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The Etiology, Pathology, and Treatment of Intestinal Fistula and Artificial Anus

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THE ETIOLOGY, PATHOLOGY, AND TREATMENT OF INTESTINAL FISTULA AND ARTIFICIAL ANUS.[1]

A CORRECT appreciation of the causes which give rise to the formation of intestinal fistula is prerequisite for the adoption of appropriate treatment. The term intestinal fistula will be used in this paper to signify a communication between the lumen of any part of the intestinal tract and the surface of the body or with any of the hollow abdominal or pelvic viscera. A practical distinction must be made in regard to the size and character of such abnormal communication into (1) fistula, (2) artificial anus. The difference is one of degree and not of kind. Speaking from a purely surgical standpoint, a fistula of the bowel is an opening through which gas or only a part of the liquid and solid intestinal contents escape, while an artificial anus implies a complete interruption of the fecal circulation at the abnormal outlet. The latter condition is determined either by the size of the defect in the intestinal wall or the existence of mechanical conditions which divert the intestinal contents in the direction of the abnormal outlet and away from the distal side of the bowel. The mechanical conditions which thus divert the fecal current are either a flexion or the presence of a spur or septum at a point opposite to the abnormal outlet, caused by a projec-

[1] Read before the Chicago Gynecological Society, June 15th, 1894.

tion of the intact part of the intestinal wall in the direction of the fistulous opening. The surgeon aims to produce such an obstruction to the fecal circulation, when he desires to procure rest for the distal part of the intestinal tract, by the formation of an intentional artificial anus. The amount of intestinal contents which escapes from the intestinal canal through such an abnormal outlet depends less on the size of the opening than the existence of one or both of the above-mentioned mechanical conditions. If the intestinal tube is straight or only slightly curved, even a large opening may resemble a simple intestinal fistula, while, on the other hand, a small opening associated with a flexion or a well-developed spur appears clinically as an artificial anus and must be treated as such. The internal fistulæ communicate most frequently with another part of the intestinal tract (bimucous fistula of Dreschfeld), the bladder, vagina, and uterus.

Etiology.—Intestinal fistulæ are divided into: 1. Intentional. 2. Accidental. The surgeon occasionally resorts to the formation of an intestinal fistula or artificial anus, in the treatment of inoperable mechanical obstruction, by resorting to a colostomy or enterostomy, according to the location of the mechanical obstacle which has necessitated the operation. If in such cases the intestinal opening is to serve only a temporary purpose, it is closed by operative measures in the same manner as will be advised in the discussion of the operative treatment of accidental fistula, after the distal part of the intestinal canal has been rendered permeable spontaneously or by subsequent operative interference.

Accidental fistulæ are produced, according to the immediate cause, by: 1. Gunshot and stab wounds of the abdomen. 2. Submural injury of the bowel. 3. Ulceration of the bowel. 4. Strangulation of the bowel. 5. Foreign bodies in the intestinal canal. 6. Malignant tumors. 7. Intestinal actinomycosis. 8. Pelvic and other abdominal abscesses. 9. Appendicitis. 10. Unintentional injury to the bowel during abdominal and pelvic operations. 11. Ligatures. 12. Sutures. 13. Drainage tubes.

Gunshot and Stab Wounds.—These injuries usually result in fatal septic peritonitis if the intestinal wound or wounds are large enough to permit escape of fecal material into the free peritoneal cavity, and not subjected in time to direct operative

treatment. A fecal fistula, external or internal, may result if the wound is small or if only a part of the intestinal wall has been injured, in which event the injured part becomes adherent to the parietal peritoneum or an adjacent hollow organ. A resulting circumscribed abscess may later, under such circumstances, perforate the abdominal wall or discharge its contents into the adherent organ and thus establish either an external or internal fistula. According to the experience of surgeons during the War of the Rebellion, such an occurrence is more likely to follow injury of the colon than wounds of the small intestines.

Submural Injury.—Partial laceration of the intestinal wall without a penetrating wound of the abdomen occasionally results in circumscribed peritonitis, caused by the migration of pathogenic microbes from the intestinal canal through the damaged wall to the surface of the bowel, where, if present in sufficient number, they may produce an abscess which not only completes the intestinal perforation, but may result at the same time in the formation of an external or internal fistula. Such fistulæ are usually small and close spontaneously in the course of time. In suspected submural injury of the bowel without evidences of complete rupture and fecal extravasation, it is of the greatest importance to enforce efficient treatment with a special view of preventing this remote complication.

Ulceration.—Ulceration of the bowel is frequently followed by the formation of an intestinal fistula if the free peritoneal cavity is shut off by adhesions before perforation takes place and the ulcer manifests no tendency to repair. In the upper part of the intestinal canal the round, perforating ulcer of the duodenum may produce such a result. I have observed two cases of perforating typhoid ulcer in which a diffuse abscess formed, which was freely incised and drained. In one case the abscess cavity contained at least a quart of fecal material which had evidently been accumulating for more than a week. The patient's general condition was such as to contraindicate search for and suturing of the perforation. In both cases life was prolonged from one to two weeks, but the patients finally succumbed to sepsis. I can readily conceive that under more favorable circumstances such patients might recover, under similar treatment, with an intestinal fistula which would in all probability peel spontaneously or could be closed later by operation

with a good prospect of success. From my own personal observation I am satisfied that the ulcers which terminate most frequently in the formation of an intestinal fistula are of a tubercular character. I have observed a number of such instances. The clinical course in such cases is almost typical. The localized peri-intestinal process is usually preceded by symptoms which point to a chronic catarrhal or ulcerative enteritis. A painless, cold abscess appears at the point where the perforated bowel has become attached to the abdominal wall. The abscess develops insidiously and progresses very slowly. If the abscess opens spontaneously or is incised, it contains, as a rule, no fecal material. The fistula forms later, or is produced at once if the granulations lining the abscess wall are scraped away with a sharp spoon. The communicating opening between the lumen of the bowel and the abscess cavity is temporarily blocked with granulations, which, when removed or when destroyed by suppuration and degeneration, establish the fistula through which gas and fecal contents escape. In one case I found such an abscess in the umbilical region, and in another in the right linea semilunaris. In both cases a fecal fistula was established, and the patients eventually died from the effects of the primary intestinal infection. Such fistulæ hasten the fatal termination and are not amenable to successful surgical treatment. Tubercular abscesses in communication with a perforated intestinal tubercular ulcer should not be incised. The proper treatment for such cases is tapping of the abscess, followed by injection of iodoform emulsion—a form of treatment which will postpone, if not prevent, the formation of an intestinal fistula. König is of the opinion that in many cases of tubercular intestinal fistula the primary disease starts in the peritoneum, resulting in perforation of the intestine from without inward. In such cases multiple fistulæ are often established in rapid succession.

