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### TRAUMATIC RETROPERITONEAL POSTAMPULLARY RUPTURE OF THE DUODENUM WITH EMPHYSEMA OF THE MESENTERY

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In this paper a case is reported of retroperitoneal rupture of the third part of the duodenum resulting from blunt abdominal trauma, and diagnosis, management and prognosis of such injuries are considered, with particular mention of (1) the sign of emphysema of the mesentery, and (2) a suggested method of treatment.

The third part of the duodenum commences at and to the right of the third lumbar vertebral body, and passes horizontally to the left in front of the body of this vertebra to end in its 4th part in front of the abdominal aorta. Its anterior surface is covered with peritoneum except where it is crossed by the superior mesenteric vessels; the posterior surface is 'bare'.

Rupture of the duodenum by blunt abdominal trauma is relatively rare. It occurred in 9% of Harrold's series of closed intestinal rupture.<sup>1</sup> Zachary Cope<sup>2</sup> states that in the Second World War wounds of the duodenum formed only 2% of all abdominal injuries. Mortality however was 50%.

#### CASE REPORT

P.M., an adult male of 26 years, was admitted to St. Mary's Hospital, Mariannhill, Natal, at 6 p.m. on 18 November 1957. His history was that 24 hours earlier he was involved in a brawl during which he was struck twice across the abdomen with a long stick. At first he appeared to suffer no ill effects from the injury but early on the morning of the 19th (15 hours after receipt of injury) he suddenly developed acute pain over the whole abdomen. This pain was constant in site and in intensity and did not abate when he was brought to hospital.

He lay supine in bed, anxious and still. Pulse rate 94 per minute. Temperature 98°F (36.7°C). Respiration was rapid and shallow. There was no air-hunger. The abdomen was distended and bore a small, fresh, superficial abrasion just below the middle of the right costal margin. There was also a narrow, linear bruise across the skin in the right iliac fossa. The abdomen was guarded throughout, with maximum tenderness in the right iliac fossa. On percussion no loss of liver dullness was found, nor was the presence of free fluid in the abdomen elicited. Auscultation of the abdomen revealed no bowel sounds. A diagnosis of rupture of the caecum was made and immediate abdominal exploration instituted.

At 7 p.m. the same evening (25 hours after injury) operation was performed under general anaesthesia of thiopentone, nitrous oxide, oxygen and Flaxedil, administered by Dr. J. Cave. Through a right paramedian incision the peritoneal cavity was entered. A small amount of blood-stained fluid escaped. The small intestine was examined from duodeno-jejunal flexure to ileo-caecal junction and the colon from caecum to sigmoid but no perforation could be found. These structures were in a state of ileus and

were markedly distended. No smell of faeces was discernible. It was noticed, however, that small blebs of gas aggregated in clusters of varying size were lying between the leaves of the mesen-

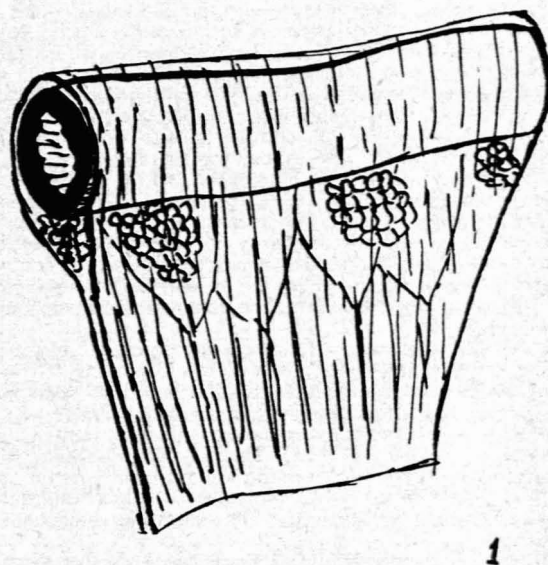


Fig. 1. Segment of jejunum to illustrate diagrammatically the surgical emphysema of the mesentery. The aggregated bubbles of gas are shown in small clusters lying in a juxta-intestinal position.

tery of the small bowel. These gas bubbles gave the involved parts of the mesentery a frothy appearance and a sensation of crepitus to the touch. They were found in patches, always in a juxta-intestinal position and never extending down to the root of the mesentery. This mesenteric surgical emphysema was most abundant in the mesentery of the jejunum. Retroperitoneal crepitus was not felt. Fig. 1 illustrates, diagrammatically, the emphysema of the mesentery.

