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Case Report

A Case of Organ Injury Scaling of the American Association for the Surgery of Trauma Grade IV Pancreatic Injury in a Patient with Pancreaticoduodenectomy after Diagnosis of Main Pancreatic Duct Injury by Endoscopic Retrograde Pancreatography

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ABSTRACT: In a basketball game, a 16-year-old boy lost his balance in the air and fell to the floor on his abdomen. Computed tomography revealed a low-density area of the pancreatic head. Endoscopic retrograde pancreatography revealed main pancreatic duct (MPD) injury and contrast medium leakage. Thus, he was diagnosed with Organ Injury Scaling of the American Association for the Surgery of Trauma grade IV pancreatic injury. Pancreaticoduodenectomy was performed. Although chylous ascites and acute stress disorder occurred, the patient was managed conservatively and discharged on postoperative day 33. Surgery is now commonly performed for MPD injury, but recently, successful nonoperative management (NOM) cases have been reported. There is no consensus on the exact treatment approach, which includes resection, drainage, or NOM, for grade IV pancreatic injury. NOM is not always the best treatment approach, and selecting the appropriate diagnostic method and surgical technique for each case is important.

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KEYWORDS: pancreatic injury, endoscopic retrograde pancreatography, pancreaticoduodenectomy

Introduction

The frequency of pancreatic injury among abdominal trauma cases is approximately 0.2%-12%, and cases of pancreatic injury with main pancreatic duct (MPD) injury are particularly rare.[1] The mortality rate associated with MPD injury is 35%,[2] and the incidence of postoperative complications is reported to be 39.5%-45%.[3] In particular,

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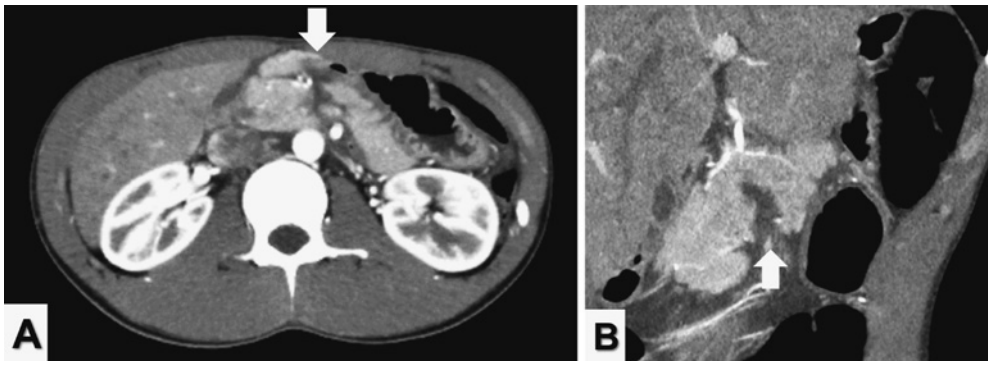

Fig. 1 Computed tomography (CT) findings: (A) axial and (B) coronal images
CT revealed a low-density area of the pancreatic head, parenchymal discontinuity in over half of the pancreatic head, and peripancreatic effusion in the anterior aspect of the vertebral body. The presence of a main pancreatic duct injury was unknown.

the complication rate for pancreatic jejunal anastomosis and pancreaticoduodenectomy is even higher, with mortality rates reaching approximately 50%.[3] Although pancreatic resection is generally performed in cases of MPD injury, cases of successful nonoperative management (NOM) by drainage and endoscopic treatment have been reported recently. Consequently, no consensus has been established regarding the diagnostic and treatment algorithms. In this report, we present a case of pancreatic injury in a patient who had undergone pancreaticoduodenectomy after MPD injury diagnosis.

