Duodeno-Pancreatic and Extrahepatic Biliary Trauma

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Learning Goals

- Know the incidence, the mechanism of damage, and the clinical presentation of duodeno-pancreatic and extra-hepatic biliary trauma.
- Establish the early management of a patient given his hemodynamic conditions; choose the most correct diagnostic tests and identify patients who are candidates for NOM.
- Identify the most correct surgical strategies for the patient in relation to the severity of the injuries.

99.1 Introduction

Duodeno-pancreatic and extrahepatic biliary trauma are traumatic lesions of the duodenum, pancreas, and extrahepatic biliary tree that very often occur in the context of major multi-organ traumas that often requires multidisciplinary management. The emergency surgeon plays a key role in the initial management, but, often following surgical reconstructions with hepato-pancreato-biliary (HPB), surgeons are required. Endoscopists, interventional radiologists, and gastroenterologists are essential not only in the early diagnosis and management of trauma but also in nonoperative management (NOM) and in the treatment of complications and long-term sequelae. Mortality and morbidity increase enormously with time in these traumas; hence, the management should be as early as possible.

99.2 Epidemiology

Although duodenal trauma is very rare, ranging from 0.2 to 0.6% of all trauma patients and 1–4.7% of all abdominal trauma, their lethality remains very high with a mortality of up to 20% [38, 41, 47]. This is mainly due to the fact that duodenal trauma is often associated with other lesions, such as pancreatic, biliary, or vascular injuries, and this can lead greater difficulties not only in the treatment but also in the diagnosis.

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F. Coccolini, F. Catena (eds.), *Textbook of Emergency General Surgery*,
https://doi.org/10.1007/978-3-031-22599-4_99

Injuries treated quickly and promptly diagnosed offer greater success, while those with delayed recognition are more often associated with poor outcome. Pancreatic trauma is rare with an incidence of less than 1% in all traumas and 3.7–11% of abdominal traumas [28, 35, 47]. As in duodenal trauma, the outcome of these can be worsened by the retroperitoneal localization which can weaken signs and symptoms of injury delaying diagnosis and treatment.

Extrahepatic biliary traumas are rarer and occur in 0.1% of adult trauma. As well as the others, these are also associated with other injuries in most traumas. Isolated lesions are extremely rare and occur only in 2–3% of cases of extrahepatic biliary lesions [19, 39, 46].

99.3 Etiology

Penetrating trauma, such as gunshot and stab wounds, are the most common causes in adult duodenal injuries although blunt traumas may cause duodenal lesions when its compression into the lumbar spine is determined. Pancreatic penetrating injuries are more frequent in series from North America, Africa, and among military involved in wars, but car or bicycle crashes remain the most common causes of pancreatic injuries in adults and children. This gland, along with duodenum, is placed in the retroperitoneum in front of the vertebral column, and blunt traumas can cause its rupture (Fig. 99.1). A classic example can be the "Chance Fracture," typically caused by seat belt injuries in which vertebral fracture is made from an excessive flexion of the spine. In around half of cases, there is an associated abdominal injury such as a splenic rupture, small bowel injury, pancreatic injury, or mesenteric tear [28, 38, 41, 49]. In extrahepatic biliary, blunt trauma is the most frequent except for the gallbladder which is more frequently associated with penetrating trauma [19, 39, 46].

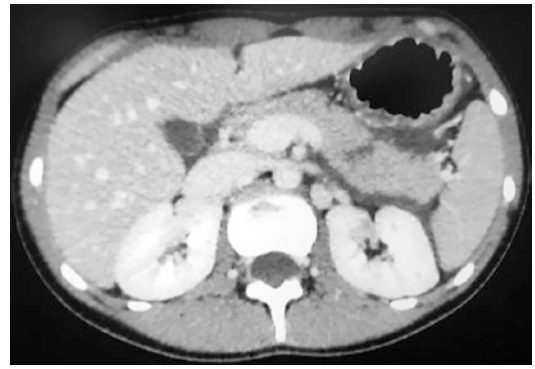

Fig. 99.1 CT scan image of body pancreatic injury (AAST Grade III)

99.4 Classification

The American Association for the Surgery of Trauma (AAST) has proposed a grading system for both duodenal, pancreatic, and extrahepatic biliary tree lesions. In AAST the injuries are graded from I to V with increasing severity and are described indicating degree and description of the lesion. In pancreatic and duodenal traumas, the type of injury is also described distinguishing between hematoma, laceration, or vascular lesion [30, 31] (Tables 99.1, 99.2, and 99.3). World Society of Emergency Surgery (WSES) revised the guidelines for pancreatic, duodenal, and extrahepatic biliary traumas by proposing a classification in four classes that considers both the AAST classification and the hemodynamic status. The final grade of the lesion depends on the higher-grade lesion among the various lesions. WSES guidelines divided the severity of the lesions into three grades: minor (WSES Class I), moderate (WSES Class II), and severe (WSES Class III–IV) (Table 99.4) [9].

