Original Articles.

INTUSSUSCEPTION.¹

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THAT intussusception is not rare is shown by the fact that over 500 cases have been reported within the last twenty-five years. According to Leichtenstein, 40 per cent. of all cases of intestinal obstruction are due to this lesion. Probably three-fourths of the cases occur in infants, though no age is exempt, even the fetus at full term not escaping. The lesion is due to the swallowing by one portion of the gut of its neighboring piece which has become constricted in consequence of a vigorous contraction of its circular fibres. According to Power, children are predisposed apparently on account of the greater length of the mesentery.

All cases should be considered, in the interest of the patient, to be surgical from the beginning. A strangulated hernia has long since ceased to be a medical disease; how much more should an internal strangulation with its similar possibilities be within reach of surgical interference if necessary. As in appendicitis, every case may not demand operation, but the responsibility should be placed in the hands of one who is ready and able to operate at the earliest opportunity.

Intussusception may be caused by sudden blows or injuries, muscular efforts, tumors of various kinds, typhoid or tubercular ulcerations, diarrhea and possibly vomiting and coughing.

The invagination is found in more than half of the cases in the ileocecal region, though other portions of the intestinal tract may be involved, Chiari and Engel each having seen a partial invagination in the stomach. The jejunum is comparatively rarely affected.

The symptoms in a typical case are sudden and acute abdominal pain, usually coming on at night, vomiting and stools containing mucus and blood. There may be diarrhea or obstipation. A tumor, not necessarily sausage-shaped, can be felt in the abdomen, generally on the right side, but until peritonitis has begun, spasm is absent or slight in degree. As the intestine becomes more and more constricted, congestion, stasis, infiltration and necrosis follow. Owing to the greater elasticity of the constricting ring as compared with the ring in external hernia, we are less liable, comparatively speaking, to find strangulation. Furthermore, the inner tubes being more liable to become gangrenous than the sheath, peritonitis may be escaped by the passage of the gangrenous portion along the digestive tract. But, in actual practice, it is not safe to rely on so slight an advantage, or to consider the condition less serious than it is, to wit, one of the most serious than can confront the surgeon.

Intussusception may be acute, chronic, chronic with acute exacerbations, single or multiple, direct or reversed.

Peritonitic adhesions may not form for weeks, or may begin with the onset of the invagination.

Spontaneous recovery may take place by disinvagination or by separation of the inner tube and evacuation

tion later; in the latter way several feet of gut may be lost, one observer (Peacock) having seen eight pieces, aggregating twelve feet, passed during the course of three years. Disinvagination without any interference beyond medical treatment occasionally takes place, but such a fortunate outcome is rarely to be anticipated. Of spontaneous separation Rydiger says that it is very satisfactory but rare, "and to speculate on a chance accident is not an established therapeutic procedure." Many such cases die later of perforation, peritonitis, stricture, etc. According to Senn, young children and infants seldom, if ever, recover in this way.

Treatment by mechanical distention with liquids, air or gas may be successful if employed early, that is, within the first twenty-four or forty-eight hours at the utmost. In acute cases it is best given with full anesthesia and the patient inverted, all preparations for laparotomy in case of failure, necessity or doubt having been made. The pressure should be slight, not over two pounds if gas be used, or if a liquid, the reservoir should not be over two or three feet above the patient. A low intussusception may rarely be pushed back by a finger or tube passed into the rectum.

There is considerable shock from such a simple procedure, and many cases of rupture of the intestine during injection have been recorded. It is difficult to reduce the final inch of the invagination, and without actual inspection one cannot tell whether the reduction has been complete or not, so that the cases of recurring intussusception are probably due to the failure of complete disinvagination and not to a fresh, independent attack. Barker says that there is a tendency of the bowel to unroll itself *up to* the point at which it first began, but no farther; in other words, the supposed reduction is not a complete one, and abdominal palpation under such conditions may fail to show any tumor.

In brief, injection is justifiable in chronic cases; where the patient refuses operation in acute cases; when beyond surgical aid and within a few hours after the onset of the attack. If the first attempt in acute cases is not successful it is useless to make a second trial.

