

## CASE REPORT

# Tube Pancreatico-Duodenostomy for Management of a Severe Penetrating Pancreaticoduodenal Injury

Anestis Hatzigeorgiadis, Konstantinos A Boulas, Nikolaos Baretas, Irene Papageorgiou, Konstantinos Blouhos

Department of General Surgery, General Hospital of Drama, Drama, Greece

### ABSTRACT

**Context** Optimal management of penetrating pancreaticoduodenal injuries and better outcomes are associated with simple, fast damage control surgery and shorter operative time. The performance of pyloric exclusion and tube duodenostomy has markedly decreased. However, there is still a trend toward their performance in cases of delay duodenal repair or severe pancreaticoduodenal injury. **Case report** The present report describes a case of a hemodynamically stable patient with a single penetrating gunshot trauma causing an AAST-OIS grade III pancreatic head injury and grade IV injury of the second portion of the duodenum. The patient was treated in our Level IV rural trauma center and submitted to primary closure of the posterolateral duodenal wall (the laceration of the contralateral inner medial duodenal wall could not be repaired), external duodenal and pancreatic drainage, and duodenal decompression by tube pancreatico-duodenostomy (insertion of a 18 Fr Foley catheter through the laceration of the pancreatic head toward the duodenal lumen), tube cholangiostomy, and pyloric exclusion accompanied with a feeding jejunostomy. **Conclusions** Tube pancreatico-duodenostomy, which is described for the first time in the literature, turned out to be effective and can be considered as an option in pancreaticoduodenal trauma when the inner medial duodenal wall cannot be repaired.

### INTRODUCTION

Optimal management of penetrating pancreaticoduodenal injuries and better outcomes are associated with simple, fast damage control surgery and shorter operative time, in contrast to definitive surgical procedures [1]. The majority of all pancreaticoduodenal injuries can be repaired safely by primary duodenal repair, and external duodenal and pancreatic drainage [2]. The performance of pyloric exclusion or tube duodenostomy for duodenal diversion or decompression has markedly decreased in current trauma practice. However, there is still a trend toward their performance in cases of delay duodenal repair or severe injury (Organ Injury Scale (OIS) of the American Association for Surgery of Trauma (AAST) grade  $\geq$  III duodenal and distal stomach injuries) [3].

The present report describes a case of a hemodynamically stable patient with a single penetrating gunshot trauma causing an AAST-OIS grade III pancreatic injury and grade IV duodenal injury. The patient was treated in our Level IV rural trauma center and submitted to primary closure of the posterolateral duodenal wall, external duodenal and pancreatic drainage, and duodenal decompression by tube pancreatico-duodenostomy, tube cholangiostomy,

pyloric exclusion accompanied with a feeding jejunostomy and without a Roux-en-Y gastrojejunostomy. The tube pancreatico-duodenostomy, which is described for the first time in the literature, turned out to be effective and can be considered as an option in pancreaticoduodenal trauma when the inner medial duodenal wall cannot be repaired.

### CASE REPORT

A 35-year-old man who had sustained a single machine pistol wound to the right lumbar was brought to the emergency department. On arrival, the patient had a blood pressure of 90/55 mmHg and a heart rate of 105 beats/min. Chest examination was unremarkable. Abdominal examination revealed: (a) a ring-shaped 1 cm  $\times$  1 cm entrance wound just caudal to the 12th rib; (b) diffuse abdominal tenderness and involuntary guarding; (c) gross hematuria. Chest radiograph demonstrated clear lung fields with no indication of injury. Chest and abdominal radiographs were unremarkable; a bullet was displayed in the midline of the abdomen at the level of the third lumbar vertebrae. A focused assessment sonography for trauma exam revealed free intraperitoneal fluid. The patient was emergently intubated and taken to the operating room for an exploratory laparotomy.

Intraoperative findings included: (a) hemoperitoneum due to a right-sided transverse mesenteric perforation treated with ligation of the right branch of the middle colic vessels; (b) fecal spillage localized around a 2 cm laceration of the transverse colon at its middle portion (Figure 1); the bullet was discovered in the bowel lumen at the site of perforation; (c) a protruding lesser sac. Division of the gastrocolic ligament revealed a lesser sac

Received March 11th, 2014 – Accepted March 17th, 2014

**Key words** Digestive System Surgical Procedures; Duodenostomy; Duodenum /injuries; Equipment and Supplies; Pancreas /injuries;