Strangulation.—The functional disturbance of the intestine following strangulated hernia, terminating in gangrene without treatment or under conservative measures, will depend upon the extent of loss of mural tissue, and will vary from a small fistula, only large enough to permit the escape of gas, to a perfect artificial anus. Occasionally such an accident follows the reposition by taxis of a damaged intestinal loop. The Littré, femoral, and

properitoneal herniæ are most likely to be overlooked by the surgeon, and consequently most frequently give rise to this complication.

Foreign Bodies.—Perforation of the intestinal wall by a foreign body, preceded by a circumscribed plastic peritonitis, frequently results in the formation of an abscess, which, when it reaches the surface or an adjacent hollow organ, is followed by an intestinal fistula. Small, slender foreign bodies, such as needles, pins, and fish bones, often perforate the intestinal wall and find their way to the surface or into neighboring organs without giving rise to an intestinal fistula. In one case I removed four fish bones from a small abscess in the median line below the umbilicus, after which the abscess healed promptly and permanently. The foreign bodies which are most frequently found in abscesses preceding intestinal fistula are sharp fragments of bone, gall stones, and enteroliths.

Malignant Tumors.—Malignant tumors may cause intestinal fistula either by producing obstruction followed by distention and ulceration on the proximal side, or by directly implicating the intestinal wall. The latter mode of origin is the most common. The malignant tumor in such instances invades by contiguity the part or organ which becomes the seat of the intestinal fistula, and at the same time perforates the intestinal wall, so that the fistula is surrounded everywhere by malignant tissue. Carcinoma more frequently pursues such a course than sarcoma. Infection of the malignant tumor with pus microbes often plays an important rôle in such cases. The suppurative infection often overshadows the malignant disease so completely that the surgeon is misled in his diagnosis and institutes treatment appropriate for abscess when the operation reveals a malignant tumor as the foundation of the difficulty. Carcinoma of the cecum complicated by suppuration has been repeatedly mistaken for appendicitis. Carcinoma of the sigmoid flexure and cecum occasionally results in a pathological anastomosis between the affected part of the bowel and an adjacent loop of the small intestine. Carcinoma of the upper part of the rectum only too often invades the bladder and results in the formation of a recto-vesical fistula. Carcinoma of the stomach and transverse colon has resulted in pathological gastro-colostomy.

Actinomycosis.—A number of cases of intestinal actinomy-

cosis have been recorded in which the disease in its course perforated the intestinal wall and gave rise to diffuse abscesses and intestinal fistula. The ileo-cecal region is the favorite locality for such processes. In the only case of this kind that came under my own observation the disease originated evidently in the ileo-cecal region, but the abscess reached the cavity of Retzius and was opened in the median line above the pubes.

Pelvic and Abdominal Abscesses.—By far the most frequent cause of intestinal fistula is pelvic and abdominal abscesses. Such abscesses sometimes are caused by migration of pyogenic microbes through a damaged or inflamed intestinal wall, perforate later the intestine, and finally open or are incised on the surface when the fistula is completed. The fistulous tract is often long and tortuous. More frequently a pyosalpinx or acute phlegmonous abscess of the parauterine connective tissue pursues such a course. Such abscesses open most frequently into the rectum, bladder, and intestinal coils upon the floor of the pelvis, but they may open into the cecum and sigmoid flexure. Externally they point most frequently in the groin, but they may also reach the surface through the sacro-sciatic notch and occasionally extend to the lumbar region. The external fistulous opening may be found in any of these localities. Not an infrequent cause of intestinal fistula is tubercular abscesses resulting from tubercular spondylitis and tuberculosis of the pelvic bones. In some cases the abscess is discharged first into the cecum or rectum; less frequently into other parts of the large and small intestines, and later reaches the surface; or the fistula forms in the course of suppurating tubercular tracts. Rectal insufflation is an exceedingly valuable diagnostic test, not only for the purpose of ascertaining whether or not the fistulous tract communicates with the intestine, but also in demonstrating the exact location of the intestinal perforation.

Appendicitis.—Appendicitis is the most frequent cause of intestinal fistula in the ileo-cecal region. The fistula is produced in one of two ways: 1. Sloughing or perforation of the appendix. 2. Rupture of an abscess of appendical origin into the cecum or adjoining intestinal loops, with the subsequent formation of an external opening. If the entire appendix is cast off as a slough with the contents of the abscess in gangrenous appendicitis, the fistulous opening involves the cecum and

occupies that part of the bowel to which the appendix is attached. Clinically such a fistula resembles a cecal fistula produced by other causes. In partial gangrene of the appendix and perforation of the organ, treated upon the expectant plan by incision and drainage without removal of the appendix, if a fistula persists, the remaining lumen of the appendix communicates with the cecum on one side and the external fistulous tract on the other. The fistulous opening into the bowel under these circumstances is so small that seldom anything else but gas escapes. Such fistulæ occasionally heal spontaneously in the course of a few weeks; but after it has become well established, closure of the fistula without operation is not to be expected. A paratyphlitic abscess rupturing into the cecum often terminates in a permanent cure, but sometimes it results in extensive destruction of the cecal wall followed by the formation of a correspondingly large fistulous opening. The location of the cecal opening will vary according to the situation of the abscess. The cases of cecal fistula which have come under my own observation involved either the anterior or posterior wall; but it may affect any part of the cecum, and occasionally the abscess ascends in the direction of the ascending colon, which it may perforate and cause a fistula of this part of the large intestine. I have seen three cases of fistula of the cecum following appendicitis in which the opening in the abdominal wall and cecum was large enough to insert three fingers. In all of these cases the fecal current was arrested at the opening by the presence of an effective spur formed by the projection of the opposite wall toward the opening in the cecum. It is in cases of this kind, if the abscess has been opened by the surgeon, that he is credited by the patients and friends with having cut the bowel, when in reality the intestinal opening either was present at the time the operation was made or occurred later by sloughing of the inflamed cecal wall.

Injury of Bowel during Abdominal and Pelvic Operations.—Under this head it is not my intention to discuss those gross lesions of the intestines occurring during abdominal and pelvic operations which the surgeon recognizes and resorts at once to the necessary treatment. I wish more particularly to refer to overlooked and incomplete wounds of the bowel as causes of intestinal fistula. Modern gynecology encourages heroic attempts

in the removal of abdominal and pelvic tumors that only a few years ago would have been regarded as inoperable by the boldest surgeons. The removal of adherent tumors and pus tubes brings the operator often in very close contact with the intestines. The inflammatory processes which have produced the firm adhesions have often resulted in great damage to the adherent part of the intestine. The intestinal wall, from pressure, cicatricial contraction, and impaired nutrition, is often found not much thicker than ordinary writing paper, hence exceedingly liable to be torn during the separation of firm adhesions. The intestine attached to a tumor or pelvic abscess by firm and old adhesions has lost its outer or peritoneal coat over an area corresponding with the extent of the adhesions. Unless the surgeon practises the necessary precaution of making the detachment at the expense of the tumor or tube, if he does not tear an opening into the bowel he will at least seriously damage the intestinal wall. I have no doubt that in numerous instances of this kind surgeons have overlooked minute perforations in the bowel which, if they did not result in fatal septic peritonitis, became the direct source later of an intestinal fistula. It must also be remembered that a greatly damaged intestinal wall is permeable to pyogenic microbes, and consequently becomes not infrequently the sole cause of a late infection after laparatomy, and, if the patient survives, of abscess and intestinal fistula. Every experienced surgeon will recall to his memory such mishaps when he could assure himself that in other respects the operation was faultlessly performed. The examination of detached intestinal loops for perforations or other serious damage should not be postponed until completion of the operation, as it may be impossible to find them again at that time. The inspection should be made at once and all defects remedied before additional adhesions are separated. By pursuing such a course, and by detaching the adhesions at the expense of the part to be removed, we will hear less in the future of septic peritonitis, abscess, and intestinal fistula arising from this cause after laparatomy.

