Our results are more intelligible in the light of the experiments of Harrison and Leonard,[2] who have found that digitalis acts by reducing the cardiac output. From their work it appears that digitalis is a cardiac sedative rather than a stimulant. Eppinger observed a case of heart failure with a minute output of 10 liters that was reduced to 5 liters when compensation was restored. The combined findings of these investigators may modify our views on circulatory failure where a reduction of cardiac output was hitherto assumed to exist and treatment was directed towards increasing the systolic discharge. If further study should permit general application of these principles to the conception and treatment of cardiovascular failure, the keynote of therapy may be cardio-sedative measures. It appears to us that venostasis as we apply it, fulfills this requirement.

The difference between the action of venostasis and digitalis is that in the latter the diastolic filling is reduced by an increase of cardiac tonus, while in venostasis the shunting of a considerable volume of blood in the extremities by simple mechanical means partially depletes the heart and accomplishes the same purpose.

Conclusion: Venostasis is an effective procedure in cardiac asthma and heart failure. It can frequently replace digitalis in the treatment of cardiac decompensation. A convenient apparatus called the "Venostat" is presented.

[1] Eppinger, H., Papp and Schwartz, Asthma Cardiale, Julius Springer, Berlin, 1924.

[2] Harrison, T. R., and Leonard, B. W., *J. Clin. Investigation*, 1926, iii, 1.

3478

Morphological and Chemical Studies of the Blood in Chronic Duodenal Obstruction.

B. N. BERG, A. WUORINEN AND J. W. JOBLING.

*From the Department of Pathology, College of Physicians and Surgeons, Columbia University.**

In the following report we wish to describe our observations of the blood changes in dogs with experimentally produced chronic duodenal obstruction. In the 12 dogs which were studied, the obstruction existed for periods extending from 2 months to 13 months.

* This work was aided by a grant from the Eli Lilly Company.

In previous communications[1] we described the changes in motility, the marked stasis and the great increase in intestinal bacteria in the duodenum, above the site of the obstruction. The types of organisms were those usually encountered in the intestine of dogs, *i. e., B. coli, Enterococci* and *B. welchii.* The influence of this prolonged stasis upon the blood was determined by frequent hemoglobin determinations, red and white cell counts, differential counts, and chemical analyses. In addition, gastric analyses were made, especially for the presence of free HCl.

All of the dogs developed a secondary anemia of variable intensity. The maximum drop in red cells ranged between one million and two and one-half million. The hemoglobin index was always below one. There were frequent remissions during which the red cell count was normal. The leucocyte count was too irregular to be significant. The morphology of the erythrocytes remained practically unaltered; occasionally a few normoblasts and a slight anisocytosis were observed in the smears. Free HCl was always present in the gastric contents.

The chemical examination of the blood included urea nitrogen, chlorides and carbon dioxide combining power. Examinations were made when the dogs were free of any symptoms. Figures which were obtained during or after periods of vomiting or shortly before death were excluded. The only significant finding was an increase in urea nitrogen. However, the variations in the urea nitrogen of a series of normal dogs observed over a prolonged period were approximately the same as those with duodenal obstruction.[2] It was noted that an increase in urea nitrogen occurred more often in dogs which subsequently showed kidney lesions.

In view of the work done by Seyderhelm, Löwenberg, Cornell, Torrey and others, with *B. coli, B. welchii,* and their toxins, we thought it possible that an anemia of the pernicious anemia type might be produced. The changes we observed were characteristic of the secondary anemias. However, in pernicious anemia, achylia is present, whereas in our experimental animals free HCl was always found in the gastric contents. Further experiments will be directed toward neutralizing or eliminating the gastric HCl in dogs with chronic duodenal obstruction.

[1] Berg, B. N., Meleney, F. L., and Jobling, J. W., *Arch. of Surg.*, 1927, xiv, 752.

[2] McKinley, E. B., (to be published later).