Pancreatitis in Children: Clinical Analysis of 61 Cases in Southern Taiwan

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Background: The purpose of this study was to analyze the characteristics of the clinical presentations, etiologies, diagnoses, and treatment of pediatric pancreatitis in southern Taiwan.

Methods: Sixty-one patients, ranging in age from 2 to 18 years (mean, 8.8 ¡ 4.8 years old), with diagnoses of pancreatitis were studied from July 1986 through June 2000.

Results: Twenty-eight pancreatitis cases resulted from physical trauma, 13 cases of which were from traffic accident (53.8% from motorcycle accident). Other pathogenic factors included systemic diseases (N=9), pancreaticobiliary-tree anomalies (N=7), toxin ingestion or drug use (N=4), Ascaris infection (N=1), and idiopathic (N=12). Symptoms included abdominal pain (N=58), vomiting (N=23), fever (N=18), and jaundice (N=2). Hyperamylasemia was found in 51 children (83.6%). Twenty-seven patients (90.0%) had elevated serum lipase levels (>190 U/L) of 30 evaluated. The amylase to creatinine clearance ratio was assayed for 35 cases, of which 28 (80.0%) were elevated (>6%). Ultrasonography revealed inflammatory changes of the pancreas in 40 of 51 patients evaluated, while computed tomogram demonstrated evidence of pancreatic inflammation for all 21 patients evaluated. Fifteen cases required surgery, while the other 46 were managed conservatively. One patient died because of acute necrotizing pancreatitis 3 days after L-asparaginase treatment for leukemia. The other patients survived well during long-term follow up.

Conclusion: Pancreatitis in children is more common than generally believed. Physical trauma, especially because of motorcycle accidents, was the leading cause of pediatric pancreatitis in southern Taiwan. The mortality rate was low. Only one patient who had undergone chemotherapy with L-asparaginase died of the disease.

(Chang Gung Med J 2002;25:162-8)

Key words: pancreatitis, children, abdominal pain, L-asparaginase.

Acute pancreatitis is generally uncommon in children, but may be associated with severe morbidity. For adults, alcoholism and cholelithiasis are the most common causes of acute pancreatitis. In west-

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Received: May 3, 2001; Accepted: Oct. 3, 2001

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ern countries, acute pancreatitis in children occurred mostly due to infections, trauma, pancreaticobiliary-tree anomalies, drug abuse, or systemic diseases.[1] In Japan, an abnormal pancreaticobiliary ductal junction was the most common cause of pancreatitis in children.[2] One study from northern Taiwan showed that trauma was the most common cause of pancreatitis in pediatric patients.[3]

We retrospectively reviewed 61 cases of pancreatitis in children occurring from July 1986 through June 2000 at our institution. Special notes were taken on the underlying causes, presenting features, clinical complications, management strategies, and outcomes of these patients.

METHODS

The medical records of 61 patients under the age of 18 years, diagnosed with pancreatitis, and hospitalized at the Chang Gung Children's Hospital from July 1986 through June 2000 were reviewed. The diagnosis of acute pancreatitis is typically based on results of physical examinations, laboratory testing, and imaging studies. Criteria for the diagnosis of pancreatitis in this study were: (1) clinical findings compatible with pancreatic inflammation and laboratory confirmation with one or more of the following: hyperamylasemia (serum amylase >390 U/L; reference range 45-130 U/L), elevated serum lipase level (>190 U/L) in the absence of other possible contributing factors, increased amylase to creatinine clearance ratio (ACCR >6%), or evidence of pancreatic inflammation from ultrasonography or computed tomographic (CT) imaging; and (2) surgical or pathologic evidence.

In this study, ultrasonographic evidence of pancreatic inflammation included blurred outline, enlargement and heterogenous echogenicity of the pancreas. The typical features of pancreatitis found on CT scan included blurred outline, swelling of pancreatic parenchyma. Two patients underwent endoscopic retrograde cholangiopancreatography due to at least three recurrent attacks of pancreatitis. Pancreatitis was defined in patients with mumps or choledochal cyst when they had vomiting or abdominal pain, elevated serum lipase level and evidence of pancreatic inflammation from ultrasonography or CT. Cases were deemed as idiopathic when identifiable causes had been excluded based on the following results: no growth of virus and bacteria, negative findings of serology, normal serum level of cholesterol and triglycerides, and no definite anatomic anomalies. Conservative management included bowel rest, nasogastric decompression, and intravenous fluid administration. Total parenteral nutrition was used in the patients who needed an extended period of gastrointestinal rest. Morbidity included pseudocyst formation or relapse. Relapse was defined when the symptoms recurred after discharge and the diagnostic criteria were fulfilled again.