It was evident that rupture of a retroperitoneal portion of the intestine had occurred—most likely in the third part of the duodenum. The caecum, ascending colon and hepatic flexure were now mobilized and turned medially to the left to expose the left kidney in its fascia and the third part of the duodenum. On the posterior aspect of this viscus, which covered the vertebral body, an oblique tear was found about 1 inch (2.5 cm.) in length. The mucosa was everted and bile-stained.

The rent in the duodenum was closed in 2 layers, the inner with a continuous catgut suture and the outer with closely applied interrupted black linen thread. Closure was difficult because the distended duodenal wall was thinned, oedematous and did

not hold sutures well. It was considered likely that duodenal fistula might develop, and an attempt at its prevention was therefore undertaken as follows:

Two separate small openings 1 inch (2.5 cm.) apart were made in the anti-mesenteric wall of the first part of the jejunum just distal to the duodeno-jejunal flexure. Two lengths of no. 4 gauge polythene tubing were passed through these apertures—one proximally into the duodenum for about 6 inches (i.e. proximal to the duodenal rupture), and the second distally into the jejunum. The proximal tube was to serve for continuous suction of the duodenum; it will be called the 'duodenal suction tube'. The distal tube was to be used initially for intestinal decompression but with the return of peristalsis was to serve as a feeding tube; it will be called the 'jejunal feeding tube'. By this means the paralysed duodenum could be kept relatively free of gastric, duodenal, biliary and pancreatic secretions. Furthermore, these secretions could immediately be returned into the jejunal feeding tube. The intubated portion of the jejunum was covered with omentum and later anchored to the upper limit of the abdominal incision, a glove drain was inserted through a separate stab incision in the right flank and passed behind the ascending colon, in a retroperitoneal position, to the traumatized and sutured duodenum.

Immediate post-operative treatment consisted of continuous gastric suction through a Ryle's tube inserted through the nose, continuous duodenal suction through the duodenal suction tube and continuous intestinal suction through the jejunal feeding tube. Adequate intravenous fluids were administered, containing 500 mg. of Terramycin (oxytetracycline) twice daily for 5 days. After 4 days bowel sounds were audible and the intestinal suction was discontinued. Water only was allowed by mouth but jejunal feeding was commenced with citrated milk to which was added protein hydrolysate as well as the foregut secretions obtained through the duodenal suction tube (800-1,200 c.c. daily). By this means the state of hydration of the patient was well maintained. At first the stab drain was fairly dry but on the 8th post-operative day there was a copious discharge of watery, faintly alkaline, bilious fluid, which diminished in amount within 48 hours but persisted in lesser amounts over the ensuing weeks. So long as this evidence of duodenal fistula persisted duodenal suction was maintained—5 weeks in all.

On the 24th post-operative day acute intestinal obstruction developed, which at operation was found to be due to volvulus of a viable loop of ileum which had attached itself to the lower limit of the original operation incision. The volvulus was corrected, and the opportunity was taken at this operation to inspect the region of the jejunostomies. The polythene tubes lay snugly in position with little tissue reaction around them. As far as the host tissues were concerned the polythene was inert and did not evoke an inflammatory response. The area of the duodenum was not disturbed.

By the 5th post-operative week there was no further discharge from the stab drain. The duodenal suction and jejunal feeding tubes were pulled out when, within 12 hours, the jejunostomy was dry.

Further convalescence was interrupted by the development of a retroperitoneal, pre-renal abscess. This was demonstrated by means of a sinogram and discharged itself through the site of the stab drain in the right flank. The patient was eventually discharged on 31 January 1958.