Table 99.1 The grading system proposed by the American Association for the Surgery of Trauma Society (AAST) for extrahepatic biliary trauma [31]

Grade[a]	Description of injury
I	Gallbladder contusion/hematoma Portal triad contusion
II	Partial gallbladder avulsion from liver bed; cystic duct intact Laceration or perforation of the gallbladder
III	Complete gallbladder avulsion from liver bed Cystic duct laceration
IV	Partial or complete right hepatic duct laceration Partial or complete left hepatic duct laceration Partial common hepatic duct laceration (<50%) Partial common bile duct laceration (<50%)
V	>50% transection of common hepatic duct >50% transection of common bile duct Combined right and left hepatic duct injuries Intraduodenal or intrapancreatic bile duct injuries

[a]Advance one grade for multiple injuries up to grade III

Table 99.2 The grading system proposed by the American Association for the Surgery of Trauma Society (AAST) for Duodenal trauma [30]

Grade[a]	Type of injury	Description of injury
I	Hematoma Laceration	Involving single portion of duodenum Partial thickness, no perforation
II	Hematoma Laceration	Involving more than one portion Disruption <50% of circumference
III	Laceration	Disruption 50–75% of circumference of D2 Disruption 50–100% of circumference of D1, D3, D4
IV	Laceration	Disruption >75% of circumference of D2 Involving ampulla or distal common bile duct
V	Laceration Vascular	Massive disruption of duodeno-pancreatic complex Devascularization of duodenum

D1 first position of duodenum, *D2* second portion of duodenum, *D3* third portion of duodenum, *D4* fourth portion of duodenum

[a]Advance one grade for multiple injuries up to grade III

Table 99.3 The grading system proposed by the American Association for the Surgery of Trauma Society (AAST) for pancreatic trauma [30]

Grade[a]	Type of injury	Description of injury
I	Hematoma Laceration	Minor contusion without duct injury Superficial laceration without duct injury
II	Hematoma Laceration	Major contusion without duct injury or tissue loss Major laceration without duct injury or tissue loss
III	Laceration	Distal transection or parenchymal injury with duct injury
IV	Laceration	Proximal[b] transection or parenchymal injury involving ampulla
V	Laceration	Massive disruption of pancreatic head

[a]Advance one grade for multiple injuries up to grade III

[b]Proximal pancreas is to the patients' right of the superior mesenteric vein

Table 99.4 The grading system proposed by the World Society of Emergency Surgery (WSES) considering both AAST grade and hemodynamic status of patients [9]

Grade	WSES class	Organ	AAST grade
Minor	WSES class I	Pancreas Duodenum Extrahepatic biliary tree	I–II I I–II–III
Moderate	WSES class II	Pancreas Duodenum Extrahepatic biliary tree	III II IV
Severe	WSES class III	Pancreas Duodenum Extrahepatic biliary tree	IV–V III–IV–V V
Severe	WSES class IV	Any[a]	Any[a]

[a]In hemodynamically unstable patients

99.5 Diagnosis

In penetrating traumas, multiple organs are generally involved, and the inspection of the wounds with the evaluation of the direction of knife or bullet or the simple assessment of abdomen tenderness can give information on the organs involved. Penetrating trauma or hemodynamic instability often forces the exploratory laparotomy, and, in this step, control of bleeding is crucial. When hemostasis has been performed, careful exploration of the other organs should be made to identify any other possible lesions. When intraoperative findings such as hepatic flexure, transverse, gastric, or liver injuries are manifested or signs, such as saponification, bilomas, or bruised duodenum, are present, a duodenum-pancreatic injury or a lesion of the external biliary tract should be supposed, and this often imposes a complete kocherization of duodenum. In less severe degrees of blunt traumas and hemodynamic stable patients, nonoperative management (NOM) can be considered, so early diagnosis of duodeno-pancreatic lesions is the real challenge. The onset of symptoms generally occurs in 6–24 h after injury but has been reported as late as 5 days after traumas [15, 40]. Patients may have vague and poorly defined symptoms with abdominal pain, especially in the upper quadrants, or back pain. In blunt trauma, impact signs such as rib fractures, bruising, ecchymosis, upper lumbar spine lesions, and seat belt injuries may suggest involvement of the pancreas or duodenum. Lipases and amylases dosage can help in the diagnosis but, by themselves, do not allow to establish the presence or absence of a duodenum-pancreatic lesion. Amylase levels are neither specific nor sensitive for diagnosis and can raise in head, hepatic, and bowel injuries, while serum lipases are more specific [21, 29]. Nowadays, repeated and combined measurements of both amylases and lipases are useful for clinical evaluation and, if elevated, are indications for further investigations [9]. The presence of free fluid in the abdomen on Extended Focused Assessment with Sonography for Trauma (E-FAST) may suggest the presence of a perforation, but, in a hemodynamically stable patient, CT scan remains the gold-standard exam [8] (Figs. 99.2 and 99.3). The presence of free fluid, peripancreatic collections, or retroperitoneal free air can be indicative of a duodenal-pancreatic lesion even if, in early hours, a variable percentage of cases can be misdiagnosed resulting in delayed manifestations [11]. On CT scan images, pancreas can appear normal up to 40% of patients with acute blunt injuries, especially when imaging is done within