Ligatures.—In small wounds and limited gangrene of the bowel Astley Cooper made a small cone, the apex of which corresponded with the injury or disease, and applied a ligature of fine silk around the base. The ligature cuts its way into the

lumen of the bowel during the time the resulting defect becomes sealed by plastic lymph. We can readily conceive under what circumstances such a procedure would prove safe and efficient. If the parts included in the ligature, and the ligature itself, are aseptic, the formation of a fistula is prevented by the production of new tissue around the ligature and included mass before the ligature reaches the lumen of the bowel. If, on the other hand, the asepsis is not perfect and suppuration occurs in the track of the ligature, an intestinal perforation is very likely to ensue. After separation of an adherent intestine bleeding points are often tied with silk. Isolation of the bleeding vessel is usually out of the question, and more or less of bowel tissue is included in the ligature. It must not be forgotten that under such conditions the bowel has been deprived of its peritoneal investment, and consequently the facilities for encapsulation of the ligature are diminished. If to this is added an extremely attenuated bowel wall, it is not difficult to understand in what way a ligature may sometimes give rise to a late perforation, peritonitis, abscess, and intestinal fistula.

Sutures.—Careless suturing of the abdominal incision is responsible for many accidents to the intestines. Undue haste in completing this part of the operation is often severely punished. Unless the operator resorts to proper precautions the needle may transfix a part of the circumference of the small intestine; on tying the suture the loop is anchored against the external incision, the ligature later cuts its way through the included part of the bowel, and, if a fatal peritonitis does not result, an intestinal fistula is sure to follow. I have seen two cases of intestinal fistula, in the practice of distinguished surgeons, where I had reason to believe that the intestinal fistula had such an origin. But this is not the only way in which sutures have produced this complication. In tying the sutures a loop of the underlying intestines may be caught between the suture and the abdominal wall, and on tightening the suture strangulation results, followed by intestinal obstruction, gangrene of the strangulated part of the bowel or coil, abscess, and fistula. Again, an intestinal coil may escape between the sutures and become strangulated between the margins of the wound with similar consequences. It is time that surgeons should recognize the suture as a cause of such complications and resort to efficient

prophylactic measures. I am strongly convinced of the value of a separate row of buried absorbable peritoneal sutures in closing the abdominal incision, both for the purpose of guarding against accidents to the intestines and as a prophylactic measure against ventral hernia. Whenever it is possible the omentum should be drawn downward far enough to cover the entire length of the incision. The use of the aseptic compress as an aid in suturing the external wound is so well known that it is only necessary to mention it in connection with my subject.

Drainage Tubes.—The last, but by no means the least, important subject which I shall discuss in connection with the etiology of intestinal fistula is the drainage tube. Prolonged tubular drainage with glass or rubber tubes is a well-known factor in the production of intestinal fistula. The opening in the bowel is produced by pressure atrophy. I am inclined to believe that the elastic pressure caused by rubber drains is more injurious than that exerted by glass tubes. Long-continued tubular drainage for suppurative lesions is more dangerous in this respect than similar methods of drainage for parenchymatous oozing or other aseptic pathological conditions. In the former case the suppurative inflammation along the drainage canal adds to the destructive effect of pressure. It will be difficult, if not impossible, to entirely eliminate this etiological element by any amount of care in cases requiring long-continued tubular drainage. In recent cases necessitating drainage for a few days I have been in the habit of surrounding the glass or rubber drain with a few layers of iodoform gauze, for the purpose of diminishing the harmful effects of localized pressure. In drainage for suppurative affections it is advisable to gradually reduce the size of the tube for the same reason, and whenever practicable interpose between the intestine and tube a few layers of iodoform gauze.

Treatment.—The treatment of an intestinal fistula must have for its aim closure of the abnormal opening with as little interference as possible with the lumen of the bowel. The statement has been made, and is borne out by clinical experience, that many intestinal fistulæ close spontaneously. This favorable termination may be expected in cases in which the opening in the bowel is small, the immediate cause of a benign and temporary character, the general health of the patient not much

impaired, and the fistulous opening in the bowel so located that it can readily become attached to the parietal peritoneum or the serous investment of an adjacent organ. The spontaneous healing of an intestinal perforation is always followed by permanent parietal or visceral adhesions. In fistulæ resulting from tuberculosis, malignant disease, and actinomycosis, spontaneous healing, from the very nature of the primary cause, is out of the question, and in the majority of these cases operative treatment with a view of closing the fistula is contraindicated. The operative treatment in such cases deserves consideration only in the event that the primary cause can be completely eliminated before an attempt is made to restore the continuity of the bowel. In fistula caused by malignant disease, in which the extent of the primary cause has rendered a radical operation inapplicable, it may be advisable to secure rest for the diseased part of the intestine by establishing an artificial anus on the proximal side. In the treatment of tubercular and actinomycotic fistulæ the primary disease must receive proper attention, and, in case it is amenable to successful treatment, the fistula will heal spontaneously or is subjected later to appropriate surgical treatment. Before I proceed further to the discussion of the surgical treatment of intestinal fistula it is important to refer briefly to a few of the more important points of the

Pathological Anatomy of Intestinal Fistula.—For the sake of simplicity I will describe the different forms of intestinal fistula as we observe them on the surface of the body, although the same remarks will apply to the internal fistulæ where similar conditions are developed.

Intestinal Fistula.—Intestinal fistula as defined in the introductory remarks of this paper presents itself in one of two forms: 1. A fistulous tract leads from the surface to the opening in the intestine. 2. The mucous membrane of the intestine lines the fistulous tract and is continuous with the skin on one side and the mucous lining of the intestine on the other. In the first variety the opening in the bowel is more or less distant from the surface, and the tract is lined by granulations (Fig. 1). In the second variety the intestinal wall reaches the surface, and the margins of the opening in the bowel form the border of the external opening, the entire fistulous tract being lined by mucous membrane (Fig. 2). In both instances the opening in

the bowel is lateral, the intestinal tube either straight or slightly curved, presenting no mechanical impediments to the fecal current.