## DISCUSSION

### 1. Mechanism of Duodenal Injury

Duodenal injury from blunt trauma to the abdomen may be of two types:

(i) *Crush injuries.* Direct trauma by a stick, animal kick, vehicular accident—indeed any blunt object—is applied to the anterior abdominal wall. The strength of the applied force need not be very great—estimated at over 6 pounds—but sufficient to impact the posterior wall of the duodenum against the body of the 3rd lumbar vertebra. The duodenal rupture is posterior and retroperitoneal.

(ii) *Blast injuries.* In these cases there is a 'blow-out' caused by the secondary movement of air away from the

scene of explosion. The duodenum ruptures away from the vertebral column.

### 2. Diagnosis of Closed Intestinal Rupture

Abdominal tenderness, guarding and rigidity as an index of intra-abdominal injury may be fallaciously interpreted. Indeed, injury to the abdominal parieties alone may evoke these signs. Loss of liver dullness due to a subphrenic collection of gas is a valuable clinical sign when present and is confirmed on an erect X-ray of the abdomen.

The most reliable and simple clinical sign of hollow viscus injury is loss of bowel sounds on auscultation of the abdomen. Rob<sup>3</sup> showed that in 95 cases of penetrating lesion of a hollow viscus peristalsis was absent in 89, i.e. 93.7%. In 71 cases with *no* lesion, peristalsis was present in 70 and absent in 1 only. Rob concluded that 'the absence of peristaltic sounds, confirmed and reconfirmed, was a positive indication for laparotomy but that the presence of peristaltic sounds was only a valuable guide and not a positive indication for conservative treatment'.

### 3. Operative Diagnosis of Retroperitoneal Duodenal Injury

Johnson<sup>4</sup> reports Schumacher's and Miller's analysis of 46 cases of retroperitoneal rupture of the duodenum. In 14 of 37 patients operated on the lesion was not found. Cope<sup>2</sup> counsels that the presence of a *retroperitoneal haematoma* should remind the surgeon of the possibility of a tear of the posterior wall of the duodenum. If the retroperitoneal haematoma is bile-stained the diagnosis is absolute.

*Retroperitoneal emphysema* was mentioned as being observed in 13 of 52 cases analysed by Johnson. In such cases retroperitoneal air would have been observed on abdominal X-ray.

*Mesenteric surgical emphysema* following abdominal trauma has, as far as I can ascertain, not been recorded. In the case described here it was a sign indicating retroperitoneal rupture of a hollow viscus, most likely the duodenum. Had the mesenteric emphysema not been observed there is no doubt that the abdomen would have been re-sutured and the injury missed. Fig. 2 depicts the pathway of the mesenteric emphysema.

The frequency of concomitant liver injury with duodenal injury is of great significance. It occurred in 9 of 52 cases (17%) in Johnson's collected series.<sup>4</sup> This serves to emphasize the need to examine the duodenum where liver injury has been found.

### 4. Complications of Duodenal Rupture

Wounds of the duodenum carry a sinister mortality of about 50%.<sup>2</sup> This is due to (a) the frequency of injury to neighbouring viscera; (b) peritonitis; (c) retroperitoneal abscess; (d) the relative inaccessibility of a large part of this portion of the intestinal tract and the likelihood of missing such injuries; (e) the formation of a persistent external duodenal fistula. The last mentioned complication is noted in 8 of the 31 patients in Johnson's analysed series who survived longer than 5 days after operation. Of these 8 patients with external duodenal fistula 5 succumbed.

