Two Cases of Resection of the Cæcum for Carcinoma.

WITH REMARKS ON INTESTINAL ANASTOMOSIS IN THE ILEO-CÆCAL REGION.

BY
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ATTENDING SURGEON MILWAUKEE HOSPITAL; PROFESSOR OF THE PRINCIPLES OF SURGERY AND SURGICAL PATHOLOGY IN RUSH MEDICAL COLLEGE, CHICAGO, ILLINOIS.

Read in the Section of Surgery and Anatomy at the Forty-first Annual Meeting of the American Medical Association, held in Nashville, Tenn., May 21, 1890.

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TWO CASES OF RESECTION OF THE CÆCUM FOR CARCINOMA; WITH REMARKS ON INTESTINAL ANASTOMOSIS IN THE ILEO-CÆCAL REGION.

The two cases reported in this paper are intended to serve as a contribution to the as yet scanty literature of resection of the cæcum. In complete excision of the cæcum the section on the proximal side of the portion to be removed necessarily falls through the ileum near its junction with the cæcum, while on the distal side the ascending colon is divided transversely, which, after the removal of the cæcum, makes it necessary to unite two bowel ends of unequal lumina if an attempt is made to restore the continuity of the intestinal canal by circular suturing. As the resected end of the colon is at least three times larger than the ileac end, circular suturing is impossible without resorting to some device by which the two lumina are made more nearly alike in size. Two methods have been suggested to accomplish this object: 1. The excision of a V-shaped piece from the distal end, the base of the portion to be removed being sufficiently wide, so that after bringing the two margins of the triangular wound in apposition by two rows of sutures, the colon should corre-

spond in size with the ileac end. Against this procedure it can be urged that it requires additional time in making the resection, and necessitates a large number of sutures which are always a source of danger, at the same time there is considerable danger from gangrene at the junction of the circular line of suturing with the line of sutures made parallel to the gut in closing the triangular wound. 2. Oblique resection of the ileum, the lumen being increased at the expense of a part of the convex portion of the bowel. This is the method which Billroth followed in a number of cases. If the section of the bowel is made sufficiently oblique so that the lumen shall correspond in size with that of the distal end, it must be apparent that after the ends have been united by sutures the insertion of the ileum into the colon is at an acute angle, the apex of the angle being directed downwards and the base in an upward direction, a condition which is invariably attended by the formation of a long spur between the lumina of the united intestines. The combined influence of the obliquity of the terminal end of the ileum to the colon, and the presence of a spur between it and the colon results in intestinal obstruction at this point. Experience has demonstrated that the fear of causing a serious and often a fatal obstruction by this method of operating is not unfounded. Billroth lost several cases from this cause, and has abandoned the operation as impracticable and dangerous. There are at present only two procedures which can be employed with safety in uniting bowel ends of unequal lumina after enterectomy: 1. Lateral implantation. 2. Lateral apposition by means of absorbable perforated approximation plates. Billroth now resorts to the former method, and with its adoption the re-

sults after excision of the cæcum have improved. If the continuity of the bowel after excision of the cæcum is restored by lateral implantation, the end of the colon is closed by invagination, and a few superficial sutures to prevent disinvagination, and the ileac end is implanted into a slit in the colon, at a point opposite to the mesocolon and about two inches from the closed end. The slit in the colon should correspond in size with the circumference of the ileac end to be implanted. The fixation of the ileum by Czerny-Lembert sutures is a time-consuming and unsafe procedure. Some time ago I devised a method of implantation in such cases which requires in its execution only one-fourth the time consumed in suturing, and the results obtained by it were far more satisfactory. The method consists in lining the ileac end to be implanted with a narrow flexible rubber ring, which is retained in place by a continued catgut suture, embracing the free margin of the bowel and the lower margin of the rubber ring. The ring itself is simply a narrow rubber band, the length of which corresponds with the size of the lumen of the bowel, and which is converted into a ring by fastening the ends together with two catgut sutures. The implantation is made by two catgut sutures, threaded each by two needles and passed at opposite points from within outwards through the upper margin of the ring and the entire thickness of the bowel, while on the opposite side the needles are only passed through the serous and muscular coats of the colon. After both sutures are in place gentle traction upon all the four ends invaginates the end of the ileum into the incision in the colon, and the colon is drawn well over the end of the ileum to the points where the needles emerged from the

ileum. When in proper position, the serous surfaces of the colon and ileum corresponding in extent to the width of the rubber ring are in accurate coaptation, after the two sutures are tied. In my experiments on animals it was found necessary only in exceptional cases to apply one or two additional superficial coaptation sutures. The rubber ring keeps the lumen of the ileum patent for the ready escape of intestinal contents into the colon, at the same time the gentle elastic pressure which it exerts upon the parts around it, is an important element in securing accurate apposition between the coaptated serous surfaces. The implantation sutures can usually be relied upon in maintaining the invagination until adhesions have taken place, but in operations upon the human being it would be well to reinforce them by a number of Lembert sutures after the bowel has been fixed in its place by tying of the invagination sutures. Of the numerous experiments on dogs in which I practiced this method of implantation, I will only cite one in illustration of what has been said concerning the ease of execution and safety of this operation.

"Dog, weight 35 pounds. Ileum divided twelve inches above ileo-cæcal region, distal end closed by invagination and three stitches of the continued suture, and the proximal end lined with flexible rubber ring was implanted into an incision in the transverse colon, and retained by two catgut invagination sutures. An omental flap an inch and a half in width was placed over the junction of the two intestines, and fixed in its place by two catgut sutures. No unfavorable symptoms after the operation. Animal when killed eighteen days later, was in excellent condition. Omentum adherent to abdominal wound, which was firmly united. Omental flap adherent

all around. Colon above new opening ten inches in length, completely empty, contracted and atrophic. New opening oval in outline, and as large as the lumen of the ileum."

In this, as well as in a number of other cases, the line of junction between the ileum and colon was covered with an omental flap, and without exception the flap was found adherent throughout, constituting a living bridge between the united intestines joined together. In a number of cases I found at the necropsy the ileum projecting slightly into the lumen of the colon, presenting around the new opening a circular ridge of mucous membrane, which in structure, and probably also in function, represented almost to perfection the normal ileo-cæcal valve. Lateral implantation of the ileum into the colon after excision of the cæcum is a speedy and comparatively safe procedure, and yields excellent functional results, but continuity of the intestinal canal under similar circumstances can be restored by a still more simple and efficient operation, viz: ileo-colostomy by approximation plates of decalcified bone. In this operation the tissues are not damaged by extensive suturing, while, on the other hand, large serous surfaces which it is intended to unite are brought together, and are kept in uninterrupted accurate contact by the absorbable bone-clamp until firm adhesions have formed. The cases here reported are of interest, because in both of them after excision of the carcinomatous cæcum the continuity of the intestinal canal was successfully restored by this method.

Case 1.—Carcinoma of cæcum; excision of cæcum and eighteen inches of ileum with corresponding portion of mesentery. Restoration of continuity of intestinal canal by ileo-colostomy with decalcified perforated bone plates. Recovery.

