

duodenum anastomosed to the open end of the stomach by the end to side suture. The common bile duct was sectioned near its entrance into the duodenum and implanted either into the stomach or upper jejunum. The upper short section of duodenum containing the entrance of the pancreatic ducts (usually 2 or more in the dog) was converted into a closed sac by inversion and closure of both ends. An external fistula of this duodenal-pancreatic sac was then established by means of a special gold plated cannula, described in a previous publication.⁴ This cannula was carefully wrapped with omentum before it was brought through a stab wound in the abdominal wall. Pancreatic juice was collected in rubber bags attached to the cannula. The juice was of course activated by the admixture of the small amount of *succus entericus* secreted by the duodenal sac. Animals have been kept in good condition in the laboratory, by special treatment to be detailed later, for as long as 6 months with no excoriation or digestion of the abdominal wall.

5180

Fatal Effect of the Total Loss of Pancreatic Juice.*

LESTER R. DRAGSTEDT, M. LAURENCE MONTGOMERY, WARREN B. MATTHEWS AND JAMES C. ELLIS.

From the Department of Surgery of The University of Chicago.

While certain of the earlier physiologists, notably Pawlow, had noted various deleterious effects from chronic pancreatic fistula in animals, these were commonly ascribed to the disturbance in digestion resulting from the absence of an important digestive juice in the alimentary tract. Elman and McCaughan¹ were the first to clearly demonstrate that these adverse symptoms were due to the removal of some necessary substance from the body and its excretion in the pancreatic juice. By an improved type of fistula which permitted greater quantities of pancreatic juice to escape than had been obtained by former workers, they found that death resulted in the dog in from 7 to 8 days when pancreatic juice in amounts of from 150 to 400 cc. was lost per day. Confirming these findings

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

* This work has been conducted under a grant from the Douglas Smith Foundation for Medical Research of the University of Chicago.

¹ Elman, R., and McCaughan, J. M., *J. Exp. Med.*, 1927, **45**, 561.

Gamble and McIver² reported that 2 dogs provided with pancreatic fistulae of the Pawlow type died in 15 to 42 days respectively and concluded that death was due to dehydration and acidosis resulting from the large loss of Na and Cl in the pancreatic secretion. Both Gamble and Elman later found that life could be prolonged by simply restoring the inorganic elements and water that were lost.

The present experiments were in progress when the paper by Elman and McCaughan appeared and they confirm their findings in all essential respects. Animals were provided with pancreatic fistulae of the type described in the preceding paper. They were given 2000 cc. of Ringer's solution intravenously for the first 5 days after operation at which time the fistula was secreting profusely and the dog was in good condition. From 500 to 1500 cc. of pancreatic juice were obtained in 24 hours, the very large amounts being doubtless due to the fact that all of the pancreatic ducts had their outlets into the duodenal sac undisturbed. The intravenous salt solution was then discontinued but the animals permitted food and water *ad libitum*. They promptly became progressively weak and depressed, lost weight markedly and either died or were moribund in 4 to 6 days. The secretion of pancreatic juice continued until death but was considerably reduced in volume. The following changes in the blood chemistry were found: a reduction in the total plasma base from 155 to 130 mM., a decrease in chloride from 101 to 84 mM., a decrease in HCO₃ from 23.0 to 8.3 mM., a shift in the pH from 7.35 to 6.95, and an increase in NPN from 33 to 55 mg., and urea N from 12 to 33 mg. The hemoglobin, red cell count and volume, and blood volume, determined by the dye method, remained within normal limits.

5181

Prolonging Life in High Obstruction by Administration of Salt Solution Below Point of Obstruction.

HILGER P. JENKINS. (Introduced by L. R. Dragstedt.)

From the Department of Surgery, the University of Chicago.

The cause of death in acute intestinal obstruction has been most generally attributed to a toxæmia. The nature of this toxæmia has not been definitely established. Although the toxic theory has been used to explain death in all types of obstruction, recently some

² Gamble, J. L., and McIver, M. A., *J. Exp. Med.*, 1928, **48**, 859.