DOI: 10.4274/tpa.46.09

Pancreatitis in childhood: clinical analysis of 20 cases

Gönül Dinler Çaltepe, Özlem Kırmemiş, Ayhan Gazi Kalaycı

Ondokuz Mayıs University Medical Faculty, Fellow at the Division of Pediatric Gastroenterology, Samsun, Turkey

Summary

Aim: Pancreatitis rarely occurs in childhood and the underlying causes differ between children and adults. The aim of this study is to evaluate the documentation of characteristics of our cases diagnosed with pancreatitis.

Material and Method: Data of the cases who were diagnosed with pancreatitis in our clinic during a 5-year period were analyzed retrospectively considering clinical and laboratory findings, underlying risk factors and outcome of the illness. Data were analysed with SPSS 16.0 computer programmee.

Results: Of the 20 patients (19 acute, one chronic pancreatitis) 14 were female and 6 were male. The mean age was 11.4±3.62 (2-18) years. The most common risk factors were systemic diseases (15%), drugs (15%), biliary diseases (15%) and trauma (10%). Nine of the cases (45%) were idiopathic. One patient with chronic pancreatitis was diagnosed with cystic fibrosis which was ongoing with relapsing episodes. Two patients had acute recurrent pancreatitis (in one patient the etiologic factor was mumps infection and in the other patient the etiologic factor was unknown). Twenty-two episodes were evaluated in 19 patients with acute pancreatitis. Serum amylase and lipase levels were elevated in 81.8% and 90.9% of patients, respectively. Pseudocysts (10%), venous thrombosis (10%) and necrotizing pancreatitis (5%) were the major complications. None of the patients died during the acute episodes and follow-up period.

Conclusions: Systemic illnesses, drugs, biliary diseases and trauma are the major risk factors for pancreatitis in childhood. Although the mortality rate is low in children, the patients should be monitored closely in terms of complications such as pseudocyst and venous thrombosis, especially in severe cases. *(Turk Arch Ped 2011; 46: 48-53)*

Key words: Pancreatitis, necrotizing pancreatitis, childhood, valproic acid, L-asparaginase, pseudocyst, venous thrombosis

Introduction

Acute pancreatitis is acute inflammation of the pancreas defined by severe abdominal pain with sudden onset and increase in pancreatic digestive enzymes. For diagnosis, at least two of these three criteria should be present: 1) severe abdominal pain with sudden onset (nausea and vomiting may accompany), 2) increase in pancreatic enzymes at least 3 fold of the upper limit of normal, 3) pancreatic imaging findings including increase in dimensions of the pancreas, decrease in pancreatic echogenicity and peripancreatic fluid accumulation (1).

Although acute pancreatitis which occurs frequently in the presence of alcohol consumption and gallbladder stone in adults is not seen very frequently in the childhood, an increase in its incidence in children has been reported in the last decade. Improvement of conditions of care and treatment in chronic diseases and increase in survival time have been noted as causes of this increase in the incidence. In contrast to adults, trauma, structural anomalies, drugs and chronic systemic diseases are the leading causes in children (2-5).

Although different factors lead to acute pancreatitis, the event consists of activation of digestive enzymes before exiting the pancreas which causes tissue demage. The first pathology observed is edema. Afterwards, inflammation develops and may lead to necrosis. Damage to the pancreas determines the risk of death.

Address for Correspondence: Gönül Dinler Çaltepe MD, Ondokuz Mayıs University Medical Faculty, Fellow at the Division of Pediatric Gastroenterology, Samsun, Turkey E-posta: dinlerg@gmail.com **Received:** 22.06.2010 **Accepted:** 31.08.2010

The risk of death is lower than 5% in mild pancreatitis, 25% in severe damage and may increase to 50%, if inflammation spreads to surrounding tissues (6). Multiple organ failure is considered to be responsible for the deaths occuring during the first few days and infection of the necrotic pancreatic tissue is considered to be responsible for the deaths occuring after the first week (6). Acute pancreatitis usually has a mild prognosis in children, frequently has an edematous characteristic and improves completely by limiting itself. However, each acute exacerbation may lead to development of chronic pancreatitis by causing persistant and progressive morphologic damages especially if underlying diseases including cystic fibrosis and hereditary pancreatitis are present or may have a lethal prognosis in the presence of diseases including diabetes, hyperlipidemia and vasculitis (1,2).