The patient was a spare man of medium height, 37 years of age, and a farmer by occupation, who came to consult me by the advice of his family physician, Dr. Minnahan, of Cato. The patient is unaware of the existence of any hereditary taint or predisposition to tuberculosis or malignant disease in his family. His health was excellent prior to August 16, 1887. On that day he was taken suddenly ill with an attack of vomiting, without any obvious cause, which lasted for six hours. The patient insists that towards the last he vomited fæcal matter. He recovered rapidly and remained in comparatively good health until the following October, when he suffered from a similar attack of four hours duration. This time he experienced a sharp pain in the ileo-cæcal region, and soon after felt a distinct swelling in that locality. From this time on until March, 1889, the pain recurred periodically, the intervals becoming shorter and shorter until pain became almost continuous with few and only slight remissions. During this time he suffered also a great deal from flatulence, the bowels were inclined to be loose, but the general health was not much impaired. Since March, 1889, diarrhœa became a prominent symptom, the stools being liquid, but showing no trace of blood or mucus. Pain increasing in severity and more constant, and always partially relieved by the free passage of gas per rectum. At the time he was admitted to the Milwaukee Hospital, October 9, 1889, he had lost 45 pounds in weight. Examination at this time revealed the existence

of a hard nodulated fixed tumor in the ileo cæcal region, and tympanites in the hypogastric and umbilical regions. Distension of the colon by rectal insufflation of hydrogen gas made the tumor more prominent, showing that its location was intra- and not extra-peritoneal. Not much tenderness on pressure. Digital exploration of rectum yielded a negative result. Marasmus and anæmia well marked. For the last seven months the patient has had from four to six liquid discharges from the bowels. Appetite impaired. Temperature normal, pulse from 80 to 90 per minute. From the history of the case, and especially from the character and location of the tumor, a positive diagnosis of carcinoma of the cæcum was made. As the ordinary medical treatment which had been pursued for months afforded but little relief, the consent of the patient and his friends to an operation was readily obtained. Laparotomy was performed on the day of his admission, October 9, 1889. Before chloroform was administered $\frac{1}{6}$ of a grain of morphine with $\frac{1}{200}$ of a grain of atropia were given subcutaneously. The strictest antiseptic precautions were carried out before and during the operation. The abdomen was opened by an incision extending from near the middle of Poupart's ligament to a point half way between the anterior superior spinous process of the ileum and the umbilicus. As soon as the peritoneum was opened the tumor came into view. It was now seen that the tumor involved the entire circumference of the cæcum, and its immobility suggested that it was intimately connected with the retro-peritoneal tissues. The ileum and colon were emptied by displacing their contents, and each part was entrusted to an assistant, who was instructed to prevent fæcal extravasation by

making digital compression until the completion of the anastomosis. The colon was divided about two inches below the margin of the tumor and the ileum near its junction with the cæcum; both sections showed that the incisions were made through healthy tissue. The bleeding vessels were tied with fine silk ligatures. Several large glands were found in the retro-peritoneal space behind the cæcum, and were enucleated in one large mass with the cæcum and a portion of the peritoneum which was adherent to the glands. After the removal of the cæcum, it was noticed that the mesentery of the lower portion of the ileum contained several enlarged glands, consequently it was removed with about eighteen inches of the ileum. The mesentery was tied in a number of small sections with fine silk ligatures before it was excised. During the whole operation a small compress was kept in the abdominal cavity to prevent prolapse of the small intestines, and to guard the peritoneal cavity against infection in case fæcal extravasation should occur. After all hæmorrhage had been carefully arrested both resected ends were closed by invagination and a few stitches of the continued suture, the first stitch was made to transfix the mesentery at the point where it was invaginated into the bowel. Medium sized perforated decalcified bone plates were used in making the ileo-colostomy by lateral approximation. An incision about two inches in length was made near the closed ends of both intestines at a point opposite the mesenteric attachment, and into each opening a bone plate was inserted, and the lateral sutures, armed with a needle, were passed about an eighth of an inch from the margin of the wound at a point half way between the angles of the intestinal wound. The surfaces of

the bowel corresponding to the part covering the plates were freely scarified with an ordinary sewing needle. The visceral wounds were now brought *vis a vis* in such a manner that both closed ends were directed downwards, bringing in this manner the free surface of the colon and ileum together. Before any of the plate sutures were tied a number of Lembert sutures were applied posteriorly, sufficiently far back so that after the approximation they should be just beyond the borders of the plates, thus affording additional security in maintaining coaptation. The posterior pair of transfixion sutures was now tied, after which both pairs of the sutures not armed with needles were tied. During the tying of these sutures it is of the greatest importance that an assistant should keep the plates accurately and closely pressed together. The last sutures to be tied were the second pair of fixation sutures, and as this was being done the bowel on each side was carefully pushed in between the plates with a probe. The sutures were tied in a square knot and only with sufficient firmness to bring the parts in apposition, as any undue pressure would have been detrimental, and might have resulted in gangrene of the tissues included between the plates. The sutures were cut short and the ends brought as near the opening as possible by pushing them in this direction with a probe. After all the approximation sutures were tied, it only remained to apply on the upper side a few Lembert sutures in the same manner as was done on the opposite side before any of the approximation sutures were tied. After the exposed parts were disinfected and dried, the bowel was returned into the abdominal cavity and anchored near the wound with a silk suture, which was made to embrace the parietal peri-

toneum and mesentery at a point opposite the anastomotic opening. The wound was closed with two rows of sutures, the first including only the peritoneum. No drainage. The subsequent history of the case was uneventful. The highest temperature was registered on the third day, when it reached 101.6° F., but returned to normal on the fourth day. During the first two days liquid food was administered by rectum. After this time the patient was allowed milk, beef tea and raw eggs, and after another week he was placed on the ordinary hospital diet which he relished greatly. The bowels moved from one to three times daily, the passages becoming gradually normal in color and consistence. The wound healed by primary union with the exception of a small place where a small parietal abscess formed at the end of the first week. On the ninth day half of the plate in the colon passed per rectum, and the following day the remaining half with the plate from the ileum with the sutures attached, was found in one of the stools. The patient left his bed on the twenty-eighth day after the operation, and three days later he returned to his home in the northern part of Wisconsin. At the time he left the hospital nothing abnormal could be felt in the right iliac region ; no pain and no tenderness on pressure. He gained rapidly in flesh and strength, and when I saw him again during the latter part of January, 1890, he weighed nearly as much as before he was taken sick. Since the operation he has had no pain, no diarrhœa, and the discharges from the bowels once or twice a day were normal in every respect. At this time, however, I was able to detect a small hard nodulated tumor behind the colon at a point above where the ileum had been attached to the colon, which I regarded as

a recurrence of the disease along the chain of lymphatics behind the peritoneum, but no evidence of a return of the carcinoma in the bowel. The specimen removed represents the entire cæcum, a number of retroperitoneal glands, eighteen inches of the ileum with the mesentery attached to it. The carcinoma had evidently started in the ileo-cæcal valve and involved the entire circumference of the cæcum, the walls of which had become greatly thickened by the infiltration. The lumen of the ileo-cæcal opening was not larger than an ordinary lead pencil, and the interior of the cæcum near the ileo-cæcal valve presented a number of deep excavations resulting from the breaking down of the carcinomatous mass. The walls of the ileum for some distance above the cæcum were greatly thickened, and as examination showed the thickening was due to the formation of new muscular fibres, the thickening must be regarded in the light of a compensatory muscular hypertrophy which occurred in consequence of the chronic obstruction at the ileo-cæcal opening. At a point corresponding to the meso-cæcum the carcinoma had reached the outer surface of the bowel, and from here undoubtedly the extension of the disease to the retro-peritoneal lymphatic glands had taken place. Stained sections of the tumor under the microscope showed that the growth was a cylindrical celled carcinoma.