**Correspondence** Konstantinos A Boulas

Department of General Surgery; General Hospital of Drama; End of Hippokratous Street; 66100 Drama; Greece

Phone: +306937265675; Fax: +302513501559;

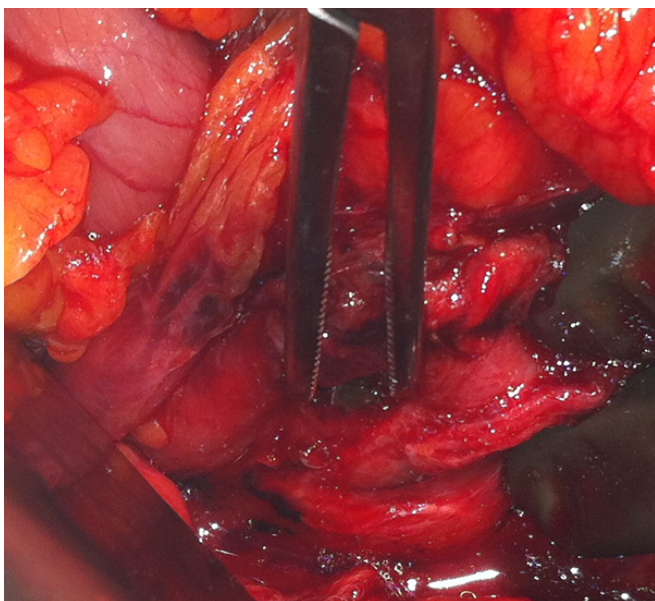
E-mail: katerinantwna@hotmail.com

hematoma; hemostatic suture of the superior branches of the pancreaticoduodenal artery was necessary to stop the bleeding; (d) an AAST-OIS grade IV injury of the second portion of the duodenum (Figure 2). An approximately 50% disruption of the duodenal circumference at its posterolateral wall was revealed when a Kocher maneuver was performed and a major laceration of the contralateral inner medial duodenal wall (attached to the pancreas) was observed through the external perforation; (e) an AAST-OIS grade III pancreatic head injury (major laceration in multiple sites of the pancreatic head without duct injury or tissue loss) (Figure 3). Intraoperative pancreatography through the cystic duct revealed an intact common bile duct, but failed to depict the pancreatic duct; and (f) a non-expanding perirenal hematoma.

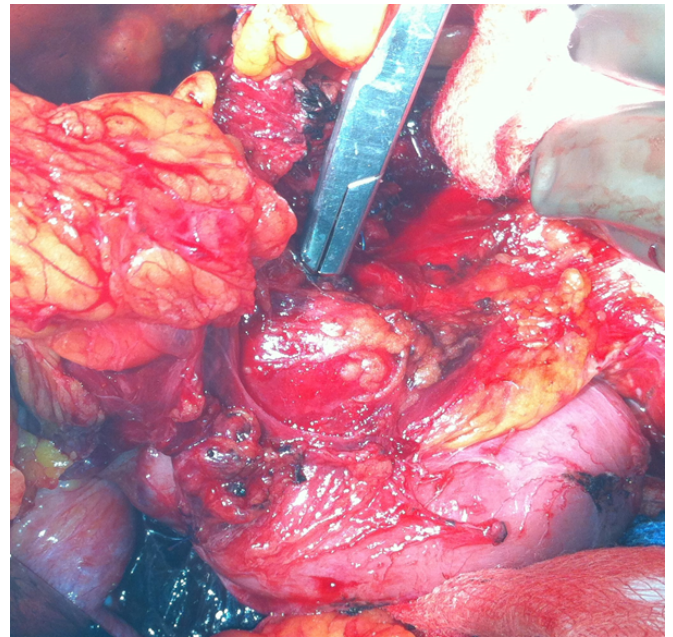
The colonic perforation was repaired by one-layer closure. The non-expanding perirenal hematoma was left alone after suturing the lacerated peritoneum to induce tamponade. The pancreaticoduodenal injury was treated with: (a) primary two-layer closure of the posterolateral duodenal wall. The laceration of the contralateral inner medial duodenal wall could not be sutured; (b) external duodenal and pancreatic drainage by two closed suction drains; and (c) duodenal decompression by tube pancreatico-duodenostomy, tube cholangiostomy and transgastric pyloric exclusion with a running absorbable



**Figure 1.** The injured transverse colon.



**Figure 2.** An approximately 50% disruption of the duodenal circumference at its posterolateral wall and a major laceration of the inner medial duodenal wall (curved dissector) are observed.