Artificial Anus.—The interruption, partial or complete, of the fecal current at or in the immediate vicinity of the fistula is

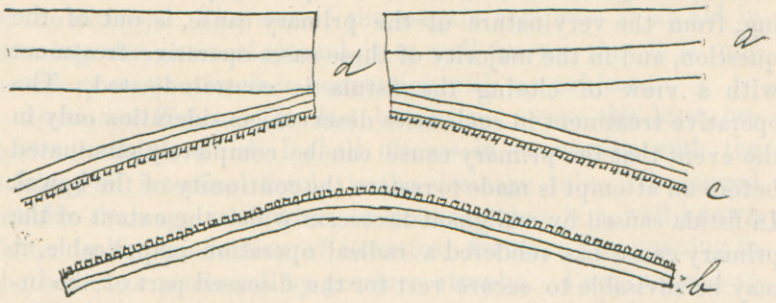

FIG. 1.—Intestinal fistula without lining of mucous membrane. *a*, abdominal wall; *b*, intestinal wall; *c*, mucous membrane; *d*, fistula.

usually due to one of three causes: 1. Intestinal obstruction below the fistula. 2. Flexion of the bowel at a point corresponding with the location of the fistula. 3. The presence of a spur opposite the opening in the bowel. If perforation of the

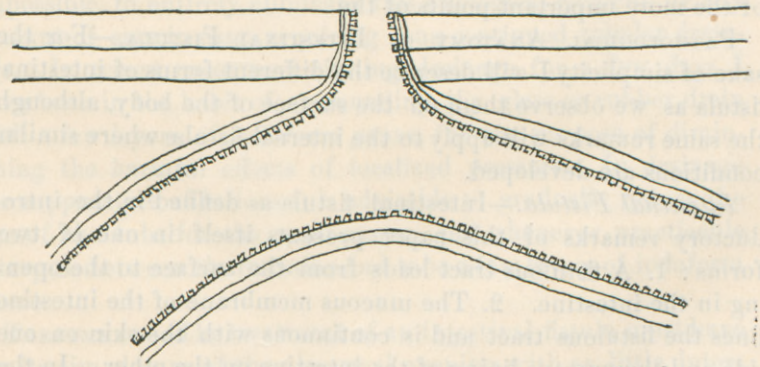

FIG. 2.—Intestinal fistula lined by the mucous membrane of the bowel.

bowel takes place in consequence of an intestinal obstruction, the cause or causes which have given rise to this accident maintain the obstruction and all of the intestinal contents escape through the fistula, which then serves the purpose of an artificial anus. If the perforated part of the bowel becomes flexed by adhesions or otherwise, the flexion narrows the lumen of the

bowel and directs the fecal current toward the abnormal outlet (Fig. 3). Under such circumstances a considerable part of the intestinal contents necessarily escapes through the fistulous opening. If the flexion becomes more acute the intestinal wall

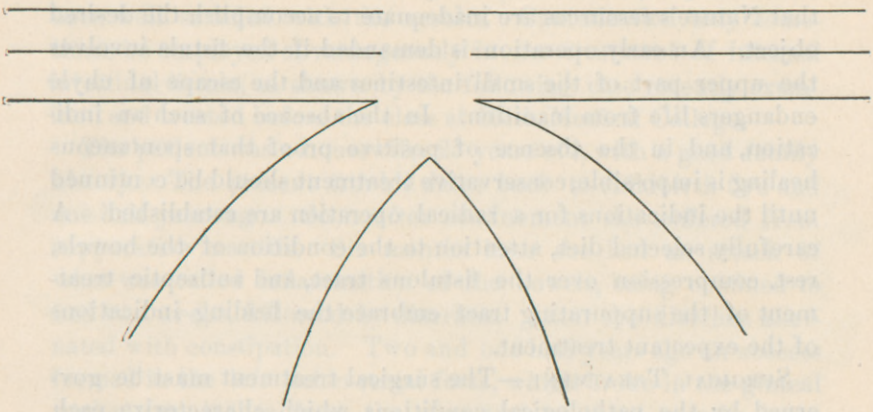

FIG. 3.—Intestinal fistula with flexion.

opposite the opening forms a spur—promontorium (Scarpa), éperon (Dupuytren)—which when fully developed completely intercepts the fecal current and transforms the fistulous opening into an artificial anus (Fig. 4).

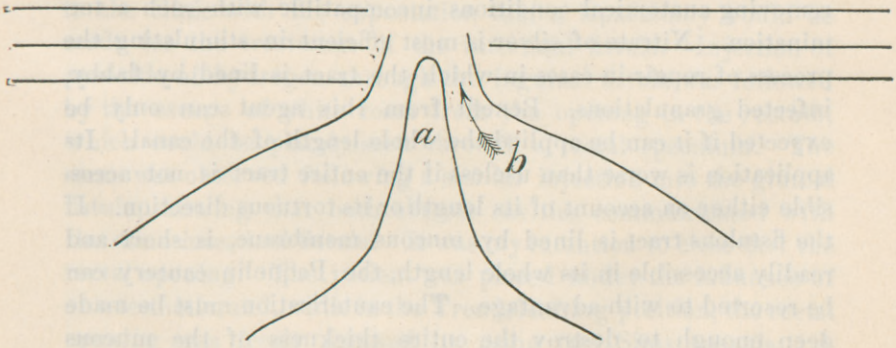

FIG. 4.—Artificial anus. *a*, spur ; *b*, direction of fecal current.

From these remarks and the accompanying drawings it necessarily follows that spontaneous healing can only be expected in cases in which the fistulous tract is not lined by mucous membrane and in which the fecal current meets with no impediment by flexion or spur formation. As the fistulous opening in the

bowel is often beyond the reach of an examination to determine the actual conditions, time plays an important part to enable the surgeon to determine whether or not surgical interference is necessary. In the absence of an *indicatio vitalis* an operation should be postponed until the clinical course has demonstrated that Nature's resources are inadequate to accomplish the desired object. An early operation is demanded if the fistula involves the upper part of the small intestines and the escape of chyle endangers life from inanition. In the absence of such an indication, and in the absence of positive proof that spontaneous healing is impossible, conservative treatment should be continued until the indications for a radical operation are established. A carefully selected diet, attention to the condition of the bowels, rest, compression over the fistulous tract, and antiseptic treatment of the suppurating tract embrace the leading indications of the expectant treatment.

Surgical Treatment.—The surgical treatment must be governed by the pathological conditions which characterize each individual case. A careful inquiry concerning the etiology and pathology in each case is therefore necessary in order to enable the surgeon to select the appropriate therapeutic resources.