Remarks.—It is interesting to note in this case that, although the carcinoma started in a place where even a slight narrowing may give rise to obstruction, the patient suffered for more than half a year from diarrhœa, which is often one of the most important clinical evidences of the existence of a chronic obstruction, especially when located below the ileo-cæcal valve. The obstruc-

tion increases the functional activity of the bowel for some considerable distance above it, and the increased secretion is forced almost as soon as it appears in the bowel, through the narrow opening beyond the seat of obstruction, on account of the increased muscular activity of the hypertrophic portion of the bowel. Chronic obstruction is followed by symptoms of acute strangulation where one of two things happens: 1. If a solid body becomes impacted in the narrowed lumen of the bowel the obstruction becomes at once complete, and the symptoms then rather point to the existence of conditions which are known to give rise to acute obstruction than to a chronic cause.

2. If from any local or general causes the compensatory hypertrophy of the bowel on the proximal side of the obstruction is rendered inadequate, the bowel becomes dilated, and finally completely incapacitated from performing its function, and the clinical picture of chronic obstruction is supplanted by symptoms of acute obstruction. From the history of the case it is evident that the carcinoma commenced more than two years ago, and was the cause of the periodical pain and diarrhœa, both of which symptoms gradually becoming more severe and persistent as the stenosis increased. Cylindrical celled carcinoma of the large intestine, like the squamous epithelioma of the lip, is slow in its growth, and, as a rule, is followed by glandular infiltration at a late date. We have every reason to believe, that had a radical operation been performed in this case before the disease extended beyond the limits of the bowel, the prospect of a permanent cure would have been good. The recurrence of the disease in the retro-peritoneal lymphatic glands four months after the operation only shows the difficulty of eradicating the disease

after lymphatic infection has occurred. The new opening between the ileum and colon must have been adequate, as the normal fæcal circulation was restored almost immediately after the operation, and has remained so to the present time. Although a fatal termination from recurrence of the disease in the retro-peritoneal space is inevitable, the results of the operation must be regarded as highly satisfactory. All has been accomplished by the operation that can be expected under these circumstances, removal of the cause of obstruction without recurrence of the disease in the bowel, and perfect restoration of the continuity, and function of the intestinal canal after such extensive resection.

Case 2.—Carcinoma of ileo-cæcal valve with invagination; Resection of cæcum with portion of colon; Restoration of continuity of intestinal canal by ileo-colostomy with absorbable perforated bone plates; Death six days after operation from peritonitis caused by deep ulcers of excluded portion of colon.

This patient was a corpulent married woman, 53 years of age, who was placed under my care at the Milwaukee Hospital, November 14, 1889, by her physician, Dr. L. Reinhard, of this city. She is the mother of eleven children, and had always been in robust health until a year before she was admitted into the hospital. No history of tumors in any member of the family. Her present illness dates back one year, when she was seized by an attack of vomiting without any apparent cause, as even then she was able to take food without causing any discomfort. The vomiting was not attended by nausea, and subsided after a few days without any special treatment. A month later a similar attack recurred, followed again by apparent complete recovery.

During the next six months she suffered from six similar attacks at intervals of one month; each attack lasting for a few days, between them the patient considered herself well. The intervals then became gradually shorter, at first every two weeks, then every week, and finally every second or third day. During all this time she never suffered from constipation, the stools being normal in frequency and character. During the last ten months she has lost forty pounds in weight, and the complexion of the face, which formerly was ruddy, has now become pale and yellow. A tumor was discovered five weeks ago in the umbilical region by her attending physician. At that time she suffered a great deal from pain and vomiting, both of which were relieved by a brisk cathartic. From this time on the bowels moved several times a day, the discharge being liquid, but contained at no time either mucus or blood. A number of physicians who examined the patient since the tumor was discovered in the umbilical region, made a diagnosis of carcinoma of the stomach, and gave it as their opinion, that the tumor involved the great curvature of this organ. Pain and vomiting have been the most prominent symptoms for a number of weeks, and were only partly relieved by subcutaneous injections of large doses of morphia. Although the patient felt more distressed after eating, the vomiting occurred at irregular intervals, and was not always brought on by taking food. A careful examination made the day before operation revealed the presence of a firm movable tumor, somewhat elongated in shape, and about the size of a medium sized orange, a little above and to the right of the umbilicus. The tumor could be easily pushed under the costal arch on both sides, and in a

downward direction on the right side nearly as far as the iliac region, but not quite as far to the left side. The mobility was less in a lateral direction. The patient was much emaciated and presented an anæmic, almost cachectic appearance. It was almost the unanimous opinion of those who examined the patient at this time, that the tumor, carcinomatous in character, was located in the large curvature of the stomach, but the possibility of carcinoma of the transverse colon was not excluded. The great mobility of the tumor induced me, at the urgent request of the patient and her husband, to make an attempt to remove it in either event. The operation was performed November 14, 1889. Immediately before the operation the stomach was washed out with a warm saturated aqueous solution of salicylic acid, and, at the same time, morphia and atropia were given subcutaneously. Chloroform was used as an anæsthetic. The abdomen was opened by an incision through the median line, extending from near the ensiform cartilage to the umbilicus. Manual exploration revealed the stomach in a healthy condition, and after careful examination it was ascertained that the tumor consisted of the structures of the ileocæcal region which had become invaginated as far as the middle of the transverse colon. The incision was now enlarged in a downward direction for the purpose of securing more easy access to the seat of invagination. Moderate traction upon the bowel below the apex of the intussusceptum and above the neck of the intussuscipiens had no effect in reducing the invagination. I now grasped the invaginated portion with both of my hands, and made firm compression for a few minutes was made for the purpose of diminishing the swelling by squeezing

out the blood and œdema fluid, and thus facilitating the subsequent steps in effecting the invagination. The neck of the intussuscipiens was dilated by inserting the tip of the index finger at different points. Traction was then again made as before, and reduction was accomplished, not, however, without making a number of longitudinal lacerations in the peritoneal covering of the intussuscipiens, the rents extending from its neck in an upward direction for two or three inches. The invaginated portion was eight inches in length, and was composed of the entire cæcum, a portion of the ascending colon and a small part of the ileum. An examination of the surface of the intussusceptum, showed that the obstacles to reduction were numerous adhesions between the apposed serous surfaces of the intussusceptum and intussuscipiens, which were forcibly separated during the disinvagination. On submitting the cæcum to a careful examination, it was evident that its interior was occupied by a tumor which appeared to involve the ileo-cæcal opening. The cæcum was therefore opened by a longitudinal incision, and examination of its interior by inspection and digital exploration revealed an ulcerating carcinoma, which occupied the entire ileo-cæcal valve, and had infiltrated a considerable portion of the cæcum. A similar incision was made into the ileum near its insertion into the cæcum, and digital examination through this opening proved that the carcinoma had diminished the size of the ileo-cæcal opening to the diameter of an ordinary lead pencil. Retroperitoneal and mesenteric glands normal. As the invaginated portion of the colon had been considerably damaged during the reduction of the invagination, it was decided to remove it with