RESULTS

There were 61 patients with a mean age of 8.8 ¡ 4.8 years (39 males and 22 females; range, 2 to 18 years). All patients fulfilled the first criterion while only six patients had surgical or pathological proof. Blunt abdominal trauma resulted in acute pancreatitis in 28 patients: motor vehicle accident (N=13, 7 from motorcycle accidents), hit by car while walking (N=2), punched (N=4), kicked (N=3), hit by bike handle bars (N=2), and incidental (N=4). Nine patients revealed underlying diseases, including mumps (N=7), nephrotic syndrome (N=1) and bacteremia post-appendectomy (N=1). Four patients had received drug therapy or ingested a toxin, including chemotherapy for lymphoma (N=1), Depakine® (sodium valproate) therapy for seizure disorder (N=2), and L-asparaginase for leukemia (N=1). Congenital pancreaticobiliary-tree anomalies were found in seven patients, including six choledochal cysts (Fig. 1) and one true pancreatic cyst. Ascaris infection was found in one case. The causes of 12 cases remained idiopathic (Table 1).

The pain was described as generalized (N=2), epigastric (N=54), or in the right upper quadrant (N=2). Only one patient presented with pain radiating to the back. Three patients presented with vomiting but reported no abdominal pain (Table 2). Jaundice was found in two patients (3.2%), both of whom were subsequently confirmed to have choledochal cysts.

Hyperamylasemia (>390 U/L) was demonstrated in 83.6% of the patients, including those diagnosed with mumps (N=7), trauma (N=19, including 6 pseudocysts), choledochal cysts (N=6), nephrotic syndrome (N=1), leukemia (N=1), Ascaris infection (N=1), on-going chemotherapy for lymphoma

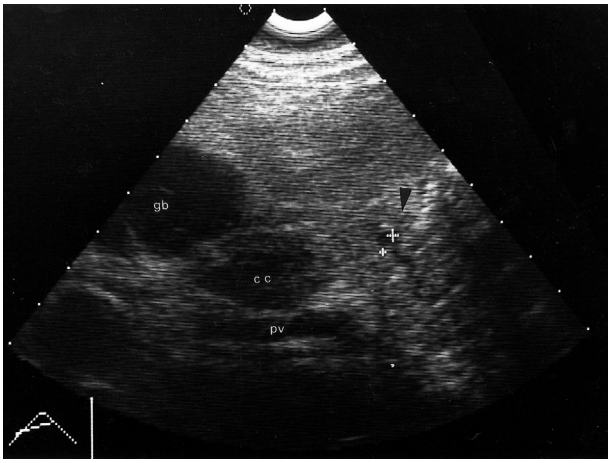

Fig. 1 Abdominal ultrasonogram revealing diffuse enlargement of the pancreas (arrowhead) with a slightly dilated main pancreatic duct (+). Choledochal cyst (cc), transverse portion of portal vein (pv), and gallbladder (gb) were also visualized in this image.

(N=1), Depakine® therapy (N=1), recovering post-appendectomy (N=1), toxin ingestion (N=1), and idiopathic (N=12). Elevated serum lipase levels were noted in 27 patients (90.0%), and 28 (80.0%) showed elevated ACCR levels (Table 3). Seventeen (62.9%) revealed abnormal findings on plain abdominal films, which included five with dilations from small intestinal-gas pockets and 12 with mass effects in their upper abdomens (Table 3). Palpable abdominal masses were noted in 15 patients including 12 pseudocysts, one true cyst, and two choledochal cysts. All patients with masses underwent ultrasonographic examinations, which confirmed the diagnoses.

Twenty-three patients needed total parenteral nutrition, including 16 who did not undergo operations. Fifteen patients underwent surgical intervention, including seven with post-traumatic injuries, six with choledochal cysts, one with a true cyst, and one

Table 1. Etiology and Basic Information for 61Pediatric Patients with Pancreatitis

Etiology	No. of patients (%)	Average age in years (range)	M : F	Hospital stay in median days (range)
Physical trauma	28 (45.9)	9.7 (2-18)	19: 9	13.4 (2-39)
Systemic disease	9 (14.7)	6.5 (2-18)	8: 1	8.8 (3-22)
Structural anomalies	7 (11.4)	6.2 (2-14)	4: 3	8.4 (5-12)
Toxins or drugs	4 (6.6)	7.9 (4-14)	0: 4	7.6 (3-12)
Ascaris infection	1 (1.6)	10.0 (10-10)	0: 1	7.0 (7- 7)
Idiopathic	12 (19.7)	10.5 (6-16)	8: 4	7.6 (3-33)
Total	61 (100)	8.8 (2-18)	39:22	10.5 (2-39)

