Acute pancreatitis in pediatric age

Poster No.:	C-1542
Congress:	ECR 2019
Type:	Educational Exhibit
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Keywords:	Pancreas, Paediatric, Emergency, Ultrasound, CT, Complications, Diagnostic procedure, Pathology, Acute
DOI:	10.26044/ecr2019/C-1542

Learning objectives

After completing this article, readers should be able to:

1. Know the imaging differences between adults and children in acute pancreatitis and to identify the main radiological findings in acute pancreatitis in pediatric age.
2. Know the normal anatomy of the pancreas and the morphologic characteristics in pediatric age.
3. Explain the utility of different diagnostic procedures.
4. List common causes for acute pancreatitis in children.

Background

DEFINITION:

Acute pancreatitis is a sudden inflammation of the pancreas that leads to an enzyme activation within the pancreas and produces an auto-digestion of the gland and local inflammation.

EPIDEMIOLOGY:

The rise in incidence of pancreatitis in pediatric population is believed to be multifactorial. Some studies have linked it to the rising incidence of obesity among children others to an increase in emergency department visits and testing of serum amylase and lipase.

ETIOLOGY:

Elucidation of the etiology of acute pancreatitis should be continued after a diagnosis of acute pancreatitis. Blunt abdominal trauma (included abdominal trauma caused by child abuse), viral infection and drug toxicity are common causes of acute pancreatitis in children.

While alcohol and gallstones are the most common causes of acute pancreatitis in many adults (up to 60%), drugs, viral infections, blunt abdominal trauma (included abdominal trauma caused by child abuse), and anatomic anomalies such as choledochal cysts and in second place abnormal union of the pancreatobiliary junction are frequent causes of acute pancreatitis in children.

- **Congenital anomalies:** periampullary obstruction choledochal cyst, abnormal union of the pancreaticobiliary junction, gallstone, cholecystitis, pancreatic divisum, tumor, ascaris aberrant
- **Infectious:** mumps, measles, coxsackie, echo, lota, influenza, epstein-barr virus, Mycoplasma, salmonella, gram-negative bacteria
- **Drugs:** L-asparaginase, steroid, valproic acid, azathioprine, Mercaptopurine, mesalazine, Cytarabine, Salicylic acid, indomethacin, tetracycline, chlorothiazide, isoniazid, anticoagulant drug, borate, alcohol
- **Trauma:** blunt injury, child abuse, ERCR, After surgery
- **Systemic disease**: Reye syndrom, systemic lupus erythematosus, polyarteritis nodosa, Juvenile rheumatoid arthritis, sepsis, multiple organ

failure, Organ transplantation, hemolytic-uremic syndrome, henoch-schoenlein purpura, kawasaki disease, inflammatory bowel disease, chronic intestinal pseudo-obstruction, gastric ulcer, anorexia nervosa, food allergy, cystic fibrosis

- **Metabolic:** hyperlipoproteinemia (I, IV, V), hypercalcemia, diabetes, $\alpha 1$ antitrypsin deficiency
- **Nutrition**: malnutrition, high-calorie infusion, vitamin A and D deficiency
- Familial, idiopathic.

CLINICAL MANIFESTATIONS

Acute pancreatitis is a disease with a wide range of clinical features, from mild and self-limiting disease up to severe symptoms that can evolve up to multisystem organ failure and death. It is important to stablish a prompt diagnosis in order to start an appropriate early treatment. Pancreatitis is less common in children than in adults and it is more likely that it is acute instead of chronic. 2 out of 3 of these criteria must be present for its diagnosis:

1. Acute onset of abdominal pain and tenderness mainly in the upper abdomen.
2. Elevated levels of pancreatic enzymes in blood or urine 3 times upper limits of normal (blood lipase is recommended).
3. Diagnostic finding imaging associated with pancreatitis.

Abdominal pain can be radiated to epigastrium and to the back or to the upper right-left quadrant. It can also come along with nauseas and vomits. The presence of jaundice or an increase in aminotransferases suggests a bile ducts compromise.