the carcinomatous cæcum. Fæcal extravasation was prevented in the same manner as in the preceding case by digital compression of the intestine beyond the line of section. The meso-colon and meso cæcum were ligated in small sections with fine silk before the parts were excised. The ileum was divided about three inches above its insertion into the cæcum, and the colon about eight inches below the ileo-cæcal valve. Both resected ends were turned inwards about an inch, and the invagination maintained by a few stitches of the continued suture, which embraced only the serous and muscular coats, and one of them also the invaginated mesentery. The continuity of the bowel was restored by an ileo-colostomy with decalcified perforated bone plates in the same manner as in the first case, only that in this instance the incision into the colon was made about six inches from its closed end, as the part below this, which had been the intussuscipiens, could not be trusted in doing its share of the work in establishing the intestinal anastomosis, on account of the pathological conditions which were produced during the time the invagination existed. The peritoneal lacerations which were made during the reduction of the invagination were closed with a few superficial sutures. Scarification of the serous surfaces which were to be included by the plates was done before the approximation sutures were tied, and a number of superficial sutures were applied outside the borders of the plates to aid these in maintaining apposition between a maximum area of serous surfaces. Through the mesentery of the closed resected ends, a suture was passed which was brought out through a button-hole made for drainage in the right iliac fossa, and after the intestine was dropped into the abdominal cavity

the approximated portion was drawn into proper position in the ileo-cæcal region by making traction on the suture, and was anchored in this locality by tying the suture over a small roll of iodoform gauze. A rubber drain was inserted through the button-hole, and the abdominal incision closed in the usual manner by two rows of sutures. External dressing was composed of a compress of iodoform gauze, and a thick layer of absorbent cotton, which was retained by wide strips of rubber plaster encircling two-thirds of the circumference of the body. Duration of the operation an hour and a half. The patient reacted well from the immediate effects of the operation, and no untoward symptoms appeared until the end of the third day, when unmistakable symptoms of septic peritonitis developed suddenly, which rapidly increased in intensity as the inflammation became more diffuse. The dressings were now removed and through the drainage opening pus was sought for, but no fluid could be found. Castor oil was given which procured free evacuation. The peritonitis proved fatal on the third day, six days after operation.

Post-mortem four hours after death. Abdominal incision united throughout. Omentum displaced towards the right iliac region and adherent to intestines. Separation of the omental adhesions liberated about half a pint of serosanguinolent fluid from the right iliac region. A fibrino plastic peritonitis which had evidently started near the site of operation was found to have become diffused from here over the lower portion of the peritoneal cavity, being especially well-marked in the right iliac region. Breaking down the adhesions the closed end of the colon was found turned in an upward direction, while the seat of approximation occupied the ileo-

cæcal region. At a point corresponding to the cut surface of the meso-colon a disintegrated softened blood clot was found. After removing the coaptated parts with adjacent portion of the colon and ileum, the serous surfaces, which had been included between the plates, were found firmly adherent throughout, and the superficial sutures completely buried underneath a layer of plastic exudation. On connecting the ileum with a hydrant a large stream of water escaped from the gut end of the colon, showing that the new opening was fully established. On closing the open end of the colon the bowel was forcibly distended without causing any leakage, a positive proof that union between the coaptated surfaces was perfect. The remnants of the plates came away by the irrigation to which the specimen was submitted, the one from the ileum was much softened, while in that from the colon about three quarters of the margin of the perforation was still intact. On slitting the bowel open on each side, where the plates had been, the anastomotic communication could be seen from each side as an oval opening with smooth margins lined with mucous membrane through which the thumb could be readily inserted as far as the first point. The approximation sutures remained attached by one of the marginal threads. The most interesting condition was found in the excluded portion of the colon, that is, in that part below the anastomotic opening which formerly had been the intussuscipiens. An old circular ulcer about a quarter of an inch in diameter with abrupt indented margins was found at a point which corresponded to the space between the two layers of peritoneum of the meso-colon. The ulcer had nearly perforated, and the peritoneum covering it was of an ashy-gray color, showing that it

was on the verge of necrosis; this point corresponded to the location of the softened blood clot from where evidently the peritonitis had taken its origin. There can be but little doubt that infection occurred from the ulcer through the necrosed peritoneum, where it was communicated to the blood clot, and from there to the peritoneum. Another ulcer somewhat smaller in size, was found about an inch higher up in the bowel and at a point opposite to the attachment of the meso-colon.

Remarks.—In this case the carcinoma, of the same tissue type as in the preceding case, developed in the region of the ileo-cæcal valve, where it infiltrated the entire circumference of the ileo-cæcal opening, thus giving rise to early stenosis and remote symptoms of intestinal obstruction. As the tumor in the umbilical region was only discovered five weeks prior to the operation, it is somewhat uncertain at what time invagination occurred. The great thickening of the wall of both the intussceptum and the intussuscipiens, the great vascularity and especially the numerous firm adhesions, would rather indicate that the invagination had existed for a long time, perhaps six months or a year. Chronic invagination can exist for a long time without becoming an immediate source of danger. Pohl has described an interesting specimen of chronic invagination taken from a man 62 years of age, who suffered from two attacks of intestinal obstruction eleven years apart. The second attack proved fatal after an illness of eleven days' duration. The post-mortem appearances indicated that the invagination which was found had existed for eleven years, and that the second attack was due to an aggravation of the mechanical difficulties at the seat of invagination, which had given rise to ulcerative

inflammation of the mucous membrane lining the intussusceptum, perforation and suppurative peritonitis. The invagination was located in the lower portion of the ileum. The intussuscipiens was 30 ctm. in length, its muscular coat hypertrophic, mucous membrane thickened and very vascular, and some of its folds adherent to the enclosed intestine; on the posterior wall near the mesenteric attachment two perforations were found. The mucous membrane of the intussusceptum was extensively ulcerated; old and firm adhesions at the neck of the intussuscipiens. The mesentery of the ileum, throughout, but especially at the seat of invagination, was much thickened. The ileum above obstruction dilated and its walls thickened. The ileum for some distance in my case was slightly dilated and its walls hypertrophic. The thickening gradually increased as the ileum approached the cæcum. The ulcers which were found in the excluded portion of the colon, and which for obvious reasons I considered the direct cause of the fatal peritonitis, were undoubtedly of long standing and were caused by the invagination. My only regret in this case is that I did not excise the entire invagination, intussusceptum and intussuscipiens, as in case this had been done the patient would not only have recovered from the operation, but would in all probability have been permanently cured. In reference to diagnosis during life, I will repeat that the most urgent and prominent symptoms pointed rather to carcinoma of the stomach than to carcinoma of the cæcum complicated by invagination. In the aged invagination is frequently caused by the presence of a malignant tumor in the bowel below the ileocæcal valve, and the obstruction, like in my case, is usually at first incomplete and gives rise to a clinical picture suggestive of chronic stenosis.

The absence of blood and mucus in the discharges, of constipation and straining, and the presence of periodical attacks of vomiting, but more especially the great mobility of the tumor, led me to suspect a carcinoma of the great curvature of the stomach rather than the conditions found during the operation. On the supposition that the tumor was located in the stomach, the abdomen was opened by a median incision, which on being enlarged afforded ample access to the parts which were to be treated by operative measures. Had the primary location of the carcinoma been known beforehand and the complication correctly interpreted, it would have been better to open the abdomen by a lateral incision, as was done in the first case. Adequate drainage, should this be required, can be established more readily after an operation through a lateral than a median incision.

INTESTINAL ANASTOMOSIS IN THE ILEO-CÆCAL REGION.

Indications.—Intestinal anastomosis by making an ileo-colostomy with perforated decalcified bone plates must now be accepted as an established surgical procedure in the treatment of the following affections: 1. Irreducible ileo-colic invagination without perforation or gangrene. 2. Cicatricial stenosis in the ileo-cæcal region. 3. Carcinoma of the cæcum with or without excision of the diseased portion of the bowel.