Abbreviations: M: male; F: female

Table 2. Signs and Symptoms in 61 Pediatric Patients with Pancreatitis

Signs and symptoms	N (%)
Pain	58 (95.0)
Vomiting	23 (37.7)
Fever	18 (29.5)
Mass	2 (3.2)
Jaundice	2 (3.2)

Table 3. Laboratory Data, Imaging Findings and Treatment for Pediatric Patients with Pancreatitis

Findings	N (%)
Amylase > 390 U/L	51/61 (83.6)
Lipase > 190 U/L	27/30 (90.0)
ACCR > 6%	28/35 (80.0)
Abnormal ultrasound	40/51 (78.4)
Abnormal CT	21/21 (100)
Abnormal plain abdomen	17/27 (62.9)
Operation	15/61 (24.5)

Abbreviations: ACCR: amylase to creatinine clearance ratio; CT: computed tomogram

post-appendectomy with intestinal ischemic changes. Surgical procedures included debridement and drainage for two patients presenting with acute abdominal pain and internal bleeding. Cystogastrostomy was performed for three patients, including two with pancreatic pseudocysts (PPC) and one with true pancreatic cyst. External PPC drainage was performed for three patients and pancreatectomy for one. Relapse was noted in nine patients. The average interval for a recurrence was 3.9 ¡ 3.2 months, ranging from 12 days to 11 months. One leukemic patient developed necrotizing pancreatitis after 3 days of chemotherapy (L-asparaginase), with the diagnosis established based on hyperamylasemia (1,618 U/L) and typical findings on ultrasonogram and CT (Fig. 2). Despite treatment with 20 μg/Kg/day octreotide, continuous intravenous drip for 30 hours, shock along with persistent severe abdominal pain resulted in death of the patient. All the remaining patients did well during a minimum of six months of follow-up.

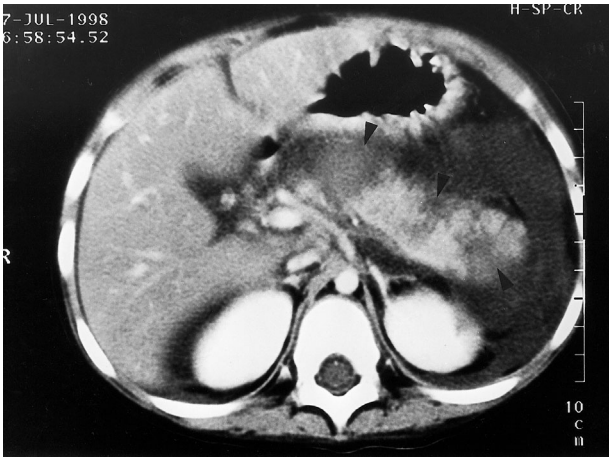

Fig. 2 Abdominal computed tomography of a leukemic patient with L-asparaginase-induced pancreatitis revealing diffuse enlargement of the pancreas with multiple lower density areas (arrowheads), which was presumed to be related to necrosis.

DISCUSSION

Pancreatitis is not uncommon in adults and was once considered rare in the pediatric patients.[4] There have been more than four new cases per year at our hospital, a prevalence rate in line with other recent reviews, which suggest that the disorder is not as rare as previously assumed.[1,3] According to the report by Tomomasa and Tabata in 1994, abnormal pancreaticobiliary ductal junction was the most common cause pancreatitis in Japan.[2] In contrast, in this study, pancreatitis was most commonly caused by physical trauma (46%). This rate was higher than that (15-38%) reported by other investigators.[2-8] It was also higher than the 37% reported by Yeung et al. in a study performed in Northern Taiwan.[3] In our study, physical traumas, especially those due to motorcycle accidents, were the most common cause of this disorder. This may be because motorcycles are commonly used for transportation in southern Taiwan.

Serum amylase levels were determined for all patients and hyperamylasemia was discovered in 51 patients (83.6%). This relatively low sensitivity, compared with other reports, may be due to delayed blood sampling, as some cases were referred from other hospitals days after onset of symptoms.[9,10] Serum lipase was measured in 30 patients and 27 (90.0%) had elevated levels (>190 U/L). This was comparable to findings from other studies, with sensitivity and specificity ranging from 86.5% to 100%.[9,10] The ACCR was initially advocated as a specific and useful diagnostic test for pancreatitis, however, a sensitivity of only 80.0% was demonstrated in our study, which was lower than the results of the amylase and lipase tests.

An abdominal ultrasound examination is a useful tool for the confirmation of laboratory diagnosed pancreatitis.[3,11] It is also helpful in monitoring patients because the equipment is portable and convenient to use. Its efficacy in diagnosing pancreatitis has been reported between 62% and 92%.[7,9] In our study, the sensitivity of ultrasound in detecting pancreatitis was 78.4%. As to contrast-enhanced CT, Clavien and Hauser (1998) reported a sensitivity and specificity of 92% and 100%, respectively.[8] In our study, CT scans were performed in 21 patients, showing evidence of pancreatitis in all of them, including 11 patients who had negative results on ultrasound examinations. Thus, we suggested that CT should be required for the diagnosis of pancreatitis in clinically suggestive patients, when abdominal ultrasound results are not clear.