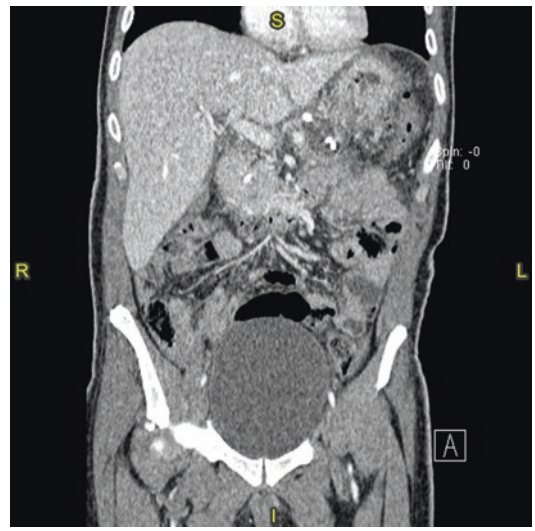

Fig. 99.2 Body pancreatic hematoma in blunt trauma

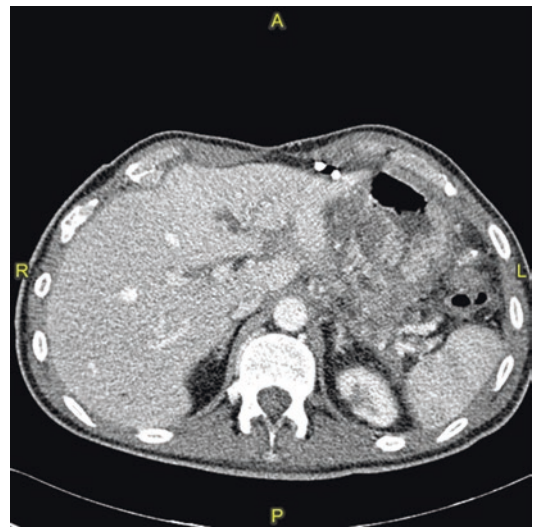

Fig. 99.3 Body pancreatic hematoma associated to SII-SIII liver hematoma, SII-SIII-SIV lacerations, and spleen laceration

the first 12 h [37]. Diagnosis often derives from a combination of clinical elements, laboratory exams, and radiological findings, and often, in patients with high clinical suspicion, a new CT-Scan with specific pancreatic phase at 12–24 h should be performed [9]. Endoscopic retrograde cholangiopancreatography (ERCP), in hemodynamically stable patients, is useful in identification and characterization of minor pancreatic lesions or biliary leaks. ERCP also offers some help in treatments of isolated biliary lesions and follow-up, even if its use is limited in the early stages of trauma and in suspected duodenal perforations [37]. Magnetic resonance cholangiopancreatography (MRCP) is a minimally invasive diagnostic modality which, like the ERCP, can be considered a second level examination. MRCP is useful in the follow-up of parenchymal damage and minor ductal injuries, providing high-quality images of the pancreatic and biliary ducts (Figs. 99.4 and 99.5). Secretin administration may help in diagnosis of pancreatic leakages by improving ductal visualization, particularly of non-dilated ducts [36]. Both ERCP and MRCP are exams performed in the late phases of the trauma's workup and generally after 48 h. They are useful in defining the chances of NOM or in the operative planning in selected hemodynamically stable patients [9]. Diagnostic Peritoneal Lavage (DPL) has a sensibility higher than 99% for the presence of hemoperitoneum, but the ability to recognize early retroperitoneal organ injuries is very low. Although DPL alone has been associated with a high number of unnecessary laparotomies [4], we must emphasize that a negative laparotomy could still lead to fewer complications when compared to a late identification of a duodenal-pancreatic lesions. The specificity of DPL is very low, and in recent years its use has in fact been progressively replaced by E-FAST and CT scan. Duodeno-pancreatic and biliary tract injuries occur within the context of multiple lesions for which an emergency exploratory laparotomy is often required. Recently, Coccolini et al. proposed the new WSES-ASST guidelines in which the diagnostic algorithm is based on the severity of the lesions. CT differentiates the severity of stable patients in WSES grades, and tests such as ERCP and MRCP can be used later to define NOM or surgical planning. Hemodynamically unstable patients or with free air, peritonitis, or evisceration on CT-Scan always require an accurate surgical exploration [9] (Fig. 99.6).

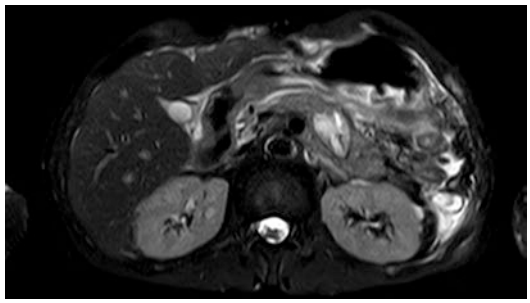

Fig. 99.4 Pseudocystic lesion of the body-tail of the pancreas due to blunt trauma

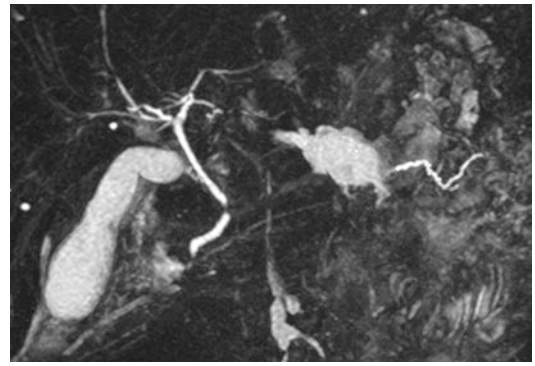

Fig. 99.5 A follow-up MRCP shows a Wirsung stent associated with a pseudocystic lesion of the body-tail of the pancreas