Findings and procedure details

1.IMAGING FINDINGS

Imaging plays an important role in the management of selected cases of acute pancreatitis, complementing laboratory investigations or when only 1 out of 3 diagnostic criteria of pancreatitis is present.

These are the common imaging findings in patients with acute pancreatitis:

Plain chest X-ray: (These findings are not specific for acute pancreatitis but important for disease severity).

- pleural effusion
- ARDS (Acute respiratory distress syndrome)
- pneumonia

Plain abdominal X-ray: (These findings are necessary for a differential diagnosis and to exclude perforation)

- ileus
- colon cut-off sign
- sentinel loop sign
- calcified gallstones or pancreatic stones, or retroperitoneal gas

Ultrasonography: (best initial imaging study to diagnose and monitor children).

- Dilatation of the pancreatic duct (the most reliable diagnostic feature), Fig. 10 on page 16
- Biliary tree abnormalities.
- It is useful to determine the pancreatic size, the echogenicity of the parenchyma, and other extrapancreatic findings (peripancreatic fluid or localized fluid collections.)
- Gallstones.

Some differences should be taken into account between the pediatric

pancreas and the adult pancreas, in children we find that:

- The pancreas is larger than the adult pancreas.
- The pancreatic head tends to be more prominent than the body and tail.
- In newborns the pancreas is hyperechoic to the liver and in the neonatal period is isoechoic or slightly hyperechoic relative to the liver.

CT scanning after 72 hours: (useful when the diagnosis is uncertain, to assess severity and to detect necrosis. Used to calculate the Modified-CTSI Mortele Index Fig. 8 on page 14 and Fig. 9 on page 15. IV contrast material is mandatory unless there is a contraindication):

- Pancreatic hypodensities, enlargement, heterogeneity,…
- Inflammatory changes in the peripancreatic fat (thickening of the retroperitoneal fascial planes, mild stranding of the fat.)
- Homogeneous enhencement in mild cases, heterogeneous in advanced cases, and no enhancement in cases of necrotizing pancreatitis.
- Collections in the lesser sac and pararenal space.

Endoscopic Retrograde Cholangiopancreatography (ERCP): should be performed in pancreatitis of unknown cause.

2.CASE REPORT:

A 13-year-old boy who was admitted to the emergency room with **24 hour pain** in the upper right-left quadrant radiated to the back. There was no history of abdominal trauma. Afebrile. A physical examination upon admittance showed normal vital signs and tenderness in the epigastric area. Laboratory tests showed amylasemia of 3432 U/L and GOT 523 U/L, GPT 717 U/L and CRP< 0.4mg/dL.

The diagnosis of pancreatitis was made as 2 out of 3 diagnostic criteria are present: characteristic abdominal pain and elevated levels of pancreatic enzymes in blood urine at least 3 times upper limits of normal. Ultrasound is the first imaging technique to be used in acute pancreatic evaluation.

Abdominal ultrasound showed a gallbladder with tiny cholesterolomas adhered to the wall, microlithiasis, and biliary sludge in the infundibulum Fig. 1 on page 8, and indicated normal caliber of the intrahepatic and extrahepatic bile ducts. Pancreas not visible because of increased bowel gas secondary to aerophagia and ileus. Not localized fluid collections are visualized. Minimal amount of sub-splenic fluid Fig. 2 on page 8 .

A diagnosis of mild acute pancreatitis without systemic complications was made and supportive treatment of intravenous fluids, analgesics and a liquid diet was started.

After 48-72h, the boy developed signs of respiratory distress such as tachypnea (50 bpm), nose flaring, hipoxemia (oxigen saturation of 93% with an oxygen therapy of 3 LPM) and intercostal retractions. Oliguria, tachycardia and lower fever (37.5º) also appeared.

Due to the severity of his acute pancreatitis, a new blood test was performed: GPT 218, GGT 209, Amylase 2090 U/L, Lipase 2438 U/L and CPR 38,7 mg/dL, leukocytes 29×10^3/µL (90% neutrophils). In order to evaluate severity of acute pancreatitis and identify complications, a contrast-enhanced abdominal pelvic CT scan was then performed.