There is no disease-specific treatment for pan-

creatitis.[3,5,12] Supportive therapy remains the basis of management. Generally, the most appropriate treatment depends on the condition of the patient, severity of the disease, and resultant complications. Antibiotic therapy should be considered for patients when there is a strong suggestion of secondary infection.[13] All efforts should be exerted to treat the patient medically and to avoid surgery. Surgical intervention during the acute phase of pancreatitis is limited to cases whose diagnoses are uncertain.[14] Surgical procedures for late-onset complications include drainage of pseudocysts and debridement or pancreatic resection for pancreatic abscesses or non-healing fistulae.[14] The size of the pseudocysts generally did not correlate with the time of disappearance ($r = -0.175$, $p = 0.586$).[15] For a limited number of cases with acute cysts failing to respond to conservative therapy and early external drainage, surgery is required to control the disease. Six of our cases underwent surgery because of clinical deterioration or progressive enlargement of PPC after supportive treatment.[15] Although internal drainage procedures are contraindicated during the acute stage when the cystic capsule is immature,[16] this kind of intervention is very important in an effort to prevent further PPC complications, and to reduce risk of death. All of our patients recovered completely after curing the underlying causes.

Reported mortality rates for pediatric pancreatitis ranged from 0 to 27%[1,3,4,6-8,17] including 27% by Buntain in 1978,[17] 21% by Weizman in 1988,[6] and 2.3% by Yeung in northern Taiwan.[3] In the present study, the only death (1.6%) occurred in a leukemic patient who had undergone chemotherapy (L-asparaginase). Pancreatitis induced by L-asparaginase was an uncommon, but potentially lethal complication.[18] It was reported that pancreatitis occurred in 2 to 18% of children receiving L-asparaginase.[19,20] The development of pancreatitis usually occurred within a median of 15 days after L-asparaginase administration.[19,20] The patient who died from necrotizing pancreatitis, a rare fulminant disease presenting with severe abdominal pain after 3 days of L-asparaginase treatment.[14] Octreotide has been reported efficacious for the treatment of acute pancreatitis,[21] following L-asparaginase treatment. However, this patient failed to respond to this treatment.

In conclusion, it seems that pancreatitis is more common in children than previously considered. Diagnosis is difficult and should be considered for any acutely ill patient with unexplained abdominal symptoms. Traumas, especially those from motorcycle accidents, were the leading cause of this disorder in southern Taiwan. The mortality rate was low and only one leukemic patient who had received L-asparaginase treatment died of the disease during this 14-year study.

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兒童胰臟炎：南臺灣61例臨床分析

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背 景： 本研究的目的，是分析本院在南臺灣，兒童胰臟炎的臨床症狀、原因、診斷及治療情形。

方 法： 經由本院1986年7月到2000年6月間病歷資料統計，收集了61例兒童胰臟炎，年齡由2歲到18歲(平均8.8 ±4.8歲)。

結 果： 二十八例是由於身體的撞傷所造成，其中車禍有13例 (53.8%是由於機車車禍所造成)。其他造成原因包括，本身疾病所引起的有9例，胰臟膽道異常的有7例，毒素或藥物引起的有4例，蛔蟲感染引起的有1例，不明原因的有12例。58例有腹痛情形，23例有嘔吐，18例有發燒，2例有黃膽。51例有高血清澱粉脢 (83.6%)。在30例檢驗血脂肪脢當中，有27例 (90.0%) 大於190 U/L；在35例檢驗澱粉脢對肌氨酸清除比值當中，有28例 (80.0%)大於6%。51例接受超音波掃描，其中40例顯示有胰臟發炎；21例接受電腦斷層掃描，均有胰臟發炎現象。46例採用保守治療，而15例須開刀治療。復發的病例有9例；另外1例白血病病人在施打天門冬素酵素 (L-asparaginase) 三天後，因爲急性壞死性胰臟炎而死亡，其他病人在長期追蹤中均存活。

結 論： 兒童胰臟炎比一般相信的還常見。身體的撞傷，尤其是機車車禍，在南臺灣是造成兒童胰臟炎最常見的原因。除了1例因使用天門冬素酵素進行化學治療引起胰臟炎而死亡之外，一般而言死亡率很低。

(長庚醫誌 2002;25:162-8)

關鍵字： 胰臟炎，兒童，腹痛，天門冬素酵素。

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