

cycle and in particular not on differences in the intensity of the action of the follicular hormone during the follicular phase of the cycle.

8305 C

Loss of Blood from Circulation in Various Types of Intestinal Obstruction.

IAN AIRD.* (Introduced by E. A. Graham.)

From the Department of Surgery, Washington University School of Medicine, and Barnes Hospital, St. Louis.

The theory that the cause of death in intestinal obstruction is a loss of blood from the general circulation into the distended and stagnant vessels of the congested intestinal wall has not in all quarters been entirely discarded. Splanchnic congestion is of course a factor of no importance in obstruction of the duodenum or uppermost jejunum: high obstruction is not therefore considered here, but a series of simple animal experiments has been performed to determine the blood loss from the general circulation in the 3 other varieties of intestinal obstruction which occur clinically—(1) simple low occlusion of the small intestine, (2) closed loop obstruction without strangulation, and (3) closed loop obstruction with strangulation of the veins draining the obstructed loop.

(1) *Simple Low Small Intestine Occlusion.* In each of 9 cats under ether anesthesia a silk ligature was tied tightly around the ileum 18 inches above the ileocaecal junction. Two fine seromuscular knots of silk were placed in the gut wall one foot above, and one foot below the point of obstruction to measure off respectively the lowest foot of obstructed bowel, and an equal adjacent loop of unobstructed bowel. In 2 of the cats the obstructing ligature broke or cut through and the animals recovered. The remaining animals died after periods of 1 to 6 days. In these the 2 measured loops were excised after death and their mucosal surfaces dried by the passage of a cotton pull-through. Only a drop or 2 of blood was lost from each loop during excision from the vessels of the mesentery and of the loop ends. The difference in weight between the measured unobstructed foot of bowel, and the lowest foot of obstructed bowel was taken to represent the maximum possible sur-

* Rockefeller Traveling Fellow from Edinburgh University, Scotland.

plus of blood in the congested wall of the latter—an obvious overestimate since some part of the increase in weight must be due not to blood but to oedema fluid. This difference varied from 0.23 to 2.5 gm. or expressed as a percentage of the blood volume of the animal (arbitrarily estimated as $7\frac{1}{2}\%$ of the body weight) from 0.11 to 1% of the blood volume. Since the lowest obstructed loop was in all cases the most congested, this figure multiplied by the number of feet in the small intestine was taken to represent the maximal possible blood loss into the wall of the whole obstructed small intestine. This total loss varied from 0.6 to 5% of the estimated blood volume—a loss comparable with only a trivial external hemorrhage.

(2) *Closed Loop Obstruction without Strangulation.* Seven cats were used for this series. Closed loops of small intestine were prepared by division, and invagination of the divided ends, and were compared with loops of unobstructed bowel of similar length, aboral to them. The lumen was not reconstituted by anastomosis. The closed loops varied in length from one-tenth to one-half of the whole small intestine. The animals died 2 to 6 days after preparation of the loops. In all cases the closed loops were distended and congested. The greatest increase in weight occurred, as would be expected, in the longest closed loop—that which included one-half of the small intestine (a closed loop relatively much longer than those encountered clinically in man) and even here the maximal possible blood loss into the loop amounted to only 11% of the estimated blood volume of the animal. In the shorter loops (one-tenth to one-quarter of the whole small intestine) the maximal possible blood loss was from 1.3 to 3% of the blood volume. In all cases the paleness of the content of the closed loop, and of the fluid in the peritoneal cavity (where any was present) excluded the possibility of measurable loss of blood from the mucous or peritoneal surfaces of the closed loop.

(3) *Closed Loop with Venous Strangulation.* The measurement of loss of fluid from the general circulation was here performed by the rubber bag technique used by Foster and Hausler¹ to exclude strangulated intestine from the peritoneal cavity. A loop of intestine was measured and inserted in a rubber balloon around whose neck a ligature was tied so tightly that the arteries of the mesentery of the strangulated bowel could just be felt pulsating through the balloon wall. After death the weight of the balloon

¹ Foster, W. C., and Hausler, R. W., *Arch. Int. Med.*, 1924, **34**, 697.

and its contents was compared with the weight of the same balloon and a bowel loop of similar length to that strangulated. Here the increase in weight is due solely to the blood lost into the wall of the loop, into the lumen, and outward into the balloon. Twelve cats were used in this series. Two of these, in which leakage at the neck of the balloon gave death from peritonitis, were discarded. In one, where the whole small intestine was strangulated, and the balloon contents compared with intestines of similar length in animals of the same weight, the blood loss was estimated at 45% of the blood volume. In 2 animals, strangulation of one-half of the small intestine gave a blood loss of 43% and 52% of the blood volume. Such a blood loss is in itself sufficient to cause death. In 7 smaller loops, each including one-third of the small intestine, the blood loss into the balloon varied from 22% to 35% of the estimated blood volume—a considerable but not a fatal loss. Using the same technique, Holt² found an even greater blood loss in the strangulated intestine of the dog.

Conclusions. Blood loss from the general circulation is an unimportant factor in simple occlusion of the intestine, and in closed loop obstruction without strangulation. In venous strangulation in the cat, blood loss is sufficient to cause death if one-half or more of the small intestine be involved. In strangulation even of smaller loops, the blood loss into them, and through them, while not in itself great enough to cause death, is yet sufficient to be a factor of importance. In clinical cases of strangulation, probably some part of the bloodstained transudate is reabsorbed by the peritoneum. No attempt was made in these experiments to estimate or to allow for such reabsorption.

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Quantitative Spreading of Fibrinogen in Unimolecular Films.

LYMAN FOURS* AND ANNE M. PERLEY. (Introduced by Francis O. Schmitt.)

From the Department of Zoology, Washington University, St. Louis.

Two general methods have been employed to spread proteins on aqueous surfaces in unimolecular films. Gorter and Grendel¹ in-

² Holt, R. L., *Brit. J. Surg.*, 1934, **21**, 582.

* University Fellow.

¹ Gorter, E., and Grendel, F., *Proc. Acad. Sci. Amsterdam*, 1926, **29**, 1262.