

## ENTEROANASTOMOSIS IN INTESTINAL OBSTRUCTION

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SO VOLUMINOUS is the literature upon the subject of intestinal obstruction that it is approached with much hesitancy. However, after a rather comprehensive review of the cases which have come under the attention of the writer during the past few years, certain observations have resulted which, while probably adding nothing new to the handling of this distressing condition, yet have not been sufficiently stressed to render their importance impressive.

By intestinal obstruction is meant a more or less complete blocking of the intestinal tract at any level between the duodenum and the anus. When the block is in the jejunum or upper ileum it is customary to designate the condition as "high obstruction," while the term "low obstruction" is employed when the lower ileum is involved. The latter term is also used when the obstruction is located in any portion of the large bowel.

Such a division is entirely arbitrary and of but little value except that it has been observed that high obstruction is usually more rapidly fatal than low obstruction. This has been explained because of a belief that the toxins developed in the intestine are more virulent in the higher portions. It is a demonstrated fact that any protein can primarily be split up into a very toxic and a non-toxic substance, and that these must be reduced to far simpler substances before being available for absorption, which, however, is not proof that the poison radical is ever absorbed as such.

That starvation is more rapid and complete in high obstruction than in low, is easily understood when we stop to refresh our memories concerning the normal physiological functions of the different intestinal levels.

Metabolism of carbohydrates begins through the catalytic action of ptyalin found in the saliva. This splits starch into maltose and glucose. This carbohydrate digestion begins in the mouth and is continued in the stomach until finally inhibited because of an excess of hydrochloric acid. It is again resumed in the small intestine through the action of the amylase of the pancreatic juice. Here the enzyme invertase converts cane sugar into lævulose and glucose. Fats are not digested appreciably until they have reached the duodenum, where the pancreatic juice and bile split them into fatty acids and glycerins. While the carbohydrates after proper preparation pass into the portal system, the fats are taken up into the lacteals of the intestinal villi and then into the thoracic duct, thus short-circuiting the liver. Proteins, which are essential constituents of all living tissue, are digested first in the stomach through the action of pepsin and hydrochloric acid. Here digestion progresses only to the peptone stage, after which it passes into the intestine. Here

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trypsin and the alkali content continue digestion until polypeptides and amino-acids result, in which form they can be utilized.

From this brief review it can be seen that but little food value can be obtained from either carbohydrate, fat or protein until these substances have passed a considerable distance along the course of the small intestine from which it can be deduced that starvation is more rapid and complete the higher the obstruction. Of at least equal importance is the function of the large intestine in maintaining a water balance through its power of absorbing water from its content. Any interference which causes complete loss of this function means rapid dehydration and death. We know that a comparatively small portion of large bowel can carry out this process satisfactorily, but a small amount of active large intestine is essential. Temporarily dehydration can be partially prevented by the subcutaneous and intravenous administration of fluids, but the water balance cannot be maintained in this manner indefinitely. That this matter is one of extreme importance can be shown by a review of certain cases, and the results obtained where this function has been maintained through the use of enteroanastomosis in preference to enterostomy.

In the presentation of the following cases only the briefest mention of essential points is made. Complete laboratory and clinical records are available, but a detailed report of each case would only be wearisome and add nothing to the conclusions deduced.

CASE No. 3481.—S. A., March 9, 1925, a hysterectomy had been performed because of a large fibroid jammed in the pelvis. The appendix was also removed. All raw surfaces were well peritonized. Vomiting persisted after operation and March 13 it was decided that intestinal obstruction had resulted. The old incision was opened. The small intestine was markedly distended and of a bluish color. It was adherent to the lower angle of the wound, which apparently was the cause of the obstruction. This was separated and an enterostomy performed above this point. Decided improvement was noted for three days, after which obstructive symptoms again recurred. March 18 a high enterostomy about six inches below Treitz's ligament was made. Again there was decided improvement. The pulse rate was lowered from twenty to thirty beats per minute and vomiting ceased. Flatus and fecal matter were passed by rectum. Improvement continued until the twenty-third when the enterostomy tube became loose, wound infection resulting. Rapidly the patient's condition became worse and death occurred upon the twenty-fifth, twelve days after the last enterostomy.

*Impression.*—In spite of the copious subcutaneous administration of saline and the intravenous injection of hypertonic salt, the patient became rapidly dehydrated and succumbed because of an infection which ordinarily would have been considered as slight.