The aim of this study is to discuss age and gender distribution, risk factors, diagnostic and therapeutic methods and the course of pancreatitis in the light of recent literature by examining files of patients followed up with a diagnosis of pancreatitis in the last 5 years in our clinic.

Material and Method

The files of the patients followed up with a diagnosis of pancreatitis between 2005 and 2010 in Ondokuz Mayıs University Medical Faculty Department of Pediatrics were examined. The diagnosis of acute pancreatitis was made with complaints specific for the disease including sudden severe abdominal pain and vomiting, increase of serum amylase or lipase levels at least 3 fold of the upper limit of normal (amylase>300 U/L, normal; 28-100 U/L, lipase>180 U/L, normal; 13-60 U/L) and/or morphologic changes in the pancreas demonstrated by imaging methods. Recurrent acute pancreatitis was defined as two or more episodes of acute pancreatitis and chronic pancreatitis was defined as persistent damage, stricture and pancreatic failure resulting from recurrent episodes. Patients with an age of 0-18 years at the time of diagnosis were included in the study.

Patients were investigated in terms of age, gender, complaints at presentation, accompanying diseases, history of drug use and history of trauma. Results of complete blood count, blood amylase, lipase, triglyceride, cholesterol, calcium and electrolyte levels, viral serologic test results, findings of abdominal ultrasonography (USG) and computarized tomography (CT) and results of endoscopic retrograde cholangiography (ERCP) and magnetic resonance cholangiography (MRCP) were interrogated by examining file information and hospital information record system (Nükleus). Patients were evaluated in terms of treatment and follow-up approaches, etiologic factors, development of complications and prognosis of the disease. Patients were considered to be idiopathic cases, when no risk factor could be found for pancreatitis.

Data obtained were entered into the computer in SPSS 16,0 package program and evaluated. When evaluating the data, continious variables were expressed as mean±standard deviation (SD) and frequency data were expressed as percent (%).

Results

Mean age of 20 patients with a diagnosis of pancreatitis was 11.4±3.6 years (2-18). 14 patients were female (70%) and 6 patients were male (30%). Two patients were younger than 2 years (Figure 1). A patient who was followed up with a diagnosis of chronic pancreatitis presented with acute exacerbation for 6 times. When this patient who was followed up for cystic fibrosis and chronic pancreatitis was excluded, 22 acute pancreatitis episodes were determined for 19 patients. Demographic and clinical properties of the patients are summarized in Table 1.

Abdominal pain was the common complaint at presentation for all patients. In three patients, pain referring to the shoulder was also prominent. In 12 patients (60%), vomiting was also present in addition to abdominal pain (Table 1).

In 9 patients (45%), no etiologic factor could be found by laboratory tests and imaging methods and they were considered to be idiopathic cases. In three patients, systemic diseases including cystic fibrosis, metabolic syndrome and Henoch-Scönlein purpura (HSP) were defined. In two patients, multiple etiologic factors were present. In a 17-year-old female patient who presented with sudden abdominal pain and vomiting and whose imaging findings supported acute pancreatitis, obesity, hypertriglyceridemia and type II diabetes mellitus (DM) were found and metabolic syndrome was diagnosed. It was informed that this patient had been using oral steroid for five days for acute urticaria. In three patients including this patient, history of drug use (steroid, valproic acid, L-asparaginase) was present. A patient who was using valproic acid for epilepsy had been kicked on the abdomen by a friend three days ago. The other patient who had a history of drug use had been diagnosed with acute lymphoblastic leukemia (ALL)

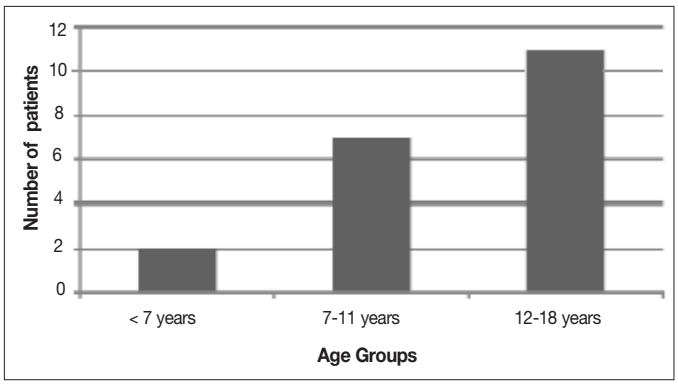

Figure 1. Distribution of the patients by age groups

and his complaints began a few days after L-asparaginase was started. Risk factors specific for pancreatitis found in the patients are shown in Table 2.