Pre-ampullary external duodenal fistulae are frequently encountered after operations for chronic duodenal ulcer. They almost always close spontaneously. The post-ampullary external duodenal fistulae are more serious because they seldom heal. The high enzyme content of the pancreatic juice no doubt interferes with duodenal repair. The copious

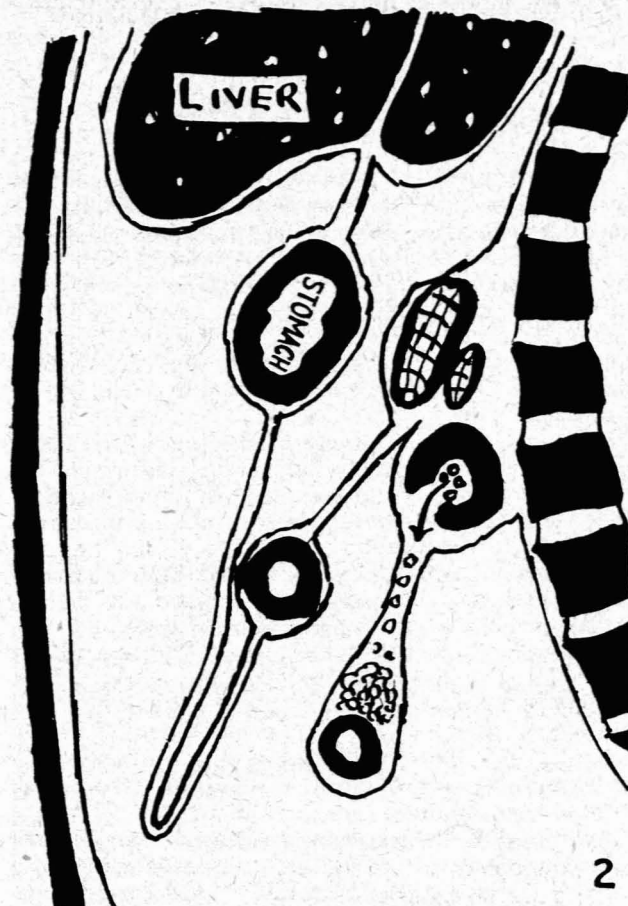


Fig. 2. A diagrammatic sagittal section through the abdomen in the median plane. A tear is shown in the duodenum with the arrow pointing to the pathway of the gas between the leaves of the small-bowel mesentery.

loss of fluids and electrolytes *via* the fistula leads to rapid dehydration and electrolyte imbalance. One has but to recall that 800-1,200 c.c. of pancreatic juice containing 8 g. of NaCl are secreted daily. Furthermore, up to 1,500 c.c. of gastric juice aspirated from the stomach is lost daily. The bile loss amounts to 300-500 c.c. Walters and Bollman<sup>5</sup> showed that animals discharging secretions through an isolated duodenal loop fistula died in 7 or 8 days.

### 5. Treatment of Retroperitoneal Duodenal Injury

Methods of treatment of retroperitoneal duodenal injury in the past have included (i) simple drainage, (ii) simple suture, (iii) suture plus gastro-enterostomy, (iv) resection of 15 cm. of duodenum and duodeno-jejunostomy, (v) suture plus jejunostomy, and (vi) end-to-end anastomosis of the duodenum.

Because post-ampullary external duodenal fistula occurs so frequently after retroperitoneal duodenal rupture, because it carries such a poor prognosis and because its treatment consists of jejunostomy through which duodenal suction is instituted, the occurrence of the fistula should be anticipated, and in *all* cases of post-ampullary duodenal injury a duodenal suction jejunostomy and jejunal feeding jejunostomy should be created at the same operation as the primary duodenal repair. Duodenal suction is obligatory. It immediately removes all high-enzyme gastric and pancreatic juice from a traumatized duodenum in a state of ileus which acts as a sump for these secretions. Furthermore, should a fistula develop despite attempt at prevention, then definite treatment of this condition can immediately be instituted without the need for the operation of jejunostomy at this stage and before dehydration and hypochloreaemia develop.

The method of treatment here put forward is simple, safe and not irrational.

#### SUMMARY

A case of retroperitoneal rupture of the third part of the duodenum is reported.

The mechanism of duodenal injury following blunt abdominal trauma is discussed, together with the pre-operative diagnosis of rupture of a hollow viscus.

The signs to be found at operation which indicate duodenal rupture are discussed, special mention being made of mesenteric surgical emphysema.

The complications of duodenal rupture are noted.

A method of treatment of retroperitoneal duodenal injuries is advocated.

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