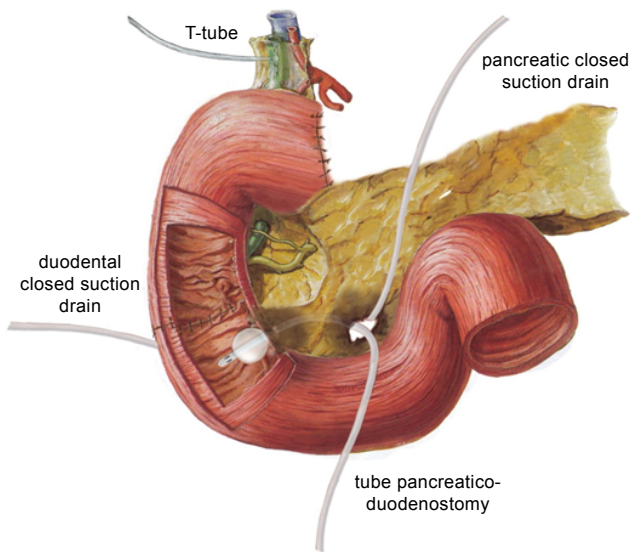


**Figure 3.** The lacerated pancreas. The traumatic tract along the bullet trajectory (curved dissector) was used for introduction of a 18 Fr Foley catheter through the lacerated anterior surface of the pancreatic head towards the duodenal lumen.

suture, accompanied with a feeding jejunostomy and without a Roux-en-Y gastrojejunostomy. The tube pancreatico-duodenostomy was consisted of a 18 Fr Foley catheter which was introduced through the lacerated anterior surface of the pancreatic head towards the duodenal lumen (Figure 4).

Postoperative course was satisfactory. The patient did not developed symptoms and signs of hemorrhage or septic abdominal complications. Intravenous fluids and colloids, total parenteral nutrition, ocreotide, and antibiotics including cephalosporin, metronidazole and aminoglycoside were administered. Enteral diet through the feeding jejunostomy was instituted on postoperative day 2. The patient was extubated from mechanical ventilation on postoperative day 6. Assessment of clinical, physical signs, radiological signs, output volume and enzyme concentration of the tube pancreatico-duodenostomy, the tube cholangiostomy, the duodenal and pancreatic closed suction drains were all employed in the postoperative management. The withdrawal methodology of the above drains was thoroughly analyzed in one of our previous reports [4].

The tube pancreatico-duodenostomy was removed on postoperative day 19, when: (a) the necessary duration period for duodenal healing was sufficient; (b) the output of the tube pancreatico-duodenostomy was minimum; (c) a contrast study through the tube pancreatico-duodenostomy did not reveal a leak from the duodenal stump or the pancreatic laceration; and (d) the duodenal closed suction catheter drainage did not fulfill pancreatic fistula criteria regarding output and amylase concentration [5]. The tube cholangiostomy was removed on postoperative day 21 with intermittent clamping 7 days before and permanent clamping 2 days before the removal of the tube pancreatico-duodenostomy, when despite clamping the output of the pancreatic and duodenal



**Figure 4.** Schematic presentation of the pancreatico-duodenostomy.

closed suction drains remained low. On postoperative day 25, an upper GI endoscopy showed that the pylorus had reopened and regular oral diet was instituted. The closed suction drain catheters were removed on postoperative day 31 and the patient was discharged home.

## DISCUSSION

Ascensio et al. [6] reported the estimated incidence of pancreatic injury to range from 0.2% to 6% of all cases of abdominal trauma. Penetrating trauma remains the most common cause of pancreatic and duodenal trauma; however, penetrating injuries are considerable more common in urban areas, whereas blunt injuries predominate in rural areas [7]. The most frequent site of pancreatic injury is the head and neck, accounting of 37% of all pancreatic injuries. The most frequent site of duodenal injury is the second portion, accounting of 33% of all duodenal injuries. Multiple sites of pancreatic and duodenal injury occur in 3% and 14% of all pancreatic and duodenal injuries, respectively [8]. Associated injuries occur in 46% of all pancreatic injuries and in 87% of all duodenal injuries.

The morbidity and mortality of pancreaticoduodenal injuries remain high. Overall mortality is almost 40% for pancreatic injuries and 16-18% for duodenal injuries, while overall morbidity is around 36% [9]. Based on current evidence, there is lack of standardized treatment of pancreatic injuries, especially for severe pancreatic injuries (grade III-IV) or combined pancreaticoduodenal injuries, although there are some key-points that are unanimously accepted: the performance of pyloric exclusion, tube duodenostomy and major pancreatic resections has markedly decreased, and damage control surgery has become more widespread. Optimal management and better outcomes are associated with simple, fast damage control surgery and shorter operative time, in contrast to definitive surgical procedures [10].