In two patients, episode of acute pancreatitis recurred. In one of these patients, no risk factor could be found by investigations performed including MRCP. In the other patient, mumps IgM antibody was found to be positive in both episodes which occured with an interval of 5 months without any sign of parotiditis.

When 22 episodes of acute pancreatitis were evaluated, high serum amylase level was found in 18 (81.8%) and high lipase level was found in 20 (90.9%). Mean amylase level was found to be 1207 and mean lipase level was found to be 1479 U/L. The highest values were 3122 and 5359 U/L, respectively (Table 3). Mean amylase and lipase levels decreased rapidly in three days and returned to nearly normal levels in approximately one week (Figure 2).

USG was performed in all patients at the time of diagnosis. In 11 patients, abdominal CT was also performed because the pancreas could not be evaluated sufficiently or clinical improvement was not observed. In 7 patients (35%), pancreatic imaging findings were normal. The most commonly observed pathologic findings were collection of free fluid in the peritoneum, heterogeneity in the pancreatic parenchyma, increase of dimensions of the pancreas and peripancreatic fluid collection.

In a total of four patients, complications including pseudocyst and venous thrombosis in two patients, necrosis in the pancreas and splenic infarction in one of these patients, pleural effusion in one patient and splenic infarction in one patient developed (Table 1). One of the patients in whom pseudocyst was found was the patient who developed necrotizing pancreatitis after L-asparaginase administration during ALL treatment protocol. The pancreas could not be evaluated on USG completely in the patient who was investigated because of inability to feed orally, abdominal pain and vomiting. On CT performed simultaneously, increase in dimensions of the pancreas, hypodens necrotic areas reaching a diameter of 1 cm in the parenchyma and thrombus in the portal vein were observed. On control CT performed on the 10th day, thrombus was observed to be disappeared and a cystic structure with dimensions of 8x7x10 cm in the pancreatic body and tail was observed. The patient's complaints diminished, but percutaneous cyst drainage was performed and a drainage catether was placed on the 20th day, because the dimensions of the cyst persisted. On follow-up, dimensions of the cyst did not change and surgical cystogastrostomia was performed in the fifth month. Afterwards no episode of pancreatitis was observed and control CT was found to be normal.

The other patient in whom pseudocyst was found had a history of use of valproic acid and abdominal trauma. On ultrasonography, increase in dimensions of the pan-

Table 1. Demographic and clinical properties of the patients

	Patients (n=20)	%
Age (Mean±SD) years	11.4±3.6 (2-18)	
Gender (F/M)	14/6	70/30
Complaint		
Abdominal pain	20	100
Vomiting	12	60
Pain referring to the shoulder	3	
Fever	1	
Diarrhea	1	
Physical examination findings	9	
Widespread tenderness in the abdomen	5	
Epigastric tenderness	4	
Normal	2	
Tenderness in the right upper quadrant		
Complication		
Pseudocyst	2	
Venous thrombus	2	
Splenic infarction	2	
Pancreatic necrosis	1	
Pleural effusion	1	
Follow-up		
Complete improvement	19	95
Chronic pancreatitis	1	

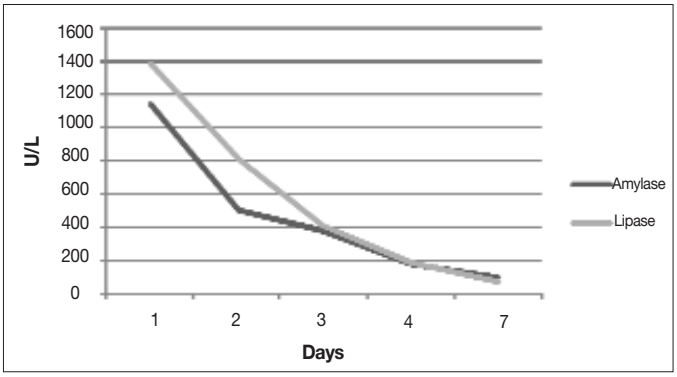

Figure 2. Mean values of amylase and lipase by days

Table 2. Underlying risk factors in the patients*

Etiologic factors	n	Etiologic factors	n
Systemic diseases	3	Trauma	2
Cystic fibrosis	1	Fall from bicycle	1
Metabolic syndrome	1	Kick in the abdomen	1
**HSP	1	Viral infection	1
Drug	3	Mumps	1
L-Asparaginase	1	Other	1
Valproic acid	1	Ascaris	1
Steroid	1	Idiopathic	9
Biliary diseases	3		
Gallbladder stone	3		

