

# INTESTINAL LESIONS PRODUCED BY BLUNT FORCE.

A REPORT OF FOUR CASES.

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WITHIN the past two years there have been admitted to the University of Virginia Hospital four cases of intestinal injury belonging to the class variously designated as "traumatic" lesions, "subcutaneous" lesions, or, as in the title of this paper, lesions by blunt force. The distinguishing characteristic of such cases, familiar of course to all, is the fact that the visceral injury is produced without penetration of the abdominal parietes. Interest in the condition arises from this fact, as also from the comparative rarity of its occurrence and from the problem of successful treatment. That these cases may fairly be considered unusual is evidenced by the fact that most of the reports in the literature are of single instances met with in the experience of various authors, yet they are frequent enough to be far more important than mere surgical curiosities.

In many of the papers reporting cases, and in such reference books as Von Bergmann and Von Bruns' "Handbuch der Practischen Chirurgie," there are elaborate discussions as to the possible mechanism by which such lesions may be produced. Without rehearsing in detail these lengthy disquisitions, suffice it to say that three mechanisms are recognized as giving rise to these ruptures. The most frequent consists in a simple crushing of the gut between a colliding abdominal force and the underlying spine or promontory of the sacrum. The second described method is by bursting. A loop of gut containing fluid or air, and so kinked as to

be temporarily closed, is subjected to severe but unequal pressure, so that it explodes in the direction of least resistance. The third method, perhaps very rare, is by ripping loose of the intestines at their points of attachment, from a forced excursion of the movable parts beyond the limits of normal mobility. Thus the duodenojejunal and ileocaecal regions may be torn by the inability of these fixed parts of the gut to keep pace with the wider range of the small intestine, during rapid forced displacement. This mechanism may be likened to the way in which the cracker may be snapped off a whip. It occurs in falls from a height where the patient lands on the feet or buttocks. Certain particular accidents are prone to cause intestinal rupture, the more common being kicks or blows from the fist over the abdomen, falls from a height, striking flat upon the abdomen on an irregular surface, "run-over" cases, where the wheel passes across the abdomen or back, and crushing of the trunk between heavy objects. There are numerous rarer and some quite curious accidents which have led to the production of the lesion, one such being the forceful contraction of the abdominal muscles themselves.

From the stand-point of the severity of the lesion, cases are classified into contusions, ruptures of some of the coats, and complete rupture. There are authorities, notably W. Körte,<sup>1</sup> who consider contusions and ruptures of some of the intestinal coats as of importance, chiefly from the fact that such lesions frequently cause a later necrosis of the visceral wall and eventuate in a perforation. As Case IV of this series illustrates, there is another aspect of such lesions, namely the development of paralytic ileus from trauma to the intestinal coats in contusions and similar injuries. Further emphasis will be laid on this point later. Obviously the next development of all lesions which cause immediate or delayed perforation is the inception of peritonitis. In small ruptures this outcome may be delayed by the everted intestinal mucosa plugging the aperture. Such cases must be quite rare, and this conservative adaptation of nature is at best but tem-

porary. The nature of the peritoneal inflammation varies somewhat with the position of the lesion. Holes in the jejunum are less dangerous than those in the ileum, because of the relatively low bacterial count of the high intestine.

CASE I (Death).—Patient was a farmer, previously in good health, twenty-six years of age. Seventy-two hours before admission to the hospital he had been kicked in the abdomen by a horse. He immediately suffered intense pain and was so shocked that he had to be carried home. Pain continued without intermission, and with great intensity all over the abdomen, up to time of operation. Twelve hours after injury vomiting began, and continued at intervals. In spite of enemata and cathartics given by his physician, bowels had not moved since onset of trouble. Urine normal. On examination, patient had frank peritonitis, apparently general. There was distention, absence of abdominal respiratory movements, rigidity and tenderness everywhere, movable dulness in both flanks, and obliteration of liver dulness. There was perhaps an accentuation of the rigidity and tenderness in the right lower quadrant. Patient's condition bad. Temperature 103°, pulse 100, leucocytes 10,200.