The **CT scan** showed homogeneous pancreatic enhancement Fig. 3 on page 9 with inflammatory changes in the peripancreatic fat Fig. 4 on page 10 (thickening of the retroperitoneal fascial planes and edema in the peripancreatic fat, mostly in the pancreatic tail). Peripancreatic fluid was detected in the right pararenal space Fig. 5 on page 11, subhepatic and perisplenic space, extending to the pelvic cavity Fig. 6 on page 12. Bilateral pleural effusion and left lower lobe consolidation Fig. 7 on page 13.

3.CASE DISCUSION:

Whereas in children anatomic anomalies, viral infections and trauma are the main causes of pancreatits, in this case report biliary sludge and microlithiasis are the most likely cause of his acute pancreatitis.

Images for this section:

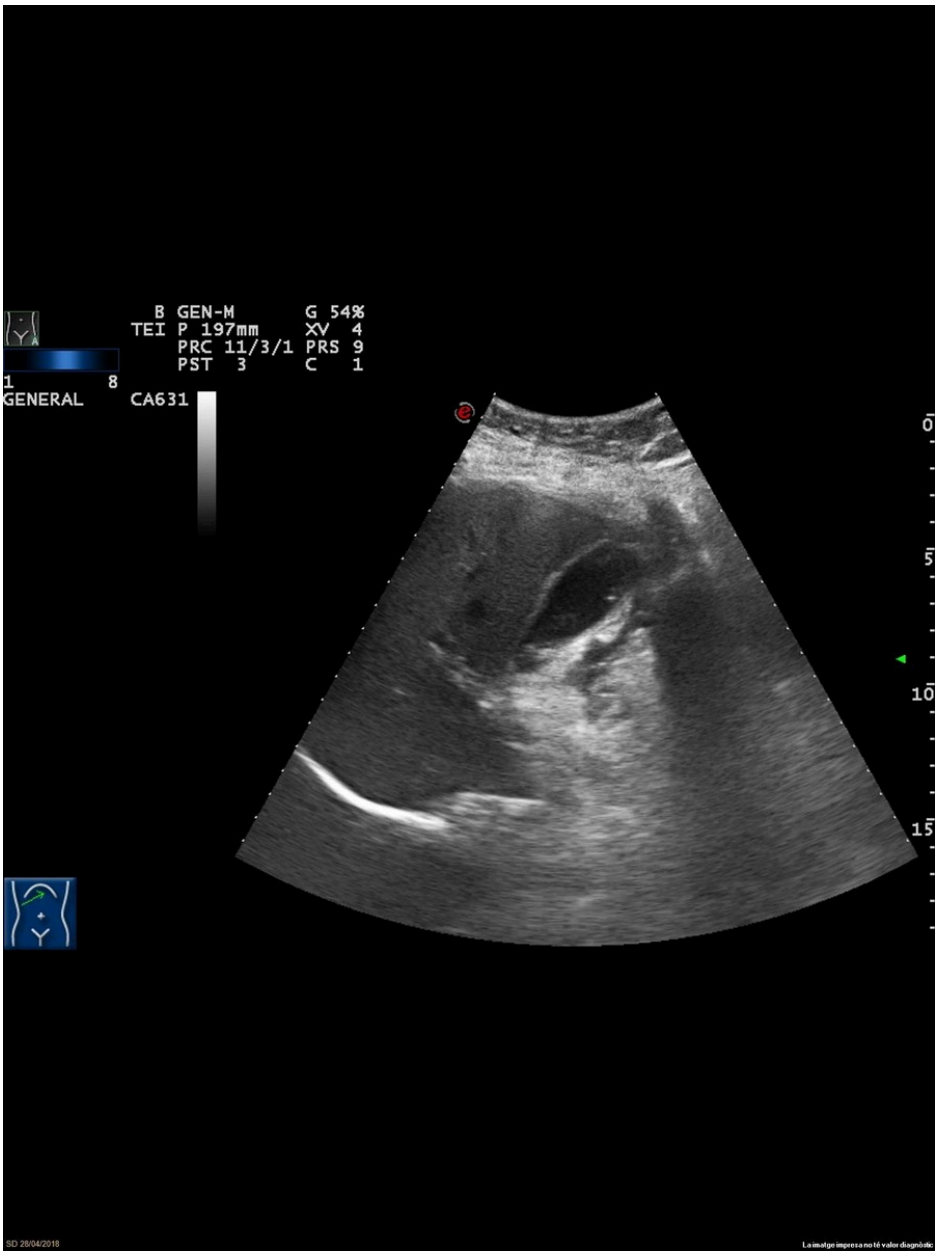

Fig. 1: Gallbladder with tiny cholesterolomas adhered to the wall, microlithiasis, and biliary sludge in the infundibulum.

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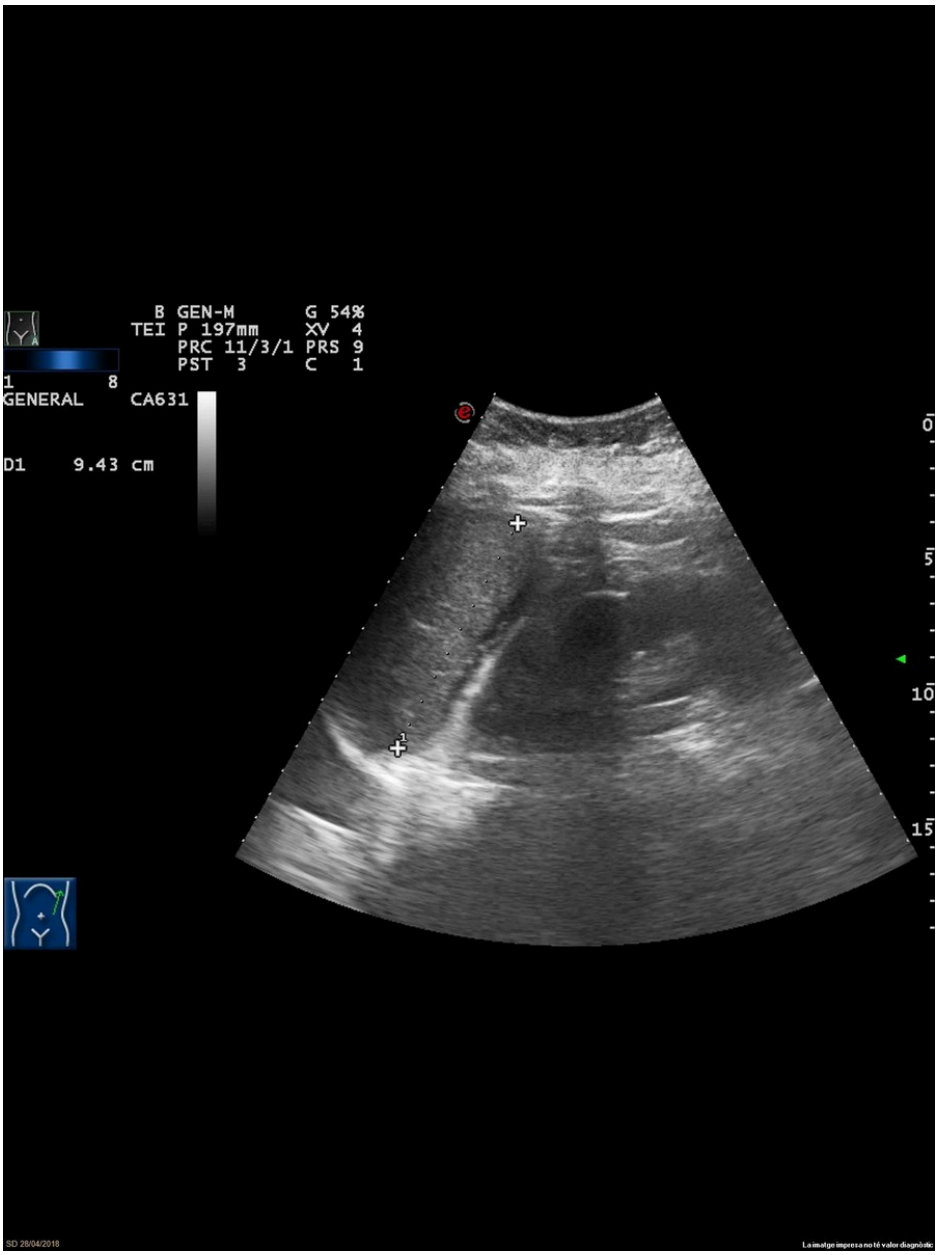

Fig. 2: Minimal amount of sub-splenic fluid.