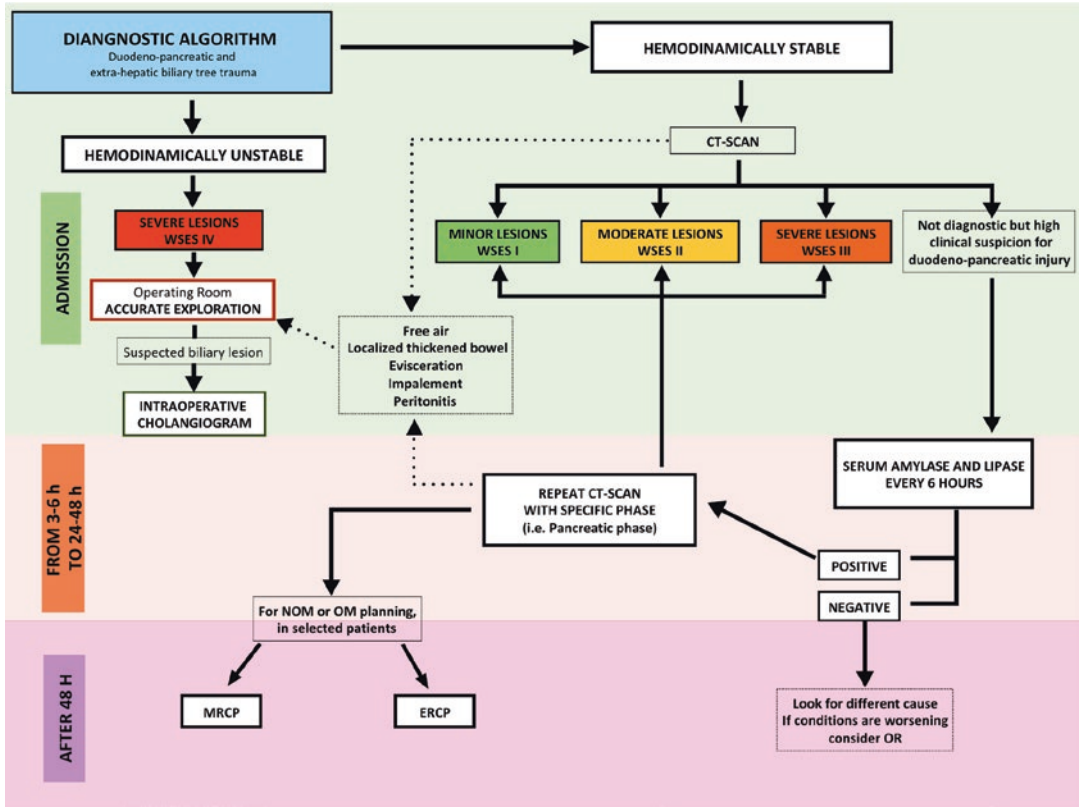

Fig. 99.6 Diagnostic algorithm proposed by World Society of Emergency Surgery based both on severity of lesions at CT scan and hemodynamic status [9]. *NOM* nonoperative management, *OM* operative management, *MRCP* magnetic resonance cholangiopancreatography, *ERCP* endoscopic retrograde cholangiopancreatography

99.6 Treatment

Given that most of duodeno-pancreatic and extra-hepatic biliary traumas are often associated with other injuries, surgical treatment is often mandatory. On the contrary, in minor traumas, stable or stabilized patients, and isolated/low-grade injuries, nonoperative management (NOM) may be considered.

99.6.1 Nonoperative Management

In a blunt trauma of duodenum, the energy transmission to the mucosa and submucosa can cause a break of vascular submucosal plexus which can lead to an intramural hematoma. In previous series, it had already been described that the surgical approach in these cases could lead to an increase in complication rate and hospital stay [17]. NOM should be based on seriates laboratory tests, bowel rest, nasogastric tube decompression, and parenteral nutrition. Duodenal obstruction, due to hematoma, is not a contraindication to NOM and generally resolves within 14 days. Otherwise, treatment could be made both in open and laparoscopically though percutaneous drainage could be viable alternatives [9, 25, 33].

In most minor pancreatic hematoma and surface lacerations (AAST Grade 1), NOM can be effective both in adults and children. In pancreatic blunt trauma in which pancreatic ducts are involved (AAST grade 2), the site of injury influences management enormously. In lesions of pancreatic tail or distal to the superior mesenteric vein, distal pancreatectomy, with or without splenectomy, is associated with a shorter period of complete resolution, while NOM is reserved only to lesions in very proximal pancreatic body injuries [13, 20].