Cauterization.—Cauterization of the fistulous tract is useful not only in expediting spontaneous healing in cases in which such a result is to be anticipated, but also for the purpose of removing anatomical conditions incompatible with such a termination. Nitrate of silver is most efficient in stimulating the process of repair in cases in which the tract is lined by flabby, infected granulations. Benefit from this agent can only be expected if it can be applied the whole length of the canal. Its application is worse than useless if the entire tract is not accessible either on account of its length or its tortuous direction. If the fistulous tract is lined by mucous membrane, is short and readily accessible in its whole length, the Paquelin cautery can be resorted to with advantage. The cauterization must be made deep enough to destroy the entire thickness of the mucous membrane. On separation of the tubular eschar the fistulous opening is enlarged, and for a time more of the intestinal contents escape through it; but in a short time the canal becomes blocked by granulations, which eventually result in its closure. Before using the cautery the length of the tract must be carefully determined, in order to protect the bowel against injury

from the point of the instrument. The same instrument is of value in the treatment of larger fistulæ, lined by mucous membrane, not complicated by mechanical impediments to the fecal circulation. I have resorted to this procedure in a number of cases of surface fistulæ lined by mucous membrane, and have been well satisfied with the results. Cauterization may sometimes be employed advantageously in the treatment of internal intestinal fistula, as shown by the following case recently examined and treated before the class at Rush Medical College.

The patient was a housewife, 25 years old, with a good family history. The present trouble dates back to childbirth five and one-half years ago. Soon after confinement she suffered from suppurative mastitis. Six months later she had an attack of what was called inflammation of the bowels, being confined to bed two weeks, followed by diarrhea. Later the diarrhea alternated with constipation. Two and one-half years ago an abscess formed in the left ischio-rectal fossa, which broke in the gluteal region, two inches from the anus, two or three months later. Stools later contained blood but no pus. Second opening appeared six months later in left inguinal region, from which gas and fecal matter escaped from the first, later intestinal contents from the first opening. Rectal examination revealed an indurated area about four inches above the anus, in the centre of which a small opening could be felt. The patient was brought to the clinic with the expectation that a laparatomy would be made for the treatment of the intestinal fistula. Injection of peroxide of hydrogen through the inguinal fistula was followed by the escape of white foam from the opening in the rectum, which could be plainly seen through a rectal speculum. The same was observed following a similar injection into the gluteal fistula, showing that both abscess cavities communicated with the same intestinal fistula. It was my intention to close first the rectal opening. The patient was placed under the influence of an anesthetic, and, while in the Trendelenburg position, the rectal opening was freely exposed by using two Sims specula. A probe was passed from the rectum into the abscess cavity, which served as a guide to the needle point of the Paquelin cautery with which the fistulous tract was thoroughly cauterized. For a few days, more fecal matter escaped through the fistula, but in the course of a week the cauterized tract was found blocked by granulations which prevented even the escape of gas. The

patient has continued to improve, and at present the rectal opening is almost closed, the discharge of pus from the abscesses greatly diminished, and there is every prospect that this simple treatment will be followed ultimately by complete closure of the fistula and healing of the abscesses.

Drainage of Abscess Cavity.—An abscess cavity interposed between the intestinal opening and the fistulous tract on the surface or in one of the pelvic organs constitutes often an insurmountable obstacle to spontaneous healing. In many such cases the abscess cavity is imperfectly drained and is being continually contaminated by fecal material. If the abscess is so located that it can be safely and more efficiently drained, such a procedure will often accomplish all that is desired. This method of procedure is particularly indicated in the treatment of pelvic abscesses complicated by intestinal fistula. It must, however, not be forgotten that under such circumstances the organs in the vicinity of the abscess are often displaced by inflammatory adhesions and exposed to injury in efforts to secure better drainage. I will cite a case in point that came under my own observation.

A lady, 35 years of age, applied to me for treatment of an intestinal fistula in the left groin. The fistula was preceded by a pelvic abscess on the same side, which was opened above Poupart's ligament. Several weeks later gas and fecal matter escaped through the opening. This condition had existed for two years. Periodical discharge of increased quantity of pus satisfied me that the original abscess cavity had not obliterated, owing to imperfect drainage. As I could find some induration on the left side of the uterus, I decided to drain the abscess into the vagina. While the patient was under the influence of an anesthetic the external opening was enlarged sufficiently to enable me to follow the tortuous canal into the pelvis to the left side of the uterus. With the left index finger in the vagina I could feel the point of the forceps when the instrument was pushed through the tissues and the mucous membrane incised over the point. The canal was dilated and a rubber drain half an inch in diameter drawn through, thus establishing through drainage. The abscess cavity was thoroughly irrigated. When I visited the patient the next day I was informed that she had passed no urine since the operation. I found the bed saturated with urine. Mistrusting what had happened, I injected into the bladder warm boric acid solution, which escaped at once

through the vaginal part of the drain. It was evident that I had transfixed with the forceps the displaced bladder. The drain was removed and a Sims catheter inserted into the bladder. The drainage of the abscess cavity from the surface was continued. The wounds in the bladder healed under this simple treatment in the course of a week, and a few weeks later the fistulous opening closed permanently.

Mechanical Repression of Spur.—The spur has been recog-

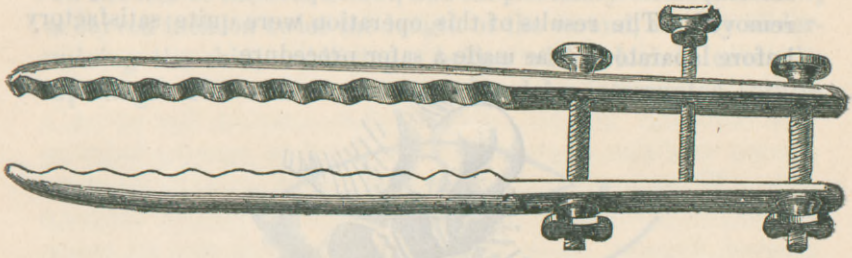

FIG. 5.—Dupuytren's enterotome. (After Esmarch.)

nized as a cause of the persistence of intestinal fistula for a long time, and different methods of treatment have been devised for its removal. Desault advised the insertion of a roll of charpie into the bowel with a view of increasing the size of the lumen of the bowel and of repressing the spur. Banks inserted a large

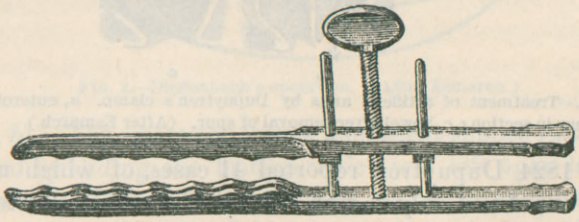

FIG. 6.—Dupuytren's enterotome modified and improved by Blasius. The instrument is applied to the spur in the manner shown in Fig. 7. (After Esmarch.)

rubber tube, which he fastened in the fistula, for the same purpose. As the formation of the spur takes place in consequence of the flexion of the bowel, we can readily understand why all such mechanical devices have proved of so little value.

Removal of Spur.—The first efforts to remove the spur by operative procedure were made by Schmalkalden in 1795. He removed the spur with scissors and knife. The disastrous re-

sults which must have necessarily followed this operation led Dupuytren to accomplish the same object by a bloodless method. He devised for this purpose a clamp (enterotome) (Figs. 5–7), which he applied to the spur, and by tightening the screws connecting the branches made it cut its way through the tissues by causing linear necrosis of that part of the septum included in its branches. The instrument effects its object in from three to eight days. It is then again applied on the side of the linear section, and the same procedure is repeated until the spur is removed. The results of this operation were quite satisfactory before laparatomy was made a safer procedure.