All authorities urge operation in one form or another, as early as possible in acute cases and at once after trying a simpler procedure, such as injection, for the same reason that one should be prepared to attack a hernia after failure to reduce it by taxis. In chronic cases it is unwise to delay over a week, simple attempts at reduction having been made meanwhile. The patient should be watched closely to forestall any acute attack. As in operating on the appendix in the interval, the risk of a laparotomy is reduced to its minimum.

After opening the abdomen there are various methods of dealing with the many conditions found. Of these we may consider artificial anus, entero-anastomosis, disinvagination or reduction, complete and partial resection.

Artificial anus has very little to recommend it. There is scarcely a recorded recovery in an acute case. Occasionally a chronic case has survived, and an acute case where a resection has followed the artificial anus which was resorted to to tide the patient along temporarily. As it does not relieve the strangulation or its consequences except the distention and

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obstruction, it must be looked upon merely as a makeshift or an evidence of faintheartedness.

Entero-anastomosis has very little more to recommend it. The intestinal current is, to be sure, re-established, but the invagination with all its possible and probable consequences still remains. A few cases, less than a dozen, of recovery in adults have been reported, most, if not all of them, being in chronic intussusception.

Disinvagination or reduction is the ideal operation, and if the case is seen early, before necrosis and firm adhesions have taken place, the outlook for its successful employment is good. Everything depends on the interference being early. Fifteen years ago Treves found that the mortality was only 30 per cent. in cases easily reduced, as against 91 per cent. in those reduced with difficulty, and since then, with the improvement in technique and diagnosis, the early operation shows a much lower death-rate.

Where the reduction is not easy on account of firm adhesions there is always a risk of tearing the bowel or of gangrene from the prolonged pressure, and in such suspicious cases it is safer to isolate or drain the area involved. Chronic cases are not necessarily difficult to reduce, even after weeks or months of invagination. In reducing, Senn advises that the edema be treated first as in a phimosis and then that counter-traction be made below the apex in order to prevent folding, in the sheath and middle cylinders; occasionally insufflation will add materially in the manipulation. To prevent re-invagination if it appears liable to take place, he also suggests that the mesentery be shortened.

Where, owing to adhesions, tumors, necrosis or perforation, disinvagination is not possible, a resection in one form or another must be resorted to. Probably the simplest method is that devised by Maunsell or some modification similar to that described by Rydygier. The entering gut is sutured to the sheath at the neck without disturbing its position, and then through a longitudinal incision in the sheath the invagination is delivered and amputated near the neck, the free edges of the stump being sutured together, controlling in that way the mesenteric vessels. After dropping the stump back into place, the opening in the sheath is closed. If the invagination cannot be delivered through the side opening after amputation it may be left to come away later in the stools. Where possible a typical Maunsell operation may be done. In this way the least possible amount of intestine is sacrificed and the mesentery is quickly and easily controlled. The use of buttons or spoons is unnecessary.

Where the sheath is gangrenous a complete excision is enforced, end-to-end or lateral anastomosis being employed. Here plates or buttons may be used if thought best. Occasionally it may be found that all of the intussusceptum and a portion only of the sheath may be removed. If the intussusception is low down resection may at times be done through the rectum without opening the abdomen.

As, for the most part, all data and methods are based on intussusception in the child and in the ileocecal portion of the intestine, it may be well, in view of the two personal cases reported to-day, to consider, in more detail, invagination in adults and especially when it takes place in the jejunum.

Adding to Braun's table made in 1885 and to

Rydygier's table made in 1895 14 cases of reduction or resection in adults over sixteen years of age reported since, we have a group of 72 cases altogether. Undoubtedly there have been many more cases that have been operated upon, but so far as could be discovered no more have been recorded.

Of 21 recoveries after reduction—including the cases of Perceval (1888), Stretton (1894) and Barker (1897)—13 were in the ileocecal or colic region, four were iliac, one jejunal and three unknown. Thirteen were chronic cases, seven acute, and one unknown.

Of 13 fatal reductions—including the cases of Davies-Colley, White (1889), Richardson (1892)—nine were ileocolic, one each, iliac and jejunal, and two unknown. Seven were acute and six were chronic, probably some of the latter being operated upon during an acute exacerbation. Shock and peritonitis were the main causes of fatal issue.