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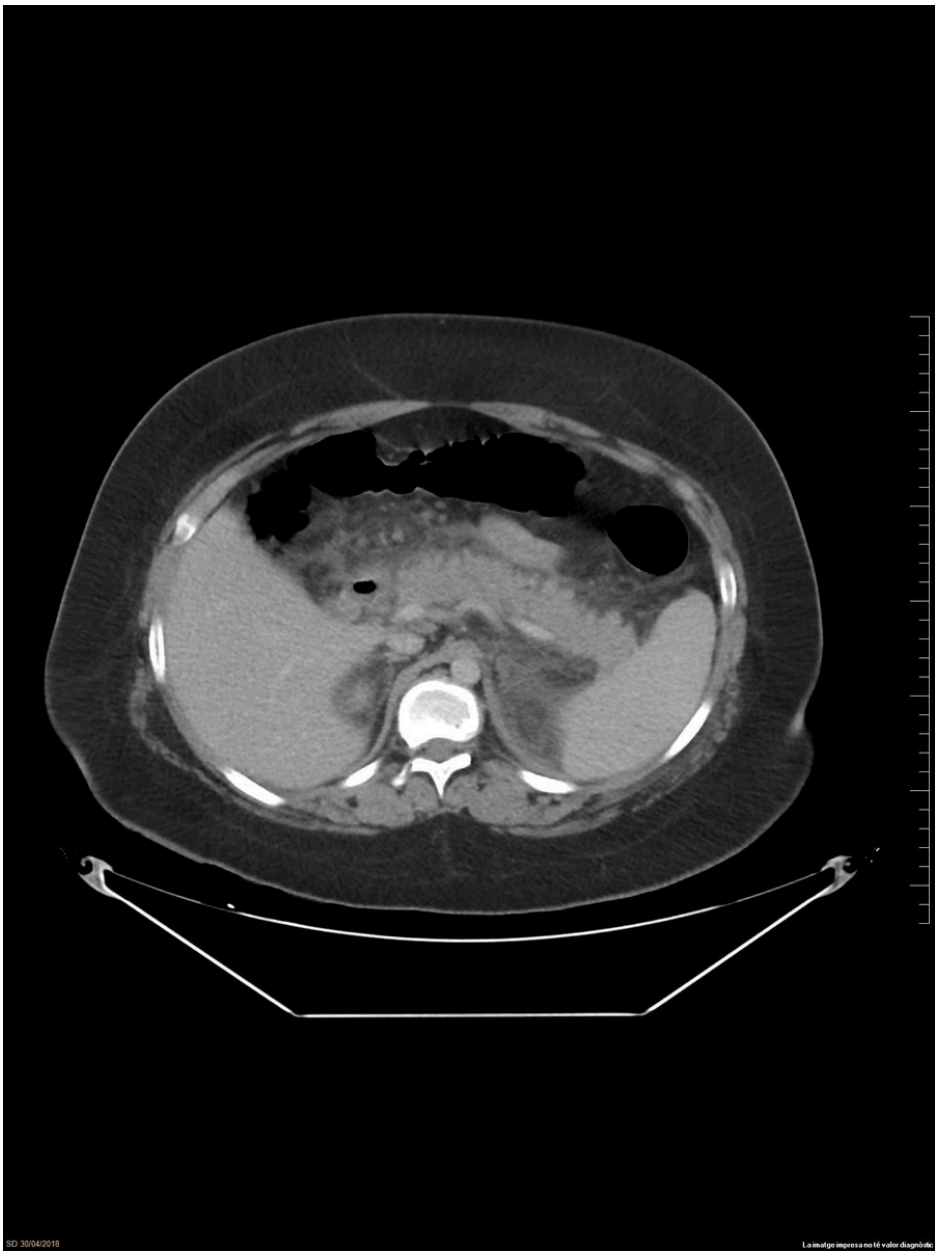

Fig. 3: Homogeneous pancreatic enhancement in CT scan.