Approximately 65-70% of all pancreaticoduodenal injuries can be safely managed by primary duodenal

closure and external drainage. The performance of pyloric exclusion or tube duodenostomy for duodenal diversion or decompression has markedly decreased in current trauma practice. However, there is still a trend toward their performance in cases of delay duodenal repair or severe injury (Organ Injury Scale (OIS) of the American Association for Surgery of Trauma (AAST) grade  $\geq$  III duodenal injury) [11].

Pyloric exclusion has traditionally been used in the management of complicated duodenal injuries to temporarily protect the duodenal repair and to prevent septic abdominal complications. However, the performance of pyloric exclusion has markedly decreased nowadays. DuBose et al. [12] identified 147 patients with grade  $\geq$  III duodenal injury in the American College of Surgeons National Trauma Data Bank. Pyloric exclusion was performed in 28 (19.0%) patients. Interestingly, pyloric exclusion was performed in only 11 (15.9%) of the 69 patients with grade III injury and in only 17 (34%) of the 50 patients with grade IV-V injury. The authors concluded that the use of pyloric exclusion in patients with severe duodenal injuries contributed to longer hospital stay and provided no survival or outcome benefit regarding septic abdominal complications. Seamon et al. [13], in their retrospective cohort study of 29 patients with grade  $\geq$  II duodenal injury or combined pancreaticoduodenal injury, reported that a trend toward a higher overall complication rate (71% vs. 33%), pancreatic fistula rate (40% vs. 0%), and length of hospital stay (24.3 days vs. 13.5 days) was evident in the pyloric exclusion patients. No duodenal fistula was detected in either patient group. The authors concluded that the performance of pyloric exclusion for penetrating advanced duodenal injury and combined pancreaticoduodenal injuries did not improve clinical outcome. Velmahos et al. [14], in their retrospective cohort study of 50 patients with grade  $\geq$  III duodenal injury, noticed that there was a trend toward performance of pyloric exclusion in patients who had more pancreatic injuries (63% vs. 24%), a higher frequency of injuries to the first and second part of the duodenum (79% vs. 42%), and more grade IV and V injuries (37% vs. 18%). However, the authors concluded that there was no difference in morbidity, mortality, intensive care unit and hospital length of stay between patients submitted to simple primary repair or pyloric exclusion.

Tube duodenostomy is practically abandoned in trauma surgery. Girgin et al. [15] identified 67 patients with grade  $\geq$  II duodenal injury; 37 of them were treated with primary repair and 30 with primary repair and tube duodenostomy. The authors concluded that tube duodenostomy increased the length of hospital stay and did not improve clinical outcome. However, tube duodenostomy is the most successful method of managing the difficult duodenal stump in general surgery [16]. When performing tube duodenostomy for duodenal stump rupture, questions about technical details arise: (a) end or lateral duodenostomy? Lateral duodenostomy is used for duodenal decompression when closure of the duodenal stump is secure. End duodenostomy and omental patching, is used for creating a controlled

duodenal fistula when technical factors prevent adequate closure of the duodenal stump; (b) tube duodenostomy with or without tube cholangiostomy? By draining the common bile duct, the following goals are accomplished: (1) duodenal decompression; (2) gain of time for relieving the edema in the distal common bile duct caused by the trauma or sutures placed around the area of the major papilla. However, tube cholangiostomy is not currently recommended [17]. In our Level IV rural trauma center, surgeons have gained increased experience in the management of duodenal stump rupture after gastric cancer surgery since the time of economical crisis has arrived in Greece. In such cases, tube duodenostomy provided us the most secure way to succeed non-redo surgery for duodenal stump rupture. Nowadays the majority of bowel transections and anastomoses in our secondary referral center are performed in handsewn fashion.

## CONCLUSION

In summary, the present report describes a patient with a severe penetrating pancreaticoduodenal injury who was submitted to duodenal diversion and decompression adjunct to primary repair and external drainage. Duodenal diversion was accomplished by pyloric exclusion in order to temporarily protect the repaired duodenum. Duodenal decompression was accomplished by tube pancreatico-duodenostomy; as the pancreatic laceration was already existed and the inner medial duodenal wall could not be repaired, we invented the tube pancreatico-duodenostomy in a way to create a controlled duodenal fistula through the lacerated pancreas and not through the already severely injured duodenum. Tube pancreatico-duodenostomy turned out to be effective and can be considered as an option in pancreaticoduodenal trauma when the inner medial duodenal wall cannot be repaired.