*Multiple risk factors were found in two patients
**Henoch-Schönlein Purpura

creas, heterogeneous appearance and peripancreatic fluid collection which supported acute pancreatitis were found and accompanying superior mesenteric vein thrombus was found on CT performed on the same day. In addition, homozygote factor V Leiden mutation was found in this patient and it was found that a pseudocyst with dimensions of 3.5x5.5x5 cm developed in the pancreatic body and tail and the thrombus was found to be disappeared on CT performed 10 days later. Control USG was found to be normal.

When 22 acute episodes were evaluated in terms of treatment, it was seen that the common approach in all patients consisted of follow-up by hospitalization, stopping of oral feeding and intravenous fluid administration. All patients were started acid suprresor treatment and nasogastric decompression was performed in patients with predominant vomiting. A somatostatin analog was used in one patient, a narcotic analgesic (meperidine) was used in three patients and enoxaparin was used in two patients because of venous thrombosis. Mean time of interruption of oral feeding was 7.1+12.1 (2-56) days (median 3 days) and total parenteral nutrition (TPN) was started in three patients. In 10 patients (45.4%), antibiotics were used (meropenem in 6 patients and sulbactam-ampicillin in 4 patients). Main reasons for starting antibiotic were increase in acute phase response, deterioration in general status and accompanying fever.

Endoscopic retrograde cholangiography (ERCP) was performed in two patients because of biliary stone. Cholecystectomy had been performed in one of these patients before and biliary stone had recurred. Stone extraction with balloon catather was performed in this patient. The other patient had stones also in the gallbladder. Biliary stone could not be visualized with ERCP. Papilla of Vater was dilated with balloon. Signs of pancreatitis improved and laparoscopic cholecystectomia was performed.

In follow-up, clinical, laboratory and imaging findings improved completely in 17 (including the patient with necrotizing pancreatitis) of 20 patients. Two patients had no complaints on discharge, but no information about their current status could be obtained, since they did not come back for follow-up visits. Stent was placed in the pancreas of the patient who had cystic fibrosis and chronic pancreatitis in another center. This patient who is also using pancreatic enzymes is being followed up with intermittent episodes of pancreatitis. None of the patients died.

Table 3. Mean values of some biochemical measurements in the patients

	Mean±SD	The lowest- The highest
Hemoglobin (g/dL)	11.9±1.7	9-13
White blood cells (/mm^3)	12650±7000	2500-31000
Amylase (U/L)	1207.4±991.4	146-3122
Lipase (U/L)	1479.4±1388.7	141-5359
AST (U/L)	85.1±202.8	5-902
LDH (U/L)	585.9±280.7	292-1047
Triglyceride (mg/dL)	228.9±523.1	48-2180
Albumin (g/dL)	3.7±0.9	1.1-5
CRP (mg/L)	75.1±80.7	1-216

AST: Aspartate aminotransferase
LDH: Lactic dehidrogenease
CRP: C- reactive protein

Discussion

Episodes of pancreatitis are seen also in children though not as frequently as in adults and pediatric cases have been reported to be increased especially in recent years (4,5). Although it is known that acute pancreatitis has a better prognosis and lower mortality rate compared to adults, morbidity and mortality varies according to the underlying systemic disease (6-8). While 80% of the etiology consists of chronic alcoholism and gallbladder stone in adult cases, trauma, drugs, systemic diseases and viral infections are the leading causes in children (2-9). In the study performed by Teung et al.(10) investigating 43 patients with an age range of 2-18 years, trauma was the leading cause with a rate of 37% and systemic disease was the second leading cause with a rate of 23%. In a seven-year retrospective study performed by Weizman and Durie (8), 61 patiens with an age range of 1-18.5 years were defined and 35% of the patients were reported to have multiple system disease and trauma was reported to be the cause in 15% of the patients. Rate of idiopathic cases vary between 8% and 35% in different series (2-8). In a large case study performed by Lopez et al. (4) including 274 children, only 9% of the cases younger than 5 years old were idiopathic, none of the cases younger than 3 years old was idiopathic and intensive etiologic investigation was recommended in children younger than 4 years old presenting with an episode of pancreatitis. In our study, systemic diseases, drug and biliary diseases were seen with an equal rate of 15% and idiopathic cases formed the largest group with a rate of 45%. There was only one case younger than 5 years old and its etiology was unknown. In 9 cases the etiology could not be determined and multiple risk factors were found in two patients. The fact that history of abdominal trauma was present in the patient who was using valproic acid because of epilepsy and the fact that the patient with metabolic syndrome and hypertrigyceridemia had been using oral steroid for the last 5 days suggested that multiple risk factors play a facilitating role in acute pancreatitis which occurs rarely in children. Use of drugs is one of the important causes of acute pancreatitis and drugs including L-asparaginase, valproic acid and steroids which were also found in our patients are the leading drugs (11,12). Although acute pancreatitis in children is

