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DISCUSSION.—DR. HERBERT REID HAWTHORNE, Philadelphia, Pennsylvania: Dr. Cohn has contributed some excellent and careful studies on intestinal obstruction. As a result of this work he has definitely established the role that bacteria play in the cause of death in strangulation obstruction. When an anastomosis may appear somewhat unsafe as a result of edema, etc., in the proximal segment of the bowel, or in routine use, the introduction of antibiotics, according to his technic, should add a most useful safeguard. A local and direct application of the antibiotic to the area of anastomosis is a much safer route when compared to the possible toxic effects of large doses administered intravenously.

DR. WILLIAM A. ALTEMEIER, Cincinnati, Ohio: I think this paper has been very interesting. Undoubtedly many of you have heard previous papers or statements which indicated that the use of antibiotics preoperatively and cleansing of the intestinal tract preliminary to intestinal resections were of questionable value or of no value. In fact, numerous people have told me that they believed preoperative and postoperative antibiotic therapy were useless in the majority of intestinal resections. Possibly this is true; but the selection of the cases in which antibiotic therapy is going to be of definite prophylactic value is too difficult for me to determine with any degree of certainty.

It seems to me that the experiments we have just heard are indicative of the definite value of preoperative and postoperative antibiotic therapy in preventing septic or infectious thrombosis of the vessels within the wall of a "devascularized" segment of bowel. It would appear that the authors have devascularized only partially the blood supply of the bowel by dividing the vessels in its mesentery. As has been pointed out by Noer and others, there is a definite intramural circulation of the bowel itself, and this has remained intact in the authors' experiments.

We all know that the intestinal tract of animals and man has a profuse bacterial flora consisting of aerobes and anaerobes. We know, further, that some of the anaerobes produce enzymes of two types in particular, (1) necrotizing enzymes and (2) coagulating enzymes which can produce thrombosis of the neighboring vessels.

The real value of this experiment has been the demonstration that the bacterial growth within this segment of bowel is minimized to the point that thrombosis of the vessels within the wall is prevented by bacterial enzymes. I think this is a fascinating experiment, and should answer for all of us the question of whether or not pre- and postoperative antibiotic therapy is important. Thank you.

DR. ALFRED BLALOCK, Baltimore, Maryland: When I moved back to Baltimore in 1941 Dr. Poth was working in the surgical laboratories. He had rigged up a beautiful device by which he would place sulfaguanidine or some such agent in meatballs. The dogs would be fed throughout the 24-hour period without Dr. Poth having to lose too much sleep. The surgeons at first would not accept his findings, but I think they do now.

DR. EDGAR J. POTH, Galveston, Texas: I certainly appreciate this presentation by Drs. Rives and Cohn. I should like to make a few remarks with the aid of some slides.

In 1941 Dr. Sarnoff, who was then a senior medical student at Johns Hopkins, showed that sulfasuxidine would protect a 50 cm loop of distal ileum from necrosis after it had been made ischemic by ligation of the blood supply. The protection was demonstrated to be due to the prevention of thrombosis of the small caliber vessels in the wall of the bowel. I should like to support today's report with the following lantern slides.

(Slide) This first slide shows our test object in animals. A 10 cm segment of distal ileum is rendered ischemic by dividing the arteries and veins in the mesentery. The vascular supply to this segment was limited to intramural vessels entering at the two extremities of the segment. This ischemic segment was sectioned in its middle and then sutured. All control animals (dogs) died within 72 hours.

(Slide) This second slide shows the results of the administration of various antibacterial agents by either the parenteral or the oral route. I should like to acknowledge that these observations were made by Dr. Johnson, who is a member of our house staff. The next column shows the result of the parenteral administration of acromycin. There is a considerable degree of protection.

Next is the administration of neomycin, 1 per cent, injected into the bowel at the time of opera-

tion only. It carries some protection, but does not protect all the animals. The preoperative preparation of the bowel with sulfasuxidine protected 75 per cent of the animals. Large doses of penicillin and streptomycin parenterally protected all of the animals, but they were ill during the immediate postoperative period. The administration of neomycin at the time of operation and postoperatively resulted in 100 per cent survival without a stormy postoperative course. Preoperative, 20-hour preparation with neomycin and sulfathalidine protects all animals, and they experience practically no postoperative anorexia.

(Slide) This slide shows the important aspects of preparation before operation. The bacteria disappeared in about one and one-half hours after the first oral administration.

The preparation extends over a period of 20 hours. Only yeasts remain. The clamp was left on the colostomy (Miles Resection) for four days. On the seventh postoperative day no bacteria could be grown, which I think is important because during the period of healing, in this paralytic period postoperatively, no bacteria are present. With the use of the two antibacterial agents, neomycin and sulfathalidine, neither of which are absorbed from the gastro-intestinal tract, they remain in the bowel and continue to be effective throughout the healing period.

(Slide) These data represent the results on 102 consecutive patients who had primary resection and open anastomoses for carcinoma of the large bowel. Eighteen patients received mechanical cleansing only. There were two postoperative deaths. Temperature arose to 101° per rectum or higher at some time postoperatively in all of these patients. Wound infections of significant degree in 78 per cent. In 35 patients who had no mechanical cleansing except sulfasuxidine for seven days preoperatively, there were no deaths. Temperature rose to 101° in 54 per cent of the patients. The wound infections dropped to 5.7 per cent. Forty-nine patients received neomycin and sulfathalidine. There were no deaths. Thirty-five per cent of the patients had a temperature of 101° or more on at least one occasion postoperatively. There was a significant wound infection in only one patient.

DR. ISIDORE COHN, JR., New Orleans, Louisiana: I would like to thank the various discussers for their comments. I would like to express publicly my appreciation to Dr. Hawthorne, since it was through his interest and through the facilities which he made available to me that I first became interested in the problem of intestinal obstruction. The current work evolved from the work on intestinal obstruction, and also from comments which both Dr. Hawthorne and Dr. Rives made. They were both convinced that if one could mechanically cleanse a colon, it was not necessary to add antibiotics for preoperative preparation. Having been brought up in the antibiotic days, I was not entirely convinced.

Dr. Altemeier's comment regarding circulation in the wall of the bowel has been brought out in the body of our paper. I did not mention it because of the lack of time, but we realize that we only devascularized the extramural vascular supply of the bowel. However, we think we did a little bit more because the complete division of the bowel and then its reanastomosis dictated that the intramural blood supply could come from only one end of the colon.

We think this also plays some role in determining the length of the segment that can be devascularized in the colon in contrast to simple devascularization of the ileum or other parts of the small bowel without an anastomosis. In addition, we believe that the increased bacterial flora of the large bowel is another factor which limits the amount of colon that can be devascularized in contrast to the small bowel.

Dr. Altemeier's suggestion about the control of the bacterial enzymes in the postoperative period is exactly the point we want to emphasize. We believe that if one controls bacterial growth postoperatively, one thereby controls bacterial enzymes and preserves the viability of the bowel wall.

Dr. Poth's remarks about neomycin and sulfathalidine represent a running controversy which I have had the temerity to hold with him for some months. We have now studied the bacteriologic effects of about fifteen different antibacterial agents for preoperative bowel preparation. Neomycin and achromycin still remain the best combination of agents in our hands. Within the past month some of our studies with the combination of neomycin and sulfathalidine, as recommended by Dr. Poth, have given results very closely similar to those obtained with neomycin and achromycin. Thank you.