CASE No. 2668.—Mrs. S. W. entered the Detroit Diagnostic Hospital suffering from intestinal obstruction of two days' duration. There had been no previous abdominal operation. Operation December 6, 1926, showed about 200 cubic centimetres of serous fluid in the abdominal cavity. The small bowel was distended, but not discolored. A Meckel's diverticulum, three-quarters inch in length, was encountered, but not disturbed as the obstruction was farther down near the ileocecal valve. At this point the small intestine was encircled by a small strip of omentum, which caused almost complete constriction. Cutting of this band relieved the obstruction, the small bowel immediately filling to the cæcum. In spite of the apparently favorable findings and the slight manipulation, the patient continued vomiting. December 8 low enterostomy was performed. This was followed by improvement lasting three days, after which obstructive

symptoms again developed. December 13 a high enterostomy was made. Vomiting ceased and improvement was marked until the enterostomy tubes loosened. Again wound infection resulted and December 21 the patient succumbed.

*Impressions.*—Again death resulted from a comparatively slight infection after the loosening of the enterostomy tubes, as well as the observation that low enterostomy is sometimes followed by a plastic peritonitis, which results in a second obstruction above the point of enterostomy. This observation has been mentioned by others and observed many other times by the writer.

CASE No. 193.—Mr. H. F. entered the hospital August 13, 1923, with signs of intestinal obstruction. There had been no previous operation. Upon opening the abdomen there was considerable free fluid and the small bowel was markedly dilated. There were several small hæmorrhagic areas in the bowel. The obstruction was evidently the result of adhesions resulting from a chronic appendix, which involved both intestine and omentum. These were separated and the appendix was removed. Vomiting continued and the obstructive signs were not relieved. August 19 a high enterostomy was performed, which disclosed a new obstruction resulting from the plastic peritonitis present. Death occurred suddenly a few hours later, the immediate cause probably being the aspiration of vomitus.

*Impression.*—This represents another case in which a second higher obstruction followed the plastic peritonitis resulting from the first.

CASE No. 11.—A. L. had previously been operated upon for the removal of an acute purulent appendix. April 26, 1923, he entered the hospital with symptoms of intestinal obstruction. Operation proved this to be true, the omentum being adherent to both intestine and parietal peritoneum so as to cause three distinct obstructive points in the terminal foot of ileum. Adhesions were freed and the omentum resected. Recovery, which was uneventful, was followed one month later by the recurrence of obstructive symptoms. These became more pronounced and then again complete. September 19 the abdomen was again opened, and it was found that the terminal three feet of small intestine were so matted that resection was thought advisable. The patient progressed favorably until September 23, when vomiting, which soon became fecal, recommenced. At this time an enterostomy above the point of resection was made. Improvement was again noted until the enterostomy tube was removed. This was followed by slight wound infection, which resulted in death October 13.

*Impression.*—An enteroanastomosis sidetracking the obstruction, performed at the first operation, would probably have resulted differently. A subsequent case will illustrate this point.

CASE No. 4013.—H. C. was relieved of an acute purulent appendix, October 13, 1928. Five days later, signs of obstruction developed. October 19 the wound was reopened and adhesions were observed, which had caused a twisting of the small intestine near the ileocecal valve, the bowel being markedly dilated above this point. The adhesions were separated and an enterostomy performed above the obstructive point. This was followed by the relief of symptoms for a period of three days after which they recurred. October 25, a high enterostomy was performed, which revealed a higher obstruction due to plastic peritonitis. The patient showed decided improvement and took nourishment well. After removal of the enterostomy tube he began to fail, and died November 1.

*Impressions.*—Here again is a case in which enterostomy was followed by a second higher obstruction due to plastic peritonitis. In spite of the use of hypodermoclysis and hypertonic saline, as well as numerous blood transfusions, the patient became much dehydrated and succumbed following slight wound infection.

CASE No. 1159.—M. G. had been operated upon December 30, 1924, because of an acute purulent appendicitis. January 20, 1925, she entered the Detroit Diagnostic Hospital because of intestinal obstruction. At this time adhesions were separated.