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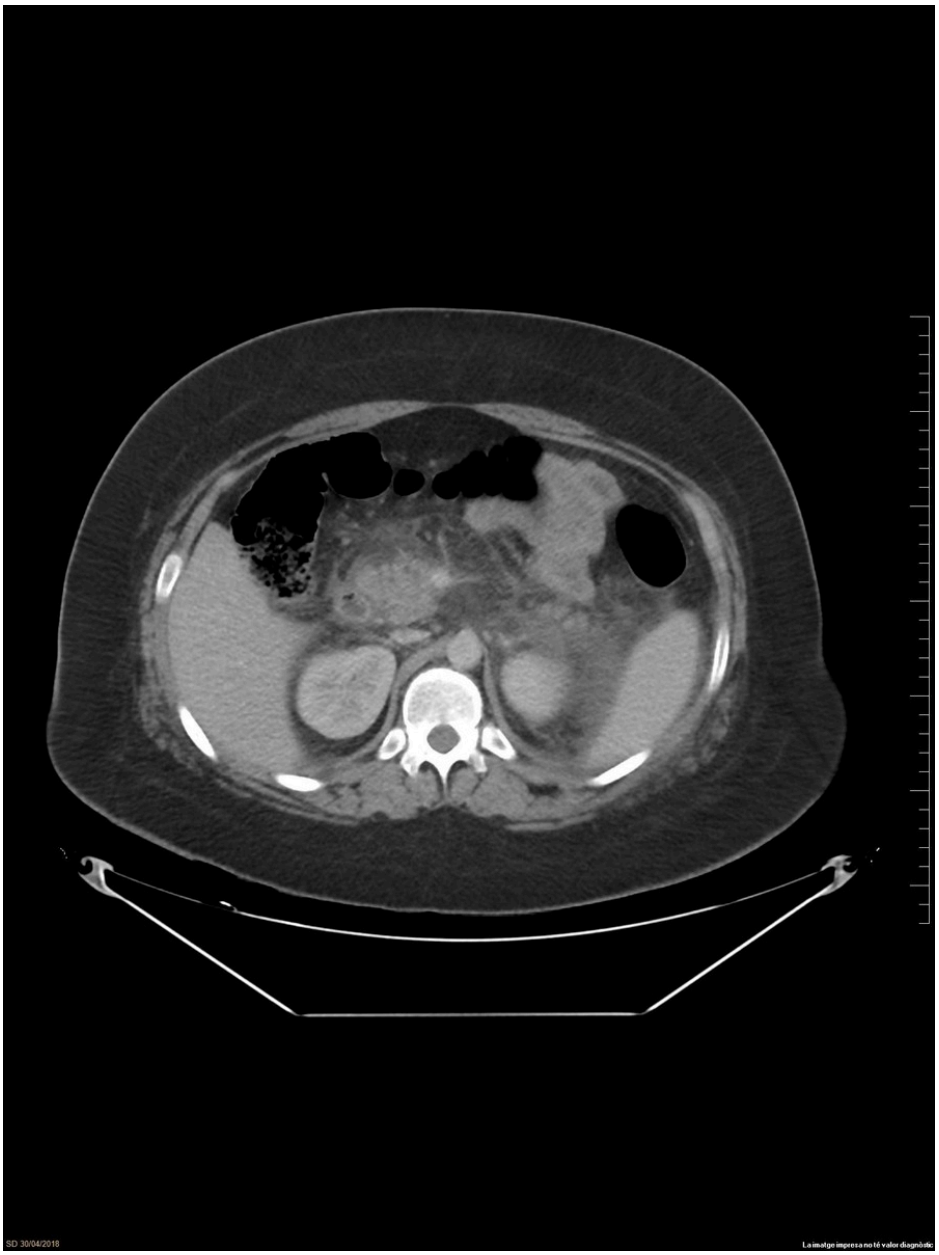

Fig. 4: CT scan that shows inflammatory changes in the peripancreatic fat (thickening of the retroperitoneal fascial planes and edema in the peripancreatic fat, mostly in the pancreatic tail).