Of 17 recoveries after resection—including the cases of Hartley (1892), Wassiljew and Munro (1898)—14 were ileocolic and one each was iliac, colic and jejunal. Six were acute or chronic with acute exacerbations, and nine were chronic, while two were unknown. In two cases (Mikulicz and Wassiljew) the resection was secondary to an artificial anus.

Of 21 fatal resections—including the cases of Abbe (1891), Senn, Robson and Munro (1897)—nine were ileocolic, seven iliac, one colic, two jejunal and two unknown. Fourteen were acute or chronic with acute exacerbations, five were chronic and two unknown. One (Esmarch) was secondary to artificial anus. Nearly all died of peritonitis or shock.

The jejunum was involved in only five of these cases:

(1) White's case, an acute invagination ten inches long and two and one-half feet from the pylorus, died on the table, the operation being abandoned.

(2) Stutsgaard's case, caused by a lipoma and of unknown duration, died in five days of peritonitis after resection of 128 centimetres.

(3) Robson's case, of seven days' duration, died after resection of four feet and an end-to-end anastomosis.

(4) Borch's case of acute ileojejunal invagination recovered after disinvagination.

(5) Writer's case of recovery after resection of thirty-two inches of jejunum.

The earlier cases, like those reported by Velse, Fuchs and others at the beginning of the present century were naturally cases of reduction, many of them being easily replaced. When in recent years resection began to be employed it was at first almost uniformly fatal, but with the improvement in technique the mortality has fallen nearly one-half, and in all probability it will never be much less because, with earlier diagnosis and operation, resection will be replaced by reduction, leaving only the desperate and neglected cases for the more serious operation.

Where the lesion involves the upper portion of the intestine any procedure must of necessity be fraught with more danger than in the cases in which the lower part of the tract is involved, but fortunately the latter region is far more frequently affected, so that with early surgical supervision and early interference in both acute and chronic cases after a judicious trial of simpler, non-operative means, many more patients should be saved. It remains in the

hands of the general practitioner to realize the grave possibilities in all cases and to protect himself and his patients by early resort to the surgeon, who, on his part, must appreciate that death, just as in strangulated hernia or in acute appendicitis, is too often the price of a useless delay.

As a contribution to the statistics of operation for intussusception in adults, the writer will add two cases of his own. Both have been briefly reported in the Boston City Hospital Medical and Surgical Reports, Series X, but it may be allowed to give the history of one a little more in detail, the fatal one being dismissed in a few words.

CASE I. Male, thirty-seven years old, was admitted to Dr. H. W. Cushing's service at the Boston City Hospital with a history of abdominal pain, obstipation, distention and tenderness in the region of the appendix for sixty hours. Operation under ether. Intussusception of the lower end of the ileum eight inches long and with beginning gangrene was found. Amputation proximally seven inches from the invagination and distally close to the cecum, or about one inch from the invagination, with end-to-end anastomosis, was made. Patient in poor condition at time of operation. On the following day he was still very ill and got out of bed against orders. Sixty hours after operation he died, a partial autopsy showing the abdomen to be full of feces from a rupture in the intestine on the proximal side of the joint, which was tight.

The history of the case of recovery after resection is as follows:

CASE II. Chin Yuen, a Chinese laundryman, twenty-one years old, entered Dr. F. H. Williams's service at the Boston City Hospital, October 21, 1898, with a history of intermittent abdominal pain in right upper quadrant for three weeks. There was also an indefinite history of abdominal pain nine months previously, but as the patient talked very little English no definite connection between the two attacks could be obtained. Considerable nausea and vomiting. Bowels regular. Sleep poor on account of pain. During paroxysms he rolled about the bed moaning, and lay preferably on his belly. Pulse 90, regular and of good strength. Heart and lungs negative. A moderately lax, tympanitic abdomen, tender on deep pressure, more resistant on the right side, with increased localized resistance in the right hypochondrium. Two days later there was a leucocytosis of 13,500.

October 27th. No vomiting for five days; the face has lost the drawn expression and he no longer cries with pain. Better appetite and sleep.