1. If in an invagination of the bowel in the ileo-cæcal region, the most frequent location where this accident occurs, reduction cannot be effected by rectal insufflation of hydrogen gas made while the patient is profoundly under the influence of an anæsthetic and held in an inverted position, treatment by laparotomy should be resorted to promptly, and in case disinvagination by direct

manipulation is found impossible, and no evidences of perforation or approaching gangrene can be detected, the continuity of the bowel should be restored by an ileo-colostomy without excision of the invaginated portion. The pathological conditions in the invaginated portion of the bowel which render the reduction impossible and which later result in gangrene and perforation are always greatly aggravated by the conditions created by the obstruction. If the obstruction is excluded by establishing an anastomotic opening between the intestine above and below it, the violent peristalsis and distension of the bowel on the proximal side of the obstruction are removed and rest is secured for the invaginated portion, an important element in the prevention of further destructive changes. Ileo-colostomy by approximation plates is made a few inches below the apex of the intussusceptum, and enough of the ileum is excluded so as to prevent any undue tension upon the parts included by the plates. Spontaneous reduction may take place some time after the obstruction has been remedied in this manner, and if this should not occur and the obstruction remains permanently, this procedure has rendered it harmless as far as the fæcal circulation is concerned, while at the same time it has placed the invaginated portion in the most favorable condition to recover from the immediate effects of the strangulation.

2. Enterectomy for cicatricial stenosis should never be practiced, as this operation is attended by a great deal more danger to life than an ileo-colostomy with approximation plates, and the latter restores the continuity of the intestinal canal with permanent exclusion of the seat of obstruction. If the lumen of the bowel can be restored by a plastic operation similar to the one

which has proved so successful in the operative treatment of cicatricial stenosis of the pylorus, this should be done in preference to an ileo-colostomy, as the danger incurred is not greater than attends this operation, while it offers all the advantages of an enterectomy minus its dangers. The pyloro-plastic operation devised by Heineke-Miculicz consists simply in incising the strictured portion parallel to the duodenum and pyloric portion of the stomach and uniting the wound transversely by a double row of sutures. The same operation is applicable to narrow strictures of the intestines. If on account of the width of the stricture this operation is not applicable, then the next safest and most efficient plan to pursue is to make an anastomosis between the bowel above and below the stricture with decalcified bone plates, which at once renders the obstruction harmless by excluding the affected portion of the bowel permanently from the fæcal circulation.

3. The method and advantages of ileo colostomy in restoring the continuity of the intestinal canal after resection of the cæcum are well illustrated by the two cases reported in this paper. If, after opening the abdomen for the operative treatment of malignant disease of the cæcum, resection is found impracticable on account of numerous adhesions or extensive involvement of the retroperitoneal or mesenteric glands, the seat of obstruction should be permanently excluded from the fæcal circulation by making an ileo colostomy with approximation plates. This procedure is far preferable to the formation of an artificial anus above the obstruction, as it removes equally well the symptoms of obstruction, doing away at the same time with the inconveniences and disgusting features necessarily associated with an artificial anus. An ileo-colostomy with decalcified perforated bone

plates is not a more dangerous operation than the formation of an artificial anus, and the remote benefits which are derived from it are incomparably superior to the conditions created by an artificial anus.

OPERATIVE TECHNIQUE.

Like all other intra-abdominal operations, an ileo-colostomy for any of the above named conditions should always be done under strict antiseptic precautions. The shock following operations in which the peritoneal cavity is exposed for an hour or more is diminished by a subcutaneous injection of morphia and atropia, given just before the anæsthetic is administered. The temperature of the operating room should not be less than 80° F. during the entire operation. If the bowel is permeable a cathartic is given the day before operation and the following morning the colon and rectum are emptied by the use of high enemata, to which is added some harmless antiseptic such as salicylic or boracic acid.

Incision.—In all operations in the ileo-cæcal region the incision should be made not in the median line, but directly over the organ to be operated on. The incision that affords most ready access to the cæcum is one extending from an inch above the middle of Poupart's ligament to a point halfway between the anterior superior spinous process of the ileum and the umbilicus. In making this incision the director should be entirely dispensed with. With a sharp scalpel the skin and superficial fascia are divided with one stroke of the knife, and then one layer after another of the abdominal muscles is divided in a similar manner until the subperitoneal fat is reached. This is picked up with the peritoneum with two toothed catch forceps and the abdominal cavity is opened between them. The hæmorrhage is

arrested at every step of the operation by applying to the bleeding points hæmostatic forceps, without losing any time in tying vessels which subsequently may not require ligation. One or two fingers are introduced through the small incision made in the peritoneum, and upon them this structure is divided to the extent of the external wound. After the peritoneal cavity is opened the part to be operated on is brought into the wound and prolapse of the small intestines is prevented by packing aseptic gauze or a clean napkin wrung out of an antiseptic solution around it. If not a sufficient number of reliable assistants are at hand, fæcal extravasation can be effectually prevented by elastic constriction of the intestine above and below where the communicating opening is to be made. The mesentery near the bowel at each of the places is perforated with a closed hæmostatic forceps and with this a narrow aseptic rubber band is drawn through, which is then tied with sufficient firmness to prevent the escape of fæcal matter. If the cæcum is to be excised two additional rubber bands are applied to the part to be removed so as to prevent extravasation from this part, after the bowel is divided. The spaces between the rubber ligatures must be carefully emptied by displacing the contents by passing the intestine between two fingers before the rubber bands are tied. The meso-cæcum must be tied in small sections with firm Chinese silk before the cæcum is removed, as otherwise troublesome hæmorrhage is incurred from slipping of the ligatures. After excision of the cæcum and as much of the colon and ileum as may be necessary, both ends are permanently closed by invagination and a few stitches of the continued suture. The best way to effect invagination is to grasp the margin of the bowel where the mesentery is attached with

an ordinary catch forceps and to carry this portion into the lumen of the bowel to the extent of an inch, when the remaining portion of the circumference of the cut end will follow, and by a little manipulation about an inch is evenly invaginated, when the first stitch is made on the mesenteric side in such a manner as to transfix the invaginated mesentery and the muscular and serous coats of the bowel. After this is tied a few more superficial stitches are taken, and the first and last stitch are tied together so as to pucker the end of the bowel somewhat in the manner done in tying a tobacco pouch. In making an anastomosis between the closed end of the ileum and colon after resection of the cæcum both ends should be made to lie side by side with the closed ends in a downward direction, and the surfaces to be united should correspond to the part of the intestine opposite the mesenteric attachment. In making an ileo-colostomy without enterectomy the anastomotic opening must be made at least 2 or 3 inches distant on each side from the part which it is necessary to exclude permanently from the fæcal circulation.

PERFORATED DECALCIFIED BONE PLATES.

