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## **Indications for the surgical management of pancreatic trauma: An update**

Pavlidis ET *et al.* Pancreatic trauma

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### **Abstract**

Pancreatic trauma is rare compared to other abdominal solid organ injuries, accounting for 0.2%-0.3% of all trauma patients. Moreover, this type of injury may frequently be overlooked or not readily appreciated on initial clinical examinations and investigations.

The Organ Injury Scale determines the severity of the trauma. Nonetheless, there are conflicting recommendations for the best strategy in severe cases. Overall, conservative management of induced severe traumatic pancreatitis is adequate. Modern imaging modalities such as ultrasound scanning and computed tomography scanning can detect injuries in fewer than 60% of patients. However, magnetic resonance cholangiopancreatography and endoscopic retrograde cholangiopancreatography (ERCP) have diagnostic accuracies approaching 90%-100%.

Thus, management options include ERCP and stent placement or distal pancreatectomy in cases of complete gland transection and wide drainage only for damage control surgery, which can prevent mortality but increases the risk of morbidity. In the majority of cases, surgical intervention is not required and should be reserved for only severe grade III to grade V injuries.

**Key Words:** Pancreas; Acute pancreatitis; Abdominal trauma; Pancreatic traumatic injury; Emergency surgery; Damage control surgery

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**Core Tip:** Pancreatic trauma management should be individualized based on the exact grade of injury. Damage control surgery is the best approach for severe life-threatening cases. However, in such cases, the presence of severe acute pancreatitis makes safe resection impossible. Endoscopic stent placement into the ruptured pancreatic duct is the best alternative after the acute phase. In cases in which local conditions allow, pancreaticojejunostomy can be performed.

## **INTRODUCTION**

The location of the pancreas behind the posterior peritoneum contributes to the rarity of pancreatic trauma, which accounts for 0.2%-0.3% of all trauma patients<sup>[1,2]</sup>. This type of trauma usually occurs in conjunction with other organ injuries, mainly to the duodenum. In cases of blunt abdominal trauma, a reasonable mechanism of injury is crushing between the action force and the vertebral column. Less rare but more severe penetrating traumas (gunshot wounds, stab wounds) are common in North America and South Africa. Morbidity and mortality rates are high in cases of gunshot injuries to the pancreas<sup>[3,4]</sup>.

It should be stressed that pancreatic trauma may frequently be overlooked in injured patients with multiple injuries, resulting in a delay in diagnosing severe traumatic pancreatitis<sup>[5]</sup>.

Of the modern imaging techniques, magnetic resonance cholangiopancreatography and endoscopic retrograde cholangiopancreatography (ERCP) have superior diagnostic

accuracy (90%-100%) compared to ultrasound scanning and computed tomography scanning (less than 60%)<sup>[6-8]</sup>.

Elevated serum amylase levels (required time 4-6 h) and a high C-reactive protein level above 150 mg/dL contribute to the diagnosis of severe pancreatitis.

A recent large multicenter national cohort study from Japan showed that the <sup>1</sup>Organ Injury Scaling of the American Association for Surgery for Trauma (grade III/IV severe), <sup>1</sup>Revised Trauma Scale score on arrival, age, and the coexistence of severe abdominal injury aside from pancreatic injury are <sup>1</sup>prognostic factors of mortality after pancreatic trauma. Among 743 patients, 84.8% had blunt injuries, and 15% had penetrating injuries. The severity of the injuries was classified as follows: grade I: 45.4%; grade II: 8.9%; grade III: 24%; grade IV: 8.3%; and grade V: 13.5%<sup>[9]</sup>.

<sup>2</sup>The aim of this manuscript is to present an updated clinical analysis of the available knowledge on the detection, classification and optimal management of pancreatic trauma. For this minireview, we selected and focused on the most relevant recent articles from PubMed.

## **STAGING SYSTEM**

Optimal management depends on the exact staging of the <sup>3</sup>injury. The Organ Injury Scale by the American Association for Surgery of Trauma for pancreatic injury severity described in Moore *et al*<sup>[10]</sup> and Søreide *et al*<sup>[11]</sup> is shown in Table 1.

The Revised Trauma Scale score to predict mortality on arrival used in Shibahaski *et al*<sup>[9]</sup> and Jeong IH *et al*<sup>[11]</sup> is shown in Table 2.

## **CONSERVATIVE MANAGEMENT**

Conservative management is adequate for grade I and grade II injuries, which represent the majority of cases, and includes proper conservative management of induced severe traumatic pancreatitis<sup>[1]</sup>. Close monitoring, no oral feeding to rest the pancreas, intravenous fluids and electrolytes, analgesics, antibiotics, total parenteral nutrition and, in the case of peripancreatic collections, percutaneous drainage are the basic

proposed measures. The use of somatostatin in its original form or its chemical analog sandostatin is indicated for cases of persistent pancreatic fistula with an output above 500 mL per day. In the rare case in which the patient develops compartment syndrome and increased intraabdominal pressure, urgent lifesaving laparotomy and wide drainage are mandatory.

