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Short Communication

Pancreatic Injury: Uncommon, Unusual, Uncanny, and Challenging Diagnostic Entity in Clinical Practice

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Abstract

Pancreatic injury, although uncommon, is difficult to diagnose because of its retroperitoneal location. Early diagnosis is critical to overcome high morbidity and mortality associated with pancreatic injury. A high degree of clinical suspicion along with understanding of the mechanism of injury and appropriate diagnostic studies would help a clinician to make a diagnosis of pancreatic injury. This brief review focusses on some basic concepts and approaches that would help a clinician to diagnose injury to the pancreas.

Keywords: Pancreas, retroperitoneum, trauma, pseudocyst, computerized tomography, magnetic retrograde cholangiopancreatography.

Introduction

The incidence of abdominal trauma is 7-10%. Blunt abdominal trauma results in a mortality of 10% [1]. Pancreatic trauma is an uncommon injury due to its retroperitoneal location with an incidence of 0.4 to 12%. It often accompanies other organ injuries resulting in high morbidity and mortality due to a sparsity of clinical presentation and a delay in diagnosis [2].

Method of injury:

Pancreatic injury results from penetrating or blunt abdominal trauma. Penetrating trauma such as stab wounds and gunshot injury not only involve the pancreas, but also some hollow viscus such as the stomach, duodenum, colon and to solid organs such as the liver, spleen, kidney, and major vasculature. In Comparison, blunt abdominal pancreatic injury is attended by injury to the duodenum, liver, and spleen. A motor vehicle accident compresses the pancreas between the spine and the steering wheel of a car resulting in injury to neck and to the body of the pancreas [3] whereas a bicycle handlebar injury to the pancreas is a common blunt injury in the pediatric age group [4]. Blunt pancreatic injury is more common in children because of the absence of a protective fat pad that surrounds the pancreas.

Embryology, applied anatomy, and physiology of the pancreas:

Embryology:

The pancreas develops from two endodermal buds during the fifth week of embryonic life. A ventral bud originates from the hepatic diverticulum and becomes the pancreatic head and uncinate process. The dorsal bud arises from the foregut and develops into the pancreatic neck, body, and tail.

During the sixth week of embryonic life, the dorsal bud grows laterally left entering the dorsal mesentery where the tail of the pancreas is situated, in an intra-peritoneal location. The ventral bud undergoes relocation due to further development of embryonic gut, uniting with the dorsal bud by the seventh week of embryonic life. By the fifth week of embryonic life, the duct of the dorsal pancreatic bud becomes the accessory duct of Santorini, and the development of the acinar system takes place to handle exocrine secretions. The duct system from the smaller ventral bud becomes the major ductal system of Wirsung. Endodermal buds give rise to endocrine and exocrine cells. α, β, and δ cells develop by the thirteenth week of life [5].

Applied anatomy:

The pancreas is an elongated J-shaped, lobulated, soft organ located in a retroperitoneal location. It traverses the posterior abdominal wall at the level of L1-L2 in the epigastric and left hypochondrium of the abdomen. It is 15-20 cm long, 1-1.5 cm thick and weighs 90-100 grams [6]. As alluded to earlier, the main duct of Wirsung traverses the entire length of the pancreas with the accessory duct of Santorini draining the lower part of the head of the pancreas.

The head of the pancreas is supplied by the superior and inferior pancreaticoduodenal arteries arising from the superior mesenteric artery. The neck, body, and tail are supplied by the pancreatic branches of the splenic artery. The venous drainage of the head is into the superior mesenteric and portal veins while the venous drainage of the neck and body are into the splenic vein.

The lymphatic drainage of the pancreas is via the splenic, celiac, and superior mesenteric lymph nodes. The pancreas is innervated by sympathetic, parasympathetic, spinal, and vagal efferent as well as the enteric nervous system [7].

Physiology:

The pancreas consists of an endocrine component called the islets of Langerhans and an exocrine component that secretes pancreatic enzymes and juice. The islets produce insulin, proinsulin, amylin, C-peptide, somatostatin, pancreatic polypeptide (PP), and glucagon. Insulin helps to lower blood sugar, and glucagon causes blood sugar to rise. The exocrine activity entails the manufacture of enzymes that are components of the iso-osmotic alkaline pancreatic juice and support the digestion of food in the intestine. Mucus is produced by goblet cells. Enzymes that digest proteins are secreted and this includes trypsin, chymotrypsin, carboxypeptidase, and elastase. Trypsin and chymotrypsin are secreted in the form of proenzymes titled trypsinogen and chymotrypsinogen. The pancreatic lipolytic enzymes constitute lipase, phospholipase, and esterase, all which digest fats. The carbohydrate digesting enzymes are lactase and amylase, which break down starch into maltose, maltotriose, and dextrins. Nucleolytic enzymes include ribonuclease and deoxyribonuclease, which break down nucleic acids into mono- and oligonucleotides. The total volume of pancreatic juice amounts to 1.4 liters per day [8].

