CLOSED INJURY OF THE COMMON BILE DUCT AND DUODENUM

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As injuries in this region are uncommon, most surgeons may expect to treat only a few in a lifetime. The object of this paper is to review the clinical features, and the ancillary aids, which may enable a diagnosis to be made. The infrequency is illustrated by an analysis of 381 cases of ruptured bowel by Rowlands (1923) in which he found only 23 duodenal injuries. Counsellor and McCormack (1935) estimated that duodenal injury occurred in only 10 per cent. of non-penetrating wounds affecting the bowel. In children the condition is rare, and in 59 intra-abdominal injuries Beckman (1929) did not find a single case. Rupture of the bile ducts alone is exceedingly rare. Milnes Walker (1953) found only 48 cases, to which he added one of his own. A case due to crushing was described by Hicken and Stevenson (1948) and one due to spontaneous rupture with gangrene from an unknown cause has been described by Hart (1951).

Type of Injury

This varies, but is conditioned by anatomy. Most important is the relative fixity of the duodenum, which, although normally protected by the rib cage and the posterior abdominal wall, is unable to escape a blow which eludes that shield. This has been well understood since Miller (1916) drew attention to it. The injury, therefore, is usually found to be not so much heavy as well directed and in an unguarded patient. It is commonest nowadays in road accidents when a driver is flung on his wheel, but it is interesting to note that even in 1919 Battle found that of 32 duodenal injuries in a series of 215 cases, 16 were due to road accidents. Then the patient was usually run over by the wheel. Pure bursting has been described by Salisbury (1945) and by Cameron, Short and Wakeley (1943).

Mortality

In all papers discussing duodenal injury a striking feature is the emphasis which the surgeon accords to the mortality. Rowlands, quoting

Berry's series and other cases, found an overall mortality of 77 per cent. In a large number of these cases delay in diagnosis or complications had made the patient's condition so grave that operation was not carried out at all. In Berry's series (1921) a further factor was that of 15 cases of duodenal rupture seven were missed, even at laparotomy. Since these papers were written there has been a steady reduction in mortality, due probably to earlier diagnosis, supplemented, in recent years by improved methods of resuscitation and parenteral feeding. This is clearly shown in the table.

TABLE OF MORTALITY
(Modified after Cohn *et al.*)

Author	Date	Cases	Mortality %
Schumacher	1910	24	91.7
Guibe	1910	26	92.3
Miller and Schumacher ..	1916	46	89.1
Soderland	1918	37	86.5
Berry	1921	17	77.0
Hinton	1940	59	57.6
Johnson	1943	52	50.0
Cohn, Hawthorne and Frobose	1952	25	20.0

Clinical Pictures

One of the most important causes of missed diagnosis is the mildness of the blow necessary. Only occasionally is there an associated ruptured liver or other visceral damage, but when this occurs the apparently major lesion is likely to over-shadow the duodenal injury.

Shock is not a feature at the onset for as Poer and Woliver (1942) have pointed out, shock only occurs when leakage takes place. The delay in leakage is due to spasm and pouting of the mucosa into the torn wall. This is a picture more commonly seen in the small bowel, where leakage may not occur for a considerable time. We ourselves have seen a patient where, despite eight holes in the small bowel due to a pitchfork, no visible peritoneal soiling was found at operation eight hours later. So regular is this delayed shock in duodenal injury,

especially in retro-peritoneal lesions, that it should always be regarded with suspicion. Local signs vary, and are also usually delayed for some hours. Tenderness, guarding and rigidity are usually so mild in the early stages that they are ascribed to bruising of the abdominal wall. Pain may be only slight, but is persistent. Referred pain is rare, but when it occurs it is most impressive. It is caused by spread of the leaking duodenal contents to the region of the spermatic vessels, where the accompanying autonomic nerves are irritated, producing pain in the testes. This was described by Butler and Carlson (1931) and by Siler (1949). Unfortunately, referred pain in the testes is not restricted to duodenal injuries, as Gordon-Taylor pointed out (1942), and may occur in any injury where retro-peritoneal fluid can spread to the testicular autonomic nerves. Another unusual distribution of pain is in cases such as that described by White, where a tear at the duodenojejunal flexure mimicked a perforated gastroduodenal ulcer.