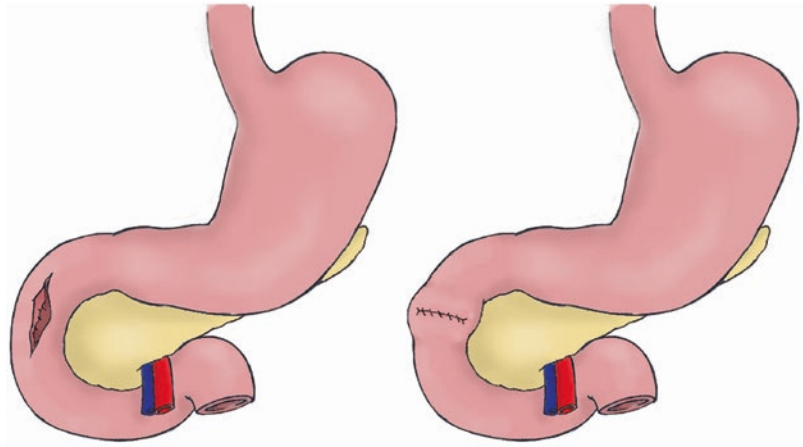

Fig. 99.7 Direct duodenal repair

Although literature about NOM in extrahepatic biliary trauma is scarce, few small cases series have demonstrated NOM to be successful in both adult and pediatric patients. Hemodynamically stable patients, with isolated gallbladder wall hematoma or contusion (AAST Grade 1), could be usefully treated with NOM [39, 44, 46]. Abdominal bile collections can be drained through percutaneous drains, and the ERCP with stent placement should be mandatory to address ductal lacerations and to promote biliary flow in duodenum.

The latest WSES-AAST guidelines, in duodenal wall (WSES I-II/AAST I-II) and gallbladder (AAST I) hematomas and in very proximal pancreatic body injuries with ductal involvement (AAST III), consider NOM feasible only in isolated lesions and in hemodynamically stable patients [9].

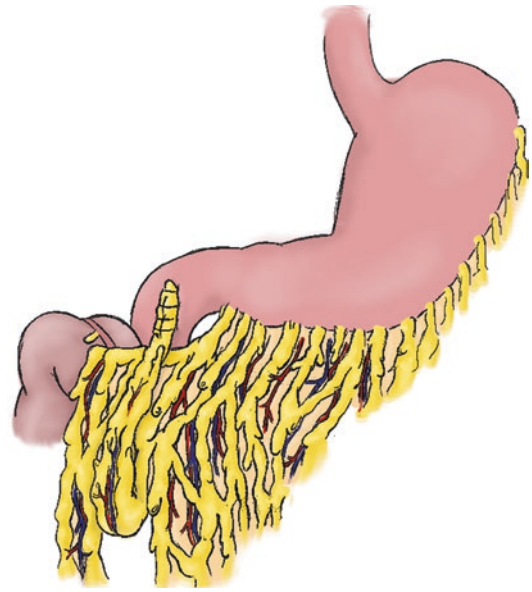

Fig. 99.8 Omental patch

99.6.2 Operative Management

In most traumas, especially in major ones with associated injuries, in hemodynamically unstable patients, and in patients with evident signs of peritonitis, perforation, evisceration, or penetrating wounds, the emergency/urgent surgical approach is mandatory, but technique is highly dependent on the extent of the injury. Stopping the bleeding remains the first aim to be carried out, followed by an adequate debridement of the duodenal walls around the laceration back to vital tissue. Direct duodenal repair can be performed in one–two layers of resorbable or non-resorbable suture, and, in order to avoid stenosis of the duodenal lumen, a transverse rather than longitudinal repair may be required (Fig. 99.7). Segmental resection and primary end-to-end duodenoduodenostomy are usually feasible when dealing with injuries to DI, DIII, or DIV, but if the injury is in the second part of duodenum, the ampulla of Vater should be carefully identified [14]. An omental patch and serosal patch may be useful in those cases where the loss of duodenal tissue cannot be primarily repaired (Fig. 99.8). These techniques are successfully utilized by placing omentum or a small bowel loop on the defect and fixed by stitches [14, 48]. In all duodenal repairs,

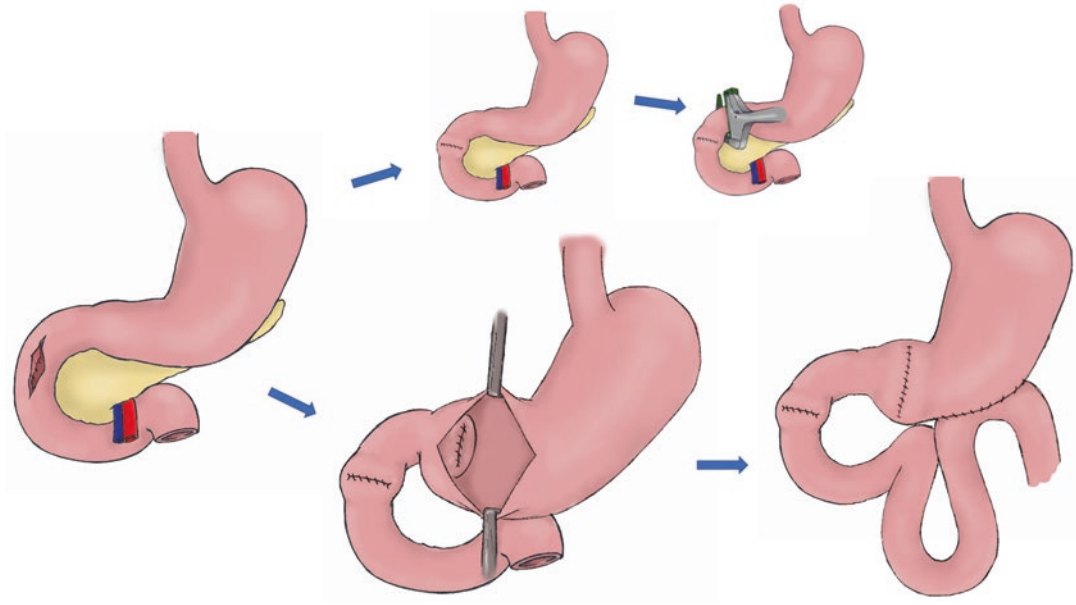

Fig. 99.9 Pyloric exclusion: the pylorus can be stapled without section or, by a gastrotomy, sutured internally with absorbable stitches. Gastric contents can be diverted through a gastrojejunostomy

nasogastric tube decompression and drainage placement are suggested.