A right rectus incision, rather low, was made, which immediately disclosed large quantities of free pus in the abdominal cavity. The ileum three feet above the ileocaecal valve was ruptured, the orifice being about 1 cm. in diameter. The abdomen was flushed freely with salt solution and a rubber tube placed in the hole in the gut, being secured by a purse-string and a retention suture. Counter-incisions for drainage were made in each flank; a drain was carried from the first incision to the pelvis, and the rubber tube in the gut was surrounded by gauze. The excess of the wound was hastily closed, patient leaving the table in very bad condition. However, his condition improved greatly after an infusion of salt solution containing 6 drops of 1 to 1,000 adrenalin to the litre. The next morning, temperature was 100.6 degrees, pulse 100, and general appearance good except for restlessness and distention. But in the afternoon, the temperature rose rapidly to 105.6 degrees and the pulse became very rapid and weak. This time there was no response to stimulation, and death ensued 42 hours after operation.

CASE II (Recovery).—Patient was a girl, previously healthy,

seven years old. She entered the hospital 36 hours after falling off a porch. She had struck upon her abdomen, on the angle of an upturned brick, such as frequently are set in the ground as a border about a flower-bed. Immediately after the accident the child suffered intense abdominal pain, and began to vomit within five minutes, continuing to do so until the time of operation. There had been complete constipation since the accident in spite of numerous cathartics by mouth. On examination, the condition was manifestly one of general peritonitis. Thighs were drawn up; abdomen rigid; general tenderness over abdomen; dullness in both flanks; liver dullness obliterated. Temperature 101.4 degrees, pulse 144. No point or area of especial tenderness.

A mid-line incision, the larger part of which was below the umbilicus, was made, and large amounts of free pus at once welled out. A careful search of the abdomen was begun at the ileocecal valve, and no lesion found until the high jejunum was reached, where there was a rupture, about large enough to admit tip of index finger. The hole was ragged, with everted mucosa about its periphery, and situated near the mesenteric attachment. It was closed with a purse-string suture of catgut, which was reinforced by mattress sutures of the same material. This caused some narrowing of the lumen at the point of repair, but the finger invaginated into the gut above could be carried down through the constricted part without difficulty. A gauze pack was placed to the point of rupture and a liberal drain placed to the pelvis. Flanks were not drained. The wound was rapidly closed, and the child left the table in very bad condition, pulse being 168 per minute.

The patient was treated as are other cases of peritonitis. She was placed in the Fowler position, given salt solution per rectum, which was very well retained, and absolutely nothing by mouth. In addition, subcutaneous infusions of salt were given for the first 36 hours, at intervals of about 12 hours apart. Feeding was resumed very cautiously, rectal alimentation being relied on until the fifth day after operation. Vomiting continued for several days, but rapidly decreased in frequency. The general condition the day after the operation was much better, pulse falling to 110, and the temperature to 100.2 degrees. The bowels moved on the third day. From this time on the patient steadily improved, with occasional slight fluctuations. On the seventeenth

day the patient had another attack of vomiting, following an indiscretion in diet, which subsided promptly after an enema and restriction of food. On the twenty-second day the patient left the hospital entirely well. The wound discharged large quantities of fluid during the first 24 hours. As this diminished the drains were gradually removed, all the original gauze being out by the fifth day. The wound was entirely healed at the time of discharge from the hospital. This patient was recently heard from, six months after her injury, and she is entirely well and has gained considerably in weight.

CASE III (Recovery).—Patient was a farmer, fifty-one years of age, in fair health except for a right inguinal hernia of 14 years standing. Fifty hours before admission, the patient stumbled while walking on his farm, fell and struck his truss, over the inguinal region, against a rock. He immediately felt a sickening pain in the lower abdomen, and collapsed, so that he experienced great difficulty in going the short distance to his house. The pain continued in intensity and became general over the abdomen. Vomiting began several hours after the injury and persisted. There was complete constipation. On examination, the abdomen was found greatly distended; with slight general rigidity, most marked in the right lower quadrant; no dulness in the flanks; liver dulness obliterated. Tenderness everywhere, most marked in the right lower quadrant. Pulse 90 per minute; temperature 100.4 degrees, leucocytes 16,000. In the previous cases a definite diagnosis of peritonitis was made. In this instance, because the injury was so peculiar and because it was thought that at one time peristaltic waves were seen, the possibility of obstruction was considered.

