

# Imaging of Pancreatic and Duodenal Trauma



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## KEYWORDS

- Trauma • Pancreatic injury • Duodenal injury • Computed tomography
- Magnetic resonance cholangiopancreatography • Blunt • Penetrating

## KEY POINTS

- Pancreatic and duodenal injuries are rare but life-threatening occurrences, often occurring concomitantly and in association with other solid organ injuries.
- Imaging findings of pancreatic and duodenal trauma on computed tomography and MR imaging are often nonspecific, and high levels of clinical suspicion and understanding of mechanism of injury are imperative.
- Familiarity with the grading schemes of pancreatic and duodenal injury is important because they help in assessing for key imaging findings that directly influence management.

## INTRODUCTION

Traumatic pancreatic and duodenal injuries are rare, especially in the setting of blunt abdominal trauma. These injuries are reported to make up only 2% of all blunt abdominal trauma.<sup>1</sup> Although exceedingly uncommon, it is imperative for radiologists to be vigilant for these injuries, because delay in diagnosis portends poor outcome with reported mortalities of up to 30% in patients with blunt pancreatic trauma,<sup>2</sup> and up to 25% in patients with duodenal injuries.<sup>3</sup> The rarity of such injuries, the complex anatomy, and the common association with concomitant multiorgan injury, which may obscure the subtlety of the imaging patterns of duodenal and pancreatic injury, pose a unique challenge. Variable imaging findings of pancreatic and duodenal injury, which may range from normal appearance to complete transection in the case of the pancreas or perforation in the case of duodenum, further complicate the situation. In addition, clinical signs and symptoms are also largely nonspecific and unreliable.<sup>1</sup>

Multidetector computed tomography (CT) plays a pivotal role in early injury surveillance in the setting of blunt abdominal trauma. In contrast, ultrasonography (US) and MR imaging play a smaller role in the initial diagnosis of pancreatic or duodenal injury, with their roles reserved for evaluation of potential posttraumatic complications. This article discusses direct and indirect imaging findings of pancreatic and duodenal injuries. CT protocols used in our institution for abdominal imaging in the setting of trauma are also detailed, as optimization of CT technique is imperative, particularly in evaluation of pancreatic trauma, because a poorly timed contrast bolus may compromise detection of pancreatic injury. Knowledge of typical mechanisms of injury and frequently associated patterns of organ injuries may provide important clues in initial assessment of the trauma CT scan, and these are also described. In addition, potential delayed complications of duodenal and pancreatic injuries are reviewed, as well as grading scales of injuries and treatment strategies.

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## EPIDEMIOLOGY

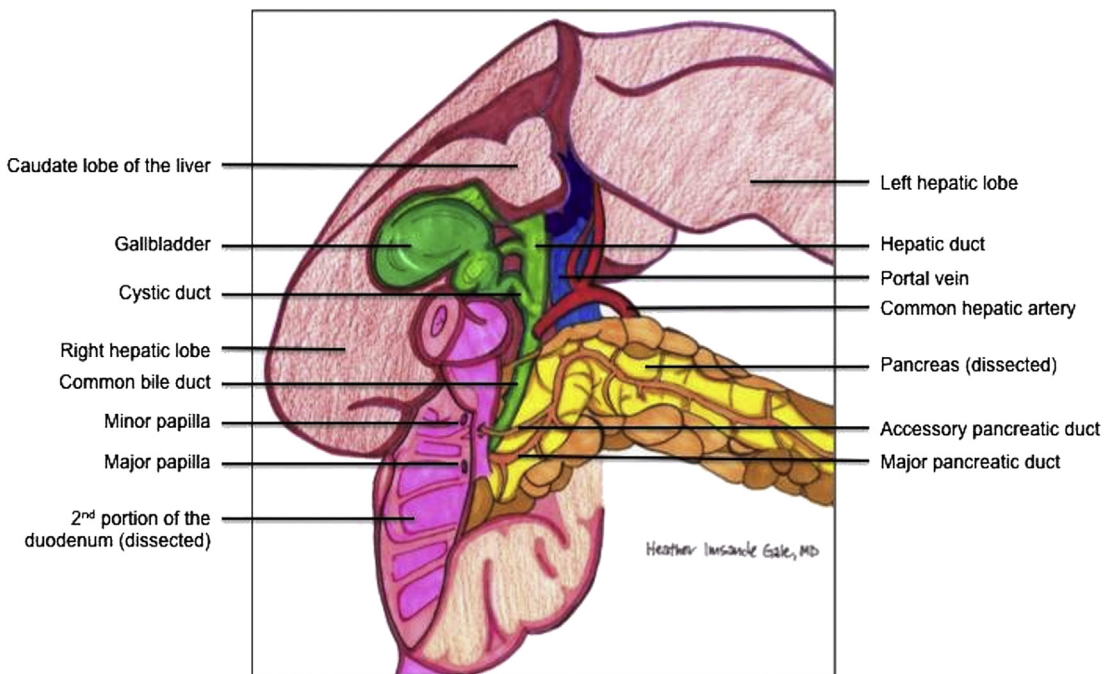
Morbidity and mortality associated with pancreatic and duodenal trauma are high. As previously stated, the mortality for either pancreatic or duodenal injury may be up to approximately 30%. Early mortality is usually related to severe hemorrhage from associated vascular injury<sup>2</sup> and multiple coexisting injuries. In contrast, multiorgan failure and superimposed infections result in delayed deaths and complications. The probability of complications associated with either of these injuries ranges from about 30% to 60%, and, in many cases, is linked to missed findings and delayed diagnosis on initial imaging.<sup>1</sup> Early diagnosis is imperative, because delay by even 24 hours can increase the risk of death 4-fold.<sup>1,4</sup> Common complications of duodenal and pancreatic injuries include pancreatitis, pseudocysts, fistulas, intra-abdominal abscesses, and bowel anastomosis breakdown, and may lead to sepsis and multiorgan failure.

Coexisting injuries are common, caused by high-impact mechanisms typically associated with duodenal and pancreatic trauma, and are reported to occur in 50% to 98% of cases.<sup>1</sup> The most frequently associated solid organ injuries include the liver (47% of cases), spleen (28% of cases), and kidneys (23%).<sup>1</sup>

## NORMAL ANATOMY AND PERTINENT RELATIONSHIPS

### Pancreas

The pancreas is an endocrine and exocrine gland that is located in the superior retroperitoneum, and is also divided into anatomic sections: head, neck, body, tail, and the uncinate process. It is typically 15 to 20 cm long, and weighs up to 100 g. It is located anterior to the left kidney and several crucial vascular structures. The pancreatic head is intimately associated with the proximal duodenum, which explains why concomitant injuries to both of these organs are so common. In addition, the head of the pancreas has close anatomic relationships with the inferior vena cava (IVC) and the portal vein, often resulting in more severe injuries when the head of the pancreas is involved, as opposed to the body/tail. Injury to the neck and/or uncinate process may result in associated trauma to the superior mesenteric artery and/or vein, because these vessels run posteriorly here. In contrast, the splenic artery and vein run superoposteriorly to the tail of the pancreas, and may become compromised in trauma to the distal pancreas. In addition, the pancreatic duct usually traverses the entirety of the pancreas and, thus, trauma to any anatomic region of the pancreas may result in duct compromise with free leakage of pancreatic enzymes (**Fig. 1**).<sup>1</sup>



**Fig. 1.** Pancreatic and duodenal anatomy.

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