October 31st (four days later). No abdominal pain since the 27th, bowels regular, general condition much improved and for several days he has been up and dressed ready for discharge, but two days afterward, on November 2d, he again had an attack of abdominal spasm and passed some blood at stool. Transferred to Dr. George W. Gay's service under the care of the writer. Examination without ether showed a tumor filling the pelvis and pushing the anterior wall of the rectum backwards, the tumor extending upwards along the right iliac fossa to the right hypochondrium. Spasm of the abdominal muscles. In view of his previous history it seemed best to delay in the hope that he would again quiet down enough to allow operation in the interval, but

as the symptoms did not improve operation was performed on November 5th.

Operation under ether.—Incision three to four inches long at the outer edge of the rectus, exposing a sausage-shaped tumor extending from beneath the left lobe of the liver to deep in the pelvis, twelve to fourteen inches in length. Towards the lower end were three gangrenous areas that ruptured on handling, allowing pus and feces to escape. After clamping the bowel above and below the intussusception, the mesentery was cut parallel to the gut and the vessels controlled with a continuous half-hitch catgut suture, but owing to the abundant vascular supply additional ligatures were required. In order to gain a little room and to save as much of the bowel as possible the gut was disinvaginated for an inch or more at the neck, but after delivery the circulation was so poor that an additional inch was amputated. After suturing each stump-end with a continuous catgut suture to control the bleeding, an end-to-end anastomosis was made with two rows of a continuous, right-angle silk suture. Owing to the edema and swelling of the gut at the lower end, a good approximation was difficult, but so far as could be seen the joint was a tight one. The mesentery of the upper portion was bluish, and in one place had a small inflammatory patch, but there was apparently life enough to warrant its being retained. To have amputated more gut in order to exclude this bit of mesentery would have necessitated another parietal incision, which in the patient's condition was not justifiable at the time.

A half-pint of salt solution had been injected into the bowel before making the anastomosis; afterwards the abdominal cavity was washed out with hot salt solution, the lower three-quarters of the incision closed with silkworm gut, iodoform wicks and a glass drain being carried in at the upper angle and isolating the region of the joint from the general cavity.

The patient stood the operation, which lasted an hour, fairly well; the pulse at the close being 130 to 140, regular and of fair strength. Strychnia, salt solution and brandy had been given under the skin. Repeated one-quarter grain doses of calomel, and stimulation were ordered.

Good recovery from the operation followed, the bowels moving within twenty-four hours by enema, and broths being retained without vomiting.

November 7th. All wicks loosened and some removed under chloroform, the remainder being taken out two days later and replaced by a light packing.

November 11th. Intestinal contents, bile and pancreatic fluid escaped from the sinus to-day, but the general condition of the patient remains good. He was then put on rectal feeding, but as symptoms of starvation appeared a second operation was advised.

November 15th. *Operation under ether.*—At the bottom of the sinus a small opening into the bowel lay an inch and a half to the inside of the line of the parietal wound, so a second incision was made close to the median line. The opening into the gut, one-half inch in diameter, lay in the midst of gangrenous and granulation tissue. Considerable time was wasted in trying to close this hole, and then the incision was enlarged and the fresh adhesions broken down in order to allow access to the bowel. Owing to its adhesions and short mesentery it split open, not at the original anastomosis, but apparently in line with the

mesentery that was considered doubtful at the first operation. The patient's condition would not warrant prolonged operation, so the ends were sutured together with ordinary silk in mattress sutures passed deeply and at some distance from the edges. Apparently a tight joint was secured. Iodoform gauze drainage. There was considerable shock, but the patient recovered quickly and showed no evidence of peritoneal disturbance. The wicks were removed and he was gaining steadily, when, on the sixth day (November 21st), leakage from both wounds appeared. As the general condition continued satisfactory, a third operation was not undertaken until November 26th, when, under ether, a fine opening admitting a probe, at the bottom of the median incision, was found lying in firm, healthy tissue. This could be easily and completely closed with fine silk. The entire median wound was then thoroughly curetted, filled with strong permanganate solution and closed with silkworm-gut sutures, a small rubber-tissue drain being carried obliquely through the first lateral incision. No shock followed this operation.

Two days later, food, with pancreatic fluid and bile, appeared as of old, but the patient was in good condition, eating solid food and gaining steadily.

December 1st. Considerable digestion of the skin, controlled, at Dr. H. W. Cushing's suggestion, by dressing with tincture benzoin compound.