known to be mostly edematous and mortality rate is known to be low, acute hemorrhagic pancreatitis related to valproic acid with a fatal prognosis has been reported (13). Therefore, history of drug use should be investigated in detail in patients with acute pancreatitis. One should be careful in terms of development of acute pancreatitis during administration of valproic acid especially in children younger than three years old and during administration of L-asparaginase in the treatment of ALL. Acute pancreatitis may proceed with recurrent episodes or chronic pancreatitis may develop at the end of episodes. In two of our patients, recurrence was observed with two and three episodes and these patients improved completely. In another patient, a diagnosis of cystic fibrosis was made with growth retardation and positive sweat chloride test along with chronic pancreatic imaging findings and recurrent episodes. A heterozygote gene mutation Del508 was found to be positive in this patient. In cystic fibrosis which progresses mostly with growth retardation, recurrent lung infection and pancreatic failure, chronic pancreatitis can be a clinical finding with a rate of 1-2% (14). In this group of patients who do not demonstrate pancreatic failure clinically and who have a milder prognosis with 4 and 5th class mutations or carrying "compound heterozygote" Del508 mutations, sweat chloride test may also be normal (14-16). In our patient, the second mutation was not found as well and "compound heterozygote" mutation was considered.

In all patients with acute pancreatitis, sudden abdominal pain is present and vomiting accompanies with a rate of 70-96% in different series. Although pain is mostly localized epigastrically and in the right upper quadrant, it may be widespread and may reflect to the back with a lower rate (3,8,10). While severe abdominal pain was present in all of our patients, vomiting was observed with a lower rate (60%). On physical examination, widespread abdominal tenderness was found in 45% of the patients. This was followed by epigastric tenderness and tenderness in the right upper quadrant. In four patients abdominal examination findings were normal.

In the diagnosis of acute pancreatitis, increase in pancreatic enyzmes is important along with typical abdominal pain. The diagnostic value of amylase is high especially in the first 24 hours during which complaints occur. Amylase level reduces in 2-5 days. After 24 hours, the diagnostic value of amylase decreases. Lipase maintains a high level for a longer time and it is found to be more reliable in the diagnosis of acute pancreatitis (1). However, severity of the disease and clinical prognosis can not be interpreted according to the high levels of these two enzymes (1,17). In two studies performed in children, high levels of amylase and lipase were found with a rate of 82-83% and 85-88%, respectively (3,10). In our study, amylase was found to be high with a rate of 82% and lipase was found to be high with a rate of 91%. Mean amylase and lipase levels reached the highest values in the first 24 hours, decreased approximately by half in the second day and decreased to near normal values at the end of one week.