Case Report

A 16-year-old Japanese boy with a 6-h history of persistent hypochondrial pain was referred to our emergency department. During a basketball game, the patient hit an opponent, lost his balance in the air, and fell to the ground on his abdomen. The patient was 173 cm tall and weighed 48.5 kg. His vital signs were stable, respiratory rate was 18 breaths per minute, SpO_2 was 99%, blood pressure was 120/60 mmHg, heart rate was 103 bpm, and body temperature was 36.4℃. The patient's pain was dull and aching, localized to the epigastrium and right hypochondrial areas, and within self-control. He had no fever, nausea, vomiting, or other associated symptoms. Focused assessment using sonography for the trauma scan showed negative findings. His white blood cell count (9200/μL; normal range, 4000-9000/μL) and serum amylase level (249 IU/L; normal range, 25-125 IU/L) were increased. On abdominal computed tomography (CT), parenchymal discontinuity over half of the pancreatic head and peripancreatic effusion in the anterior aspect of the vertebral body were observed (Fig. 1A, B). No other injured areas were observed. Upon performing endoscopic retrograde pancreatography (ERP), leakage of the contrast medium was observed from the MPD in the pancreatic head. Because a stent could not be placed distal to the injured area, an endoscopic nasopancreatic drainage (ENPD) tube was placed up to the proximal end of the injured area (Fig. 2A, B). NOM was considered, but the patient was judged to be suitable to undergo semi-emergent surgery because of failure to insert a pancreatic stent, young age, blood test results, abdominal findings, and various imaging tests.

Laparotomy was performed under general anesthesia. We performed vertical midline incision. When we opened the abdomen, slightly cloudy ascites was observed. We confirmed the absence of any damage to the liver, spleen, or entire intestinal tract. The omental bursa was opened, and Kocher's maneuver was performed to expose the pancreas. Saponification of fatty tissues was observed on the anterior surface of the pancreas. Furthermore, we performed dissection of the anterior surface of the pancreas and confirmed the presence of ENPD tube prolapse from the dorsal side of the pancreatic head. We performed a transection of the pancreas in front of the portal vein. We placed a 5-Fr pancreatic duct tube into the side of the pancreatic head. A 5-Fr pancreatic duct tube was found to prolapse from the same location as ENPD tube (Fig. 3A, B). Pancreaticoduodenectomy was performed because we determined that it was impossible to preserve the pancreatic head. The surgical duration was 6 h and 49 min, and the blood loss was 270 mL. No blood transfusions were performed.

On pathology, the resected specimen demonstrated a 27

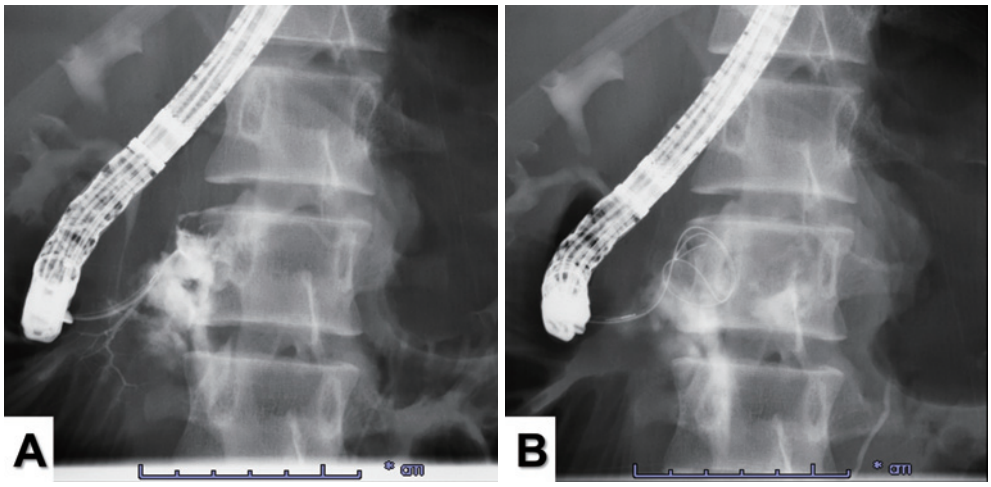

Fig. 2 Endoscopic retrograde pancreatography findings
(A) Leakage of contrast medium from the main pancreatic duct in the pancreatic head.
(B) Because a stent could not be placed distal to the injured area, an endoscopic nasopancreatic drainage tube was placed up to the proximal end of the injured area.