Symptoms and signs of pancreatic injury:

Symptoms and signs of pancreatic trauma are limited because of the retroperitoneal location of the pancreas. These symptoms and signs are limited to epigastric pain, vomiting, and epigastric tenderness.

Laboratory findings:

Serum amylase and lipase level elevations have low specificity and sensitivity in the diagnosis of pancreatic injury. An elevated pancreatic enzyme level must raise a suspicion of pancreatic injury, while a normal level within the first 6 hours of injury does not rule out pancreatic injury [9]. Diagnostic peritoneal lavage for raised amylase level may be useful, although amylase can also be elevated in injuries involving salivary gland, duodenum, liver, head, and face.

Radiological studies:

Plain X-ray of the abdomen:

Plain radiography may show a foreign body such as bullet fragments following penetrating injuries as well as injury to bones, associated pulmonary parenchymal injury, gastric dilation, and pneumoperitoneum. Widening of C-loop of the duodenum may be seen in pancreatic bleeding with duodenal distension. A “colon-cutoff” sign may indicate dissection along transverse mesocolon wherein distended colon with gas abruptly terminates at the splenic flexure. Localized ileus may be present as a sentinel loop [10]. The findings on plain X-ray of the abdomen are non-specific.

Ultrasound:

Ultrasound is limited by the retroperitoneal location of the pancreas. Contrast enhanced ultrasound is useful in pediatric and pregnant individuals [11] as well as in an emergency. It is dependable in the follow-up of complications such as pseudocyst.

Computerized Tomography (CT) and Contrast Enhanced CT (CECT):

CT is the diagnostic modality preferred in those who are hemodynamically stable following trauma to the abdomen. Multidetector-row CT is faster to scan and reduces artifacts due to bowel loops. The ability to detect ductal injury can be as low as 43% [12].

A multi-slice CECT scan is a good non-invasive diagnostic modality for the detection of pancreatic injury. Repeated CECT in the presence of continued symptoms improves its accuracy. It is not a good modality for diagnosing injury to the pancreatic duct. It however helps to identify injury to other abdominal organs [13].

Magnetic retrograde cholangiopancreatography (MRCP):

MRCP is helpful in demonstrating pancreatic parenchyma as well as the duct. However, it is a static study [14]. Dynamic secretin stimulated (DSS) MRCP provides information about leakage from the main pancreatic duct. It is non-invasive and faster than ERCP [15].

Endoscopic retrograde cholangiopancreatography (ERCP):

It is the best diagnostic method to demonstrate the presence or the absence of ductal integrity. It is not only diagnostic but also therapeutic since it helps in ductal stenting as well as assists to undertake transgastric cystoenterostomy. However, it is invasive and can lead to complications such as acute pancreatitis [16].

Therapy:

Early diagnosis is the key to prevent the morbidity and mortality associated with pancreatic injury. Initially, hemodynamic stability is attained followed by the evaluation of associated injuries including to the pancreatic duct. While injury to the head of the pancreas is complicated by the vascular anatomy, it is not the case in injury to the body and the tail. Therapy is based on the Association for the Surgery of Trauma (AAST) score which is described in table 1.

Table 1: AAST organ injury scoring for pancreatic injury [17].

Grade	Finding	Injury category	Treatment
1	Hematoma Laceration	Major contusion without ductal injury Major laceration without ductal injury or tissue loss	Non-operative management
2	Hematoma Laceration	Contusion involving > one portion of the pancreas Disruption involving < 50% circumference	Non-operative management
3	Laceration	Pancreatic parenchymal injury with major pancreatic duct injury or distal transection	Distal pancreatectomy. Other: PG, PJ, & stenting*
4	Laceration	Major pancreatic duct injury right of superior mesenteric vein (proximal pancreatic transection)	Drainage alone, PG, PD, & midsegment pancreatectomy
5	Laceration	Massive disruption of pancreatic head	Same as for grade 4 injury

PG: pancreaticogastrostomy, PJ: Roux-en-Y pancreaticojejunostomy, stenting* with repair of the pancreas and its duct, PD: pancreaticoduodenectomy.

Non-operative management involves close hemodynamic monitoring, clinical evaluation of the abdomen, pain management, prophylaxis against stress ulcer, early enteral feeding if no contraindication exists [18]. In grade 3 injury, the spleen is spared when distal pancreatectomy is undertaken [19]. Management of grade 4 and 5 injuries is controversial. The safest way to manage grade 4 and 5 injuries is by external drainage in the absence devitalized pancreatic head or duodenum with intact ampulla Vater [20].

Complications

Pancreatic fistula in the post-operative period, intra-abdominal abscess, vascular complications, fluid collection, pseudocyst, pancreatic exocrine and endocrine insufficiency.

Conclusion

Although challenging, the diagnosis of pancreatic injury can be made early, despite its retroperitoneal location, when a high degree of clinical suspicion based on the mechanism of injury and focused radiological evaluation are employed. A pancreatic injury scale is very helpful in the management and care of patients with pancreatic injury. Early grade injury is managed conservatively, while later grade injury requires a judicious surgical approach.

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