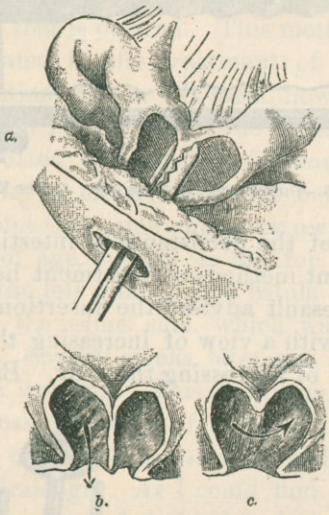

FIG. 7.—Treatment of artificial anus by Dupuytren's clamp. *a*, enterotome applied; *b*, the spur in section; *c*, bowel after removal of spur. (After Esmarch.)

In 1824 Dupuytren reported 41 cases, of which number 29 were cured and only 3 died. Later Heimann collected 83 cases with a mortality of 4.83 per cent. The most recent statistics collected by Körte comprise 111 cases with 11 deaths. In many of the cases, however, the fistula remained. After the removal of the spur the margins of the fistula were usually destroyed with the actual cautery. I shall show further on that the spur develops in consequence of flexion, and that if the flexion is arrested in the operative treatment of artificial anus its removal is superfluous. The recent advances made in intestinal surgery will render Dupuytren's operation obsolete in the near future.

Closure of Fistula by Plastic Operation.—The closure of intestinal fistula by plastic operation was introduced by Dieffenbach. It was not his intention, by the operation which he devised, to close the opening in the bowel at once, but to cover it with a bridge of skin, leaving the closure to be accomplished later gradually by granulation. Between two elliptical incisions he excised the margins of the fistulous opening (Fig. 8, *a*)[1] and the skin surrounding it. A bridge of skin is made by making on one side of the oval defect, and the necessary distance from it, a curved incision twice the length of the wound, and, by undermining the skin, mobilizing a bridge with which to cover the opening. The oval wound was closed by interrupted sutures

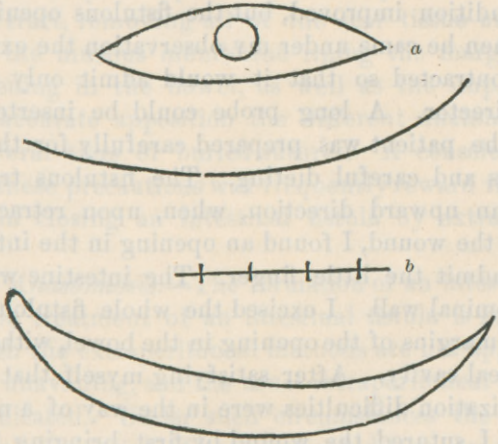

FIG. 8.—Dieffenbach's operation. (After Esmarch.)

(Fig. 8, *b*). The operation leaves a crescent-shaped raw surface, produced by sliding the bridge, which was left open to heal by granulation. This operation, as well as plastic closure by pedunculated flaps, had its field of usefulness before abdominal operations were rendered comparatively safe by an improved technique and the general adoption of aseptic precautions, but is seldom, if ever, resorted to at the present time.

Suturing of Fistula without Opening the Peritoneal Cavity.—The closure of an intestinal fistula by vivifying its margins and suturing, without detaching the bowel or opening the peritoneal cavity, has not yielded very satisfactory results. The operation is only adapted for cases in which the intestine is

[1] König, vol. ii., p. 405, Fig. 50.

attached to the abdominal wall and the fistulous opening is readily accessible, and where no canalization impediments are present. I have succeeded in two cases in closing the fistula completely and perfectly by one operation.

The first case was a young man, 18 years old, who was attacked suddenly by circumscribed suppurative peritonitis in the upper part of the abdominal cavity. An abscess formed, which was opened at the left border of the left rectus muscle a little below the level of the umbilicus. A few days later nearly all of the intestinal contents escaped through the opening. The character of the chyle which escaped indicated that the intestinal perforation was near the stomach. The amount of intestinal discharge gradually diminished in quantity, the patient's general condition improved, but the fistulous opening failed to close. When he came under my observation the external opening had contracted so that it would admit only an ordinary grooved director. A long probe could be inserted its entire length. The patient was prepared carefully for the operation by laxatives and careful dieting. The fistulous tract was enlarged in an upward direction, when, upon retraction of the margins of the wound, I found an opening in the intestine large enough to admit the little finger. The intestine was adherent to the abdominal wall. I excised the whole fistulous tract, and with it the margins of the opening in the bowel, without opening the peritoneal cavity. After satisfying myself that no spur or other canalization difficulties were in the way of a normal fecal circulation, I sutured the wound by first bringing in accurate contact the mucous membrane by fine silk sutures, placing them close together. In the next row of buried sutures, of catgut, I included the entire thickness of the bowel wall *minus* the mucous membrane. The next row of buried sutures, of the same material, included the entire thickness of the abdominal muscles, and finally the skin was sutured separately, using for this purpose again fine silk. The antiseptic dressing was retained by broad strips of adhesive plaster. Stomach feeding was prohibited for three days. The entire wound healed under one dressing by primary union. The operation was performed several years ago and the patient has remained in perfect health. I have no doubt that in this case the peritonitis and abscess resulted from perforation of a duodenal ulcer. The thickness of the intestinal wall, as well as the size of the lumen

of the bowel, indicated that the fistula occupied this part of the intestinal tract. In the second case, a man aged 30, the fistulous opening involved the cecum and formed after an attack of appendicitis. The opening was large enough to introduce two fingers, and nearly all of the intestinal contents escaped through this abnormal outlet. Four or five operations had been made, with the result that after each operation the size of the intestinal opening was increased. The patient was subjected to preparatory treatment for at least a week, when a similar operation was performed as in the last case, with the same satisfactory immediate and remote results. In advising a resort to this, as far as life is concerned an absolutely safe operation, I must insist in the first place upon the necessity of freely excising the fistulous tract, removing all of the scar tissue and a circular strip of the mucous membrane lining the margins of the fistulous opening in the bowel, as well as the importance of bringing in accurate apposition the different anatomical structures by several tiers of buried sutures. A conscientious observance of these precautions will frequently reward the surgeon by success in closing an intestinal fistula by extraperitoneal suturing.