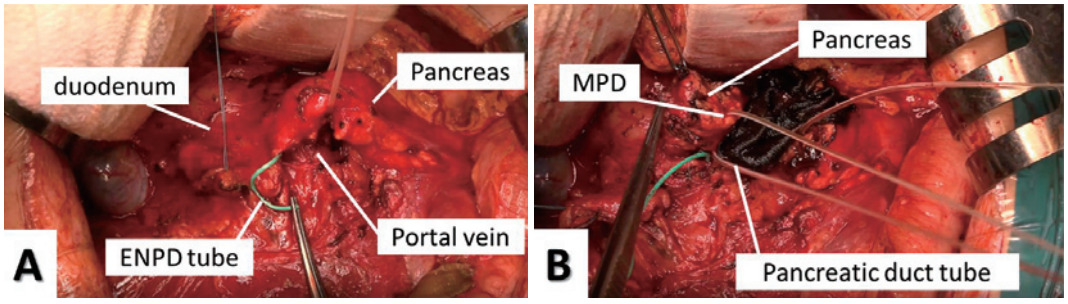

Fig. 3 Intraoperative findings
(A) We performed a dissection of the anterior surface of the pancreas and confirmed the presence of endoscopic nasopancreatic drainage tube prolapse from the dorsal side of the pancreatic head.
(B) We performed a transection of the pancreas in front of the portal vein. We placed a 5-Fr pancreatic duct tube into the pancreatic head. A 5-Fr pancreatic duct tube prolapsed from the same location as the endoscopic nasopancreatic drainage tube.

× 9-mm disruption of the pancreatic parenchyma and surrounding hematoma in the pancreatic head at approximately 40 mm away from ampulla of Vater. Macroscopically, the injured area contained MPD (Fig. 4A, B). Microscopic examination demonstrated fresh hemorrhage, and an MPD tear was observed (Fig. 4C-E).

The patient was treated with antibiotics, proton-pump inhibitors, and parenteral nutrition support after surgery. His abdominal pain was significantly relieved, and his white blood cell count and serum amylase levels returned to normal. No postoperative pancreatic fistula was observed. Oral intake started on postoperative day 4. On postoperative day 8, the drainage fluid became cloudy. The triglyceride level in the drainage fluid was elevated to 282 mg/dL. He was diagnosed with chylous ascites. Subcutaneous injections of 300 μg octreotide were initiated. After treatment, the chylous ascites disappeared, and the drain was removed on postoperative day 32. The day after the surgery, his speech decreased and his facial expression became stiff; he was diagnosed with acute stress disorder. The patient was treated with psychiatric medications and received psychological care. His mental health improved at discharge from the hospital. Thereafter, the patient progressed well and was discharged on postoperative day 33. Follow-up examination at 6 months showed no complications.