X-rays in Diagnosis

Much emphasis has been laid on this by a number of authors, but as Cohn, Hawthorne and Froese (1952) point out, only a positive film is of value. The presence of gas in the peritoneal cavity or tissues has been reviewed in two papers by Jacobs, Culver and Koenig (1944) and Koenig and Culver (1947), which state that it is present in 80 per cent. of cases. (This obviously does not apply where only the bile ducts have been injured). Newell, Rosenbaum and Canter (1951) describe a case where X-ray diagnosis was followed by recovery. In cases where the gas escapes in the perinephric zone, there is, as would be expected, a reduction of the shadow of the psoas major, similar to the changes when a perinephric abscess develops.

The administration of opaque substances has been suggested by Siler, but this is a dangerous procedure unlikely to be of much help.

Serum Amylase

In view of the intimate relationship between duodenum and pancreas, it might be expected that the estimation of serum amylase would be of value. This, however, is not the case, as Lister pointed out as early as 1914, and as others have done since then. Especially is it useless when a fistula side-tracks the secretions.

Operation Findings

Although from a consideration of the history and physical signs, aided by X-ray findings, the surgeon may suspect a ruptured duodenum or bile duct, the diagnosis is usually only established in the operating theatre. At operation, cases fall into two groups—those with bile or duodenal contents free in the

peritoneal cavity and those in which the lesion is entirely retro-peritoneal. It is the latter which is more dangerous and more likely to be missed, both before and at operation.

In retro-peritoneal rupture the escaped fluid is seen outside the margin of the duodenum, as it spreads behind the peritoneum. The peritoneum itself is raised and tense with a glazed surface. In some cases bile is present in the fluid, and can be seen shining through; in others bruising is more apparent. The source of the bile can usually only be detected when the peritoneum has been incised and the duodenum mobilized. The wound may vary from a minute hole to a large tear, or may be an area of wide destruction due to crushing. In these last cases, if pancreatic injury is present, it may give rise to areas of fat necrosis.

In more advanced cases there are, of course, secondary manifestations, such as peritonitis and its sequelae—signs of a case already too long delayed.

Treatment

This should be by open operation. A few cases have been reported where recovery has occurred spontaneously, but this must on the whole be ascribed to good fortune rather than good judgment. The aim of the surgeon should be to do as little as possible to save the patient's life (Poin-dexter, 1935).

Only in cases where shock is severe should there be delay before operation. An intravenous infusion will always be needed, and should be started before operation. A Ryle's tube should also be passed, before operation. Apart from these points, preparation proceeds as usual in an abdominal operation, and the usual pre-medication is given.

A right paramedian incision is best, as it is the most flexible for access to all parts of the abdomen, and also allows preliminary inspection of all the other viscera. In cases where the damage is easily exposed the surgeon will proceed at once to deal with it, but when it is concealed one or more structures must be mobilized. In the simplest cases only the duodenum need be freed. In awkward ones it may be necessary to free the colon, and in the most difficult, full mobilisation of duodenum and pancreas may be necessary.

Closure of simple tears of the duodenum is best carried out in two layers, sewing up the hole transversely to the line of the bowel wherever possible. Linen thread sutures are preferable. The suture line should be supported by sewing the omentum down.

Tears of the bile duct present more difficulty, owing to the danger of stricture formation. When this appears likely it is wise to insert a tube around which the duct is sutured. If a T-tube is employed

the advantage of adequate drainage is also enjoyed. Sometimes it is necessary to abandon all hope of repair and ligate the duct. The gall bladder is then anastomosed to the stomach or jejunum. A drawback, is the danger of a 'blow-out' of the ligated duct; this problem was early experienced by many surgeons in their first attempts at pancreatectomy.