A range of techniques have been deployed in the largest trauma centers in the presence of high-grade trauma when pancreas is involved, and duodenal repair is complex. In these cases, the risk of pancreatic fistula is higher, and the exclusion of gastric secretions from the duodenum with different techniques can allow better healing in a shorter time. An approach to duodenal trauma was described by Stone and Fabian in the "triple ostomy" technique consisting of jejunostomy, gastrostomy, and duodenostomy especially for higher-grade trauma in the second duodenal portion [45]. Furthermore, in 1974, Berne had already presented the concept of "duodenal diverticulization" whose essential components included gastric antrectomy, duodenostomy, gastrojejunostomy, and drainage [5].

These two techniques have now been largely left behind in favor of pyloric exclusion (PE). In PE, the gastric contents can be diverted through a gastrojejunostomy, and the pylorus can be stapled without section or, by a gastrotomy, sutured internally with absorbable stitches so that it can spontaneously open a few weeks later or reopened endoscopically [27] (Fig. 99.9). Nevertheless, many surgeons prefer a gastric emptying via a suction tube along with parenteral or enteral nutrition. In grades III, IV, and V, complex reconstruction techniques are often required. In lesions of D1 or D2 but proximal to the papilla, antrectomy and gastrojejunostomy is a feasible, instead, when the ampulla is involved or the lesion is distal to it, a Roux-en-Y duodenojejunostomy should be performed with the proximal stump. In complete destruction of the duodenum-pancreatic complex and associ-

ated devascularization (Grade 4), pancreaticoduodenectomy should be considered. Although class IV and V injuries require complex reconstructions in about half of cases, staged procedures have been suggested to improve outcomes, and support of hepatobiliary surgeons should be considered case by case [10, 25].

Many duodenal injuries discovered at laparotomy are AAST Grade 1 and 2 and can be repaired primarily, and, in some series, up to 60% of patients with duodenal lesions, regardless of severity, can be repaired with primary duodenorraphy [16]. The most modern studies are in fact "pressing" toward direct repair even in large and high-grade lesions when feasible. The more conservative techniques are in fact related to a lower mortality and a better outcome compared to the more complex reconstruction procedures that must be reserved only when primary repair is not possible [12, 34]. In all hemodynamically unstable patients with pancreatic lesions or in those in whom the NOM is not allowed, immediate operational management is mandatory. Damage Control Surgery (DCS) should be considered in the presence of patients in shock and with massive bleeding. The surgical strategy is strictly dependent on the degree, extent, and location of the lesion. During surgical exploration, the pancreas must be well visualized, and the status of the main ducts evaluated. The opening of the gastrocolic ligament together with the Kocher maneuver allows the exposure of the anterior aspect of the gland, while the lateral mobilization of the spleen and the dissection of the splenic flexure of the colon allow visualization and manual palpation of the body and tail [2]. Most pancreatic lesions in which the ducts are not involved can be treated with drainage placement alone, and laceration repairing may be associated with an increased risk of pseudocyst formation [24]. It is well established that pancreatic lesions with interruption of the main ducts at or to the left of the superior mesenteric vein (SMV) must be treated with distal pancreatectomy with or without spleen preservation [9]. The management of the pancreatic stump is more uncertain, although in the past it was thought that selective ligation of the pancreatic duct significantly reduced leaks [6]; a recent series of 704 pancreatic traumas questioned its usefulness [7]. The management of pancreatic head is much less standardized with higher morbidity and mortality rates. Often, especially in multi-organ injuries, drain positioning alone is the best option. When conditions are favorable, a duodeno-preserving total pancreatectomy or a subtotal pancreatectomy with a pancreaticojejunostomy of the distal stump may be performed, but the remaining pancreatic tissue can result in severe exocrine and endocrine dysfunction.

Except for gallbladder hematomas (Grade 1) for which NOM is possible, cholecystectomy is the intervention of choice in all gallbladder lesions. Gallbladder is involved in about 30–60% of all extrahepatic biliary injuries, and most are an intraoperative finding. Cystic duct and main bile ducts injuries (Grades 3–5) generally occur in conjunction with lesions of the pancreas, duodenum, and liver, and treatment is strictly dependent on the severity of the lesions. Among the most appropriate surgical alternatives, primary repair over a T-tube can be useful especially in lesions where the laceration is partial but may result in strictures and need for reconstructive surgery. In most of complete duct lesions, a Roux-en-Y hepaticojejunostomy or a choledochojejunostomy remains the only alternatives.

The new WSES-AAST guidelines highlighted the various therapeutic alternatives according to the degree of the lesion and the stability of the patient [9] (Fig. 99.10).