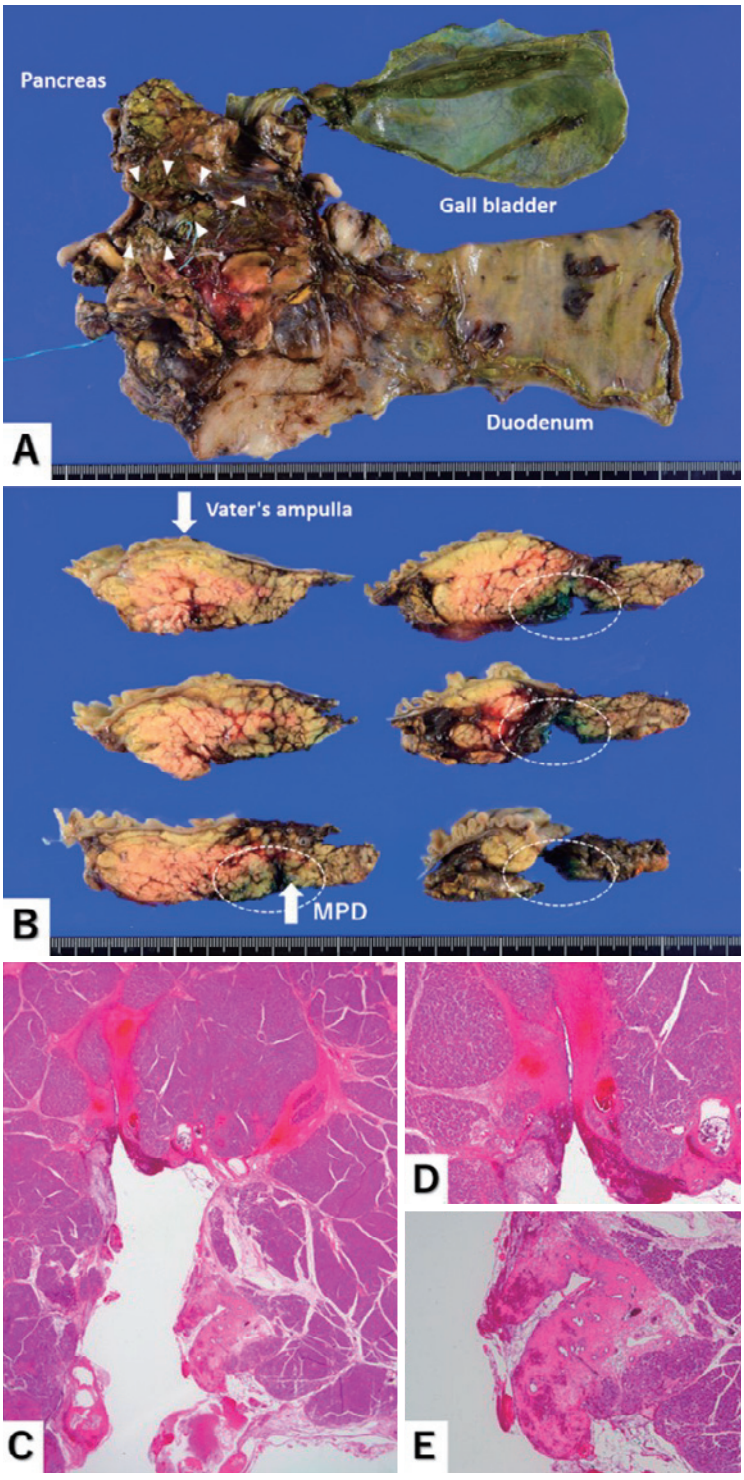

Fig. 4 Pathological findings

(A) The resected specimen demonstrated a 27×9-mm disruption of the pancreatic parenchyma and surrounding hematoma in the pancreatic head approximately 40 mm away from Vater's papilla. The triangle indicates the injured area.

(B) Macroscopically, the injured area contains the main pancreatic duct. The dotted line indicates the injured area.

(C–E) Microscopic examination demonstrated fresh hemorrhage and tear of the main pancreatic duct (hematoxylin and eosin staining, ×20, ×40, ×40).