### **INDICATIONS AND OPTIONS FOR SURGICAL MANAGEMENT**

Much debate exists regarding the best strategy for severe grade III to grade V injuries. The management options include ERCP and stent placement into the major pancreatic duct, distal pancreatectomy in cases of complete gland transection, and wide drainage only for damage control surgery, which can prevent mortality but increases the risk of morbidity.

However, pancreatic trauma management should be individualized based on the exact grade of injury. Damage control surgery is the best alternative for severe life-threatening cases. In such cases, the presence of severe acute pancreatitis makes safe resection impossible. Endoscopic stent placement into the ruptured pancreatic duct is the best alternative after the acute phase. In cases in which local conditions allow, pancreaticojejunostomy can be performed<sup>[9]</sup>.

Another study recommended resection surgery rather than drainage for grade IV pancreatic injuries, thus avoiding the need for reoperation<sup>[12]</sup>.

A recent multicenter national survey in Japan showed that serum amylase levels and ERCP can more accurately indicate injury to the main pancreatic duct in hemodynamically stable patients. Poor outcomes were reported in patients with long-standing injuries who were initially managed nonoperatively<sup>[13]</sup>.

Early pancreatic resection is recommended when possible for grade IV pancreatic duct injuries; otherwise, the development of peripancreatic fluid collections requires drainage<sup>[14]</sup>.

In difficult cases, damage control surgery is the best alternative<sup>[4,15]</sup>.

A recent multicenter trial showed that the updated management strategy should include earlier endoscopic evaluation and pancreatic duct stenting. However, a completely transected major pancreatic duct will likely require surgery, which can improve long-term outcomes<sup>[16]</sup>.

Conservative management of pancreatic trauma is often feasible and effective. When surgical management is needed, the options should be resection or a more limited approach. A distal pancreatectomy with splenectomy can be performed safely, but proximal injuries require a stage-specific approach<sup>[17]</sup>.

When possible, primary repair of the pancreatic duct can be attempted<sup>[18]</sup>. A comparison between blunt and penetrating trauma showed that the latter type of injury is worse<sup>[19]</sup>.

The risk factors determined by regression analysis include other intraabdominal injury, hypovolemia, and penetrating injury<sup>[20,21]</sup>.

The characteristics of pancreatic injuries among trauma patients have been studied in detail<sup>[22]</sup>.

An analysis of immediate, intermediate and long-term outcomes of grade IV injuries showed that resection should be chosen when possible. The majority of patients who undergo drainage procedures will require additional interventions<sup>[12]</sup>.

In a systematic review and meta-analysis of pancreatic trauma occurring in children, most patients could initially be managed conservatively. In addition, ERCP was found to offer high diagnostic accuracy and to facilitate the repair of ductal injuries<sup>[23]</sup> in both children and adults<sup>[24]</sup>.

Modern imaging techniques<sup>[25]</sup> as well as radiological and endoscopic interventions have changed the perception that surgery is mandatory for abdominal solid organ injuries; a more selective surgical strategy is now considered<sup>[26,27]</sup>. Multidisciplinary collaboration among surgeons, endoscopists, radiologists and intensivists is crucial for managing pancreatic trauma<sup>[28]</sup>. However, more complex conditions exist in severe hepatopancreatobiliary trauma<sup>[29,30]</sup>.

For isolated grade III pancreatic duct injury, a Roux-en-Y pancreatojejunostomy is feasible<sup>[31]</sup>.

According to the aforementioned, the anatomic location of the pancreas and its close relationship with major vascular structures such as mesenteric vessels, portal vein, and aorta, as well as the duodenum, predisposes for co-existing injuries. Therefore, the severe pancreatic trauma would be combined with major vascular injuries at 28% of the incidence<sup>[32]</sup>. Penetrating traumas more likely need emergency surgery compared with blunt traumas<sup>[33]</sup>. It should be emphasized that when pancreatic trauma is accompanied by hemorrhage due to major vascular injury or peritonitis caused by gastrointestinal tract perforation, urgent laparotomy is mandatory, regardless of the grade of pancreatic injury. For the latter, damage control surgery may be sufficient and related with improved outcomes<sup>[33]</sup>, given the recent advancements in imaging modalities that make nonoperative management of pancreatic trauma possible at a later stage<sup>[4,5]</sup>; otherwise, a more detailed imaging modality is required after the acute phase to identify overlooked pancreatic injury. Thus, modern multidisciplinary management approaches have decreased mortality<sup>[34]</sup>, and the majority of cases can be managed conservatively. ERCP, which determines the anatomical integrity of the main pancreatic duct and the possibility for stent placement, may be used to avoid surgical intervention in most cases<sup>[35-37]</sup>. Patients with severe traumatic pancreatitis in the subacute phase should be mainly managed nonoperatively<sup>[1]</sup>.

## **CONCLUSION**

Pancreatic trauma is rare, and its management requires an individualized approach. Conservative management is sufficient for the majority of patients with low-grade injuries. In severe cases with pancreatic duct involvement, much controversy over the optimal patient management strategy still exists. Damage control surgery is the best option for such cases and should be used when indicated. Modern radiologic and endoscopic interventions have allowed select patients to avoid reoperation.

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