The most difficult cases are those in which a segment of duodenum is not viable. In these cases Welch (1951) suggests resection of the duodenum with anastomosis of the proximal end to the jejunum. While this may be satisfactory in the first and two last segments of the duodenum, it is obviously much less practicable in the second. Although theoretically it is possible in the second portion with implantation of the pancreatic and bile ducts (as in removing the head of the pancreas), it is not reasonable in a patient already severely shocked from his injury. In these cases it is usually wiser to repair the bowel using omentum to assist the closure. Drainage is necessary in all cases. Some surgeons have suggested gastroenterostomy, with or without pyloric exclusion. Unfortunately, this has not often proved satisfactory.

Post-operative Care

In all cases both solid and fluid food should be withheld for three days, and hourly aspirations or continuous gastric suction should be maintained during this period. This allows sealing off by adhesions, and the process of repair begins. Intravenous fluids are given during this period as necessary. After the third day, if the patient's condition permits, oral fluids are given in small amounts. If, however, there is a fistula or peritonitis has developed, the treatment will be continued longer. Antibiotics are given in all cases. The drain may be shortened or removed after the third day when there is no appreciable escape of fluid.

Case Report

The patient, aged 15, a young healthy male, was kicked in the abdomen at 8 a.m. by his brother. The blow was a mild one, but was followed almost at once by severe pain in the right hypochondrium. The patient was seen by a doctor, but no severe injury was recognised. Four hours later the pain became more severe and generalized in the upper abdomen. Pain appeared 12 hours later in the point of the right shoulder, and the patient vomited twice. The patient was admitted to hospital at 1 a.m. the following day, and on admission was found to be shocked, and was pale, cold, and sweating. Respiration was shallow and rapid, and deep breathing produced severe pain in the right

hypochondrium. No abnormality was found in the chest, but there was slight generalized tenderness of the abdomen and slight rigidity on the right side of the abdomen, especially in the region of the gall bladder. Guarding was general, but the release sign was negative everywhere, and bowel sounds were normal in all parts of the abdomen. There were no signs of free fluid.

Operation 2 a.m. A right upper paramedian incision was made under general anaesthesia. A large amount of bile-stained fluid was present in the abdominal cavity. This was sucked out, and found to be escaping from behind the duodenum along its upper border close to the foramen of Winslow. No obvious duodenal injury was present, but a second collection of fluid could be seen through the peritoneum above and lateral to the duodenum on the posterior abdominal wall. The colon was freed and depressed downwards, and the duodenum completely mobilized and turned medially. A minute tear was found in the common duct at its point of entry into the duodenum. This was repaired easily with thread, and a piece of omentum drawn up and sewn down over it. A large drain was inserted through the flank to the duodenal bed, and the duodenum anchored into position again with interrupted sutures.

Post-operatively the patient remained shocked for 12 hours, and then gradually improved. Intravenous saline was given for three days. A moderate amount of serous fluid drained from the wound, and the tube was removed on the fourth day. Following this the patient made an uneventful recovery.

Comment

This case is typical of a duodenal injury in its clinical picture. The presenting feature was shock developing about six hours after a mild injury. No X-ray evidence was obtained, and it would probably not have altered the treatment anyway; on the other hand, we would not decry it, as it is never a disadvantage to have the maximum information before operating on any case.

Literature

Amidst the copious literature which we have reviewed whilst studying this condition three papers have appeared to us to be most useful:

1. A paper by Cohn, I. Jnr., Hawthorne, H. R., and Frobese, A. J. (1952). This paper reviews all available American and English literature.
2. A paper by G. K. Lauritzen (1947). This gives an excellent appraisal of methods of treatment, and reviews continental literature.
3. A review of traumatic rupture of the bile ducts by Milnes Walker (1953).

Summary

1. Injury to the duodenum and bile ducts is an infrequent lesion often caused by minor injury and easily overlooked.

2. Except in cases with other complicating injury, shock is not marked at the onset. The injury may be overlooked in treating more obvious lesions.

3. Delayed shock is a characteristic feature of duodenal injury, almost always taking over six hours to develop.

4. X-rays are of value in diagnosis only when positive. The signs sought are escaped gas and obliteration of the psoas shadow.

5. Early operation is essential.

6. Surgery should be minimal to save life.

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