Intestinal Anastomosis.—The formation of an intestinal anastomosis in the treatment of an intestinal fistula is indicated in cases in which the extraperitoneal methods are not applicable or have proved unavailing, and the usual intraperitoneal operations are contraindicated. Under such circumstances the exclusion from the fecal circulation of the perforated loop, by the formation of an anastomotic communication between the afferent and efferent limbs of the loop, will remove the annoyances incident to an intestinal fistula and place the parts in a more favorable condition for spontaneous healing or more successful surgical intervention. The anastomotic opening should be made at least two inches in length. The operation can be performed most safely by the use of decalcified perforated bone plates or by Czerny-Lembert sutures. For the purpose of showing the value of this method of procedure in rare cases I will relate a case that came under my observation a few years ago. A lady, 30 years of age, suffered for several weeks from pelvic peritonitis, which resulted in the formation of an abscess, which was opened above Poupart's ligament on the left side. A few days after the abscess was incised, gas and fecal matter escaped from this opening.

Additional abscesses on the same side appeared, which were either opened externally or discharged through the first abscess cavity. The fecal fistula remained. The case came under my charge in my hospital service nearly a year after the first attack. The patient was greatly emaciated; more than one-half of the intestinal contents escaped through the abnormal outlet. The fistulous tract led down into the cavity of the pelvis to the left of the uterus. Rectal insufflation of hydrogen gas demonstrated that the fistula was above the ileo-cecal valve. After a few days of preparatory treatment I opened the abdomen and found the lower part of the ileum rolled up into a mass by numerous and firm adhesions. I made a faithful attempt to unravel the mass, but had to abandon the task. I could not find the perforated part of the intestine. The mass comprised from three to five feet of the lower part of the ileum. Excision of this mass was absolutely out of the question, owing to the patient's general condition and the number and character of the adhesions. I finally succeeded in finding the intestine on the proximal side, and established between it and the adjacent sigmoid flexure a communication with the aid of large decalcified perforated bone plates, and closed the external incision. Very little fecal material escaped from the fistula after the operation, while the discharges from the bowels became more copious and liquid. It was evident that the fecal current had been diverted away from the numerous adherent coils of the lower part of the ileum into the sigmoid flexure. The patient improved in general health and was relieved from the annoyances incident to an intestinal fistula. A number of times the fistulous opening closed, but reopened; this occurrence is always attended by a limited discharge of pus. The abscess cavity has evidently never healed completely, and undoubtedly maintains the fistula. I anticipate that the excluded part of the intestinal canal will continue to undergo progressive atrophy, and that ultimately the fistulous opening will close spontaneously. So far the operation has resulted in restoring the continuity of the intestinal canal by excluding from functional activity the partially impermeable lower part of the ileum. It appears to me that a similar procedure would often prove of great value in the treatment of vesico-intestinal fistula in which the operative closure of the opening and enterectomy are impracticable.

Enterectomy.—The mortality attending enterectomy and cir-

cular enterorrhaphy in the treatment of intestinal fistula and artificial anus remains great even in the hands of experienced operators. The statistics of Reichel give a mortality of 37.8 per cent, and those of Hertzberg 27 per cent. In view of this fact it is apparent that this operation should be reserved for cases not amenable to successful treatment by safer procedures. I am confident that the indications for this operation can be limited to *exceptional* cases. If the intestine is not attached to the abdominal wall, it is much safer to open the free peritoneal cavity in search of the affected part of the intestine than to follow the fistulous tract as a guide. If possible, the intestine should be tied on each side of the fistula with a strip of gauze or a rubber band before it is detached, in order to guard more efficiently against fecal extravasation. The operation should be performed with the patient in the Trendelenburg position and the peritoneal cavity amply protected by aseptic compresses during the resection and suturing. After the resection the continuity of the bowel should be restored by circular enterorrhaphy by Czerny-Lembert sutures.

Preliminary Transverse Suturing of the Intestinal Opening as a Prophylactic Measure against Infection during the Operation for Artificial Anus.—There can be little doubt that the operative treatment of intestinal fistula or artificial anus requiring opening of the abdominal cavity has been attended by an alarming mortality, owing to infection caused by the escape of feces through the intestinal opening. Packing the opening with gauze or cotton is a very inefficient way in which to prevent fecal extravasation. The use of clamps and ligatures on each side of the opening in the bowel is equally unreliable. It appears to me the only safeguard against this source of danger is preliminary closure of the intestinal opening by suturing, placing the sutures so close together as to absolutely prevent the escape of any of the intestinal contents. After this has been done the field of operation is once more thoroughly sterilized before the abdomen is opened and the intestine detached. The sutures should include all of the tunics of the bowel. With few exceptions this row of sutures will remain as Czerny sutures, to be buried, after the bowel has been detached, by Lembert stitches. I have already made the statement that I look upon flexion of the bowel as the most important factor in producing the spur, and that measures which are calculated to correct the flexion

will prove useful in removing the spur. In artificial anus, produced accidentally or intentionally, the flexion is caused by the prolapse of the intestinal loop into, and sometimes even beyond, the opening in the abdominal wall. If the intestine is detached the flexion is diminished or completely corrected, and its recurrence is prevented by transverse suturing of the intestinal opening. I am fully convinced of the correctness of these statements, and will corroborate them by the report of two cases of artificial anus which I operated upon in the clinic of Rush Medical College during the last session. The first patient was a man 29 years old, Irish-American. About a year before he entered

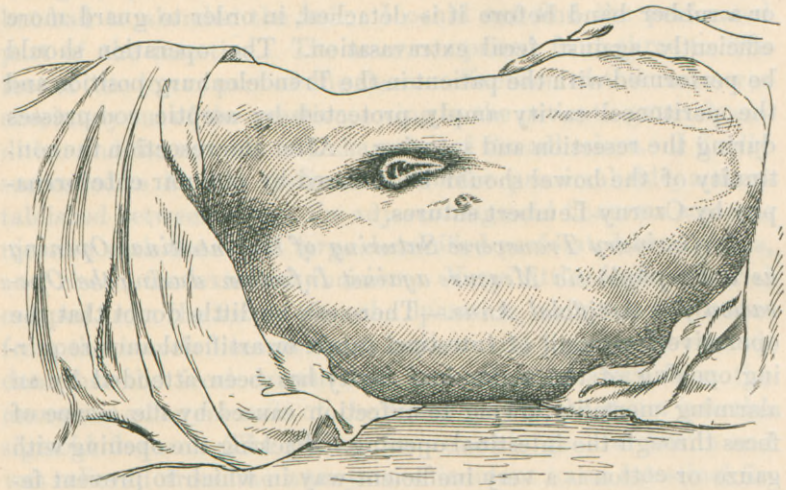

FIG. 9.—Artificial anus following appendicitis. Well-marked ectropion of the mucous membrane.

the Presbyterian Hospital he was taken suddenly with severe pain in the right iliac fossa. The attending physician made a diagnosis of appendicitis, and four days later opened an abscess at a point about two inches toward the inner side of the anterior superior spinous process of the ilium. A few days later feces escaped through the opening. An attempt was made to prevent the escape of fecal matter by applying a compress. Then followed twelve operations, with the intention of closing the fistula, in one of the hospitals in St. Louis. The only result effected by the operations was increased size of the opening. When the case was presented in the clinic the opening in the abdominal wall and the anterior wall of the cecum was large enough to insert

three fingers. In the centre of the opening I found a well-developed spur which effectually prevented the entrance of any of the intestinal contents into the colon. The border of the opening in the abdominal wall was lined by the ectropic mucous membrane of the cecum (Fig. 9). The ileo-cecal valve could be seen and felt below the spur. The patient was prepared for the operation by dieting, laxatives, and daily warm bath for a week. The operation was commenced by suturing the oblong vertical intestinal opening transversely, using for this purpose fine silk and an ordinary sewing needle (Fig. 10). After the lumen of the intestine with its contents was shut off from the field of ope-