A low right rectus incision was made, and at once gas escaped from the peritoneal cavity, and turbid fluid was discovered, especially in the pelvis, where there was quite an accumulation of pus. The appendix was normal. The intestine was then traced upward, and a foot above the ileocaecal valve was found an opening, opposite the mesentery, about 1 cm. in diameter. As this was pulled up faeces and gas escaped, as though the hole had become for a time occluded by the damaged loop sticking to another loop, or to the parietal peritoneum. The aperture was closed with fine black silk sutures. The pelvis and right lumbar fossa were drained through the original in-

cision, and packs were carried to the sutured spot in the bowel. A counter-incision was made for drainage in the left flank. The patient stood the operation well.

Second operation: Obstructive symptoms developed, and three days after the first operation it became necessary to do an enterostomy just above the point of rupture. The fecal fistula thus formed drained profusely, relieving the obstructive symptoms, but causing infection of the abdominal wall and extensive ulceration from the digestive action of the discharges. The patient meanwhile was passing some of his intestinal contents through the normal channels.

Third operation: After the patient had been relieved of several slight obstructive attacks by simple restriction of diet, the enterostomy was closed, three months after the first operation. The ulcerated area is now healing well and there is no leakage of intestinal contents. The patient is practically well, being about in a chair, and remaining in the hospital simply for convenience in having the healing wound dressed.\*

CASE IV (Recovery).—Patient was a colored boy, fifteen years old, previously entirely healthy. While he was standing between an open gate and its gate-post, a cow had charged violently against the gate, crushing the boy against the post, and forcibly driving a part of the gate against the abdomen just to the right of the umbilicus. This occurred 101 hours before admission. Immediately after the accident, there was sharp abdominal pain, collapse, and free vomiting. The pain at this time was described as general over the abdomen, although most intense just to the right of the umbilicus. The attack of primary vomiting soon subsided, and there was no further vomiting,—a peculiar feature of this case. Distention increased gradually, constipation was practically absolute. There was no nausea to indicate reversed peristalsis. On admission, the clinical findings were as follows: abdomen greatly distended, but not rigid; no visible peristalsis; tenderness general but not marked; no

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\* This patient, Case III, died six weeks after sending this paper to press. At his death the surgical results were apparently entirely satisfactory. There was no fecal fistula, no obstruction, no peritonitis. So far as could be learned, death resulted from a general asthenia, the patient never becoming very strong, and the end coming quite suddenly and unexpectedly.

muscle spasm and no masses felt. On percussion, there was general tympany, and no movable dullness discovered. Pulse good, 110 per minute; temperature (rectal) 101 degrees, leucocytes 4,000. The absence of rigidity, free fluid, leucocytosis, or marked tenderness made against peritonitis, and hence against ruptured bowel. The absence of signs of hemorrhage pointed against rupture of the liver or kidney. A diagnosis of adynamic ileus from trauma was made.

First operation: A mid-line incision, chiefly above the umbilicus was made, and at once there was a gush of old blood. This was not very great in amount and was soon mopped out. There was no soiling of the peritoneum. The upper intestine, greatly distended, was picked up and traced downward. After passing down a number of feet, a loop was reached which presented marked signs of injury. There was no perforation, but over an area about 14 cm. long, the gut was contused, its serous coat ragged and rough, and the muscular wall infiltrated with old extravasated blood. This loop oozed when handled and was considered the source of the free blood above mentioned. Below this area the intestine was flat, collapsed, and empty, presenting a marked contrast to the distended condition above. A further search, hampered by the ballooned gut, revealed no other lesion. The injured area was 5 or 6 feet above the ileo-cæcal valve. An enterostomy was made immediately above the traumatized area of the intestine, a tube being inserted into the lumen of the gut.

Second operation: The tube placed in the intestine, as just described, never drained. The marked distention of the abdomen became even greater, but there was still no nausea nor vomiting. Apparently all peristaltic movement, normal or reversed, had been reflexly inhibited. Eserin and pilocarpin administered repeatedly in large hypodermic doses were without effect. Another operation was done, four days after the first, with the idea of relieving any possible kinking around the tube. No cause, other than lack of motive force, could be discovered to account for the lack of drainage. A solution of eserine (1 mg. to 2 c.c. of salt solution) was applied to the serous surface of a loop of dilated gut without causing any contraction whatever. To relieve the distention, a large amount of the gas and fecal contents of the paralyzed gut was mechanically emptied out. This time, in clos-

ing, instead of putting in a tube, the loop of gut already opened was packed outside the abdominal cavity in gauze. On the third day following this second operation, the enterostomy began to drain fecal material for the first time, on the eleventh day after the original injury. There was rapid relief of distention, and marked general improvement in the patient's condition.

