The Efficacy of Chloromycetin in the Treatment of Strangulation Obstruction *

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THE PERITONEAL cavities of animals dying from experimental strangulation obstruction of the lower small intestine have been shown to be the site of accumulation of large amounts of fluid.[1] This material will kill normal animals in amounts as small as 3 cc. per Kg. when injected into the peritoneal cavity. There is strong evidence which indicates that this fluid plays a significant role in the lethal issue of strangulation obstruction.[1, 6] The determination of the effects of a broad spectrum antibiotic, Chloromycetin, upon the toxicity of this fluid was the concern of the following experiments.

Materials and Methods

Sixty unselected adult mongrel dogs were divided into three groups.

Group 1: The purpose of this part of the study was to determine if it were possible to produce nontoxic peritoneal fluid by placing Chloromycetin inside a closed loop of strangulated bowel. Utilizing fractional, intravenous Nembutal anesthesia and sterile technic, the lower ileum was exposed in four dogs through a midline abdominal incision. An encircling tie of umbilical tape was placed at one extremity of a 10 cm. segment of ileum. A small opening was made in the bowel wall through which ten Chloromycetin capsules (250 mg. each) were introduced into the lumen. After closure of the enterostomy in two layers, another umbilical tape tie was placed around the ileum so as to complete the closed loop obstruction. The venous supply to this segment was then divided and ligated (Fig. 1). Closure of the abdominal wound was effected and the animals were returned to their cages. After 48 hours they were again anesthetized so that the peritoneal fluid could be collected. Eight normal dogs received an intraperitoneal injection of this fluid in the amount of 3 cc. per Kg. Survival time was recorded for all recipient animals.

Group 2: The objective of the following experiments was to determine the effect of placing Chloromycetin in an extra-luminal position but in close vicinity to strangulated bowel. The abdominal cavities of eight dogs were opened utilizing the technic described above. A closed loop obstruction of the ileum was created by passing umbilical tape ties around each extremity of a 10 cm. segment of bowel. All veins supplying this portion of the small intestines were ligated. The altered ileum was then placed inside a polyethylene bag having a volume of one quart. Four of the plastic bags contained 2,500 mg. of Chloromycetin each. Umbilical tape ties were used to maintain the bowel within the bag (Fig. 2). The animals were sacrificed after 48 hours so that the bags along with the contents could be recovered. Eight normal animals were given an intraperitoneal injection of fluid (3 cc./Kg.)

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from the bags containing Chloromycetin. An equal number of animals received a similar dose of untreated fluid. Survival time was recorded for all recipient animals.

Group 3: This part of the study was concerned with the efficacy of Chloromycetin when administered along with toxic strangulation obstruction fluid. The terminal ileum was strangulated in eight dogs according to the method described above except that no antibiotics or plastic bags were used. At, or shortly before death, the peritoneal cavity was opened for collection of the accumulated fluid. Sixteen anesthetized normal dogs were given an intraperitoneal injection of this fluid in the amount of 3 cc. per Kg. One-half of these animals received an intraperitoneal injection of Chloromycetin acid succinate (50 mg./Kg.) at the time of injection of the strangulation obstruction fluid. Survival time was recorded for all recipient animals.

Results

Group 1: All four donor animals had recovered from anesthesia within eight hours. They were alert and active at the end of the 48-hour period when they were sacrificed. The peritoneal cavity of each animal contained from 75 to 200 cc. of dark colored fluid. The strangulated bowel revealed no evidence of gross rupture, in fact it still contained black fluid in three animals. Neither the peritoneal fluid nor the involved gut produced the usual odor characteristic of untreated gangrenous bowel. It was not necessary to anesthetize recipient

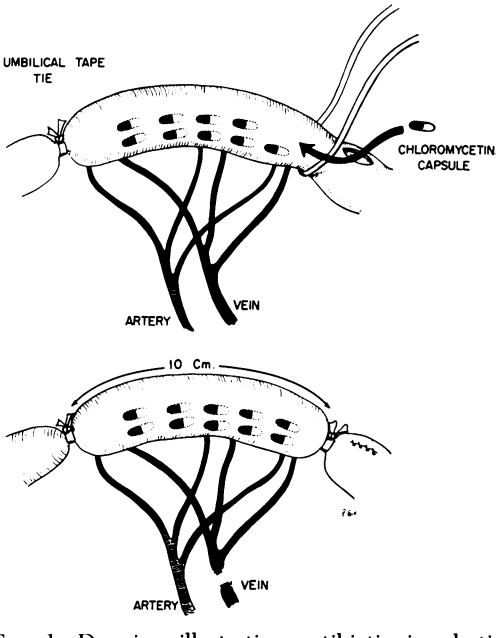

FIG. 1. Drawing illustrating antibiotic in plastic bag along with strangulated bowel.