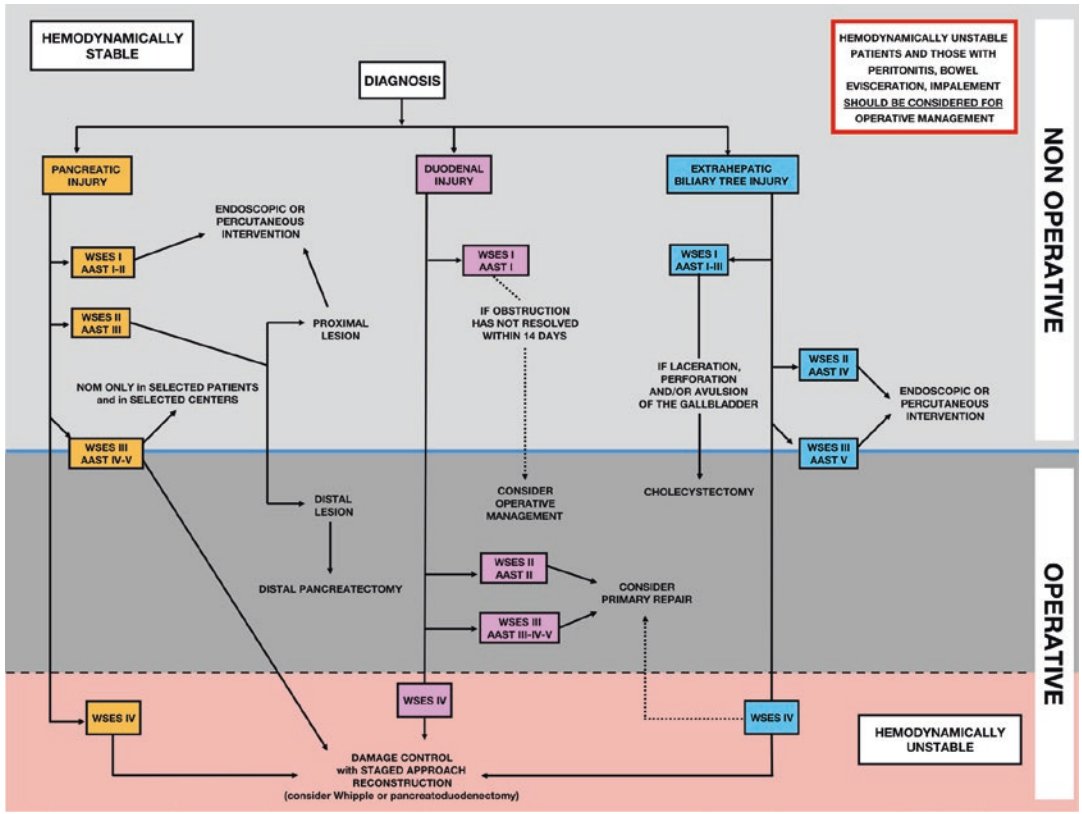

Fig. 99.10 The WSES-AAST proposed management algorithm duodeno-pancreatic and extrahepatic biliary tree traumatic lesions [9]. *NOM* nonoperative management

99.7 Outcomes and Complications

The management of duodenal-pancreatic trauma is often complex, and, in most patients, other organs are also involved; therefore, the mortality rates remain very high. The overall mortality rate of duodenal injuries continues to be significant, up to an average of 17%. Major complications reported after a duodenal trauma are duodenal fistula, intra-abdominal abscess, pancreatitis, obstruction, and bile duct fistula. Overall mortality of duodenal injuries is significant up to an average of 17%, but it is linked to associated vascular or pancreatic lesion. When other causes are excluded, mortality to duodenal injury itself is probably less than 5% [3, 10, 14, 42]. Among most important factors influencing morbidity and mortality are mechanism of trauma (blunt or penetrating), delayed diagnosis, localization, and size of lesion [42]. Generally, mortality in penetrating trauma is higher than in closed trauma, respectively, 25–28% and 12–15%. High mortality is often conditioned by injury to adjacent organs and great vessels, especially in penetrating injuries as well as the complications deriving from the treatment (dehiscence, sepsis, and multi-organ failure) [3, 14, 42]. In the multicenter series by Cogbill et al., the mortality rate for blunt trauma was higher (14.4%) than penetrating ones (3.6%), and this difference was mostly attributed to a delayed diagnosis of blunt duodenal injury [10].

The size of the defect as well the location is pivotal in the choice of reconstruction. Penetrating injuries result in less tissue loss and, if identified early, better management. Snyder et al. demonstrated lower mortality and morbidity in patients

with duodenal lacerations of less than 75% [42]. Furthermore, the technical difficulties resulting from lesions of D2, containing the ampulla of Vater and the pancreatic head, force the surgeons to perform more complex surgical procedures with consequent longer recovery and higher mortality rates [14]. Time to diagnosis plays a key role in conditioning the prognosis of duodenal-pancreatic trauma, especially for blunt trauma. Delayed diagnosis has been shown to be one of the fundamental outcome factors; in fact, in these cases, the mortality seems to double with greater possibility of duodenal fistula formation [10, 22]. Mortality rate in pancreatic blunt injury is less than 10% while in penetrating ones is about 15–20% and most caused by unstoppable bleeding. Morbidity is much higher, ranges from 11 to 62%, and derives from major complications such as pseudocyst formation, pancreatic fistula, abscesses or intra-abdominal sepsis, and post-traumatic pancreatitis [1, 18, 23, 43, 47]. Time of diagnosis also plays an important role; in pancreatic injury, up to 40% of pancreatic lesions can be misdiagnosed on CT scans within 12 h influencing the outcome [11, 37]. Post-traumatic glucose intolerance is common in all critical patients, but persistent new-onset endocrine or exocrine dysfunction after traumatic distal pancreatectomy is very low (<4%), and insulin is more frequently required in proximal pancreatic resections or Whipple procedure [26, 32].