Third operation: This consisted simply of the closure of the fecal fistula two weeks after the second operation. A resection, with lateral anastomosis, was performed, the only noteworthy feature of which was the difficulty encountered from adhesions. After this, the patient's convalescence was comparatively uneventful. He was discharged in very good condition, forty-three days after admission to the hospital.

In reviewing these cases one fact is especially worthy of emphasis. All four patients were brought in late in the history of the illness, the shortest intervening period since injury being 36 hours. The reason for such delay is in part explained by the fact that this hospital draws many of its patients from a widely spread rural population. Two important features of our cases depend upon this delay. In all of them, the development of abdominal and general symptoms had proceeded so far that the existence of a condition imperatively demanding a laparotomy was very manifest. If, however, the long interval following injury made the diagnosis and method of treatment matters of easy decision, for the same reason the successful prosecution of treatment was rendered all the more difficult. The experience of others lends weight to these assertions.

All authorities emphasize the difficulty in deciding upon the presence of a visceral lesion in the first hours following injury. In nearly all severe abdominal insults, whether or not they be associated with damage to the deeper structures, there is rapidly developing shock, usually associated with intense pain and vomiting. This condition may last for a number of hours. If there has been rupture of a hollow viscus, with ensuing peritonitis, the primary shock may merge into the latter condition without a perceptible demarcation. On the other hand, the symptoms of peritonitis may be delayed, appearing



some time after shock has subsided, and following an interval of marked seeming improvement. The difficulty of the situation in cases seen early is therefore quite evident. Is the patient simply suffering the symptoms inseparable from a severe contusion of the abdominal wall, or has he already passed from the primary shock of the trauma into the peritoneal disturbance following on ruptured gut? Or, again, the first severe upset from the accident has subsided somewhat; but is this to be a progressive return to normal, or is it merely an interval of quiescence before symptoms of a spreading peritonitis appear? The most important and difficult step in the handling of such cases lies just here. To wait for the development of distention, rigidity, the obliteration of the liver dulness, etc., is to throw away the great advantage of early intervention, before the general peritonitis, which causes these symptoms, has been established. Andrews<sup>2</sup> even advises against waiting for successive hourly leucocyte counts, and with wisdom. To overcome the difficulty various writers lay emphasis on various clinical observations. The cardinal symptoms of pain, tenderness, muscle spasm, shock, and vomiting may be quite as pronounced in severe parietal trauma alone as when visceral lesion is associated, hence subsidiary points have attracted attention in the effort to determine the presence of an injury to intestine, etc. Thus Munro, in Keen's "System of Surgery," cites Perez<sup>3</sup> as laying great stress on the value of continued, rapid and superficial breathing. In the same article, Mauclaire and Roger<sup>4</sup> are quoted as believing the injury to be serious when the muscle spasm and tenderness rapidly become general over the abdomen, and do not remain confined to the area of injury in the early hours after its occurrence. These points have failed however to impress the majority of observers with their importance. Indeed Bottomley<sup>5</sup> after analyzing an equal number of cases of abdominal injury, with and without visceral lesion, found that shock, pain and vomiting varied in individuals in the early hours, irrespective of the nature of the lesion, and that many cases could only be decided by exploration. In fact, this is the opinion of practically all recent writers on the subject, and

emphasis is laid on the necessity for exploring all cases of trauma of the abdomen by blunt force sufficiently severe to arouse the suspicion that the viscera have suffered. It is urged, and with reason, that the additional assault of the anæsthetic and exploration on a person already suffering from shock—who may not have internal injuries—is decidedly less to be avoided than the chance of permitting a ruptured gut to leak unrestrained, until it shall have given rise to sufficiently outspoken symptoms to make the nature of the injury evident. This necessity for exploration has not, we feel, been sufficiently impressed upon the medical profession in this country. The lack of appreciation of this necessity on the part of our patients' physicians is a decidedly more potent factor in the delay elapsing before they come to us, than is the number of hours travel that separate them from us. The difficulty of diagnosis is easily appreciated from the facts already presented, but this difficulty in itself should make all the more evident the wisdom of immediate consultation with a surgeon and exploration in most instances.