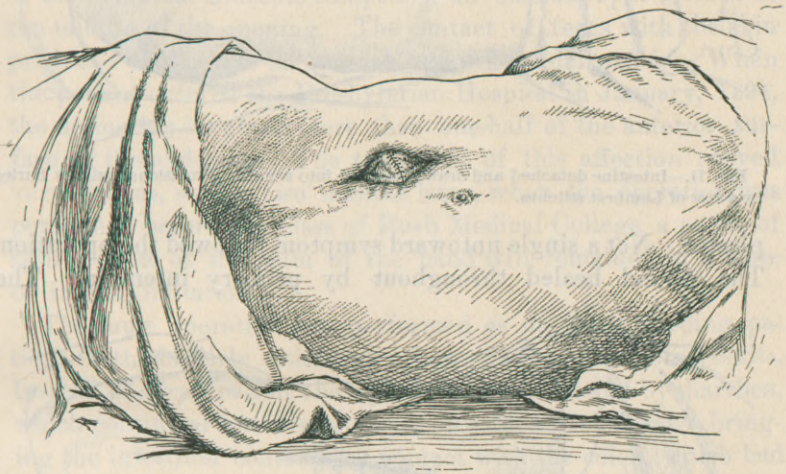

FIG. 10.—Provisional sutures including all of the tunics of the bowel. Transverse suturing of intestinal opening.

ration, the surface was once more thoroughly disinfected. The next step in the operation consisted in including in two elliptical incisions the margins of the abdominal opening and the scar tissue in its vicinity. The peritoneal cavity was opened by a straight incision extending downward from the lower angle of the two incisions. The bowel was detached from the abdominal wall and drawn forward into the external incision. The strip of skin and scar tissue was carefully trimmed away from the bowel with scissors, when the provisional sutures were buried by a row of Lembert stitches (Fig. 11).

The prolapsed part of the bowel was cleansed, dried, and

replaced in the abdominal cavity and the external wound closed by four tiers of sutures (Fig. 12). The usual antiseptic dressing was applied and confined in place by broad strips of adhesive

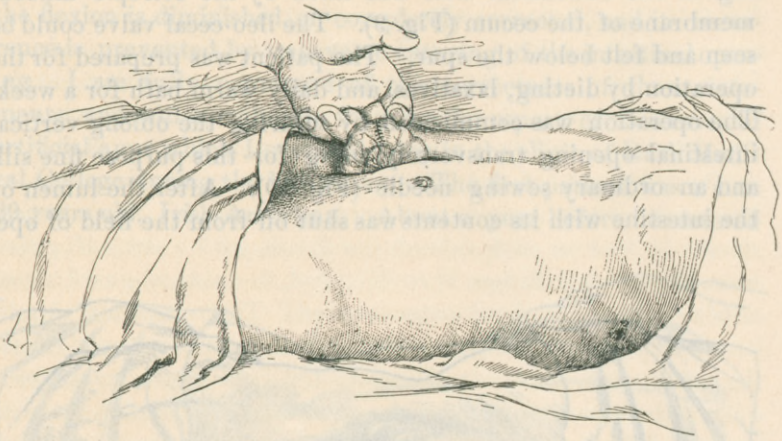

FIG. 11.—Intestine detached and drawn forward into wound. Provisional sutures buried by a row of Lembert stitches.

plaster. Not a single untoward symptom followed the operation. The wound healed throughout by primary intention. The

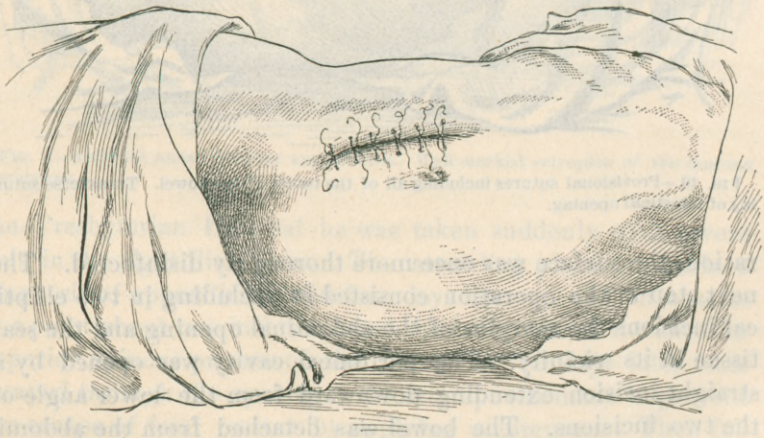

FIG. 12.—Operation completed.

bowels responded to a laxative on the third day and subsequently moved daily without further assistance. The patient left the hospital at the end of four weeks with instructions to wear a pad for at least six months.

The second case was a girl 9 years old. During October last she suffered from an acute attack of appendicitis, which resulted in the formation of a large abscess. The abdomen was opened, the perforated appendix was removed. It was noticed that the anterior wall of the cecum presented a large gangrenous patch. It was deemed advisable to anticipate perforation by excluding this area from the free peritoneal cavity by a ring of sutures uniting the visceral with the parietal peritoneum. The balance of the incision was closed with the exception of a space for drainage. The patient's general condition improved promptly after the operation. The gangrenous part sloughed away, leaving a large opening in the cecum. Through this opening nearly all of the intestinal contents escaped, as an efficient spur formed at the middle of the opening. The contact of feces with the skin produced in this case an intense and diffuse dermatitis. When the patient entered the Presbyterian Hospital in January, 1894, the dermatitis involved more than one-half of the anterior surface of the abdomen. The treatment of this affection proved very tedious, so that two months later, when the operation was performed before the class of Rush Medical College, a patch of skin the size of the palm of the hand still remained in a state of intense irritation.

The same operation was performed as on the preceding patient, with similarly satisfactory immediate and remote results. Instead of constipation the operation was followed by diarrhea, which continued for several days, provoked probably by bringing the intestinal contents in contact with the colon, which had been almost completely excluded from the fecal circulation for five months. The wound healed by primary intention throughout. The dermatitis disappeared promptly after the removal of the cause. The patient left the hospital in perfect health four weeks after the operation.

A study of these cases has convinced me that the provisional closure of the intestinal opening by transverse suturing before using the knife is the most efficient prophylactic measure against infection, and that resection of the intestine for fistula and artificial anus can be avoided in the majority of cases, and that in its place transverse suturing and correction of the flexion will yield better results.

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