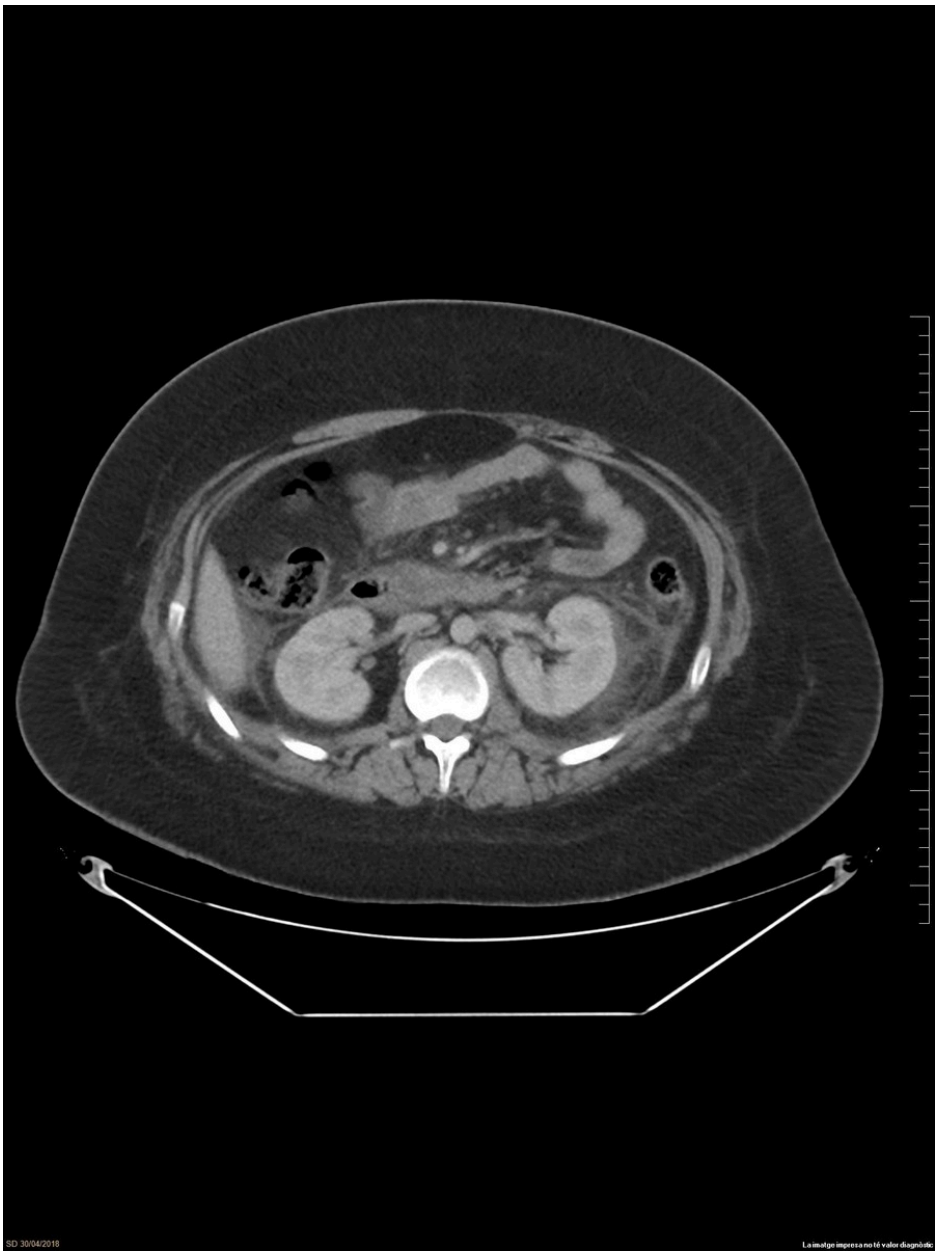

Fig. 5: CT scan showing peripancreatic fluid in right pararenal space.