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March 25, 1925, the patient returned because of definite recurrent obstruction. The small bowel was obstructed as well as the transverse colon, which was involved in the adherent mass. Again the adhesions were separated and the omentum so placed and sutured as to aid in the prevention of recurrence. May 25, 1925, the patient re-entered the hospital with complete obstruction, which was located in the ileum one foot from the cæcum. At this time a lateral anastomosis was made between the ileum above the obstructed point and the mid-portion of the transverse colon. The patient left the hospital June 11, feeling much improved. July 7, 1925, she again entered the hospital because of obstruction. At this time it was found that the anastomosis was closed because of adhesions and a second anastomosis was made four inches proximal to the previous one. She left the hospital July 24 apparently relieved. November 16, 1925, symptoms of obstruction having recurred, adhesions between the abdominal wall, omentum and the anastomosis were separated.

February 4, 1926, obstruction recurred. The abdomen was opened and an anastomosis was made between the upper sigmoid and ileum, thus widely sidetracking the adherent mass. After this, symptoms were much improved, except for violent and almost continuous headaches. March 11, 1926, a resection of bowel beginning at the small intestine distal to the last anastomosis was made. This was performed in two stages, the first operation consisting in simply dividing the small intestine and inverting the end near the anastomosis, while the distal end of the small bowel was brought out through the wound. The second stage was accomplished April 15, 1926, when the free end of small intestine, the cæcum, ascending and transverse colon were removed. The patient was free from trouble until September 27, 1926, when vomiting recurred. In October this was again observed and at this time the patient insisted that the vomiting was associated with menstruation. Radiographs showed no obstruction.

January 22, 1929, definite obstructive signs recurred and the abdomen was opened once again. The small intestine was found adherent to the abdominal wall about two feet above the anastomosis. The lumen was almost obliterated and the bowel was torn in the attempt to free it. Resection of three inches and end-to-end anastomosis were done. At this time it was observed that the abdomen was remarkably free from adhesions. Since this time the patient has remained perfectly well and has gained many pounds in weight.

*Impressions.*—Clinically, this patient improved much more rapidly after entero-anastomosis than any case ever had after enterostomy. Convalescent dehydration was not observed, even though her primary condition was much worse than in cases where death had resulted after simple enterostomy.

CASE NO. 3379.—G. B. had been operated upon December 12, 1927, because of an acute retrocecal appendicitis. The appendix was ten inches long and very adherent. The wound had become infected. June 9, 1928, he suffered an attack of vomiting, which lasted two days. October 28, 1928, he entered the hospital after four days of vomiting, which had become fecal in character. On opening the abdomen free fluid was present and the small intestine was greatly distended and spotted with hæmorrhagic areas. An omental band was found which caused low intestinal occlusion. This was severed and an enterostomy made above the obstructed point. The condition of the patient improved gradually until November 20, when fecal vomiting again recurred. The abdomen was opened and a second obstruction found one foot above the enterostomy. Two feet of intestine were resected and an end-to-end anastomosis made. However, fecal vomiting continued and the patient became rapidly worse. November 23 a high right rectus incision was made and the small intestine above the previously obstructed point was anastomosed to the colon at the hepatic flexure. The opening was about two and one-half inches. Vomiting ceased and recovery progressed uneventfully. The patient has since claimed excellent health, although there is present a fascia separation, which requires the use of a belt.

*Impressions.*—This is probably the most advanced case of intestinal obstruction that I have ever seen recover, and it would seem that the enteroanastomosis and early reestablishment of water balance played an important part in the result.

CASE No. 2111.—E. P. had been operated upon for the removal of the appendix about two years previously. This operation had been performed in an eastern hospital and no record of the condition found was available. He entered the hospital April 2, 1926, because of intestinal obstruction of two days' duration. Operation disclosed adhesions between omentum and terminal ileum one inch from the ileocecal valve to be responsible. These were separated and the omentum resected. Recovery was stormy for three days, then uneventful.

December 21, 1928, the patient again entered the hospital because of intestinal obstruction. The small intestine was found to be glued into an obstructive mass for a distance of six inches from the ileocecal valve. The adhesions were separated, leaving much raw surface on the intestine. Fearing a rapid recurrence, an ileocecostomy was performed, sidetracking the denuded area. Recovery was uneventful, and the patient has remained well since.

The above case is representative of two similar ones in which similar results were obtained.