Cases which are seen somewhat later usually are easier to diagnose. The persistence for hours of vomiting, or its recurrence after an interval of cessation, is an important indication that there is more than a superficial contusion. The same is true of the persistence and increase of rigidity, tenderness, and distention. When these findings are supplemented by obliteration of liver dulness, fluid in the flanks, fever, leucocytosis, etc., we have of course an unequivocal picture of peritonitis, which with the history of trauma, makes the diagnosis of subcutaneous rupture of a hollow viscus almost certain. The only other condition which could cause doubt would be the rupture of some parenchymatous organ, like the liver or spleen, with hemorrhage into the abdominal cavity. Such a lesion would usually be associated with anæmia, restlessness, thirst, low red corpuscle count and the other signs of concealed hemorrhage. The two lesions are so closely related in their cause and treatment, that they may really be considered as belonging to the same class of cases, and therefore not further discriminated.

In those cases seen later, the treatment is the same as in the group of early cases previously discussed; namely, exploratory laparotomy. The difference lies only in the fact that the indications for operation now are much clearer, the operative procedures required more difficult and time-consuming, and the prognosis much more grave. To the general statement that all these cases should be operated, there is but one exception; namely, where the patient is already moribund. Even here refraining from operation should be carefully considered, because as Case 11 reported in this paper and experience with peritonitis of other origin in many other instances has shown, the rule of never giving up hope is a pretty good one. At any rate the operator gives his patient the benefit of a chance by interfering, whereas such a case left to nature is equivalent to an admission of defeat.

The chances for a successful termination without operation are practically *nil*; with operation, the chances vary inversely with the period intervening between the receipt of injury and the time of intervention. Thus Petry<sup>6</sup> collected 42 cases, of which 18 were operated in the first 24 hours, with success in 44.5 per cent.; whereas of the remaining 24 cases operated later than 24 hours, 75 per cent. were lost. A summary of Brunner's statistics shows that within the first 10 hours a majority recover; from 10 to 20 hours, the chances are even; and after 20 hours there is a rapid increase in the percentage of cases lost. It is admitted that this probably represents too favorable a view of the results, as more successful than unsuccessful cases are apt to be reported and collected. The force of this stricture is seen by comparing Brunner's figures with those of Berry and Giuseppi<sup>7</sup> collected from the records of 10 London hospitals for a period of 15 years (1893-1907) and embracing in all 132 cases. Of these, 48 cases were not operated and all died. Seventeen of 84 cases operated were saved, 12.8 per cent. of the total number of cases. No case recovered when operated upon more than 28 hours after injury, and only two when operated more than 12 hours after injury. These figures speak with sufficient eloquence for the importance of early operation. It

will be noted that the latest of our peritonitis cases died, and the earliest made the easiest recovery.

There is, of course, another factor in the question of mortality than the simple one of time, and that is the value of the therapeutic measures invoked. The great improvements inaugurated in the last few years in the treatment of general peritonitis show their effects very clearly in this group of cases. These improvements are familiar to the entire surgical world as the Fowler-Murphy method, and may be summarized briefly as the elevated posture, the rigid restriction of everything by mouth, and the administration of fluids in small amounts and at frequent intervals per rectum. We feel that to this we owe the recovery of two of our cases long after the deadly time-limit of 28 hours of Berry and Giuseppi. That this is probably true, is further suggested by finding other successful late cases (Legnani,<sup>8</sup> Poncet<sup>9</sup>) in the literature of the last three years.

The repair of the local damage depends upon its extent. A small hole is best closed by sutures; a large lesion may be best handled by resection and anastomosis, if the patient be received early and in good condition; otherwise by enterostomy. This is really a matter of subsidiary importance, provided its execution is not so difficult mechanically as to prolong the operation unduly. The essential question is the successful treatment of the peritonitis, the extent of which depends largely on the duration of the condition. In all of our cases it was quite general. It is our practice to drain the pelvis, the site of the lesion after its repair, and sometimes the lumbar fossæ. Then the patient is put almost upright in bed, rectal administration of normal saline solution is started, and usually a subcutaneous infusion. The weight of authority, in all but some of the recent publications, urges the use of free irrigation of the abdominal cavity with sterile normal salt solution in large amounts (30-50 litres). It is the experience of this clinic that better results are obtained without such irrigations, unless there be gross soiling with fæces, undigested food, etc. It may seem unnecessary to protest against the giving of cathartics to these patients, but our cases testify to the con-

trary. In the second case, a number of doses of salts escaped promptly through the perforation in the jejunum, and were found along with many other things in the pelvis. As to the convalescence, there is nothing requiring remark as different from that of peritonitis cases in general, except to point out that some vomiting is to be expected, perhaps for a number of days, and that one should be on guard against a secondary obstruction.