In the diagnosis of pancreatitis, USG is used frequently, since it is convenient, inexpensive and noninvasive. The most important findings supporting the diagnosis are increase in the pancreatic dimensions and decrease in the echogenicity of the pancreas. When the fact that ultrasonographical findings may be normal is considered, the sensitivity of USG in the diagnosis of acute pancreatitis varies between 62% and 95% (8,10,17). In acute pancreatitis, CT is rather sensitive especially in terms of determining necrosis and visualizing the spread of necrosis. Its sensitivity is 92% and specificity is 100%. In cases in whom enzyme increase is non-diagnostic and the pancreas can not be fully visualized with USG, CT is recommended, but in cases with mild prognosis, CT is not necessary (10,17). Peripancreatic fluid collection, inflammation and pancreatic necrosis observed on CT were found to be related to the severity of the disease and the mortality rate in patients with these findings was reported to be high (18). In all of our patients, USG was performed on the first day and ultrasonographic findings were found to be normal in seven patients and increase in the dimensions of the pancreas and decrease in echogenicity or heterogeneous appearance were found in seven patients. In 11 patients, CT was performed, since clinical status did not improve or the pancreas could not be visualized completely and in addition to similar findings observed on USG, venous thrombosis which was not observed on USG was found in two patients. In a study performed by Mortele et al.(19) who evaluated CT's of 100 adult patients with pancreatitis retrospectively, vascular anomalies including splenic vein thrombosis, superior mesenteric vein thrombosis and portal vein thrombosis (PVT) were noted to accompany acute pancreatitis not uncommonly. Peripancreatic venous thrombi can occur by stasis, spasm and direct mass effect of the inflammated pancreas which develop during an episode of pancreatitis and direct intimal damage via pancreatic enzymes released from the venous wall (19,20). It has been reported that splenic vein thrombosis and mesenteric vein thrombosis are complications developing in cases with severe pancreatitis, but PVT can be observed even in cases with moderate severity and it has been recommended that physicians should be careful about this subject (19). When evaluated according to criteria of severity noted by DeBanto et al (7) (death, need for surgical intervention, pseudocyst, formation of abcess or infected necrosis and findings of organ dysfunction), necrotizing pancreatitis and pseudocyst were present in patients who developed venous thrombosis and there were patients with criteria of severe pancreatitis in our study. This suggested that CT or magnetic resonance imaging (MR) (especially in children because it does not have radiation load) should be used in addition to USG to follow up complications closely in cases with severe progression.

ERCP which is mostly used in adults is being performed also in children currently in an increasing number of centers (21,22). It is used both for diagnosis and for treatment in acute pancreatits with biliary etiology and for diagnosis in recurring pancreatitis (23).

In the treatment of acute pancreatitis, intravenous fluid supply, nutritional supply and pain control are essential. Antibiotics are not used in edematous pancreatitis. Although antibiotics are mainly used in infected necrotizing pancreatitis, prophylactic antibiotic use in necrotizing pancreatitis is becoming a current issue considering that necrotic pancreatic tissue is infected more easily and development of infection increases mortality moreover (1,24). While selecting antibiotics, bacterial flora in the surrounding tissue and the drug's properties related to penetrance into the pancreatic tissue are considered. In this regard, third generation cephalosporins, piperacillin, quinolones, imipenem and metronidazole are the prefered antibiotics (25). All studies about antibiotic usage and selection were conducted in adults. There are no studies conducted in children on this subject. Although there was only one case with necrotizing pancreatitis among our patients, antibiotics were used in nearly half of the patients. Although this suggested that antibiotics were used unnecessarily in some cases, more studies and accumulation of information are needed in children.

Consequently, acute pancreatitis should be absolutely considered in children who present with severe abdominal pain, have underlying systemic disease and a history of drug use including valproic acid and steroids or a history of blunt abdominal trauma and the diagnosis should be supported by pancreatic enzyme measurements and USG. In cases with severe clinical status and/or in whom the pancreas can not be visualized well, close follow-up with CT or MRI in terms of complications is important.

