**Name of Journal:** *World Journal of Gastrointestinal Surgery*

**Manuscript NO:** 74170

**Manuscript Type:** MINIREVIEWS

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

Pavlidis ET *et al*. Pancreatic trauma

Efstathios Theodoros Pavlidis, Kyriakos Psarras, Nikolaos G Symeonidis, Georgios Geropoulos, Theodoros Efstathios Pavlidis

**Efstathios Theodoros Pavlidis, Kyriakos Psarras, Nikolaos G Symeonidis, Theodoros Efstathios Pavlidis,** 2nd Propedeutic Department of Surgery, School of Medicine, Aristotle University, Thessaloniki 54642, Greece

**Georgios Geropoulos,** Department of General Surgery, University College London Hospitals, London NW1 2BU, United Kingdom

**Author contributions:** Pavlidis TE designed the research, contributed new analytic tools and analyzed the data; Pavlidis ET performed the research and wrote the paper; Psarras K, Symeonidis NG, Geropoulos G analyzed the data and reviewed the data.

**Corresponding author: Theodoros Efstathios Pavlidis, PhD, Chief Doctor, Director, Full Professor, Surgeon,** 2nd Propedeutic Department of Surgery, School of Medicine, Aristotle University, Konstantinoupoleos 49, Thessaloniki 54642, Greece. pavlidth@auth.gr

**Received:** January 3, 2022

**Revised:** March 17, 2022

**Accepted:** **May 12, 2022**

**Published online:**

**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

Pavlidis ET, Psarras K, Symeonidis NG, Geropoulos G, Pavlidis TE. Indications for the surgical management of pancreatic trauma: An update. *World J Gastrointest Surg* 2022; In press

**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[1,2]. 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[3,4].

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[5].

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%)[6-8].

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 Organ Injury Scaling of the American Association for Surgery for Trauma (grade III/IV severe), revised trauma scale score on arrival, age, and the coexistence of severe abdominal injury aside from pancreatic injury are 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%[9].

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 injury. The organ injury scale by the American Association for Surgery of Trauma for pancreatic injury severity described in Moore *et al*[10] and Søreide *et al*[1] is shown in Table 1.

The revised trauma scale score to predict mortality on arrival used in Shibahaski *et al*[9] and Jeong *et al*[11] 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[1]. 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[9].

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

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[13].

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

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

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[16].

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[17].

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

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

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

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[12].

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[23] in both children and adults[24].

Modern imaging techniques[25] 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[26,27]. Multidisciplinary collaboration among surgeons, endoscopists, radiologists and intensivists is crucial for managing pancreatic trauma[28]. However, more complex conditions exist in severe hepatopancreatobiliary trauma[29,30].

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

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[32]. Penetrating traumas more likely need emergency surgery compared with blunt traumas[33]. 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[33], given the recent advancements in imaging modalities that make nonoperative management of pancreatic trauma possible at a later stage[4,5]; 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[34], 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[35-37]. Patients with severe traumatic pancreatitis in the subacute phase should be mainly managed nonoperatively[1].

**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.

**REFERENCES**

1 **Søreide K**, Weiser TG, Parks RW. Clinical update on management of pancreatic trauma. *HPB (Oxford)* 2018; **20**: 1099-1108 [PMID: 30005994 DOI: 10.1016/j.hpb.2018.05.009]

2 **Johnsen NV**, Betzold RD, Guillamondegui OD, Dennis BM, Stassen NA, Bhullar I, Ibrahim JA. Surgical Management of Solid Organ Injuries. *Surg Clin North Am* 2017; **97**: 1077-1105 [PMID: 28958359 DOI: 10.1016/j.suc.2017.06.013]

3 **Chinnery GE**, Krige JE, Kotze UK, Navsaria P, Nicol A. Surgical management and outcome of civilian gunshot injuries to the pancreas. *Br J Surg* 2012; **99 Suppl 1**: 140-148 [PMID: 22441869 DOI: 10.1002/bjs.7761]

4 **Roberts DJ**, Bobrovitz N, Zygun DA, Kirkpatrick AW, Ball CG, Faris PD, Stelfox HT; Indications for Trauma Damage Control Surgery International Study Group. Evidence for use of damage control surgery and damage control interventions in civilian trauma patients: a systematic review. *World J Emerg Surg* 2021; **16**: 10 [PMID: 33706763 DOI: 10.1186/s13017-021-00352-5]

5 **Torba M**, Gjata A, Rulli F, Kajo I, Ceka S, Asqeri T. Delayed diagnosis and treatment of high grade blunt pancreatic trauma. Case report and review of literature. *Ann Ital Chir* 2017; **88**: 539-545 [PMID: 29339584]

