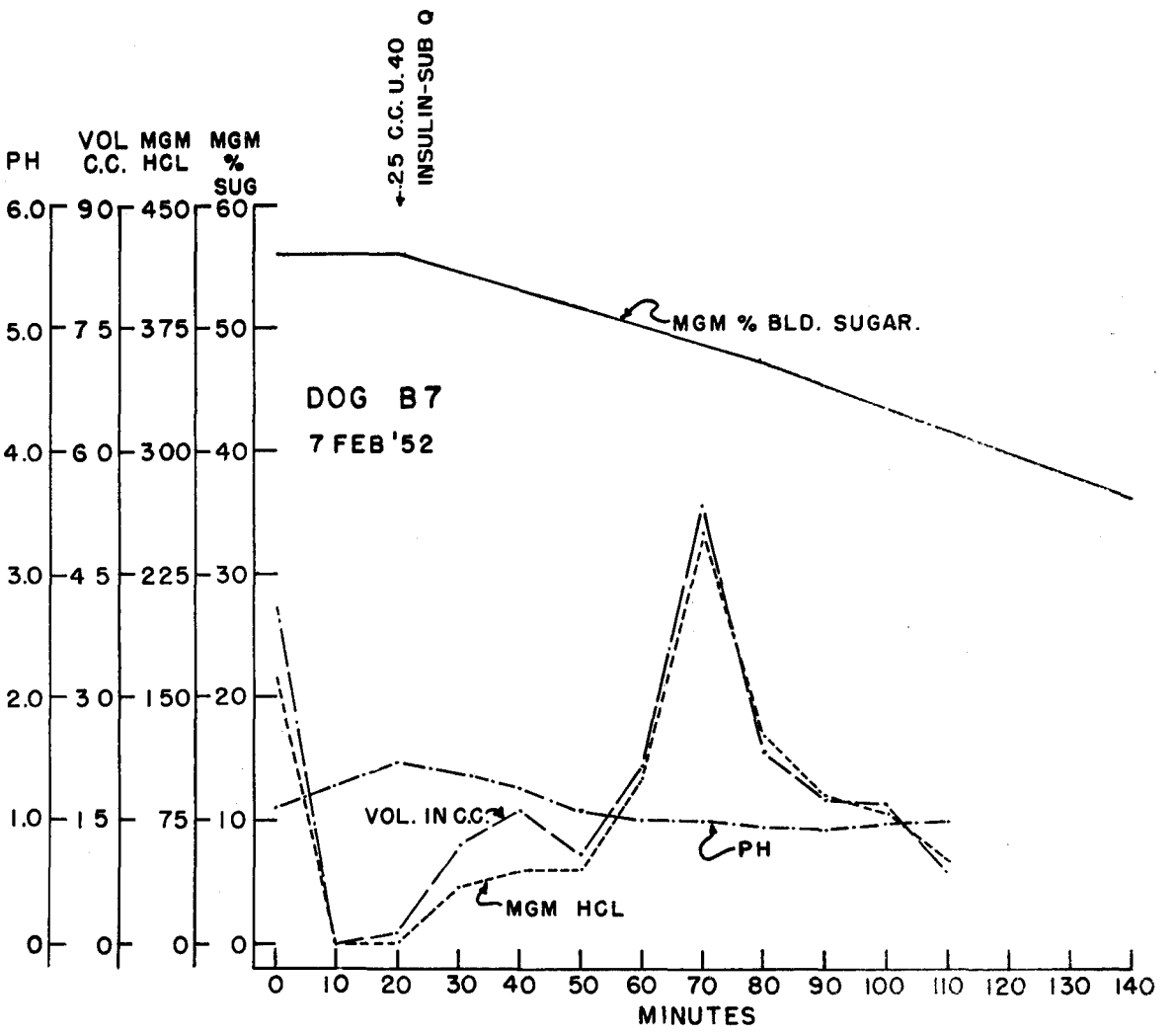


FIG. 3 GASTRIC SECRETORY EXPERIMENT-INSULIN HYPOGLYCEMIA STIMULUS

normality of the secretions obtained indicates that there is very little dilution from swallowed saliva; 2) the slight distention of the stomach with air decreases the effective propulsive force of gastric contractions toward the pylorus by working against a cushion of air, also the weight of the tip permits the gravitation of secretion to the most dependent portion of the stomach where it is continually picked up allowing very little, if any, escape of contents through the pylorus; 3) as the high normality of the secretions indicates that there is a minimal dilution from swallowed saliva, so does it indicate that the dilution from the retrograde flow of duodenal contents is minimal; 4) this continuous type of aspiration prevents the contents from remaining in the stomach and changing the acidity; 5) contamination with blood due to trauma of gastric mucosa is not encountered since the mucosa does not collapse around the tip.

It seems probable that this method could be adapted for general clinical use, specifically: 1) as an aid to diagnosis of peptic ulcers and pernicious anemia; 2) to obtain gastric washings for diagnosis of tuberculosis and cancer of the stomach; 3) to obtain the insulin hypoglycemia response for completeness of vagotomy; and 4) for the removal of gastric contents preceding gastric surgery.

V. CONCLUSIONS

A simple method for obtaining gastric secretion from the intact dog by continuous suction supplemented with a positive pressure has been developed. This is similar to the Wangensteen suction in the utilization of negative pressure formed by water flowing in a closed system. Positive pressure of such a system is also utilized by venting it into the stomach via a double lumen tube to keep the mucosa from collapsing around the catheter tip thus potentiating the pressure differential and giving a more effective collecting force for the withdrawing of secretions.

VI. RECOMMENDATIONS

This tube is recommended for use where it is desired to focus primary attention on gastric activity in the intact animal and under conditions which are reasonably physiological in scope.

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