CASE No. 4365.—M. R. had been operated upon April 22, 1929, for the removal of a large impacted fibroid. In September of the same year she was seen because of a partial intestinal obstruction, which relieved itself. Symptoms, however, recurred and October 12, 1929, the abdomen was opened because of complete obstruction. A considerable portion of small intestine was adherent in the pelvis. While attempting to free these adhesions the intestine was badly torn. The tear was closed with a double layer of sutures and a lateral anastomosis made between small intestine at a point above the obstruction and the transverse colon. The patient showed rapid improvement, but still suffered from recurring attacks of abdominal pain and vomiting. December 19 the second stage of the operation was performed. This consisted in the removal of the small intestine from the point of anastomosis to the cæcum, which was adherent in the pelvis. This portion was nine feet long and many obstructive points were encountered forming dilated bowel areas filled with fecal matter and pus. So adherent and friable was the bowel that its lumen was opened three times during the dissection. The end of the small bowel near the anastomosis was inverted, while a short portion left to the cæcum was attached to the lower angle of the wound, the patient's condition making inadvisable the removal of the useless portion of large intestine at that time.

Parenthetically, resulting observations have been of interest. As long as the patient was confined to bed all bowel movements occurred normally, even though radiographic examination showed a filling of the inactive portion of the large intestine after a barium meal. However, as soon as the patient assumed an upright position and began to walk, gravity played a more important part, and fecal matter was occasionally discharged through the cecal fistula.

Another interesting observation was that the shortening of the small intestine has so interfered with the digestion of some foods that they always appear in recognizable form when eaten. Other foods are completely digested, thus showing that digestion of certain foods occurs simultaneously with absorption of others at certain intestinal levels. Further observations are contemplated.

At present this patient is in excellent health, eating well of a regulated diet and having gained many pounds.

CASE No. 1319.—M. L. This case is mentioned simply because it is one of several and represents a type. The only unusual thing about the case is the patient's age, which was eighty-three when she was first seen, with complete obstruction of two days' duration, due to a carcinoma at the junction of the rectum and sigmoid. Colostomy was performed six inches above the tumor. The patient lived five years in comfort, dying but a week ago from a coronary thrombosis.

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The mortality rate in cases of intestinal obstruction treated by enterostomy has been approximately 40 per cent. In contra-distinction to this our records show six cases of low small intestinal obstruction treated by enteroanastomosis without a fatality, many of which were much further advanced than some which proved fatal after treatment by enterostomy.

In conclusion, I would state that the factor of water balance is of decided importance. Subcutaneous and intravenous administration of fluids aids decidedly and the use of hypertonic saline is of extreme value; yet, in spite of all these aids, dehydration eventually occurs unless the physiological action of the large bowel is re-instated.

By preference we now treat high obstruction, which is rare, by means of enterostomy and relief of the obstruction, the enterostomy being closed at the first manifest improvement in the patient's condition.

Low obstruction, including the transverse colon, is preferably handled by sidetracking the obstruction through enteroanastomosis, subsequent resection being done when indicated, and obstruction below this point is best cared for by means of colostomy.

DISCUSSION: DR. THOMAS G. ORR, of Kansas City, Mo., remarked as to the poor results obtained by simple high enterostomy, that it is a fairly well-known fact that in experimental animals, if the upper jejunum is drained death results in a few days. He had run a series of experiments in animals doing a simple jejunostomy and in a second series obstructing the gut and doing a jejunostomy as a part of the treatment. The animals died much more quickly with a simple jejunostomy than they did if they obstructed and waited for a few days before doing the jejunostomy. In other words, he thought with a jejunostomy the animals died much quicker than with the simple obstruction.

The cause of death in intestinal obstruction is still undecided. He was very suspicious, however, that the loss of the upper intestinal tract secretions is much more important than the question of any absorption of toxin from the obstructed gut.

While the administration of sodium chloride and water will unquestionably prolong life in intestinal obstruction, there is another element in the disease which is not replaced by this treatment. The loss of other secretions into the gut above, especially the pancreatic secretions, appear to be important. Jejunostomy should be used with a good deal of care, because of this particular danger. Professor Wilkie discussed this last year and showed very definitely that by draining the upper jejunum into the gut below that he was able to save patients.

Dr. Rader of Omaha has treated a number of patients in which he anastomosed the ileum to the sigmoid with success, thereby avoiding the extensive external drainage of the upper intestine. Loss of upper gut secretions is very intimately bound up with the question of the cause of death, and deserves considerable study. I believe that too much emphasis has been placed upon jejunostomy as a treatment in acute intestinal obstruction.