6 **Vasquez M**, Cardarelli C, Glaser J, Murthi S, Stein D, Scalea T. The ABC's of Pancreatic Trauma: Airway, Breathing, and Computerized Tomography Scan? *Mil Med* 2017; **182**: 66-71 [PMID: 28291454 DOI: 10.7205/MILMED-D-16-00084]

7 **Sharbidre KG**, Galgano SJ, Morgan DE. Traumatic pancreatitis. *Abdom Radiol (NY)* 2020; **45**: 1265-1276 [PMID: 31576413 DOI: 10.1007/s00261-019-02241-7]

8 **Ayoob AR**, Lee JT, Herr K, LeBedis CA, Jain A, Soto JA, Lim J, Joshi G, Graves J, Hoff C, Hanna TN. Pancreatic Trauma: Imaging Review and Management Update. *Radiographics* 2021; **41**: 58-74 [PMID: 33245670 DOI: 10.1148/rg.2021200077]

9 **Shibahashi K**, Sugiyama K, Kuwahara Y, Ishida T, Okura Y, Hamabe Y. Epidemiological state, predictive model for mortality, and optimal management strategy for pancreatic injury: A multicentre nationwide cohort study. *Injury* 2020; **51**: 59-65 [PMID: 31431334 DOI: 10.1016/j.injury.2019.08.009]

10 **Moore EE**, Cogbill TH, Malangoni MA, Jurkovich GJ, Champion HR, Gennarelli TA, McAninch JW, Pachter HL, Shackford SR, Trafton PG. Organ injury scaling, II: Pancreas, duodenum, small bowel, colon, and rectum. *J Trauma* 1990; **30**: 1427-1429 [PMID: 2231822 DOI: 10.1097/00005373-199011000-00035]

11 **Jeong JH**, Park YJ, Kim DH, Kim TY, Kang C, Lee SH, Lee SB, Kim SC, Lim D. The new trauma score (NTS): a modification of the revised trauma score for better trauma mortality prediction. *BMC Surg* 2017; **17**: 77 [PMID: 28673278 DOI: 10.1186/s12893-017-0272-4]

12 **Ball CG**, Biffl WL, Vogt K, Hameed SM, Parry NG, Kirkpatrick AW, Kaminsky M. Does drainage or resection predict subsequent interventions and long-term quality of life in patients with Grade IV pancreatic injuries: A population-based analysis. *J Trauma Acute Care Surg* 2021; **91**: 708-715 [PMID: 34559164 DOI: 10.1097/TA.0000000000003313]

13 **Ando Y**, Okano K, Yasumatsu H, Okada T, Mizunuma K, Takada M, Kobayashi S, Suzuki K, Kitamura N, Oshima M, Suto H, Nobuyuki M, Suzuki Y. Current status and management of pancreatic trauma with main pancreatic duct injury: A multicenter nationwide survey in Japan. *J Hepatobiliary Pancreat Sci* 2021; **28**: 183-191 [PMID: 33280257 DOI: 10.1002/jhbp.877]

14 **Lin BC**, Hwang TL. Resection versus drainage in the management of patients with AAST-OIS grade IV blunt pancreatic injury: A single trauma centre experience. *Injury* 2022; **53**: 129-136 [PMID: 34364681 DOI: 10.1016/j.injury.2021.07.033]

15 **Ordoñez CA**, Parra MW, Millán M, Caicedo Y, Padilla N, Guzmán-Rodríguez M, Miñan-Arana F, García A, González-Hadad A, Pino LF, Rodríguez-Holguin F, Serna JJ, Salcedo A, Ferrada R, Ivatury R. Pancreatic damage control: the pancreas is simple don't complicate it. *Colomb Med (Cali)* 2020; **51**: e4164361 [PMID: 33795904 DOI: 10.25100/cm.v51i4.4361]

16 **Biffl WL**, Zhao FZ, Morse B, McNutt M, Lees J, Byerly S, Weaver J, Callcut R, Ball CG, Nahmias J, West M, Jurkovich GJ, Todd SR, Bala M, Spalding C, Kornblith L, Castelo M, Schaffer KB, Moore EE; WTA Multicenter Trials Group on Pancreatic Injuries. A multicenter trial of current trends in the diagnosis and management of high-grade pancreatic injuries. *J Trauma Acute Care Surg* 2021; **90**: 776-786 [PMID: 33797499 DOI: 10.1097/TA.0000000000003080]

17 **Aldridge O**, Leang YJ, Soon DSC, Smith M, Fitzgerald M, Pilgrim C. Surgical management of pancreatic trauma in Australia. *ANZ J Surg* 2021; **91**: 89-94 [PMID: 33369826 DOI: 10.1111/ans.16498]