Conflict of interest: None declared

References

1. Banks PA, Freeman ML, Practice Parameters Committee of the American College of Gastroenterology. Practice guidelines in acute pancreatitis. Am J Gastroenterol 2006; 101: 2379-400. (Full Text)
2. Whitcomb DC, Lowe ME. Pancreatitis: acute and chronic. In: Walker WA, Goulet OJ, Kleinman RE, Sanderson IR, Sherman PM, Shneider BL, (eds). Pediatric Gastrointestinal Disease. Fourth edition. Ontario: BC Decker Inc, 2004: 1584-97.
3. Werlin SL, Kugathasan S, Frautschy BC. Pancreatitis in children. J Pediatr Gastroenterol Nutr 2003; 37: 591-5. (Abstract) / (Full Text) / (PDF)
4. Lopez MJ. The changing incidence of acute pancreatitis in children: a single-institution perspective. J Pediatr 2002; 140: 622-4. (Abstract) / (Full Text) / (PDF)
5. Durmaz Süoğlu Ö. Çocukluk çağı pankreatitleri. Türkiye Klinikleri J Pediatr Sci 2007; 3: 32-41.
6. Gravante G, Garcea G, Ong SL, et al. Prediction of mortality in acute pancreatitis: a systematic review of the published evidence. Pancreatology 2009; 9: 601-14. (Abstract) / (PDF)
7. DeBanto JR, Goday PS, Pedroso MR, et al. Acute pancreatitis in children. Am J Gastroenterol 2002; 97: 1726-31. (Abstract)
8. Weizman Z, Durie PR. Acute pancreatitis in childhood. J Pediatr 1988; 113: 24-9.
9. Öztürk Y. Çocukluk çağında akut pankreatitler. Çocuk Sağlığı ve Hastalıkları Dergisi 2007; 50: 146-53. (Abstract)
10. Yeung CY, Lee HC, Huang FY, et al. Pancreatitis in children experience with 43 cases. Eur J Pediatr 1996; 155: 458-63. (Abstract) / (Full Text)
11. Trivedi CD, Pitchumoni CS. Drug-induced pancreatitis. J Clin Gastroenterol 2005; 39: 709-16. (Abstract) / (Full Text) / (PDF)
12. Guevara-Campos J, González-Guevara L, Vacaro-Bolívar I, Rojas JM. Acute pancreatitis associated to the use of valproic acid. Arq Neuropsiquiatr 2009; 67: 513-5. (PDF)
13. Mileusnic D, Donoghue ER, Lifschultz BD. Pathological case of the month: sudden death in a child as a result of pancreatitis during valproic acid therapy. Pediatr Pathol Mol Med 2002; 21: 477-84. (Abstract)
14. Gooding I, Bradley E, Puleston J, Gyi KM, Hodson M, Westaby D. Symptomatic pancreatitis in patients with cystic fibrosis. Am J Gastroenterol 2009; 104: 1519-23. (Abstract)
15. Salvatore F, Scudiero O, Castaldo G. Genotyp-phenotype correlation in cystic fibrosis: the role of modifier genes. Am J Med Genet 2002; 111: 88-95. (Abstract) / (Full Text) / (PDF)
16. Conklin L, Zeitlin PL, Cuffari C. Cystic fibrosis presenting as recurrent pancreatitis in a young child with a normal sweat test and pancreas divisum: a case report. J Med Case Reports 2008; 2: 176. (Full Text) / (PDF)
17. Agarwal N, Pitchumoni CS, Sivaprasad AV. Evaluating tests for acute pancreatitis. Am J Gastroenterol 1990; 85: 356-66. (Abstract)
18. Balthazar EJ, Robinson DL, Megibow AJ, Ranson JH. Acute pancreatitis: value of CT in establishing prognosis. Radiology 1990; 174: 331-6. (Abstract) / (PDF)
19. Mortelé KJ, Mergo PJ, Taylor HM, et al. Peripancreatic vascular abnormalities complicating acute pancreatitis: contrast-enhanced helical CT findings. Eur J Radiol 2004; 52; 67-72. (Abstract) / (Full Text) / (PDF)
20. El-Wahsh M. A case of portal vein thrombosis associated with acute cholecystitis/pancreatitis or coincidence. Hepatobiliary Pancreat Dis Int 2006; 5: 308-10. (Abstract)
21. Paris C, Bejjani J, Beaunoyer M, Ouimet A. Endoscopic retrograde cholangiopancreatography is useful and safe in children. J Pediatr Surg 2010; 45: 938-42. (Abstract) / (Full Text) / (PDF)
22. Issa H, Al-Haddad A, Al-Salem AH. Diagnostic and therapeutic ERCP in the pediatric age group. Pediatr Surg Int 2007; 23: 111-6. (Abstract)
23. Dever JB, Irani S, Brandabur J, Traverso LW, Kozarek RJ. Outcomes of interventional ERCP in hereditary pancreatitis. Clin Gastroenterol 2010; 44: 46-51. (Abstract) / (Full Text) / (PDF)
24. Slavin J, Neoptolemos JP. Antibiotic prophylaxis in severe acute pancreatitis–what are the facts? Langenbeck's Arch Surg 2001; 386: 155-9. (Abstract) / (PDF)
25. Powel JJ, Miles R, Siriwardena AK. Antibiotic prophylaxis in the initial management of severe acute pancreatitis. Br J Surg 1998; 85: 582-7. (Abstract) / (PDF)