

# Pancreas-preserving double pancreaticogastrostomy after traumatic injury to the head of the pancreas: a case report

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## Abstract

Traumatic injury to the main pancreatic duct requires surgical treatment, but optimal management strategies have not been established. In patients with isolated pancreatic injury, the pancreatic parenchyma must be preserved to maintain long-term quality of life. We herein report a case of traumatic pancreatic injury with main pancreatic duct injury in the head of the pancreas. Two years later, the patient underwent a side-to-side anastomosis between the distal pancreatic duct and the jejunum. Eleven years later, he presented with abdominal pain and severe gastrointestinal bleeding from the Roux limb. Emergency surgery was performed with resection of the Roux limb along with central pancreatectomy. We attempted to preserve both portions of the remaining pancreas, including the injured pancreas head. We considered the pancreatic fluid outflow tract from the distal pancreatic head and performed primary reconstruction with a double pancreaticogastrostomy to avoid recurrent gastrointestinal bleeding. The double pancreaticogastrostomy allowed preservation of the injured pancreatic head considering the distal pancreatic fluid outflow from the pancreatic head and required no anastomoses to the small intestine.

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## Keywords

Pancreaticogastrostomy, pancreatic trauma, central pancreatectomy, pancreas-preserving surgery, gastrointestinal bleeding, Roux limb

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## Introduction

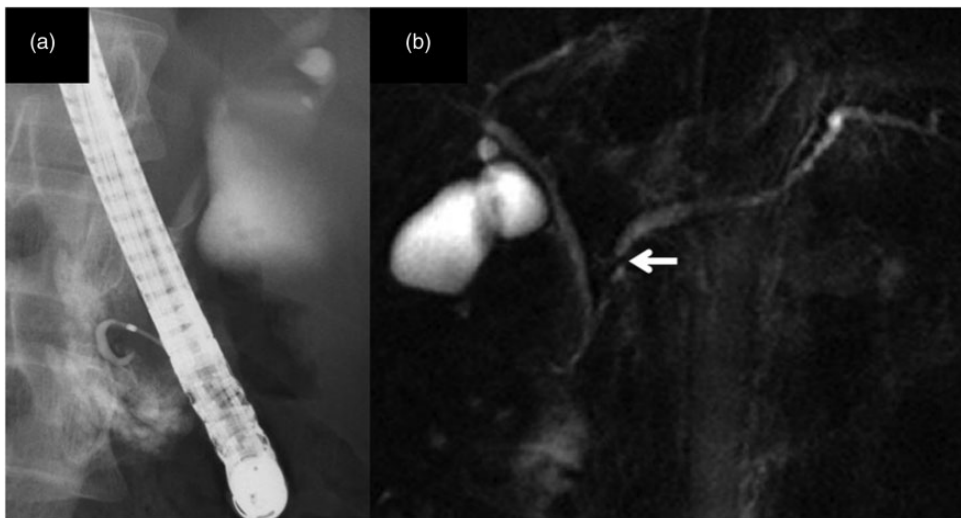
Traumatic pancreatic injuries are associated with significant morbidity and mortality. Injuries to the main pancreatic duct are classified by the American Association for the Surgery of Trauma Organ Injury Scale (AAST-OIS) as grade III or higher. Although these injuries generally need surgical intervention, ideal management strategies that provide the best clinical outcomes have not been established.

In patients who are otherwise stable with an isolated pancreatic injury, it is important to choose an organ-sparing procedure when possible to maintain long-term quality of

life with adequate pancreatic endocrine and exocrine function and splenic function. We herein describe a patient who sustained a pancreatic injury in the distant past and presented with complications following Roux-en-Y pancreaticojejunostomy.

## Case presentation

A 35-year-old man sustained a blunt traumatic injury to the pancreas with pancreatic duct rupture in the head of the pancreas (Figure 1). He was initially treated by operative drainage of the leaking pancreatic fluid and insertion of a drain into the dilated distal pancreatic duct (Figure 2).



**Figure 1.** (a) Endoscopic retrograde cholangiopancreatography shows that contrast did not flow distally and that extravasation of contrast was present in the damaged pancreas. (b) Magnetic resonance cholangiopancreatography shows that the main pancreatic duct was completely ruptured in the head of the pancreas and that the distal pancreatic duct was dilated. The arrow shows the location of the injured pancreatic duct.

