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Case Report: Acute Pancreatitis with Necrosis Leading to Chronic Pancreatitis and Complications

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Abstract
Acute pancreatitis (AP) is a common clinical entity and one of the leading causes of morbidity and mortality from local and systemic complications. Recent insights into diagnosis and management, as well as common interventions for AP, pseudocysts, and pancreatic duct involvement, have been discussed in this article. Emerging literature from endoscopic and radiological evidence-based imaging and potential biomarkers has modified its management approach. Artificial intelligence, machine learning-based precision medicine and application of antioxidants like quercetin may have potential therapeutic implications. Further, advanced cross-sectional imaging including CECT and MRI is useful for early detection and management in necrotizing pancreatitis or pseudocyst formation. In addition, organ failure, infection, and systemic involvement like sarcopenia should also be noted for overall impact and prognosis. The impact of individualized treatment as per the needs using both conventional and novel methods is beneficial for better care. Endoscopic retrograde cholangiopancreatography (ERCP) and parenteral nutrition in the setting of critical illness have also been added to the algorithm for overall improvement.

Keywords: Acute pancreatitis, Pseudocyst formation, Pancreatic duct, Endoscopic retrograde cholangiopancreatography (ERCP), Artificial intelligence, Antioxidant therapy, Quercetin, Necrotizing pancreatitis, Organ failure, Sarcopenia, Parenteral nutrition, Imaging, Biomarkers, Precision medicine.

Introduction

Acute pancreatitis (AP) is an acute inflammatory disease that can result in significant morbidity and mortality. The two leading causes of AP are gallstones and alcohol consumption; however, other factors, including hyperlipidemia, trauma, and certain medications, can also cause the disease[1,2]. AP is characterized by severe epigastric pain, nausea, vomiting, and can result in serious complications, such as pancreatic necrosis, organ failure, and pseudocyst formation[3,4]. Advances in imaging technology, including CT, MRI, and endoscopic retrograde cholangiopancreatography (ERCP), have significantly improved the diagnosis and management of AP, allowing for early detection and intervention and reducing the risk of complications[5,6].

Recent research has demonstrated the potential for artificial intelligence (AI) and machine learning algorithms to improve the diagnosis and prognosis of AP, particularly in predicting disease severity and outcome based on clinical and imaging data[7]. Additionally, the role of antioxidants, such as quercetin, has been investigated as a potential therapeutic intervention for the management of the disease[8]. With the progress of AP, there is a greater emphasis on precision medicine to deliver personalized treatment strategies, particularly in the management of complications such as pseudocyst formation and extra-pancreatic infection, which can further exacerbate the disease course[9,10]. The management of AP involves a

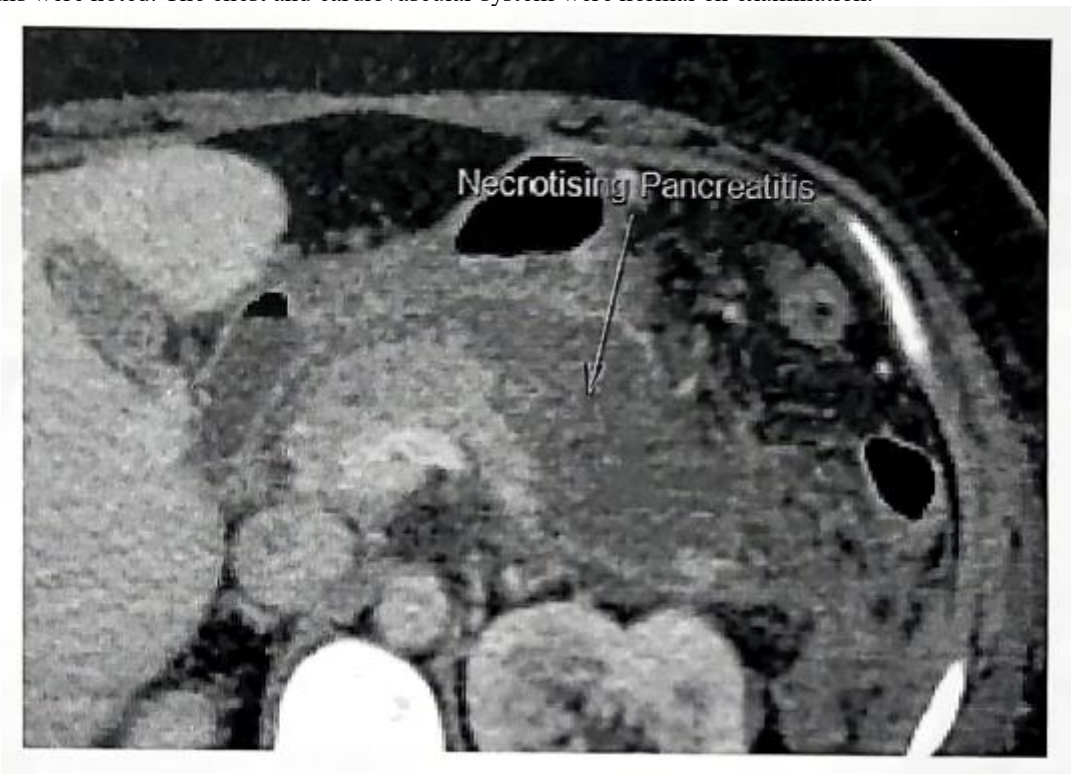
multidisciplinary approach, including medical management, supportive care, and surgical or endoscopic interventions as needed. The use of parenteral nutrition, especially in the setting of severe AP, is an active area of investigation in optimizing clinical outcomes in patients with extensive pancreatic injury[11]. Although there have been significant advances in the treatment and management of AP in recent years, challenges remain, including determining the most effective therapeutic interventions for complications such as organ failure and sarcopenia, which are common in chronic pancreatitis[12,13].