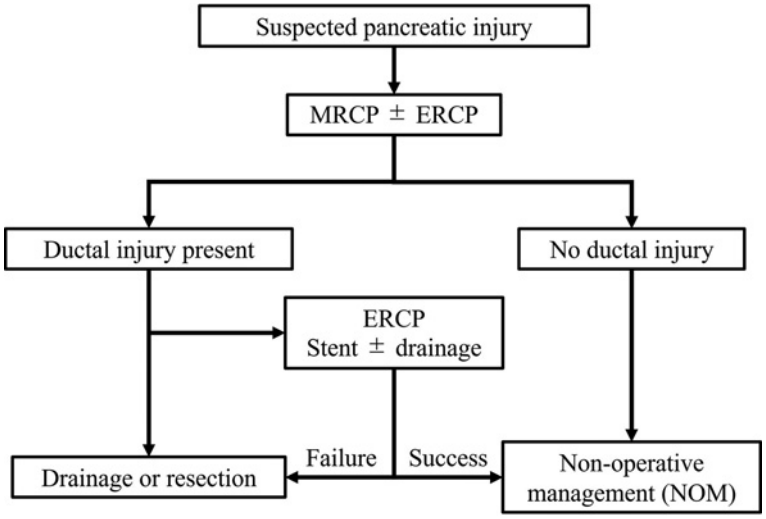

Fig. 5 Reference 12 was used as a citation and modification

Discussion

In Japan, pancreatic injuries are categorized according to the Japanese Association for the Surgery of Trauma (JAST) classification version 2008 for pancreatic injuries.[4] In the United States, pancreatic injury is evaluated using the Organ Injury Scaling of the American Association for the Surgery of Trauma (AAST-OIS).[5] The JAST classification version 2008 for pancreatic injuries only classifies the depth of pancreatic injury, whereas the AAST-OIS classification includes both the site and depth of injury. According to the JAST classification version 2008 for pancreatic injuries, all cases of pancreatic trauma with duct injury are referred to as type IIIb pancreatic injuries. Distal pancreatectomy is the recommended procedure for type IIIb pancreatic body or tail injuries, with splenic preservation when possible. Type IIIb pancreatic head injuries without massive disruptions are usually managed with drainage. Pancreaticoduodenectomy is indicated for type IIIb pancreatic head injuries with massive disruption. However, damage control surgery or staged operation with delayed reconstruction should be considered when the patient's condition is unstable.[1] In contrast, AAST-OIS grades I and II injuries exclude duct injuries, whereas AAST-OIS grades III-V injuries include duct injuries. In patients with AAST-OIS grade III injury, which includes distal transection or parenchymal injury with duct injury, pancreatic resection is recommended. Patients with AAST-OIS grade V injury, which includes massive disruption of the pancreatic head, should undergo pancreaticoduodenectomy or damage control surgery. However, there is no consensus on the exact surgery for grade IV pancreatic injury, which includes proximal (to the right of the superior mesenteric vein) transection or parenchymal injury affecting the ampulla of Vater. The Western Trauma Association guidelines recommend drainage,[6] whereas the Eastern Association for the Surgery of Trauma guidelines recommend pancreatic resection.[7]

The most important point to decide on the most appropriate treatment strategy is the presence of damage to the MPD. It is difficult to diagnose an MPD injury using CT alone because the sensitivity and specificity of CT examinations vary from 43% to 91% and from 90% to 95%, respectively.[8,9] Although magnetic resonance cholangiopancreatography (MRCP) is generally superior to CT in terms of its ability to visualize MPD, it cannot visualize the injured branches of the pancreatic duct. MRCP is inferior to ERP in terms of its diagnostic ability.[10] The significance of performing ERP immediately after injury is that it not only provides useful information through a more accurate evaluation of the MPD injury but also allows for pancreatic duct drainage and an early decision on whether to perform surgery or not. Especially in cases of pancreatic head injury, unlike pancreatic tail injury, ERCP findings are important for the accurate diagnosis of MPD injury and the determination of surgical and treatment strategies.[11] Kjetil et al.[12] proposed a simple management algorithm (Fig. 5). In Fig. 5, MRCP and ERCP are the keys for determining treatment management. Depending on the MPD location and degree of damage according to the ERCP findings, NOM may be possible by performing endoscopic pancreatic stenting or ENPD. The ENPD tube may

also be useful in locating the injured site at the time of surgery.[11] ERCP is highly versatile from diagnosis to treatment.