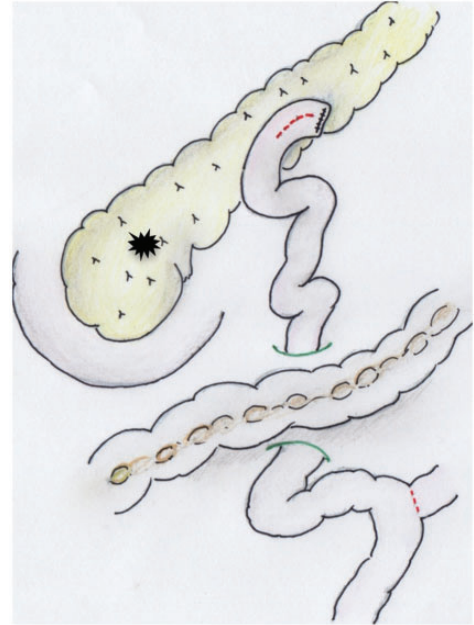


**Figure 2.** Computed tomography scan performed after insertion of a tube into the dilated distal pancreatic duct. The arrows indicate the tube.

Two years later, the duct drain prolapsed and was difficult to reinsert. The patient developed abdominal and low back pain; therefore, we created a side-to-side anastomosis between the dilated distal pancreatic duct and jejunum as a Roux-en-Y limb (Figure 3).

Eighteen months after the second operation, the patient developed chronic abdominal pain and gastrointestinal bleeding from the Roux limb. He exhibited similar symptoms several times, and nonoperative management with endoscopic hemostasis was successful each time. The remainder of the patient's history was unremarkable.

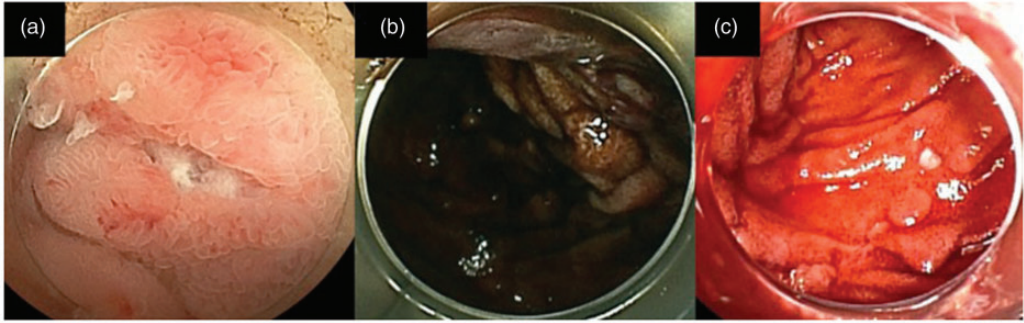
The patient presented to our institution at 48 years of age with worsening abdominal pain and recurrent gastrointestinal bleeding. The physical examination was unremarkable. Laboratory studies showed a decrease in the hemoglobin concentration from 12.3 to 9.4 g/dL over 1 day and a slight increase in the blood urea nitrogen concentration to 27 mg/dL. Extravasation of intravenous contrast was not seen on an enhanced computed tomography scan. Double-balloon endoscopy showed multiple erosions and ulcers in the Roux limb with bloody enteric content and fresh blood (Figure 4). The patient was diagnosed with anemia due to gastrointestinal bleeding from the Roux limb; however, a



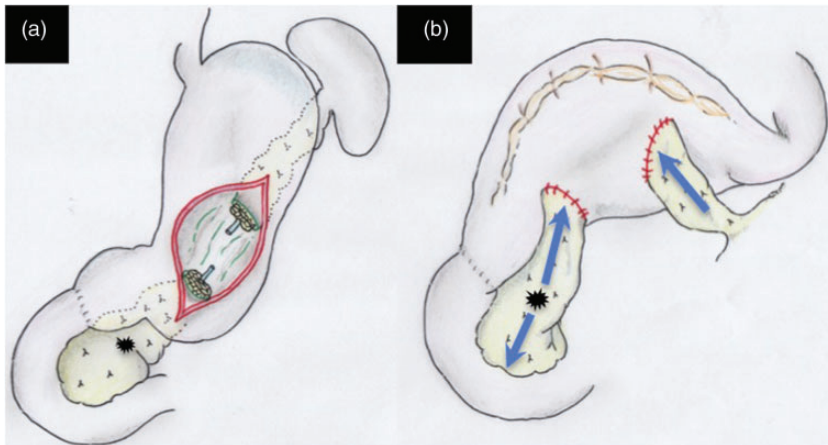
**Figure 3.** Schema of the procedure after a side-to-side anastomosis between the dilated distal pancreatic duct and the Roux limb. The black star marks the location of the pancreatic injury.

specific site of bleeding could not be identified. In spite of transfusion of 4 units of red cell concentrate after hospitalization, the bleeding continued and the anemia progressed to a hemoglobin concentration of 7.0 g/dL. Therefore, we decided to perform emergency surgery.

