Review

Management of duodenal trauma

CHEN Guo-qing and YANG Hua*

【Abstract】Duodenal trauma is uncommon but nowadays seen more and more frequently due to the increased automobile accidents and violent events. The management of duodenal trauma can be complicated, especially when massive injury to the pancreatic-duodenal-biliary complex occurs simultaneously. Even the patients receive surgeries in time, multiple postoperative complications and high mortality are common. To know and manage duodenal trauma better, we searched the recent related literature in PubMed by the keywords of duodenal trauma, therapy, diagnosis and abdomen. It shows that because the diagnosis and management are complicated and the mortality is high, duodenal trauma should be treated in time and tactfully. And application of new technology can help improve the management. In this review, we discussed the incidence, diagnosis, management, and complications as well as mortality of duodenal trauma.

Key words: ***Duodenum; Wounds and injuries; Diagnosis; Therapeutics***

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Duodenal trauma is not often encountered in clinic but recently it has an increased incidence because of frequent automobile accidents and violent events.[1] Due to its complicated anatomies, the diagnosis of duodenal trauma is difficult. The diagnostic accuracy is low and the rate of missed diagnosis is high. After duodenal trauma is confirmed, a surgery should be carried out as soon as possible. And the surgery should be given according to the location of trauma and the adjacent organs. However, even the surgery is applied in time, the incidence of complications and mortality rate are still high.

In order to review the diagnosis and management of duodenal trauma, we searched the recent related literature in PubMed by the keywords of duodenal trauma, therapy, diagnosis and abdomen. We first retrieved the related reviews and extracted the useful information they provided. Then we searched every related study in these reviews and found the needed information. Some of the references were also the source of information. Finally twelve studies were included and we reviewed the information about incidence, diagnosis, management, complications after surgery and mortality. The detailed information we obtained is shown as follows.

Incidence

Due to the increased incidence of traffic accidents and unpredicted injuries, duodenal injuries are seen more and more frequently.[1] The reported incidence of duodenal injury ranges from 3.7% to 5% in the literature and it is often accompanied by other abdominal injuries because of the close anatomic relationship to the liver, gallbladder, pancreas, etc.[2] The majority of duodenal injuries are caused by penetrating trauma. Blunt injury is infrequent but difficult to diagnose because of its vague clinical symptoms and signs. It is reported that the second portion of the duodenum is injured most commonly, approximately in one third of the cases reported.[3]

Diagnosis

The anatomy of the duodenum is unique and complex because of its close relationship to adjacent structures. Lying deep within the abdomen, the duode-

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Department of General Surgery, Xingqiao Hospital, Third Military Medical University, Chongqing 400037, China (Chen GQ and Yang H)

*Corresponding author: Tel: 86-23-68755705, E-mail: hwbyang@126.com

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num is well protected in the retroperitoneal space. Duodenal trauma has such clinical characteristics as follows: (1) low diagnostic accuracy before operation, with the rate of definite diagnosis before operation always below 10%,[4] (2) accompanied by other injuries, due to the special and complicated anatomy of the duodenum, (3) high incidence of missed diagnosis during operation, which can reach 20%,[5] and (4) high incidence of postoperative complications and mortality rate, which can reach as high as 50%.[6]

The diagnostic accuracy of duodenum injury is low because it has no specifical clinical symptoms and signs. And because of the special anatomy of duodenum, the injury may not present with any peritoneal irritation sign, especially when the second and third parts of duodenum are injured. If other abdominal organs are injured simultaneously, the diagnosis would become more confusing. It has been shown that if the interval between injury and operation is longer than 24 hours, the injury would be considered as a severe one,[7] from which we can see the importance of early diagnosis. Thus the following clinical signs detected should be particularly emphasized: (1) abdominal pain especially when the right upper quadrant is injured. And if the pain is intensified progressively with apparent peritoneal stimulation and radiation pain to the small of the back, the duodenum is very likely injured. (2) Retching or vomiting with blood in the vomitus. (3) Abdominal distension especially in the upper quadrant with infrequent or muted borborygmus. (4) Anterior sacral crepitus in digital rectal examination. (5) Detection of fluid like bile or intestinal juice by diagnostic abdominocentesis. However, surgeons need to know that negative results cannot exclude the possibility of duodenum injury.

Abdominal plain films, ultrasonic test and CT scan can also help the diagnosis of duodenum injury. Retroperitoneal air, free intraperitoneal air or other signs such as obliteration of the psoas muscle shadow and scoliosis of the lumbar vertebrae can give a clue of injury.[8] Under the circumstance of absence of positive signs, air or water-soluble radiopaque contrast medium can be injected through a nasogastric tube just before the abdominal film is taken. If leakage happens, rupture of duodenum can be confirmed. Barium is forbidden, as it is hard to clear up during surgery and may cause infection after surgery.