December 9th. General condition improving rapidly; lateral wound closed; apparently no pancreatic fluid, but a little pus from the sinus.

December 17th. Again a slight escape of pancreatic fluid and bile.

January 18th. The discharge continues about the same, the skin being completely protected by the benzoin.

January 25th. Three heavy silk loops (those used at the second anastomosis) discharged to-day. Patient in excellent condition.

February 4th. Lateral sinus, which reopened temporarily, has again closed.

February 18th. Patient cheerful and helpful about the ward.

March 17th. Discharge is now barely sufficient to moisten litmus paper, upon which it uniformly gives an acid reaction.

March 27th. Sinus healed. Patient fat and healthy.

April 11th. Wounds firmly closed; patient discharged wearing an abdominal swathe.

At the time of operation the intussusception, which was seen to be in the jejunum, was apparently a reversed one, but careful examination later showed that it was a direct invagination. The specimen, when measured after preservation in alcohol, showed that at least thirty-two inches had been excised.

It would have been better to have operated at the time the patient was ready to be discharged, or, at the latest, when the recurrence of the acute symptoms began, as in that way a partial excision might have been substituted for the complete one. No cause in the shape of a tumor or ulcerations could be found.

ANTHRAX EPIDEMIC.—A slight epidemic of anthrax, according to the *Journal of the American Medical Association*, has appeared among cattle in southern Chester County, Pa. The disease has also appeared in the region of Chambersburg, four cattle and two horses having died within the past few days.

THE GROWTH AND EXTENSION OF CARCINOMA.¹

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THE carcinoma is a tumor which arises from epithelial tissues and is characterized by unlimited growth locally and by the formation of tumors of a similar structure in other parts of the body. When we examine its microscopic structure we find that it is composed of two sorts of tissue: (1) epithelial cells arranged for the most part in solid masses, which vary in their size and form, growing in spaces which are called alveoli; (2) connective tissue which surrounds the alveoli and bears the blood-vessels for the nutrition of the cells in the alveoli. This connective tissue is called the stroma. Neither stroma nor blood-vessels penetrate the masses of epithelium. When we examine normal epithelial structures we find a very similar arrangement of tissues—epithelial cells growing in the closest juxtaposition with connective tissue, but never penetrated by it. Whether we consider covering epithelium or glandular epithelium, the arrangement of tissue is always the same.

If we take any normal epithelial structure and suppose that the cells at some point begin to multiply with unlimited activity and penetrate into the adjoining connective tissues, we have the structure of the carcinoma. It is not sufficient for the epithelium to proliferate. Epithelial tissues are the most active of any tissues of the body. Both the covering and the glandular epithelial cells are constantly becoming used up in the course of their physiological activity, and the loss is constantly repaired by the formation of new epithelial cells. This power of regeneration is sufficient not only for the ordinary wear and tear of the tissues, but extensive losses of cells are as easily repaired. Further, the epithelium may be excited to greater activity by various means, and large masses of tissue composed principally of epithelium may be produced. I say principally of epithelium, for, in consequence of a definite law of nutrition, when a tissue is growing actively and requires more food, the old blood-vessels will enlarge and new ones be formed. In consequence of this, along with the epithelial masses, considerable connective tissue with blood-vessels will be produced. An epithelial growth of this kind repeats the formation of the normal structures and is called typical. There is no penetration of the connective tissue by the growing masses of epithelium. There is no normal prototype for the structure of the carcinoma. We express this by saying that the simple hyperplasia we have been speaking of is typical, while the carcinoma is atypical.

When we compare the epithelium in the different epithelial structures of the body, we find differences in the size and form of the epithelial cells, and in their arrangement. These differences are to a certain extent apparent in the carcinomas which arise in different parts, and from the histological examination of the tumor we can say with considerable accuracy from what tissue it has arisen. To explain the growth of the carcinoma it will be necessary to consider for a moment the structure of the connective tissue. This is essentially formed of fibres, between which are cells. It carries the blood-vessels everywhere, and in it the lymphatics arise. In the tissue the cells lie in spaces,

¹ These remarks were illustrated by the projection of photo-micrographs.—Read before the Massachusetts Medical Society, June 13, 1899, and recommended for publication by the Society.