18 **Venianaki M**, Ierodiakonou D, Chryssou E, Chrysos E, Chalkiadakis G, Lasithiotakis K. Primary Repair of Traumatic Complete Pancreatic Rupture. *Am Surg* 2021: 31348211038566 [PMID: 34402676 DOI: 10.1177/00031348211038566]

19 **Buitendag JJP**, Kong VY, Laing GL, Bruce JL, Manchev V, Clarke DL. A comparison of blunt and penetrating pancreatic trauma. *S Afr J Surg* 2020; **58**: 218 [PMID: 34096212]

20 **Biffl WL**, Ball CG, Moore EE, Lees J, Todd SR, Wydo S, Privette A, Weaver JL, Koenig SM, Meagher A, Dultz L, Udekwu PO, Harrell K, Chen AK, Callcut R, Kornblith L, Jurkovich GJ, Castelo M, Schaffer KB; WTA Multicenter Trials Group on Pancreatic Injuries. Don't mess with the pancreas! A multicenter analysis of the management of low-grade pancreatic injuries. *J Trauma Acute Care Surg* 2021; **91**: 820-828 [PMID: 34039927 DOI: 10.1097/TA.0000000000003293]

21 **Joos E**, de Jong N, Ball CG, Quigley S, Trottier V, Massé M, Engels PT, Rao J, Gillman LM, Visser R, Widder S, Hameed MS, Vogt KN; Canadian Collaborative on Urgent Care Surgery (CANUCS). Time to operating room matters in modern management of pancreatic injuries: A national review on the management of adult pancreatic injury at Canadian level 1 trauma centers. *J Trauma Acute Care Surg* 2021; **90**: 434-440 [PMID: 33617195 DOI: 10.1097/TA.0000000000003025]

22 **Wiik-Larsen J**, Thorsen K, Sandve KO, Søreide K. Incidence and characteristics of pancreatic injuries among trauma patients admitted to a Norwegian trauma centre: a population-based cohort study. *Scand J Gastroenterol* 2020; **55**: 1347-1353 [PMID: 33027601 DOI: 10.1080/00365521.2020.1829032]

23 **Kopljar M**, Ivandić S, Mesić M, Bakota B, Žiger T, Kondža G, Pavić R, Milan M, Čoklo M. Operative versus non-operative management of blunt pancreatic trauma in children: Systematic review and meta-analysis. *Injury* 2021; **52 Suppl 5**: S49-S57 [PMID: 32089286 DOI: 10.1016/j.injury.2020.02.035]

24 **Sealock RJ**, Othman M, Das K. Endoscopic Diagnosis and Management of Gastrointestinal Trauma. *Clin Gastroenterol Hepatol* 2021; **19**: 14-23 [PMID: 31605872 DOI: 10.1016/j.cgh.2019.09.048]

25 **Odedra D**, Mellnick VM, Patlas MN. Imaging of Blunt Pancreatic Trauma: A Systematic Review. *Can Assoc Radiol J* 2020; **71**: 344-351 [PMID: 32063010 DOI: 10.1177/0846537119888383]

26 **Leppäniemi A**. Nonoperative management of solid abdominal organ injuries: From past to present. *Scand J Surg* 2019; **108**: 95-100 [PMID: 30832550 DOI: 10.1177/1457496919833220]

27 **Al-Thani H**, Ramzee AF, Al-Hassani A, Strandvik G, El-Menyar A. Traumatic Pancreatic Injury Presentation, Management, and Outcome: An Observational Retrospective Study From a Level 1 Trauma Center. *Front Surg* 2021; **8**: 771121 [PMID: 35155546 DOI: 10.3389/fsurg.2021.771121]

28 **Krige J**, Jonas E. Pancreatic trauma with main pancreatic duct injury. *J Hepatobiliary Pancreat Sci* 2021; **28**: e42-e43 [PMID: 34009750 DOI: 10.1002/jhbp.973]

29 **Streith L**, Silverberg J, Kirkpatrick AW, Hameed SM, Bathe OF, Ball CG. Optimal treatments for hepato-pancreato-biliary trauma in severely injured patients: a narrative scoping review. *Can J Surg* 2020; **63**: E431-E434 [PMID: 33009897 DOI: 10.1503/cjs.013919]

30 **Walker AE**. The Adult Pancreas in Trauma and Disease. *Acad Forensic Pathol* 2018; **8**: 192-218 [PMID: 31240039 DOI: 10.1177/1925362118781612]

31 **Naiem MEA**, Arabi NA. Isolated pancreatic injury in an adolescent treated with Roux-en-Y pancreatojejunostomy: a case report and review of the literature. *J Med Case Rep* 2021; **15**: 474 [PMID: 34526117 DOI: 10.1186/s13256-021-03042-7]

32 **Biffl WL**. Duodenum and pancreas. In Moore EE, Feliciano DV, Mattox KL. Trauma. 8th ed. New York: Mc-Graw-Hill, 2017: 621-638.