In this case, MPD injury was suspected on CT, and ERCP was performed immediately to determine whether a complete disruption was present. Because it was difficult to place the ENPD tube in the pancreatic tail, NOM was judged to be difficult; thus, surgery was performed. Intraoperative findings revealed that the ENPD tube was useful in identifying the site of injury, and the pancreatic head injury was closer to the duodenum than expected. Vital signs remained stable throughout the surgery; therefore, we did not choose drainage. If the pancreatic head could be closed, Letton-Wilson surgery was considered. However, because a pancreatic fistula was inevitable because of the proximity of the duodenum and because the patient was young, had stable vital signs, and was operatively tolerant, we decided to perform a one-stage pancreaticoduodenectomy.

Regarding the complications of peripancreatic drainage versus resection, Lin et al.[13] reported a higher complication rate in the drainage group (resection, 75%; drainage, 86%; $P \geq 0.999$). Although no significant differences were observed in the drainage group, repeated and prolonged stenting treatment could result in ductal stricture. Ball et al.[14] also reported that 80% of their patients in the drainage group who had controlled pancreatic fistulas required secondary operative intervention, such as Roux-en-Y pancreatic fistulojejunostomies, extended distal pancreatectomy, and Frey procedure for persistent fistula or delayed main duct stricture. Conversely, the fistulas in all resection groups closed within 64 days. Furthermore, the drainage group were more likely to report low mental and physical health and poor quality of life scores. The drainage groups were forced to undergo a prolonged and complicated treatment course, which included repeated operations, additional procedures (surgical or endoscopic), and intermittent return to the healthcare system for assessments and treatment. Thus, Ball et al. concluded that pancreatic resection should be performed in patients with grade IV pancreatic injury.[14]

In this case, the patient had an acute stress disorder due to wound pain and environmental changes, resulting in a significant decline in his quality of life. However, after a one-stage surgery, he was discharged on postoperative day 33, and his mental health improved. Although chylous ascites was observed as a postoperative complication, it could have been a complication due to trauma, and no complications, such as glucose intolerance or pseudocysts, due to surgery were observed. It is not known exactly why octreotide suppresses chylous ascites. It is speculated that octreotide suppresses the secretion of digestive juices, which decreases hepatic and portal blood flow, resulting in decreased intestinal function and lymphatic fluid volume in the intestine. Additionally, octreotide constricts the smooth muscle of the lymphatic vessels, leading to a reduction in lymph flow excretion.[15]

As in the present case, in cases of extensive pancreatic injury or complete transection, the caudal MPD may not be contrasted, making it difficult to place a drainage tube distal to the injured area. Even if a drainage tube can be placed, the pancreatic fistulas may not be closed. If the pancreatic duct drainage does not improve the pancreatic fistulas, the patient should undergo surgical treatment.[2] However, the continuously spreading inflammation and autodigestion make it more difficult to execute pancreatic resection when performing laparotomy.[13] It is necessary to evaluate whether there is an improvement in the pancreatic fistulas by performing repeated imaging evaluations, including ERP and CT, for several days to 1 week after the injury.[2] Depending on the disease course, a shift to surgical treatment should not be hesitated, but studies about when to perform surgery or the limits of continued NOM are lacking. Although the number of reports of successful NOM cases has been increasing recently, NOM may lead to increased radiation exposure, delay of surgical conversion, increased surgical difficulty, increased complication rate and consequent prolonged treatment period, and decreased quality of life. Of course, pancreatectomy for traumatic pancreatic injury is not safe, but if the patient has a tolerance to surgery, resection should be regarded as a treatment strategy that can be completed in a short time.

In conclusion, our case of AAST-OIS grade IV pancreatic injury diagnosed using ERP was treated by pancreaticoduodenectomy. The diagnosis and standard treatment of traumatic pancreatic injury remain controversial. Although there are some reports of successful conservative treatment, it is not always the best. It is important to select the appropriate diagnostic method and surgical technique according to the patient's condition, including vital signs.

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Authors' contribution: All authors were involved in the management of the patient and conception of the manuscript. M.I. drafted the case report. All authors have read and approved the final version of the manuscript and agreed to be accountable for all aspects of the work.

Conflicts of interest: None declared.

Consent for publication: The patient and his family provided consent for the publication of this case report.

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