After having tried all kinds of material, organic and inorganic, absorbable and inabsorbable, for making the apposition plates, I have finally settled on decalcified bone as the most suitable material. In preparing the plates the compact layer of an ox's femur or tibia is cut with a fine saw into oval plates, ¼ of an inch in thickness, 2½ to 3 inches in length and 1 inch in width. The plates are then decalcified in a 10 per cent. solution of hydrochloric acid, changed every twenty-four hours, until they have become sufficiently soft, so that they can be bent in any direction

without fracturing. After decalcification they are washed and immersed for a short time in a weak solution of caustic potash, so as to remove the acid. Until quite recently I dried the plates between blotting paper compressed between two pieces of tin so as to keep the plates from warp-

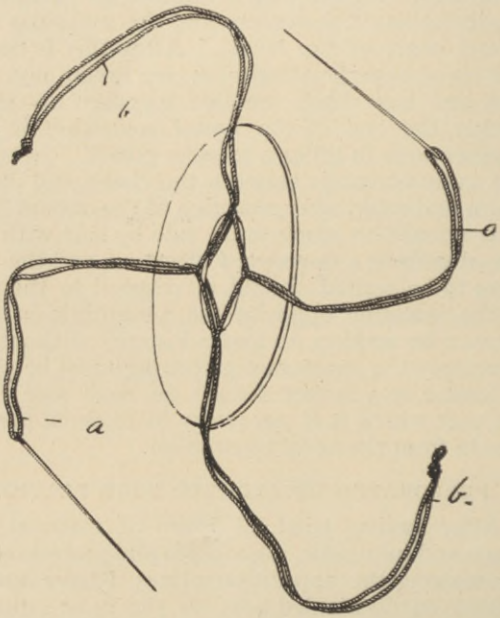

FIG. 1.—Perforated decalcified bone plate, threaded and ready for use. (*a*) Fixation or lateral sutures; (*b*) apposition or end sutures.

ing during the drying process. The central opening and perforations for the threads were made after the plates were dry. Experience has taught me that it is unsafe to use material for plates which when exposed to the fluids of the intestinal canal

will imbibe a sufficient amount of fluids to increase to two or three times in thickness, as such increase in the thickness of the plates may cause a sufficient degree of pressure to cause gangrene of the parts included between them. This happened in at least two of my gastro-enterostomies. Since then I have not dried the plates, but keep them after decalcification in a solution of equal parts of alcohol, glycerine and water which keeps them in a pliable, soft condition, and such plates undergo no change in size after their introduction into the stomach and intestine until they are gradually removed by absorption and disintegration from the third to the tenth day. After the acid has been removed the central oval opening can be readily made with a sharp penknife, and the four perforations around it for the threads are made with a fine drill, and after the plate is threaded it is kept ready for use in the solution first mentioned.

Any one conversant with the manner in which the plates are threaded can keep them in the solution until they are needed. When the plates are to be used they are washed in a 2 per cent. carbolic acid solution and the threads or sutures attached by threading two fine sewing needles, each with a piece of aseptic silk 24 inches in length, which are tied together; the knots become the ends of the end sutures, while the middle of such thread holds a needle and becomes the terminal part of the lateral or fixation sutures. The fastening of the threads upon the plate is done by the lock stitch by another thread passing through the perforations in the shape of a loop and fastened at the back. I now keep on hand three different sizes of the plates. The largest size is used for gastro-enterostomy, the second for intestinal anastomosis, and the smallest plates

are intended to be used in operation on children in cases of congenital stenosis of the intestines, invagination and other forms of intestinal obstruction where it becomes necessary to make an intestinal anastomosis. As a rule the central opening in the plate should correspond to the lumen of the organ which has become partially or completely obliterated by the cause which has produced the obstruction. Thus, in gastro-enterostomy the perforation in the plate should be as large as the lumen of a normal pylorus; in ileocolostomy it should correspond in size with the lumen of the ileum. Messrs. Schorse & Co., 302 Chestnut street, Milwaukee, keep on hand different sizes of the plates preserved in a moist state, ready threaded, and furnish with each pair four straight Hagedorn's self-threading needles. Objection has been made against the bone plates to the effect that they are not always at hand when needed. But like catgut, silk, drainage tubes, and other essential materials used in the treatment of wounds, they should be kept on hand ready to be used in an emergency. The different kinds of rings devised by Abbe, Matas and Brokaw, as substitutes for the bone plates, lack some of the most important advantages possessed by the plates. Catgut is a material which, when brought in contact with the alkaline secretions of the intestinal canal, becomes, in a few hours, so soft and macerated that it cannot be relied upon as a support. All ring supports bring into apposition only a small area of serous surfaces, and the pressure is not equally distributed. Davis' catgut mats are superior to the catgut rings, but the material of which it is composed is so highly hygroscopic that when acted upon by the intestinal contents they swell up rapidly and become as soft as a rag in a few hours. I immersed one

of the plates which Dr. Davis kindly sent me in a warm solution of common salt, and in three hours it had increased to three times its former thickness and had become so limpid that in the same condition in the intestinal canal it would furnish little or no support in maintaining uninterrupted apposition. The same objection applies to the catgut rings and catgut mats as to the dried bone plates, that when used in the dry state they increase rapidly in thickness from the imbibition of fluids, and as the sutures are unyielding the pressure thus produced may become a cause of pressure gangrene.

An extensive clinical experience and numerous experiments on animals have satisfied me that thus far no better material has been suggested for making the approximation plates than decalcified bone. Decalcified bone plates kept moist in an antiseptic solution do not increase in thickness by imbibition of fluids when used in the stomach or intestinal canal, and they serve as an efficient mechanical support in bringing together and maintaining accurate coaptation of large serous surfaces which it is intended to unite in establishing an intestinal anastomosis. The decalcified bone plates can be relied upon in maintaining equable surface pressure upon the tissues interposed between them for at least three or four days, which is the time required in obtaining a sufficiently firm union by cell proliferation from the apposed serous surfaces. Indestructible and inabsorbable material should never be used in the preparation of approximation plates, as such substances in the stomach or intestines, where they are used, may cause irritation, or even ulceration and perforation; or they may pass on and become impacted in the narrowed portion of the bowel. Dr, Stamm, of Fremont, O., made plates of the

thin portion of the scapula of a calf, and used them in a gastro-enterostomy for carcinoma of the pylorus. The patient died forty days after the operation, and at the necropsy the plate inserted into the stomach was found unchanged in this viscus.

Incision of the bowel.—In ileo-colostomy the bowel is incised on the convex surface opposite the attachment of the mesentery and near the closed end, if the cæcum has been resected, and two or three inches from the obstruction, if the conditions do not require or justify an enterectomy. The incision must be large enough to readily admit the insertion of the plate without using any force, and yet not too large, as, if this mistake is made, the plate may escape through the incision after the sutures have been tied. Hæmorrhage from the visceral wound is usually slight and ceases spontaneously; but should it become necessary to arrest it, it is much better to use the continuous catgut suture than to attempt to ligate the bleeding points. The best way to make the incision is to compress the bowel between the thumb and index finger of the left hand in a direction parallel to the organ, and then with a sharp-pointed bistoury perforate the wall of the bowel and cut from within outwards between the fingers in an upward direction.

Insertion and fixation of the plates.—As the incised bowel is supposed to be empty and kept so either by digital compression or by elastic constriction with a rubber band, there is no danger of fæcal extravasation taking place. Mucus and small particles of fæcal matter are removed with small pledgets of gauze or antiseptic cotton. The plate is inserted while the bowel is held in the same position as when the incision is made. The plate is inserted edgewise, and as it is completely

in the lumen of the bowel, traction is made on the sutures in such a manner that the plate makes half a turn, so that its upper surface faces the wound. It is now accurately adjusted, so that