Laparoscopy also helps diagnosis. If possible, duodenoscopy can find the rupture directly, but unfortunately it is not suitable for traumatic patients. Although routine laboratory tests are not helpful in the preoperative diagnosis of duodenal rupture, some authors find that the serum amylase is an important marker. Serum amylase is elevated in 50% of patients with duodenal or upper gastrointestinal injury.[9]

Explorative laparotomy remains the ultimate diagnostic test if a high degree of suspicion of duodenal injury continues. The explorative procedures should be careful, comprehensive, accurate and quick. The duodenum should be explored if such signs appear: (1) free gas or fluid looking like bile with undetermined origin; (2) extraction of intestinal juice or fluid like bile from retroperitoneal hematoma; and (3) edema, hematoma, ecchymosis or crepitus in the periduodenal retroperitoneum or root of mesentery and mesocolon. It requires a careful detection for an accompanied injury to the pancreas as well as the bile duct and the ampulla, especially when the second portion of duodenum is injured. Severe duodenal injury, according to Snyder and his coworkers[10], is associated with the following factors: (1) missile or blunt injury; (2) injury of the first or second portion of the duodenum; and (3) adjacent common duct injury. Besides if serum amylase level is elevated, a diligent search for duodenal rupture is required. The presence of a normal serum amylase level, however, does not exclude a duodenal injury.

Management

The principle of duodenal injury treatment is to take the overall situation into account and handle matters in order of importance and urgency. Blocksom and his coworkers[11] reported that if the systolic pressure is lower than 90 mm Hg before surgery, the mortality can reach 46%; and if the patient needs a transfusion more than 1 000 ml, his hospital stay will be apparently longer. So we should pay attention to controlling bleeding, correcting shock and preventing infection during the early treatment of duodenum injury. At the same time, patients need to receive surgeries as soon as possible to control bleeding completely, correct shock further and recover the intestinal continuity. The operation methods should be based on the factors of injury site and type, time interval, individual situation and severity of peritoneum pollution.

The vast majority of duodenal injuries may be managed by simple procedures such as debridement and primary repair or resection and anastomosis. The detailed choices of operation are as follows.

For intramural haematoma, which develops in the submucosal or subserosal layers, it is not perforated. Open the serosa, evacuate the haematoma without violating the mucosa and repair the wall of bowel carefully. However, controversially others believe that operation will increase the incidence of perforation and to leave the hematoma intact is better. Nasogastric decompression after operation is enough.[12]

If the range of duodenum injury is less than 50% of the circumference, with regular injury border, adequate blood supply and without serious peritoneum pollution, the injury could be closed transversely and the decompression of duodenum could be achieved by jejunostomy. It is believed that 75%-85% of duodenum injury could be closed primarily and the incidence of duodenal fistula is less than 10%.[13]

If the range of duodenum injury is more than 50% of the circumference or primary closure of the defect may narrow the lumen of the bowel or result in undue tension and subsequent breakdown of the suture lines, segmental resection and primary end-to-end duodenoduodenostomy are advised, especially when the first, second or third part of duodenum is injured.[14] If a large part of duodenum is lost, suture of two ends will be impossible without causing undue tension on the suture line. If a large tissue of the first part of duodenum is lost, surgeries of duodenal diverticulization should be carried out, which include closure of the duodenal injury, gastric antrectomy with end-to-side gastrojejunostomy, tube duodenostomy, and generous drainage in the region of the duodenal repair.[15] The main problem of duodenal diverticulization is that it is a time-consuming operation, and thus not recommended in hemodynamically unstable patients or when several accompanied injuries are presented. Otherwise if such injury is distal to the ampulla of Vater, closure of distal duodenum and Roux-en-Y duodenojejunostomy is appropriate. If the injury happens to the second part of duodenum, because of the limited mobilization of this part, a direct anastomosis of Roux-en-Y over the injury in an end-to-side fashion is appropriate. This method can be also applied to other parts when the primary anastomosis is impossible.

If the patient has massive peripancreatic hemorrhage, proximal pancreatic duct or ampullary injuries that preclude the possibility of reconstruction, pancreaticoduodenectomy should be applied.[16] Snyder reported that ampullary injuries had an incidence of only 3%. Howerer in a study of Asensio and colleagues[17] which included 170 patients who underwent pancreaticoduodenectomy in 50 reported series, the overall mortality rate reached 33%. So pancreaticoduodenectomy should be applied carefully.

Finally, it should be emphasized that the best operation methods are those relatively simple and close to physiological condition ones, such as primary suture, tube duodenostomy and initial anastomosis. In gastrostomy, duodenostomy or jejunostomy, a drainage tube should be used. It is applied for decompression of the duodenum and protection of the duodenal suture line. It had favorable results with tube decompression: a fistula rate of 2.3% with tube decompression and 11.8% without.[18] External drainage should also be performed because of the early detection and control of duodenal fistula.

Complications and mortality

The most serious complication following the treatment of duodenal injury is duodenal fistula. In a collective review of 15 series containing 1 408 patients with duodenal injuries, Asensio and colleagues[17] reported an average incidence of duodenal fistula for 6.6%. Other complications reported with duodenal trauma include intra-abdominal abscess, pancreatitis, duodenal obstruction and bile duct fistula. The overall mortality rate of duodenal injuries remains to be significant, with an average incidence of 17%.

Conclusion

Exploratory laparotomy remains the final diagnostic test if a high suspicion of duodenal injury continues after all auxiliary examinations are applied. Most duodenal injuries can be managed by simple repair. More complicated injuries need more sophisticated operation techniques and are followed by a high incidence of postoperative complications especially the duodenal fistula and high mortality. Tube decompression and external drainage are necessary and helpful. The perioperative nutrition support and reasonable applica-

tion of antibiotics are also beneficial.

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