The patient underwent resection of the Roux limb, which was the source of bleeding, and central pancreatectomy including the area of the anastomosis and extending to the main pancreatic duct. Because both the head and tail of the pancreatic parenchyma appeared normal, including the injured pancreas head, we attempted to preserve both parts of the remaining pancreas. We considered the distal pancreatic fluid outflow tract from the pancreatic head and performed primary reconstruction with a double pancreaticogastrostomy without using the jejunum to avoid recurrent



**Figure 4.** (a–c) Double balloon endoscopy shows multiple erosions and ulcers in the Roux limb with bloody enteric content and fresh blood.



**Figure 5.** (a, b) Appearance after resection of the Roux limb and central pancreatectomy. We performed primary reconstruction with preservation of the head and tail of the pancreas using a double pancreaticogastrostomy without anastomosis to the Roux limb. An incision was made in the anterior wall of the stomach, and a tube was inserted into each main pancreatic duct to create an incomplete external fistula through the anterior wall of the stomach. The black star marks the location of the pancreatic injury. The arrows indicate the pancreatic fluid outflow path.

gastrointestinal bleeding. An incision was made in the anterior wall of the stomach, and the pancreaticogastrostomy was performed such that the stump of the pancreatic head was invaginated into the posterior wall at the gastric antrum, and the stump of the pancreatic tail was invaginated into the posterior wall of the proximal stomach (Figure 5). A drain was inserted into each pancreatic duct to create an incomplete

external fistula through the anterior wall of the stomach. The patient was discharged 34 days postoperatively and developed a Grade B pancreatic fistula (International Study Group of Pancreatic Surgery classification). Although the drain amylase concentration was high and we had to maintain drainage for more than 3 weeks postoperatively, no fluid collection or cavity was present in the abdomen.

We treated the pancreatic fistula by exchanging the drain two times. The drain in the duct of the pancreatic tail spontaneously fell out. The drain in the duct of the pancreatic head remained in place and was transected and internalized endoscopically before discharge.

The surgical specimen showed multiple nonspecific erosions and ulcers in the resected Roux limb (Figure 6). The patient was followed up every 3 months and had not developed diabetes or any nutritional disturbances by 1 year postoperatively. The remaining pancreatic tissue, including the distal pancreatic head, appeared normal without atrophy on a computed tomography scan. He was doing well without abdominal pain or evidence of gastrointestinal bleeding at the time of this writing.

## Discussion

This is the first report of pancreas-preserving surgery with double anastomoses to the stomach for a patient with a traumatic pancreatic duct injury in the proximal head of the pancreas. By maintaining exocrine outflow from the pancreatic head to the distal aspect of the pancreas, it is possible to preserve the injured pancreatic head. A double pancreaticogastrostomy preserves pancreatic and splenic function without anastomoses to the small intestine.

Traumatic pancreatic injuries are relatively rare; only a small number of patients is usually reported from any single

institution, and individual surgeons often have limited experience.<sup>1,2</sup> However, such injuries are accompanied by a high incidence of complications with injuries to adjacent blood vessels and other viscera as well as high mortality.<sup>3,4</sup> Therefore, appropriate diagnosis and treatment as early as possible following trauma are necessary. The priorities for surgical treatment include control of bleeding, control of leakage, and repair of damaged organs. Additionally, the surgeon must consider time delays, the skill of the surgical team, the degree of resection, and the particular surgical approach. The surgeon must be familiar with the possible treatment options and be able to make a thorough assessment.<sup>5,6</sup> Because the pancreas has important endocrine and exocrine functions, the surgeon should consider both lifesaving and organ-sparing techniques to maintain long-term quality of life.

Traumatic injuries are classified into Grades I to V according to the AAST-OIS scale.<sup>7</sup> Nonoperative management is generally recommended for Grade I and II injuries according to the AAST-OIS, and recent reports have described the utility of endoscopic pancreatic duct stenting.<sup>8</sup> Pancreatic resection is recommended for patients with Grade  $\geq$ III pancreatic injury, and distal pancreatectomy is acceptable for patients with Grade III injuries.<sup>7,9</sup> No single standard operative approach has been established for Grade IV injuries. Procedures for major ductal injuries have included



**Figure 6.** Gross pathology images. Multiple nonspecific erosions and ulcers developed, especially near the anastomosis in the mucosa of the resected Roux limb.

extensive caudal pancreatectomy, pancreaticoduodenectomy, the Letton–Wilson procedure, the Bracey procedure, and the Martin procedure.<sup>10–15</sup> The Eastern Association for the Surgery of Trauma guideline provides only conditional recommendations for pancreatic resection in patients with AAST-OIS Grade IV injuries because extensive caudal pancreatectomy may impair pancreatic endocrine and exocrine function, thus worsening patients' quality of life.<sup>7,16</sup> Pancreaticoduodenectomy, which is associated with high morbidity and mortality, is not recommended.<sup>16</sup> For this reason, among patients with AAST-OIS Grade IV injuries, choosing the optimal surgical intervention for patients with proximal lesions is difficult.<sup>17,18</sup> Limited data are available to support the recommendation of pancreaticoduodenectomy for patients with Grade V injuries. The indications are limited to main pancreatic duct injury associated with intrapancreatic bile duct injury, duodenal injuries near the papilla of Vater, extensive duodenal injury, and injuries complicated by extensive hemorrhage in the pancreaticoduodenal area.

