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Relative Effect of Blood Given by Jejunostomy and Ileostomy.

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Previous experiments^{1, 2} have indicated that blood or red blood cells when introduced by stomach tube into normal dogs will produce a marked rise in blood urea nitrogen. These experiments also indicated that the red cells and particularly their contained hemoglobin seemed to be the active factor in producing this alimentary azotemia rather than the plasma. Finally, since marked rises in blood urea nitrogen were also obtained following ingestion of protein, it seems as though the rise is probably due to and to a large extent proportional to the absorption of protein from the gastrointestinal tract.

All of the above conclusions were based on the results of introducing blood by tube directly into the stomachs of experimental animals, while the following experiments were performed by introducing blood or red blood cells into the jejunum and ileum of dogs.

Method. Ten experiments were performed on 4 dogs. Two of the dogs had a jejunostomy of the Maydl type 2 feet below the ligament of Treitz and the other 2 dogs had an ileostomy of the Mann-Bollman type 20 cm proximal to the ileocecal valve. The blood or red blood cells was introduced by tube into these enterostomy openings. In 2 experiments whole beef blood was used, in 5 beef red blood cells and in 3 human red cells were used.

Blood urea nitrogen determinations, using essentially the method of Van Slyke and Cullen³ were made every 4 to 6 hours on each dog, from one to 3 days following the introduction of whole blood or of red blood cells by enterostomy into the respective levels of the small intestine. As in the previous experiments on oral administration, the dogs were given their usual amount of food divided into 4 small meals daily. Water was given freely in the usual amounts.

Results. Whole blood administration. Following the administration of whole beef blood into the jejunum, there was a marked rise in blood urea nitrogen content within 3 hours from the intro-

¹ Chunn, C. F., and Harkins, H. N., *Proc. Soc. Exp. Biol. and Med.*, 1940, **45**, 569.

² Chunn, C. F., and Harkins, H. N., *Surgery*, 1941, **9**, 695.

³ Van Slyke, D. D., and Cullen, G. E., in Peters, J. P., and Van Slyke, D. D., *Quantitative Clinical Chemistry*, Williams and Wilkins Company, Baltimore, 1932, **2**, 547.

duction of the first dose of blood with a return to the normal level 24 hours after the introduction of the last dose of blood. In marked contrast to this course, was the result of giving as much as 750 cc blood into the lower ileum where no elevation of blood urea nitrogen occurred.

Results. Red blood cells administration. In all cases except one, the administration of red blood cells produced the same results as the use of whole blood. The one exception was a dog in which giving of human red blood cells by low ileostomy was accompanied by an increase in blood urea nitrogen of from 14 to 24 mg %. It was then found that this dog had received a single large feeding of meat just before this rise occurred which may have been a causative factor. A typical set of experiments is shown on Chart 1, illustrating the contrast between the results produced by red blood cells administration into a jejunostomy and into a low ileostomy.

CHART SHOWING THE EFFECT OF BLOOD CELLS IN THE PRODUCTION OF ALIMENTARY AZOTEMIA AT DIFFERENT LEVELS OF THE GASTROINTESTINAL TRACT OF DOGS.

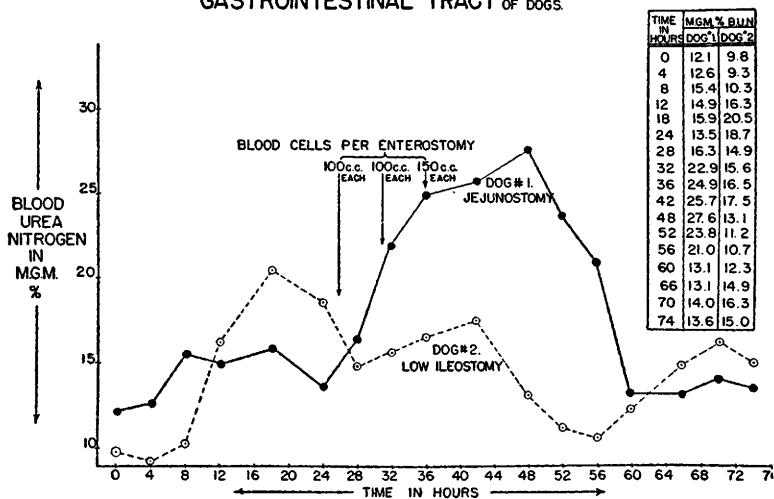


Fig. 1.

Results. Whole blood intraperitoneally. Three normal dogs were given 150 cc, 200 cc, and 230 cc respectively of citrated whole blood intraperitoneally, using aseptic technic. No elevation of blood urea nitrogen occurred in any of the 3 experiments.

Comment. Correlation of these results with those of experiments where blood was administered by mouth would indicate that alimentary azotemia only results when blood is placed in the upper half of the intestinal tract. This may be because of a necessary digestion

in or absorption from this portion of the gut. Our results cannot give a conclusive answer as to which of these factors is more important. Administration of a 5% urea solution produced as marked a rise in blood urea nitrogen when introduced into the stoma of one of the low ileostomy dogs as when introduced into one of the jejunostomy dogs. This would indicate the importance of the element of digestion but is not conclusive because urea is such a readily diffusible substance.

Conclusions. Alimentary azotemia in the dog occurs after the intragastric or intrajejunal administration of whole blood or red blood cells. On the other hand, similar amounts introduced low into the ileum or into the peritoneal cavity produced practically no rise in blood urea nitrogen. Alimentary azotemia results, then, only from the presence of blood in the upper intestinal tract.

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Detection of Minute Amounts of Serum Antibody by Agglutination of Antigen-Coated Bacterial Cells.

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The authors recently described a local serum reaction¹ occurring upon the ear of a rabbit (at the site of a prior injection of serum antigen) when a very small quantity of homologous antiserum was injected intravenously elsewhere in the body. The amount of antiserum injected was so small that it was not possible to detect antibody in the animal's serum by the use of the conventional method of testing, *i. e.*, the precipitation test employing the antigen dilution method. In order to determine such minute amounts of circulating antibody in the blood of injected animals it became necessary to devise a technic which would be both accurate and extremely sensitive. This was accomplished by developing a method which involves coating the cells of a suspension of *Serratia marcescens* with serum antigen and observing the agglutination of such cells upon addition of the animal serum being tested. That bacterial cells can be coated with serum antigen and subsequently agglutinated with an immune serum (homologous to the serum antigen) was reported by Jones.²

¹ Jones, L. R., and Roberts, E. C., *J. Immunol.*, 1941, **40**, 107.

² Jones, F. S., *J. Exp. Med.*, 1927, **46**, 303.