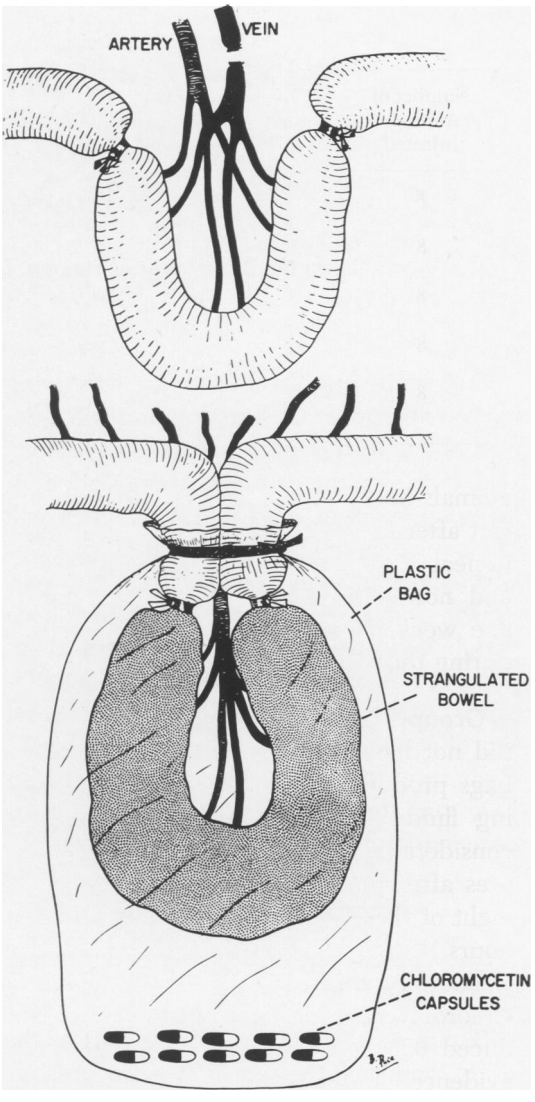

FIG. 2. Method by which antibiotic was introduced into the closed loop of strangulated bowel.

TABLE 1. *Results Following Injection of Strangulation Obstruction Fluid into the Peritoneal Cavities of Normal Dogs*

Number of Animals Injected	Dose of Strangulation Fluid	Category	Survivors
8	3 cc./Kg.	Chloromycetin placed inside the lumen of strangulated bowel of donor animals	8
8	3 cc./Kg.	Strangulation fluid of donor animal collected in plastic bag	0
8	3 cc./Kg.	Chloromycetin placed in plastic bag along with strangulated bowel of donor	8
8	3 cc./Kg.	Toxic strangulation obstruction fluid given to recipient animals	0
8	3 cc./Kg.	Chloromycetin acid succinate given along with toxic strangulation obstruction fluid	7

animals because they registered no discomfort after injection of the fluid into the peritoneal cavity. All eight dogs were alive and normal in appearance at the end of one week. None appeared ill at any time during this period of observation.

Group 2: The four donor animals which did not have Chloromycetin in the plastic bags produced 735 cc. of dark, foul smelling fluids. Recipient animals experienced considerable discomfort for about ten minutes after the intraperitoneal injection. All eight of these animals were dead within 16 hours.

The four animals which had 2,500 mg. of Chloromycetin in each plastic bag produced 628 cc. of dark, odorless fluid. No evidence of discomfort was registered by the eight recipient animals following injection of this fluid into the peritoneal cavity and they were all alive one week after having received the fluid.

Group 3: The eight donor animals were all dead within 28 hours. Each animal's peritoneal cavity yielded from 125 to 400 cc. of dark foul fluid. All eight animals which received an intraperitoneal injection of fluid were dead within 16 hours. Seven of the eight animals which were given Chloromycetin acid succinate along with the fluid were alive at the end of one week.

Discussion

Loss of electrolytes, blood and other body fluids contribute to the downhill course which is characteristic of individuals suffering from strangulation obstruction. Meticulous replacement of these materials does not eliminate the final fatal result.[5] The lumen of a closed loop of strangulated bowel is the site of accumulation of large amounts of dark, foul, toxic fluid. Loss of integrity of the bowel wall allows this material to gain access to the peritoneal cavity where it is rapidly absorbed. If the strangulated loop of gut is placed in a plastic bag so that exposure to the fluid is prevented, then the animal survives much longer.[2] The nature of the material responsible for the toxicity of strangulation obstruction fluid has long been debated.

Previous experiments have shown that it was possible to eliminate the toxic properties of the fluid by high speed centrifugation. When the speed of centrifugation was 700 RPM or less, the supernatant fluid remained toxic and the centrifugate was found to be nontoxic.[4] At speeds of 1,500 RPM toxic characteristics were assumed by the centrifugate while the supernatant fluid proved to be nonlethal.[3] Microscopic examination of the toxic centrifugate revealed myriads of bacterial cells of many varieties. The fact that it was possible to remove the toxic component of the fluid by centrifuga-

tion constitutes strong evidence against the lethal agents' being an exotoxin. The several different methods used to sterilize the centrifugate resulting from high speed centrifugate always rendered it nontoxic. All these findings point towards bacteria as being responsible for the toxicity of strangulation obstruction fluid.

This contention is further supported by the demonstration of the ability of Chloromycetin to prevent the formation of toxic peritoneal fluid when placed inside the lumen of strangulated bowel. Nontoxic fluid also resulted when Chloromycetin was placed in close contact with strangulated bowel but in an extra-luminal position. In addition to showing that Chloromycetin would prevent the development of toxic fluid, it was also demonstrated that this antibiotic would prevent death when administered to normal animals along with toxic fluid. The fact that antibiotics neutralize the effect of peritoneal fluid known to be lethal in amounts as small as 3 cc. per Kg. also supports the bacterial explanation for toxicity.

Conclusions

1. The peritoneal fluid which results from strangulation obstruction of the lower small intestine is toxic when injected into the peritoneal cavities of normal animals.

2. When placed inside the lumen of strangulated bowel, Chloromycetin will eliminate the toxicity of the resulting peritoneal fluid.

3. Nontoxic fluid results when Chloromycetin is placed in a plastic bag along with strangulated bowel.

4. The survival rate of normal animals is markedly improved by the simulatenous intraperitoneal administration of Chloromycetin along with toxic strangulation obstruction fluid.

5. These findings support the role of bacteria in the lethal issue of strangulation obstruction.

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