Main pancreatic duct injury is regarded as the most significant prognostic factor in patients with traumatic pancreatic injuries, and it influences the choice of the surgical procedure.<sup>19</sup> The patient described in the present report had a traumatic pancreatic injury with a very proximal pancreatic duct injury that was classified as an AAST-OIS Grade IV injury. We considered four strategies for treatment after the first

operation: pancreaticoduodenectomy, extensive caudal pancreatectomy, central pancreatectomy, and no resection. In this complicated case, we chose to avoid pancreatectomy with preservation of organ function because the pancreatic injury was isolated with only minor parenchymal damage and the patient was hemodynamically stable. Table 1 shows the possible reconstruction options after resection of the pancreas. Only drainage of the leaking pancreatic fluid and creation of an internal fistula from the distal pancreatic duct to the stomach were initially performed, and a pancreaticojejunostomy was performed at the second operation. Unfortunately, the hemorrhage was difficult to control, and resection of the Roux limb and pancreas could not be avoided. However, the pancreatic resection was limited to the central portion of the gland, and the spleen was preserved. In addition, the injured pancreatic head where the outflow tract of pancreatic fluid was obstructed was reconstructed and preserved.

In patients with minimal parenchymal injury, pancreatectomy can be avoided by ensuring that the pancreatic fluid drains to the peripheral pancreas even if the main pancreatic duct is obstructed. Limiting the pancreatectomy to central resection preserves splenic function and prevents the occurrence of overwhelming post-splenectomy infection, a serious and possibly fatal complication.<sup>20</sup> In this patient, pancreaticogastrostomy was selected to avoid recurrence of gastrointestinal

**Table 1.** Possible options for reconstruction after pancreas resection.

Procedure	Possible options for surgical reconstruction
Pancreaticoduodenectomy	PG or PJ
Distal pancreatectomy	Closure or PG or PJ
Central pancreatectomy	Stump of pancreatic head: Closure or PG or PJ Stump of pancreatic tail: Closure or PG or PJ

PG, pancreaticogastrostomy; PJ, pancreaticojejunostomy.

bleeding with reconstruction of a Roux-en-Y limb while considering the occurrence of delayed gastric emptying. Pancreaticojejunostomy for the distal pancreatic stump can be tolerated if drainage is assured.<sup>21</sup> Several studies have shown that pancreatic duct occlusion is a safe technique for selected patients at high risk of developing a postoperative pancreatic fistula compared with pancreaticojejunostomy. This may be appropriate in some patients, but the risk of diabetes in the short term is higher than that with pancreaticojejunostomy.<sup>22</sup> We decided that pancreatic duct occlusion was not the best option for this patient because our most important strategy was to preserve pancreatic function.

To the best of our knowledge, no previous reports have described hemorrhage from the Roux limb as the only the outflow for pancreatic secretions, as seen in this patient, and the underlying mechanism has not been elucidated. The endoscopic findings suggested involvement of blind loop syndrome caused by bacterial overgrowth in the Roux limb or concentrated pancreatic secretions; however, the etiology could not be determined. A relatively long Roux limb in which only pure pancreatic fluid flows may not be desirable considering the physiological microbiome, and a reconstructive procedure that allows pancreatic fluid to drain into the stomach may be more physiologic. In this patient, such a procedure might have contributed not only to the treatment and prevention of digestive tract hemorrhage but also to the resolution of abdominal pain.

## Conclusions

Double pancreaticogastrostomy preserves the pancreatic parenchyma after central pancreatectomy, preserving the head and tail of the pancreas and spleen. This is appropriate for patients with benign diseases, and attention must be paid to the

occurrence of delayed gastric emptying. More experience is needed to standardize this procedure for such pancreatic injuries.

## Authors' contributions

Patient care and surgery: YA, HS, KM, YK, KE, AY

Pathological diagnosis: AK

Writing – original draft: YA

Writing – review and editing: HS, YK, YS, AKL, NS

Supervision: YK, AS, HH, YH, NS

All authors read and approved the final manuscript.

## Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

## Declaration of conflicting interest

The authors declare that there is no conflict of interest.

## Ethics approval and consent to participate

This report was approved by the ethics committee of our institution. Written informed consent was obtained from the patient for all procedures performed and for publication of this case report and any accompanying images. A copy of the written consent is available for review by the Editor of this journal.

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