33 **Kuza CM**, Hirji SA, Englum BR, Ganapathi AM, Speicher PJ, Scarborough JE. Pancreatic Injuries in Abdominal Trauma in US Adults: Analysis of the National Trauma Data Bank on Management, Outcomes, and Predictors of Mortality. *Scand J Surg* 2020; **109**: 193-204 [PMID: 31142209 DOI: 10.1177/1457496919851608]

34 **Velmahos GC**, Tabbara M, Gross R, Willette P, Hirsch E, Burke P, Emhoff T, Gupta R, Winchell RJ, Patterson LA, Manon-Matos Y, Alam HB, Rosenblatt M, Hurst J, Brotman S, Crookes B, Sartorelli K, Chang Y. Blunt pancreatoduodenal injury: a multicenter study of the Research Consortium of New England Centers for Trauma (ReCONECT). *Arch Surg* 2009; **144**: 413-9; discussion 419-20 [PMID: 19451482 DOI: 10.1001/archsurg.2009.52]

35 **Lin BC**, Liu NJ, Fang JF, Kao YC. Long-term results of endoscopic stent in the management of blunt major pancreatic duct injury. *Surg Endosc* 2006; **20**: 1551-1555 [PMID: 16897285 DOI: 10.1007/s00464-005-0807-0]

36 **Kim S**, Kim JW, Jung PY, Kwon HY, Shim H, Jang JY, Bae KS. Diagnostic and therapeutic role of endoscopic retrograde pancreatography in the management of traumatic pancreatic duct injury patients: Single center experience for 34 years. *Int J Surg* 2017; **42**: 152-157 [PMID: 28343030 DOI: 10.1016/j.ijsu.2017.03.054]

37 **Ito K**, Endo A, Kobayashi M, Otomo Y. Severe pancreatic injury with total disruption of main pancreatic duct successfully managed by multi-stage endoscopic therapy: a case report. *Acute Med Surg* 2022; **9**: e735 [PMID: 35169488 DOI: 10.1002/ams2.735]

**Footnotes**

**Conflict-of-interest statement:** There is no conflict of interest associated with any of the senior author or other coauthors contributed their efforts in this manuscript.

**Open-Access:** This article is an open-access article that was selected by an in-house editor and fully peer-reviewed by external reviewers. It is distributed in accordance with the Creative Commons Attribution NonCommercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited and the use is non-commercial. See: https://creativecommons.org/Licenses/by-nc/4.0/

**Provenance and peer review:** Invited article; Externally peer reviewed.

**Peer-review model:** Single blind

**Peer-review started:** January 3, 2022

**First decision:** March 12, 2022

**Article in press:**

**Specialty type:** Surgery

**Country/Territory of origin:** Greece

**Peer-review report’s scientific quality classification**

Grade A (Excellent): 0

Grade B (Very good): B

Grade C (Good): C, C

Grade D (Fair): 0

Grade E (Poor): 0

**P-Reviewer:** Fiori E, Italy; Iwao Y, Japan; Litvin A, Russia **S-Editor:** Gong ZM **L-Editor:** A **P-Editor:** Gong ZM

**Table 1 Pancreatic injury scale**

|  |  |  |  |
| --- | --- | --- | --- |
| **Grade** | **Type of injury** | **Description of injury** | **Abbreviated injury score**  |
| I | Hematoma | Minor contusion without duct injury | 2 |
| Laceration | Superficial laceration without duct injury | 2 |
| II | Hematoma | Major contusion without duct injury or tissue loss | 2 |
| Laceration | Major laceration without duct injury or tissue loss | 3 |
| III | Laceration | Distal transection or parenchymal injury with duct injury | 3 |
| IV | Laceration | Proximal transection or parenchymal injury involving the ampulla | 4 |
| V | Laceration | Massive disruption of the pancreatic head | 5 |

**Table 2 Modification of the revised trauma score**

|  |  |
| --- | --- |
| **Revised trauma score** | **New trauma score** |
| **Glasgow coma scale** | **Systolic blood pressure (mmHg)** | **Respiratory rate** | **Coded value** | **Glasgow coma scale** | **Systolic blood pressure (mmHg)** | **Oxygen saturation (%)** |
| 13-15 | > 89 | 10-29 | 4 | 3-15 | 110-149 | ≥ 94 |
| 9-12 | 76-89 | > 29 | 3 | ≥ 150 | 80-93 |
| 6-8 | 50-75 | 6-9 | 2 | 90-109 | 60-79 |
| 4-5 | 1-49 | 1-5 | 1 | 70-89 | 40-59 |
| 3 | 0 | 0 | 0 | < 70 | < 40 |