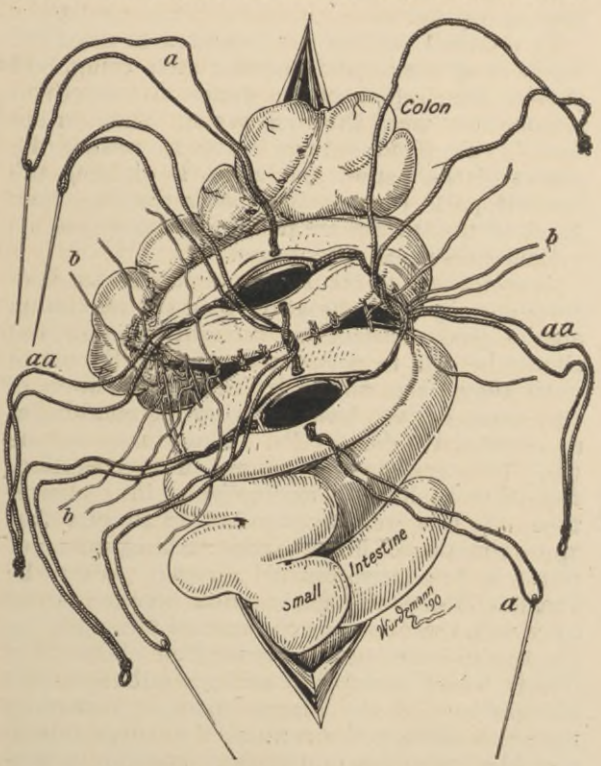

FIG. 2.—Ileo-colostomy without resection of cæcum. Showing plates in position, one in the ileum, the other in the colon. (*a*) lateral or transfixion sutures passed through the margin of the wound. (*aa*) end ligatures hanging out of the wound. (*b*) posterior row of superficial or Lembert sutures.

its ends are equidistant from the angles of the

visceral wound. The plate is then fixed in this location by transfixing the entire thickness of the wall of the bowel near the margin of the wound with the needle attached to the lateral or fixation suture.

The lateral sutures are intended to draw the margins of the wound asunder after tying, and prevent the slipping of the plates, and for these reasons they merit the designation "fixation suture." The end sutures serve to retract the angles of the wound and assist in holding the coapted parts in apposition after they are tied. After all the sutures are tied the opening presents a diamond-shaped appearance.

Scarification of the serous surfaces.—In ileocolostomy by approximation plates a maximum area of serous surfaces is brought together and should be kept in accurate contact by the plates until they have united by the interposition of new tissue derived from proliferating endothelial and connective tissue cells. If anything can be done to stimulate the process of regeneration, definitive healing is accomplished in a shorter time. It is a well known fact in surgery that approximation of intact serous surfaces does not result in the formation of a lesion. When the surgeon desires to secure union between serous surfaces he resorts to mechanical irritation for the purpose of inducing a circumscribed plastic peritonitis, which invariably results in adhesions and obliterations of the serous space. Reasoning from this analogy, I was induced to study experimentally the effects of traumatic irritation in hastening the formation of a lesion and cicatrization between apposed serous surfaces. The results of the experiments show that serous surfaces of the intestine which were scarified before apposition was made with bone plates formed adhesions ear-

lier, and the definitive healing was accomplished in a much shorter time, than in cases where the peritoneum was left intact. In most of the cases the inflammatory process was limited to the portion of the bowel interposed between the plates. Without exception the adhesions formed were firmest and the definitive healing was initiated first when scarification was performed, results which clearly demonstrate the fact that the reparative process between serous surfaces which it is intended to unite is hastened by traumatic irritation. Traumatic irritation with the point of an aseptic needle is the most potent means to provoke a circumscribed plastic peritonitis, and is followed within a few hours by a copious exudation of plastic lymph, which, like a cement substance, mechanically agglutinates the coaptated surfaces. The same measure, by destroying the continuity of the non-vascular endothelial layer of the peritoneum, brings at once in contact the vascular network of both sides and opens up a direct route for the new vessels, an important element in the rapid healing between the surfaces held in contact by the plates. Davis, of Birmingham, has made some adhesion experiments by scratching off the endothelial lining of the peritoneum, and claims that adhesions form more rapidly than after scarification. I should not feel warranted in depriving the peritoneum of the histological elements which, above all others, take the most active part in the production of new tissue. In inflamed serous surfaces karyokinetic figures are seen earliest in the endothelial cells, and the inflammatory product from the fixed tissue cells are derived largely from this source. Scarification inflicts the necessary degree of traumatic irritation without loss of tissue, upon which depends so much in the subsequent

process of repair. When the plates are *in situ* the serous surface of the bowel over an area corresponding to the size of the plates should be scarified with an aseptic needle. The scarification should not be so deep as to cause bleeding, but only deep enough to tear the endothelial lining. I am in the habit of making straight lines, which are crossed by other lines, mapping out, as it were, the endothelial surface into small squares representing a diminutive mosaic pavement.

Approximation of the intestines.—After both surfaces have been thoroughly scarified the intestines which it is intended to unite are brought together by an assistant in such a manner that the two wounds are directly opposite each other.

The approximation sutures are now properly arranged so that when they are to be tied the corresponding threads can be readily found. Before any of the sutures are tied it is well to unite the serous surfaces along the posterior margins of the plates with a few superficial sutures. (Fig. 2 b.) After this has been done, the posterior pair of fixation sutures is tied with sufficient firmness to approximate, but not to compress, the parts between them. The sutures are to be tied always in a square knot so as to prevent slipping of the knot. Next the pair of end sutures away from the operator is tied, and when this has been done the opposite pair is tied. All of the sutures are cut short as soon as they are tied. The last sutures to be tied are the remaining fixation sutures, and while these are being tightened the margins of the bowel are inverted between the plates with a director or probe. The cut ends of the last knot are pushed with a probe towards the opening. Approximation has now been completed and all that is left is to reinforce the action of the plates by suturing the serous surfaces over

the anterior margins of the plates by a few stitches of the continued suture.

The part of the intestine exposed during the operation should now be thoroughly cleaned by

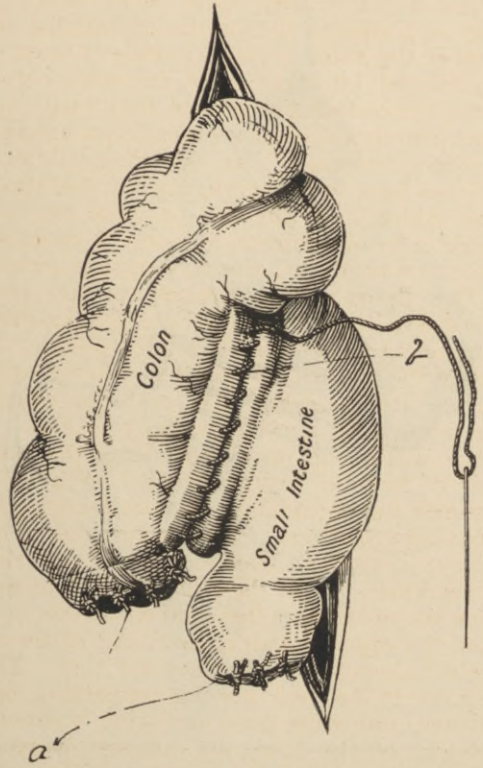

FIG. 3.—Ileo-colostomy as seen after resection of the cæcum. (*a*) Closed ends of the colon and ileum directed downwards; (*b*) serous surfaces over the anterior margins of the plates united by a number of stitches of the continued suture.

irrigation with sterilized hot water, and after

being well dried with an antiseptic sponge or dry gauze, the part clamped together by the bone plates is ready to be replaced into the abdominal cavity after having first thoroughly cleansed and dried the iliac fossa.

