(rebreathing the air in a small balloon) the liver constricts powerfully during the rise of general blood pressure and remains constricted even as the heart begins to fail. If it is denervated, however, it dilates for a time as the general blood pressure is rising; but before this has reached its maximum the liver often begins to constrict maximally. This delayed constriction may be prevented by removal of the adrenals; then the denervated liver volume passively follows the general blood pressure throughout the course of the asphyxia.

4912

Evaluation of X-Ray Evidence as Criteria of Intestinal Obstruction.

OWEN H. WANGENSTEEN AND FRANCIS W. LYNCH.

From the Department of Surgery, University of Minnesota.

Late diagnoses in simple obstruction of the bowel are due in large measure to the absence of local physical findings which help in other abdominal disasters to corroborate the suspicion that a surgical emergency obtains. The usual textbook description of the physical findings in intestinal obstruction is an ante mortem picture. Regurgitant vomiting and abdominal distension are heralds of death and not physical findings significant of the presence of acute bowel obstruction.

The employment of the X-ray to detect bowel obstruction was suggested about 20 years ago, but it is not widely used for this purpose today and several recent writers state that the employment of X-rays is of no value in the diagnosis of obstruction. In this study an attempt has been made to evaluate the X-ray criteria in the early recognition of bowel obstruction.

Normally gas exists throughout the entire intestinal tract, but when an X-ray film is made of the abdomen, gas is discernible only in the stomach and colon, and especially at the flexures. Its intimate admixture with fluid in the small intestine precludes its demonstration on the X-ray film, though tiny bubbles are constantly present at least in portions of the small intestine. The accumulation of the gas in the small intestine is therefore proof of the existence of delay in transit of the content through the small intestine and usually means intestinal stasis.

In this study simple obstruction was established in 20 dogs; 16

of these were complete, the bowel being severed and the ends inverted. In the other 4, partial obstructions were established by ligating the bowel with gauze. Seventeen dogs were obstructed in the lower one-third of the small intestine and 3 were in the sigmoid. One of the latter animals lived 50 days. In 2 dogs X-ray observations were made following the establishment of strangulation obstruction accomplished by a ligature of an intestinal loop 3 feet in length together with its mesentery. All of the obstructions were done aseptically; the simple obstructions were made under ether anesthesia, and the strangulation obstructions were done under procaine infiltration of the abdominal wall reinforced by a preliminary injection of morphine.

In 3 animals after establishing obstructions low in the ileum gastrostomies were made and barium given post-operatively in an attempt to determine the time at which the barium would reach the site of intestinal occlusion. The animals were X-rayed frequently post-operatively and daily measurements of the abdominal circumference were made until the time of death.

In some instances saline was administered subcutaneously—400 cc. of 1% solution being given daily. In a few instances perforated lead shot were fastened to the bowel proximal to the obstruction such that an accumulation of gas in the intestine could easily be followed and its location easily interpreted. In a group of 7 dogs with simple obstruction, plates were taken at intervals of 1 to 2 hours for the first 9 hours after the obstruction, with the point in mind of determining when gaseous distension of the intestine occurred.

In summarizing briefly the results of these experiments, we demonstrated that the X-ray film without the employment of the contrast medium is a reliable method of determining a block in the intestine. Within 4 or 5 hours after intestinal occlusion there was definite evidence of gaseous distension in the loops of the small intestine. After 20-24 hours the distension of the intestine proximal to the point of obstruction was fairly general even though clinical distension was usually not obtained. A measurable increase in the circumference of the abdomen was usually noted only about 24 hours before death. It was an interesting observation in these experiments that in simple obstruction fluid does accumulate above the point of intestinal occlusion though not in the same measure as observed in the human. When saline was administered subcutaneously, however, fluid levels or mirrors were obtained when the dogs were rayed in the standing posture. In one instance only 35 cc. of fluid was obtained from the intestine proximal to the obstruction at death,

but definite fluid levels could be seen in the X-ray film. In the 2 dogs in which strangulation obstructions were established gaseous distension of the proximal loops was noted on the X-ray film, but the strangulated segments failed to exhibit dilatation. A report of further X-ray studies on strangulation obstruction will be made subsequently.

In the instances in which barium was given through a gastrostomy tube an interval of 20 hours was usually necessary before the barium reached the site of intestinal block. The employment of contrast media to determine the presence of bowel occlusion is to be condemned, but flat plates of the abdomen constitute a measure of real value in detecting intestinal stasis. The stethoscope will serve to differentiate whether the obstruction is mechanical or inhibitive. The former exhibits loud intestinal noises; in the latter the abdomen is silent.

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Motor Activity of the Distal Bowel in Intestinal Obstruction: Comparison with the Obstructed and Normal.

HERBERT A. CARLSON AND OWEN H. WANGENSTEEN.

From the Department of Surgery, University of Minnesota.

The bowel distal to the point of obstruction is normal anatomically, whereas the proximal bowel exhibits anatomical changes. Alvarez[1] states that most of the motor activities of the stomach and bowel are brought about and regulated largely by the internal pressure due to the presence of food or gas, on which basis an eventual condition of inactivity in the bowel distal to a complete obstruction would appear to be understandable. But the distal bowel has been found to evacuate enemas and transport barium in approximately normal time. In this study an attempt has been made to study the motor activity of the distal segment of the bowel in the presence of simple obstruction. There were 22 dogs obstructed, the point of severance being usually 3 to 5 feet above the ileo-caecal valve. The proximal end was turned in and the distal end anchored to the skin in 8 dogs. In 14 others both ends were inverted.

Small rubber balloons were inserted into the bowel and the contractions of the bowel recorded upon a smoked drum by means of a

[1] Alvarez, W. C., "The Mechanics of the Digestive Tract." Paul B. Hoeber, New York. 1928. 24.