Patient Information

This is a 25-year-old female patient, with a diagnosis of acute pancreatitis. One of the complications, in this case, is the development of a pancreatic pseudocyst. The patient had complaints of epigastric pain, nausea, and vomiting, as per the symptoms of acute pancreatitis[1]. Risk factors for pancreatitis include gallstones and alcohol intake, however, the patient did not have any history of gallstones or alcohol use [2]. The patient did not have any family history of pancreatic problems, diabetes, or hypertension [3]. In the case of this patient, pancreatic pseudocyst, large in size, was observed in the tail of the pancreas that displaced the stomach and duodenum on CECT and MRI of the abdomen [4,5]. The clinical course of this patient and the imaging findings suggested acute necrotizing pancreatitis [6]. In this patient, dilation of the pancreatic duct was also seen [7].

Clinical Findings

On admission, the patient was a 25-year-old female who complained of abdominal pain. It was severe in nature and localized in the epigastric region, radiating to her back. It was post-prandial. Nausea and vomiting were also present. The patient was afebrile on examination, and her pulse rate and blood pressure were 74 beats/min and 120/80 mmHg, respectively. On general examination, there was grade I clubbing, generalized lymphadenopathy with 2 lymph nodes of 2 × 2 cm palpable in the posterior triangle of the neck. Pedal edema was also present^3. On abdominal examination, the abdomen was soft on palpation. There was tenderness in the right iliac fossa, with some guarding, no rigidity. Bowel sounds were present. Percussion was painful; hence, further abdominal assessment could not be done. Packed cell volume was decreased (40.6%), and lymphocytes were low (16.6%). Her renal profile revealed high blood urea nitrogen (BUN) of 19 mg/dl. Albumin was low at 2.9 g/dl, which may be an indication of malnutrition as seen in cases of malabsorption in pancreatitis. Urinalysis revealed the presence of ketone bodies, suggesting a catabolic state likely due to prolonged fasting, vomiting, and metabolic stress associated with acute pancreatitis. This also reflects impaired glucose metabolism and the shift toward fat breakdown for energy, common in severe inflammatory states. No obvious distension, sinus, or dilated veins were noted. The chest and cardiovascular system were normal on examination.



The patient appeared acutely unwell with evidence of systemic features such as clubbing, lymphadenopathy, and pedal edema. These may be secondary to peripancreatic inflammation caused by acute pancreatitis^4. Packed cell volume was decreased (40.6%), and lymphocytes were low (16.6% [5]. Her renal profile revealed high blood urea nitrogen (BUN) of 19 mg/dl. Albumin was low at 2.9 g/dl. This may be an indication of malnutrition as in cases of malabsorption in pancreatitis