Dos and Don'ts

- In minor traumas, stable or stabilized patients, and isolated/low-grade injuries of duodenum, pancreas, and extrahepatic biliary tree (AAST Grade 1), non-operative management (NOM) may be considered.
- Duodeno-pancreatic and extrahepatic biliary trauma are traumatic lesions that often occur in the context of major multi-organ lesions. Surgical treatment is strictly dependent on the extent and location (including, for example, the ampulla of Vater or the pancreatic head) of the lesion and can range from simple washing and drainage to more invasive approaches such as duodenopancreatectomy.
- In hemodynamically unstable patients and in patients with evident signs of peritonitis, perforation, evisceration, or penetrating wounds, the emergency/urgent surgical exploration is mandatory, and the technique is highly dependent on the extent of the injury.
- In emergency setting, stopping the bleeding remains the first aim to be carried out, and Damage Control Surgery (DCS) should be considered.

Take-Home Messages

- Duodeno-pancreatic and extrahepatic biliary trauma are rare and often associated to other lesions.
- Hemodynamic status of the patient determines management strategy.
- In the diagnosis, CT scan is crucial in assessing the degree of injury.
- In isolated pancreatic, duodenal, and gallbladder hematomas, NOM can be considered with close clinical monitoring.
- In unstable patients, the surgical approach is mandatory, and the surgical strategy depends on the degree of the lesion.

Questions

1. Report the grade of a duodenal injury involving 90% of the circumference of D1 according to the American Association for the Surgery of Trauma Society (AAST) for Duodenal trauma:
   A. II Grade.
   B. **III Grade.**
   C. IV Grade.
   D. V Grade.

2. Report the grade of major pancreatic laceration without duct injury according to the American Association for the Surgery of Trauma Society (AAST) for Pancreatic trauma:
   A. I Grade.
   B. **II Grade.**
   C. III Grade.
   D. IV Grade.
3. Report the grade of a complete gallbladder avulsion from liver bed associated with a complete left hepatic duct laceration according to the American Association for the Surgery of Trauma Society (AAST) for extrahepatic biliary trauma:
   A. II Grade.
   B. III Grade.
   C. **IV Grade.**
   D. V Grade.
4. Report the grade of a major contusion of the pancreas tail associated with a parenchymal injury involving the ampulla:
   A. II Grade.
   B. III Grade.
   C. **IV Grade.**
   D. V Grade.
5. Report the class of major pancreatic laceration without duct injury in a hemodynamically unstable patient according to World Society of Emergency Surgery (WSES) classification:
   A. Class I.
   B. Class II.
   C. Class III.
   D. **Class IV.**
6. Choose the truest one from the following statements:
   A. The cooperation between the various professional figures (endoscopist, radiologist, gastroenterologist) is sufficient in the management of hepato-pancreatic-biliary traumas, making the figure of a dedicated HPB surgeon superfluous.
   B. Mortality from these injuries is still very high and is generally associated with single injuries to vital organs.
   C. **Often a duodenal trauma is associated with lesions of the pancreas, biliary, or vascular tract; therefore, the figure of a dedicated HPB surgeon becomes fundamental even when nonoperative management (NOM) is chosen.**
   D. Extrahepatic biliary traumas are often associated with other lesions and are more frequent than pancreatic or duodenal lesions.
7. Define which diagnostic exam still represents the gold standard in a hemodynamically stable patient with suspected duodenal-pancreatic trauma:
   A. **CT-Scan.**
   B. Eco-Fast.
   C. Magnetic resonance cholangiopancreatography (MRCP).
   D. Diagnostic peritoneal lavage (DPL).
8. A 17-year-old boy reported a superficial laceration of pancreatic tail without ducts injury in a car accident. CT scan of the abdomen reports peripancreatic edema, edema of the mesentery, and absence of free air. The patient is hemodynamically stable, has elevated amylase and lipase, and has severe abdominal pain. Define the most appropriate therapeutic management:
   A. Diagnostic Peritoneal Lavage (DPL).
   B. **Nonoperative Management (NOM).**
   C. Explorative Laparotomy.
   D. Distal pancreatectomy.
9. A 47-year-old man is stabbed in a brawl. The patient is hemodynamically stable, but CT-Scan reveal periduodenal free air, free fluid in the Douglas, and a complete laceration of the first duodenal portion, immediately after the pylorus. Choose the most appropriate therapeutic management:

A. Nonoperative management (NOM).
B. Pancreatoduodenectomy.
C. **Exploratory laparotomy, antrectomy, and gastrojejunostomy.**
D. Pyloric exclusion (PE).

10. After a simple bicycle accident, a 19-year-old girl does a CT scan of the abdomen for abdominal pain showing a gallbladder hematoma with no signs of perforation and a mild pancreatic contusion. Immediately after the examination, the patient becomes hemodynamically unstable, and intubation becomes necessary. Choose the most appropriate therapeutic management:
A. **Exploratory laparotomy.**
B. Nonoperative management (NOM) with fluid infusions, amine support, and mechanical ventilation.
C. Magnetic resonance cholangiopancreatography (MRCP).
D. Diagnostic Peritoneal Lavage (DPL).

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