---

## Conflict of Interest

The authors have no potential conflict of interest.

---

## References

1. Lahiri R, Bhattacharya S. Pancreatic trauma. *Ann R Coll Surg Engl* 2013; 95:241-245. [PMID: 23676806].

2. Degiannis E, Glapa M, Loukogeorgakis SP, Smith MD. Management of pancreatic trauma. *Injury* 2008; 39:21-29. [PMID: 17996869].

3. Yilmaz TB, Hauer TJ, Smith MD, Degiannis E, Doll D. Operative techniques in pancreatic trauma-A heuristic approach. *Injury* 2013; 44:153-155. [PMID: 23103081].

4. Blouhos K, Boulas KA, Konstantinidou A, Salpigktidis II, Katsaouni SP, et al. Early rupture of an ultralow duodenal stump after extended surgery for gastric cancer with duodenal invasion managed by tube duodenostomy and cholangiostomy. *Case Rep Surg* 2013; doi:10.1155/2013/430295. [PMID: 24159410].

5. Bassi C, Dervenis C, Butturini G, Fingerhut A, Yeo C, et al. Postoperative pancreatic fistula: an international study group (ISGPF) definition. *Surgery* 2005; 138:8-13. [PMID: 16003309].

6. Asensio JA, Petrone P, Roldán G, Pak-art R, Salim A. Pancreatic and duodenal injuries. complex and lethal. *Scand J Surg* 2002; 91:81-86. [PMID: 12075842].

7. Fatovich DM, Phillips M, Langford SA, Jacobs IG. A comparison of metropolitan vs rural major trauma in Western Australia. *Resuscitation* 2011; 82:886-890. [PMID: 21481512].

8. Asensio JA, Demetriades D, Hanpeter D, Gambaro, Chahwan S. Management of pancreatic injuries. *Curr Probl Surg* 1999; 36:325-419. [PMID: 10410646].

9. Antonacci N, Di Saverio A, Ciaroni V, Biscardi A, Giugni A, et al. Prognosis and treatment of pancreaticoduodenal traumatic injuries: which factors are predictors of outcome? *J Hepatobiliary Pancreat Sci* 2011; 18:195-201. [PMID: 20936305].

10. Chinnery GE, Mabida TE. Pancreaticoduodenal injuries: re-evaluating current management approaches. *S Afr J Surg* 2010; 48:10-14. [PMID: 20496818].

11. Stawicki SP, Schwab CW. Pancreatic trauma: demographics, diagnosis, and management. *Am Surg* 2008; 74:1133-1145. [PMID: 19097525].

12. Dubose JJ, Inaba K, Teixeira PG, Shiflett A, Putty B, et al. Pyloric Exclusion in the Treatment of Severe Duodenal Injuries: Results from the National Trauma Data Bank. *Am Surg* 2008; 74:925-929. [PMID: 18942615].

13. Seamon MJ, Pieri PG, Fisher CA, Gaughan J, Santora TA, et al. A Ten-Year Retrospective Review: Does Pyloric Exclusion Improve Clinical Outcome After Penetrating Duodenal and Combined Pancreaticoduodenal Injuries? *J Trauma* 2007; 62:829-833. [PMID: 17426536].

14. Velmahos GC, Constantinou C, Kasotakis G. Safety of repair for severe duodenal injuries. *World J Surg* 2008; 32:7-12. [PMID: 17952703].

15. Girgin S, Gedik E, Yagmur Y, Uysal E, Baci B. Management of duodenal injury: our experience and the value of tube duodenostomy. *Ulus Travma Acil Cerrahi Derg* 2009; 15:467-472. [PMID: 19779988].

16. Isik B, Yilmaz S, Kirimlioglu V, Sogutlu G, Yilmaz M, et al. A life-saving but inadequately discussed procedure: tube duodenostomy. Known and unknown aspects. *World J Surg* 2007; 31:1616-1624. [PMID: 17566821].

17. Paluszkiwicz P. Should the tube cholangiostomy be performed as a supplement procedure to duodenostomy for treatment or prevention of duodenal fistula? *World J Surg* 2008; 32:1905. [PMID: 18338204].