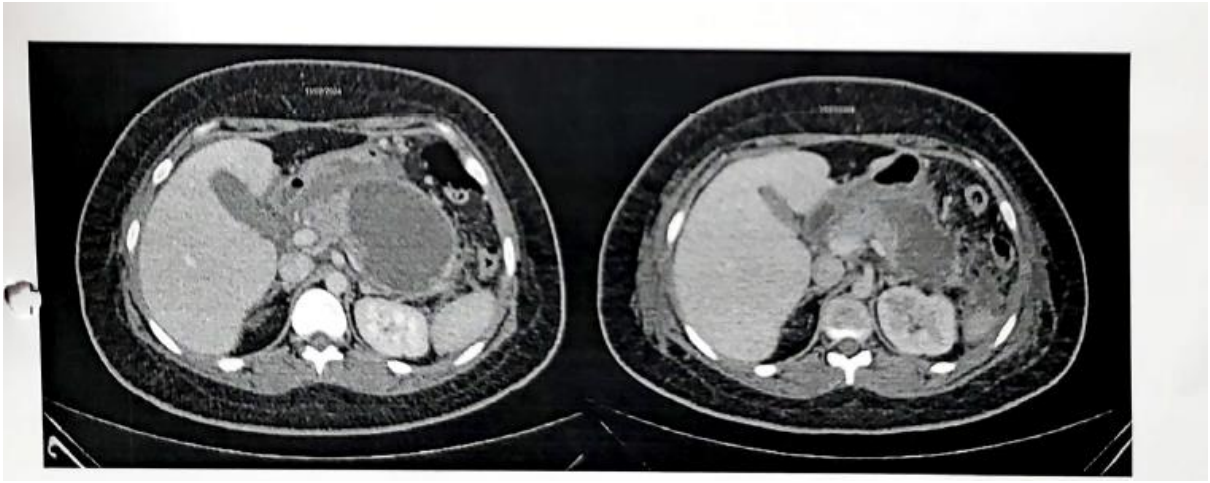
[6]. Cytology from FNAC from the cervical lymph nodes was sent, which showed granulomatous inflammation. A GeneXpert for Mycobacterium tuberculosis test was negative. She was later diagnosed with goblet cell adenocarcinoma of the appendix, and the case is now being followed up [7].

Diagnostic Assessment

The patient had typical symptoms of acute pancreatitis, including epigastric pain, nausea, vomiting, and the blood tests showed increased pancreatic enzymes such as amylase and lipase levels which are diagnostic markers of acute pancreatitis [11].

CT imaging, including an initial contrast-enhanced CT scan (CECT) of the abdomen, confirmed a large well-defined cystic collection measuring approximately 9.9 x 9.2 x 8.9 cm with septations in the tail of the pancreas, which is consistent with a pancreatic pseudocyst. The pseudocyst was causing compression of the stomach, duodenum, and transverse colon, which indicated the significant mass effect of the collection [2]. The imaging also showed peripancreatic fat stranding, indicating the inflammatory process in the pancreas. However, no pancreatic ductal dilatation or obstruction, pancreatic necrosis or mass, or other organ involvement was noted [3].

MRI confirmed the pancreatic pseudocyst and provided additional information about the cyst's internal characteristics. The MRI indicated no pancreatic ductal dilatation or biliary obstruction as the CBD measured 5.6 mm, which is within normal range [14]. It also ruled out any extra-pancreatic infection and noted minimal ascites without evidence of gastrointestinal perforation or gallbladder pathology [15].



FNA of the cervical lymph nodes was performed to rule out any underlying infectious or malignancy-related causes. The results were suggestive of granulomatous inflammation and GeneXpert testing for Mycobacterium tuberculosis came out negative [16].

In conclusion, these diagnostic assessments confirmed the diagnosis of acute pancreatitis with pseudocyst formation, provided information on the severity of the disease, and ruled out other possible causes of the patient's symptoms, such as infectious or malignant processes [7].

Therapeutic Intervention

As part of the plan of care, the management of acute pancreatitis was done according to her presenting acuity and the complications that ensued. In the early phase, the patient was managed with supportive care, including aggressive intravenous fluid resuscitation using Ringer's lactate to prevent hypovolemia and maintain perfusion. Pain was managed with intravenous acetaminophen (1 g every 8 hours) and intravenous tramadol (50 mg as needed) during the initial acute phase. Proton pump inhibitor therapy was initiated with pantoprazole 40 mg IV twice daily to prevent stress-related mucosal damage. Electrolyte imbalances were corrected, and the patient was kept nil per oral (NPO) to allow pancreatic rest. A low molecular weight heparin (enoxaparin 40 mg subcutaneously once daily) was administered prophylactically to prevent thromboembolic events due to immobility and inflammation-associated hypercoagulability. This involved correction of electrolyte imbalances and repletion of volume losses through fluid resuscitation, use of analgesics such as acetaminophen and NSAIDs for pain, as well as resting the pancreas [11]. In view of her presenting acuity and given that there was massive pancreatic inflammation on her CT abdomen, she was given IV fluid resuscitation to prevent hypovolemia [8].