So far, this paper has consisted chiefly in a consideration of the possibilities resulting from rupture of the intestine. Three of our four cases involved this lesion, and the great majority of reports in the literature are of such injuries. Our fourth case presents certain interesting features which are deserving of individual comment, best made in separate paragraphs from those devoted to a consideration of rupture. Although the etiological factors of intestinal contusions, such as Case IV presents, may be identical with those causing rupture, and indeed a contusion may later become a perforation from the necrosis of the injured areas, nevertheless the clinical picture and necessary treatment of such a case as Case IV presents distinct differences from Cases I, II and III. The pathological development, in the two groups, of course proceeds along very different lines. With the establishment of a rupture, peritonitis ensues; there follows inevitably the evidences of the local inflammation with the constitutional signs of rapid toxic absorption. When a contusion, as in our last case, causes a local paralysis of the intestinal musculature, with a consequent ileus, there follows naturally the syndrome indicative of obstruction. It would be a work of supererogation to elaborate here the typical descriptions of peritonitis and intestinal obstruction. The slower development, lower leucocyte count and better general condition of the patient in obstruction will usually help in the diagnosis as well as the local differences in abdominal signs and symptoms. But while it is possible that some obstruction cases arising from blunt intestinal contusions may present the typical appearance, ours certainly did not. Nausea and vomiting, most characteristic features of obstruction, were strikingly absent after the first

hours. The allied symptom of sharp colicky pain, and the accompanying sign of visible peristalsis were also not discovered. These peculiarities occasioned some difficulty in making a diagnosis, but in looking back over the case, it would seem highly probable that the contusion of the gut not only caused a direct paralysis of the area damaged, but also resulted in a reflex suppression of peristalsis throughout the small intestine. In no other way is it easy to explain the curious clinical symptoms and operative findings. The wonderfully good condition of the patient during the long interval of adynamic obstruction (ten days in all) is worthy of comment. So also is the utter failure of the administration of pilocarpin and physostigmin to reestablish peristalsis. With the renewal of this function the case presented then simply the common problem of closing a fecal fistula.

Although rupture is more frequent and results in a more fulminant disturbance, the occurrence of paralytic obstruction from blunt force presents essentially the same problem. That is to say, such lesions demand, in our opinion, exploratory laparotomy and the appropriate handling of the obstruction. In early cases, with active peristalsis above the damaged loop, a lateral anastomosis, with resection of the injured area, is perhaps indicated. In an instance such as ours, of four days standing and with no evidence of muscular action in the gut, the requirement would seem to be immediate establishment of an enterostomy, with the mechanical removal of as much gas, fecal matter, and intestinal secretion as possible. One very definite result of this procedure is to relieve the great distention of the obstructed bowel, which contributes much toward aiding the return of peristalsis. This relief of tension is in itself sufficient argument against the view which some might advance, that nature should be left to take care of the case. Admitting that the contusion may subside and the damaged loop once more take up its function and thus relieve obstruction, it is very doubtful if this would occur were the overdistention not relieved.

In conclusion, there are a few details concerning these injuries, which should be mentioned for the sake of complete-

ness. These accidents are most frequently met with in males during youth and early manhood, and in females during childhood, these of course being the periods of greatest exposure to trauma from the habits of life. Preëxisting lesions, such as hernias, ulcers, adhesions, etc., of course increase the liability of rupture should trauma occur. Our third case is an illustration of this statement. Lax abdominal muscles afford less protection than a wall which is contracted, and hence very sudden accidents are more frequently the cause of visceral lesion than those in which the patient has some warning. All parts of the gastro-intestinal tract have been injured, to say nothing of the other abdominal viscera, but the ileum and jejunum are more often involved, the colon and stomach less frequently. Thus in 219 cases, the small intestine was affected 172 times, the large 26 times and the stomach only 21 times. Lesions of course may be multiple, or may be associated with rupture of other organs. We are inclined to feel that vomiting is apt to arise sooner if the lesion be above the level of the umbilicus than if it be below. Thus Case II began to vomit almost immediately, whereas in Case I and Case III there was quite a pronounced interval before vomiting commenced.

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