

more effective than Kantrex or Chloromycetin in neutralizing the lethal potential of gangrenous 10 cm. segments of ileum. The ability of an antibiotic to neutralize such segments appears directly related to the concentration achieved within the peritoneal cavity. Where other factors were constant, the intraperitoneal route of antibiotic administration gave best results. Neither dilution of the antibiotic solution in 100 cc. of saline nor delay of injection up to 4 hours after the onset of strangulation significantly affected the results. It is possible to neutralize the lethal characteristics of experimental gangrenous bowel segments up to 30 cm. in length for periods up to 28 hours by the intraperitoneal administration of Keffin.

#### DISCUSSION

DR. J. ENGLEBERT DUNPHY (San Francisco): I would like to say a word about this condition's direct applicability to patients. The very nature of Dr. Barnett's experiment does eliminate intestinal obstruction, which, of course, as we know, with a gangrenous loop in man is a very important feature of the ultimate demise of the patient.

I believe we can divide intestinal obstruction into three groups, speaking primarily of small bowel obstruction. In the early patient with mechanical obstruction there may be a vascular factor—we do not know. In this situation there is no answer except immediate, early operation. This should be undertaken in every patient.

The second group are those patients who come in after 4 or 5 days with obvious pure mechanical obstruction. A gangrenous segment would have been fatal in that period of time. In this group one can be quite relaxed and have ample time to prepare the patient for operation.

The in-between group manifests symptoms for 48 hours or thereabouts, which presents great difficulty in selecting the ideal time to operate. To me, one of the most challenging experiences of the clinical surgeon is to prudently delay operation sufficiently so that the patient may be reasonably conditioned, and at the same time to operate as quickly as possible in dealing with potential or actual gangrenous bowel. In this area Dr. Barnett's studies may give us some additional leeway.

#### References

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I do not believe that the particular antibiotic used in his experiments is necessarily acceptable as the best in man. The important point is: Wide spectrum antibiotics, intelligently used early, provide some time to prepare the critically ill patient for the definitive operation. In the end there is still only one way to treat intestinal obstruction, and that is to operate.

DR. RICHARD C. CLAY (Miami): One thing, I believe, that deserves attention in this regard is that not only evil humors, but vegetative bacteria may pass through the wall of gangrenous but unperforated bowel. Sometime recently I had the occasion—the misfortune, I guess I should say—to treat, however successfully, a case of tetanus resulting from organisms which passed through the wall of gangrenous but unperforated bowel. These organisms were recovered from the peritoneal fluid. Of course, the culture was delayed, and the patient was well on the way to recovery from obvious tetanus by the time the organism was identified.

This has led me to believe that when gangrenous bowel, or even appendix, is encountered the patient should be considered to have a wound of high risk for development of tetanus. The patient, if previously immunized, should receive a booster dose of toxoid, otherwise a dose of human antitoxin at this time.

As you all know, the presence of tetanus organisms in the intestines of a fairly large percent-

age of the population was originally called to the attention of the medical profession by Dr. Matas. He pointed out that among livery stable employees it was an almost universal finding; so I would like to point out that I think gangrenous bowel and gangrenous appendix should be an occasion for tetanus prophylaxis.

DR. WILLIAM O. BARNETT (Closing): We agree with Dr. Dunphy that intestinal obstruction can be treated operatively, and that is precisely why we have attempted to develop this approach.

We currently introduce a small polyethylene catheter into the abdomen of patients with intestinal obstruction during the preoperative period for antibiotic administration. Because it is impossible preoperatively to differentiate simple from strangulated obstruction in many instances, we are convinced that this practice is sound. With simple obstruction, intraperitoneal antibiotic may prevent development of gangrene. If strangulation has already occurred, then valuable time for thorough preoperative preparation can be gained with minimal production of toxic intraperitoneal bacterial products.