She was not started on antibiotics as there was no evidence of infected pancreatic necrosis. Antibiotic use in non-infected pancreatic necrosis is controversial [2]. The patient was also observed for signs of infection or organ failure, and no further treatment was provided initially.

The pancreatic pseudocyst had to be managed as it was causing significant mass effect. Continued observation was done as her pseudocyst had led to gastric obstruction, which is a common complication. Percutaneous drainage of the

pseudocyst was performed, which was based on radiologic confirmation [13]. The percutaneous drainage was done to provide symptomatic relief. The procedure helped in the pseudocyst deflation, thus relieving compression of adjacent structures such as the duodenum and stomach, which caused significant mass effect on the organ [4].
Analgesics were administered as a short-term measure to relieve her pain as she had a pancreatic pseudocyst. She was put on non-opioid analgesics and a modified diet to prevent further pancreatic stimulation after her pain had been managed. In view of the large fluid collections around the pancreas, the patient was closely monitored for any signs of infection, such as fever and high inflammatory markers.
ERCP was part of the management plan. The procedure was to be performed in view of the mild pancreatic duct dilation on her contrast CT. There was also no evidence of surgical abdomen, and after more than 4 weeks, she still had no evidence of biliary obstruction. Surgical intervention was, however, not indicated as there were no clinical features of biliary obstruction, no gallstones, and hence no evidence of gallstone-induced pancreatitis.
Parenteral nutrition (PN) was started for her in view of her inability to eat during her pancreatitis. The PN was to provide her with adequate nutrition and avoid malnutrition [7]. This is because she had pancreatic insufficiency secondary to the acute pancreatitis, and the PN was also to help her recover from her condition as the inflammation resolved.
As part of the final recovery phase, an elective laparoscopic cholecystectomy was performed at the 12-week follow-up visit. Although the initial diagnostic imaging did not reveal gallstones, the surgical team recommended gallbladder removal as a preventive measure due to the risk of biliary sludge or microlithiasis contributing to recurrence of pancreatitis. The procedure was uneventful, and the patient recovered well postoperatively. No complications such as bile leak, infection, or post-cholecystectomy syndrome were observed. This intervention was considered critical in reducing the long-term risk of recurrent acute pancreatitis episodes, and the patient was discharged with follow-up advice and dietary counseling.
In the management and follow-up plan, monitoring pancreatic enzymes and blood glucose levels would be done as there would be a possibility of her developing diabetes mellitus secondary to pancreatic damage [8]. She was referred to a dietitian because sarcopenia and a high risk of nutritional deficiencies are possible in patients with chronic pancreatitis [9].

Monthly Follow-Up and Outcome

The patient was monitored closely over a 3-month follow-up period. Monthly imaging studies (CECT/MRI) revealed gradual regression in the size of the pancreatic pseudocyst, with significant reduction of mass effect on adjacent structures such as the stomach and duodenum. The patient reported marked improvement in appetite, resolution of abdominal pain, and normalization of bowel function. Serum amylase and lipase levels returned to normal by the end of the second month. Nutritional status improved, with weight gain and normalization of serum albumin.
Given the absence of gallstones during initial imaging but the clinical risk of recurrence, an elective laparoscopic cholecystectomy was performed at the 12-week follow-up as a preventive measure. Postoperative recovery was uneventful. No new collections or signs of pancreatic necrosis were noted. The patient was advised long-term follow-up for endocrine insufficiency and possible onset of diabetes, and was counseled for regular dietary monitoring to prevent sarcopenia and nutritional deficiencies. At the 3-month mark, the patient remained stable and symptom-free.