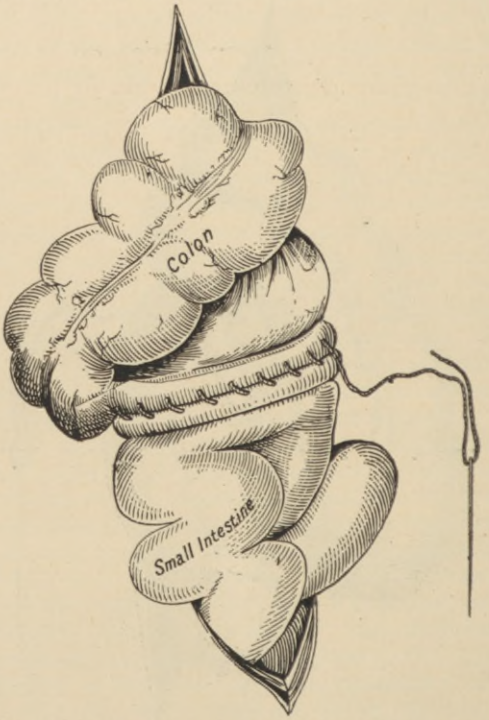

FIG. 4.—Ileo-colostomy, completed as seen without resection of the cæcum.

Anchoring of the seat of anastomosis.—As the blind end of the colon is to serve the part of the artificial cæcum in the future, and the new opening will serve as a substitute for the ileo-cæcal

opening, these parts should be assigned the place occupied previously by the organs removed. Anchoring of the seat of anastomosis in the ileo-cæcal region is an important step of the operation, as it will secure the most favorable anatomical and physical conditions for restoration of the normal fæcal circulation, and will at the same time keep the parts in the neighborhood of the wound, an important matter should anything go wrong at the seat of operation. Should perforation or suppuration occur these conditions are more readily accessible and can be more efficiently dealt with in the right ileac region than if the anastomosed parts are dragged away into some more remote part of the abdominal cavity, perhaps buried among a number of coils of the small intestines. The anchoring can be readily done by passing a small suture through the mesentery in the direction of the blood-vessels opposite the new opening on one side and through the peritoneum and the subserous structures at the proper point of the other, and tying with sufficient firmness to bring the parts into apposition. Scarification of a limited area of peritoneum on both sides will hasten the formation of adhesions and increase their power of resistance.

Drainage—Drainage is always indicated when a considerable portion of the retro-peritoneal space has been laid bare, and it could never be dispensed with if in the course of a resection of a considerable portion of the large intestine where many ligatures have to be used in controlling the hemorrhage from the mesenteric vessels. If the incision is made in the inguinal region efficient and direct drainage can be established through the lower angle of the wound. The best drainage is secured by combining tubular with capillary drainage. This can be done by protecting

the intestines and the peritoneum in the vicinity of the lower portion of the wound with several layers of idoform gauze, which is used in the form of a ring through which is inserted a glass drain, the size of the little finger, with small lateral perforations in its distal end. A glass drain should reach sufficiently far to carry away the wound secretions from the seat of visceral approximation. With the bowel anchored in the ileocaecal region, the gauze tampon surrounding it, and the glass drain in close proximity, abundant precautions have peen provided for to prevent the accumulation of intra-peritoneal effusion, and in the possible event of fæcal extravasation a direct outlet for its escape has been established. Unless special indications arise, drainage can be dispensed with after the third day, as at this time firm adhesions between the apposed intestines have taken place, and transudation will have ceased.

Closure of abdominal incision.—The closure of an incision in the abdominal walls in any other place than the median line requires special care. An incision through the different muscular layers of the abdominal wall closed in the ordinary manner with one row of sutures is very liable to be followed later by the formation of a ventral hernia, on account of the peritoneum on each side of the wound becoming everted, thus interfering with the accurate coaptation of the muscular layers and the resulting cicatrix only too often permanently separates the muscles. To prevent the interposition of the peritoneum between the muscles it is absolutely necessary to unite it separately with fine silk sutures, which are cut short and buried. The remaining portion of the wound can be accurately approximated by a second row of sutures. These su-

tures should not include more than one-twelfth of an inch of the skin and embrace all of the muscular layers. If, as is usually done, more skin is included, there is danger of the skin becoming inverted, which again interferes with an ideal healing of the wound. A few superficial stitches between the deep sutures will secure accurate coaptation between the superficial portion of the margin of the wound.

Dressing of the wound.—In operations where drainage is unnecessary the wound is dusted with iodoform and covered with a strip of protective silk. Several layers of iodoform gauze are then applied and over these a thick compress of salicylated cotton, all of which is retained by a number of strips of rubber adhesive plaster, long enough to encircle two-thirds of the circumference of the body. As an additional protection against subsequent infection, and as a means of exercising equable compression, a thick layer of ordinary cotton is applied over this dressing and retained by an ordinary abdominal binder or roller bandage. If it is necessary to establish drainage a somewhat similar but less bulky dressing is applied, but a space is left for the drainage tube which is kept aseptic by keeping it closed with a plug of antiseptic cotton. This is removed as often as required, every three to six hours, and the fluid which has accumulated is withdrawn with an ordinary syringe to the nozzle of which an aseptic rubber tube is attached. I have always been in the habit after exhaustion of the glass tube to fill it again with a warm physiological solution of salt which is withdrawn in a similar manner.

After-treatment.—During the first twenty-four hours the patient is nourished exclusively by rectal feeding. Thirst is quenched with small

pieces of ice in the mouth, sipping of hot water, and if there is much prostration, brandy and water are given. Peristaltic action of the bowels is suspended by a few small doses of opium. The bowels should not move for at least forty-eight hours. Should at this time tympanites set in, a mild laxative, such as castor oil or one of the mild saline cathartics, can be given, and the action hastened if required by a small stimulating rectal enema. On the second day small quantities of fluid nourishment can be given by the mouth, and in the course of a week a light solid diet is prescribed. The sutures are removed at the end of the first week, but the external support by strips of adhesive plaster and a well-fitting binder must be continued until the completion of the definitive healing of the abdominal wound which requires at least three weeks. The patient should not be allowed to sit up or leave his bed before the expiration of this time. The plates will come away with the fæcal discharges about a week after the operation.

CONCLUSIONS.

1. Resection of the cæcum for carcinoma can be done with a fair prospct of a permanent cure if the operation is performed before infiltration of the retro peritoneal and mesenteric glands has occurred.

2. Ileo-colostomy with absorbable perforated approximation plates is the best method of restoring the continuity of the intestinal canal after excision of the cæcum.

2. The best material for approximation plates is decalcified bone preserved in an antiseptic solution.

4. Hygroscopic and indestructible or inabsorbable material should not be used in the prep-

aration of approximation plates or rings as the former may cause pressure gangrene, and the latter may prove a source of danger by remaining permanently as a foreign body in the organ in which it has been introduced.

5. Ileo-colostomy without resecection of the cæcum is indicated in cases of intestinal obstruction from inoperable carcinoma of the cæcum, irreducible invagination without perforation or evidences of gangrene and in cicatricial stenosis in the ileo-cæcal region not amenable to a plastic operation.

6. Scarification of the serous surfaces interposed between the bone plates is the most reliable means of hastening the formation of adhesions and of shortening the process of definitive healing.

7. Resection of the cæcum and ileo-colostomy with or without enterectomy should be done through a lateral incision, extending from near the middle of Poupart's ligament to a point halfway between the anterior superior spinous process of the ilium and the umbilicus.

8. Suturing of the serous surfaces just beyond the margins of the bone plates renders material aid in maintaining apposition between the serous surfaces which it is intended to unite and furnishes an additional safeguard against fæcal extravasation.

9. Anchoring of the approximated parts in the ileo-cæcal region with a mesenteric-peritoneal suture should be done in ileo-colostomy after resection of the cæcum.