Discussion

Acute pancreatitis (AP) is a condition where the pancreas becomes inflamed. This inflammation can lead to serious complications throughout the body, such as organ failure, infection, and the development of pseudocysts in the abdomen. The condition is characterized by the activation of pancreatic enzymes that lead to pancreatic cell injury and systemic inflammation due to the release of inflammatory mediators. The severity of acute pancreatitis can vary from mild to severe, with potential local and systemic complications, including necrosis, fluid collection, and multi-organ dysfunction syndrome. The condition can be diagnosed based on clinical presentation, which often includes abdominal pain, nausea, and vomiting, in conjunction with elevated pancreatic enzymes like amylase and lipase in the blood[15]. In this patient, the initial evaluation with CECT revealed a large pseudocyst in relation to the tail of the pancreas, measuring approximately 9.9 x 9.2 x 8.9 cm. This cystic structure is causing significant mass effect on adjacent organs, including the stomach and duodenum^6. The presence of internal septations and stranding of peripancreatic fat on imaging studies are indicative of severe pancreatitis, likely an acute necrotizing process. The management of this patient would be initially supportive, focusing on fluid resuscitation, pain control, and nutritional support. The patient was on IV fluids and inotropic support, and his vitals and input and output were being monitored closely. An opioid analgesic was given during the first 24 hours, followed by a non-opioid analgesic [8]. The patient was put on parenteral nutrition since he could not take anything by mouth during the first week [9]. Although endoscopic retrograde cholangiopancreatography (ERCP) can be used to manage certain causes of acute pancreatitis, such as biliary stones, there was no evidence of gallstones or biliary dilatation in this patient, so an ERCP was not performed [10]. Imaging studies like MRI and CT scans are not only used for diagnosis but also for guiding management decisions, particularly regarding the pancreatic pseudocyst. A percutaneous drainage of the pancreatic pseudocyst was performed to alleviate symptoms and prevent complications, such as gastric outlet obstruction or damage to the pancreatic duct [11,12]. Extra-pancreatic infection is always a concern in pancreatitis as it can lead to a worse overall prognosis and systemic inflammatory response syndrome (SIRS) or sepsis [13]. Quercetin, an antioxidant compound, has been studied for its potential benefits in reducing oxidative stress and inflammation in pancreatitis, showing promise in preclinical models and early clinical trials [14]. The incorporation of artificial intelligence (AI) and

machine learning into diagnostic algorithms is an exciting area that could improve predictive accuracy of disease severity [15]. While mortality from necrotizing pancreatitis has improved significantly with the evolution of medical and surgical management, long-term sequelae of pancreatitis, such as pancreatic insufficiency, diabetes, and sarcopenia, are being increasingly recognized and need to be addressed [16]. These late complications highlight the need for long-term follow-up and care, including endocrine assessment and nutritional support, to optimize recovery and prevent recurrence of the condition.

Conclusion

In summary, a 25-year-old female, presented with acute pancreatitis complicated by pancreatic pseudocyst formation. Early diagnosis through imaging (CECT, MRI) was crucial in confirming the diagnosis and guiding management decisions. The treatment approach, including percutaneous drainage and parenteral nutrition, effectively relieved symptoms, and the patient is being closely monitored for potential complications such as pancreatic insufficiency and diabetes. The integration of AI and machine learning into future diagnostic algorithms shows promise for improving patient outcomes by facilitating more accurate risk stratification and personalized treatment plans. Ongoing research into novel therapies, such as antioxidants and endoscopic interventions, is anticipated to enhance the prognosis of patients with severe forms of pancreatitis and its complications.

Patient Perspective

The patient expressed her gratitude for the timely intervention and the clarity provided regarding her condition and treatment options. She was involved in decision-making throughout her care process, which allowed her to have a better understanding of her health condition and treatment plan. The patient is hopeful for a full recovery and is committed to following up regularly with her healthcare providers.

Informed Consent

Informed consent was obtained from the patient before initiating any diagnostic or therapeutic interventions. The patient was provided with detailed information regarding the nature of her condition, potential treatment options, and possible risks and benefits. She consented to the interventions, including the **percutaneous drainage** of the pseudocyst and **parenteral nutrition**. The patient was encouraged to ask questions and expressed understanding of her treatment plan.

Authors' Contribution

The authors of this report contributed equally to the research, writing, and editing of the manuscript. The clinical diagnosis, management, and therapeutic decision-making were conducted by the consulting medical team. The research and manuscript writing were collaborative efforts, with each author providing significant input on various sections of the report.

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Conflicts of Interest

There are no conflicts of interest to declare.

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