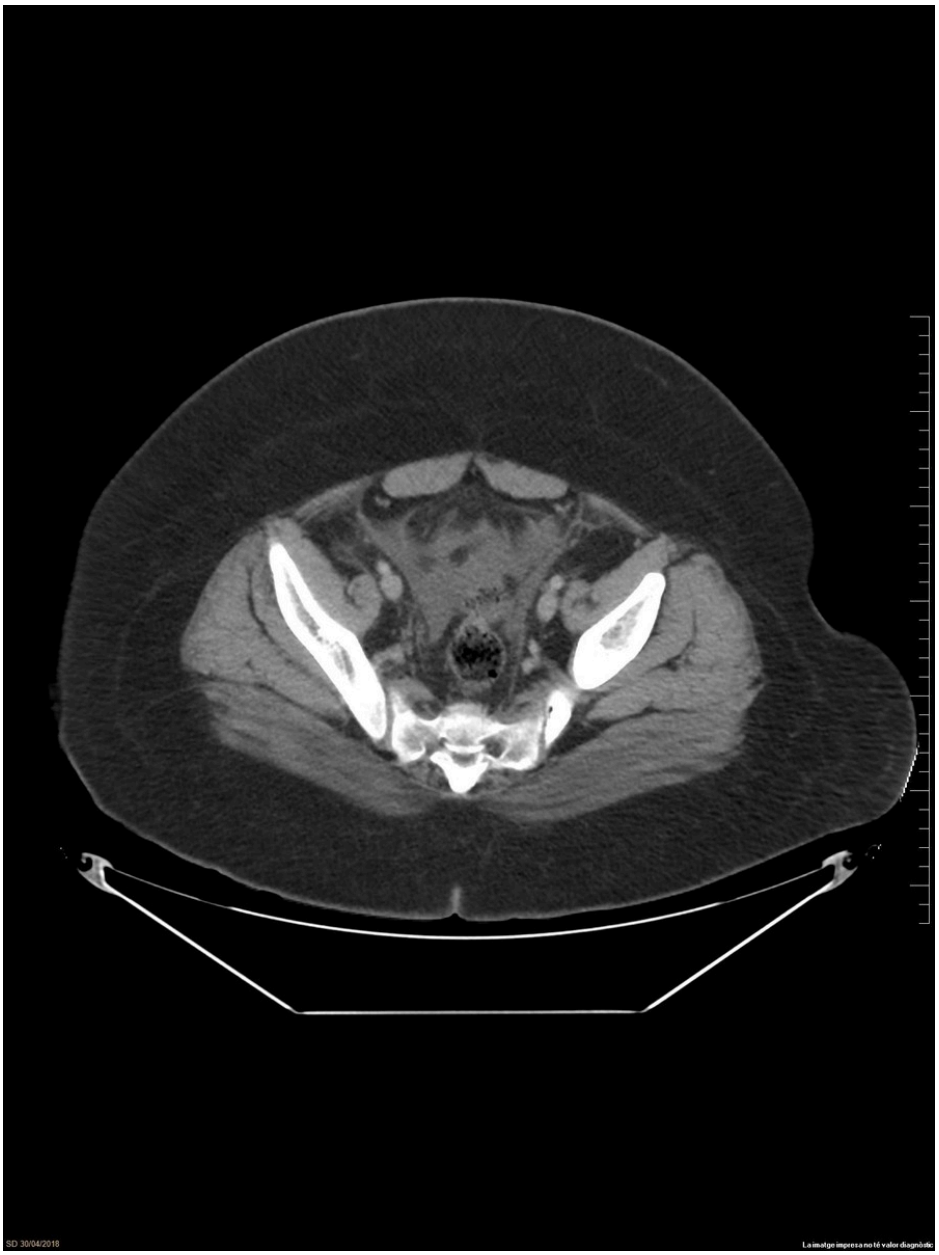

Fig. 6: CT scan showing free fluid in the pelvic cavity.

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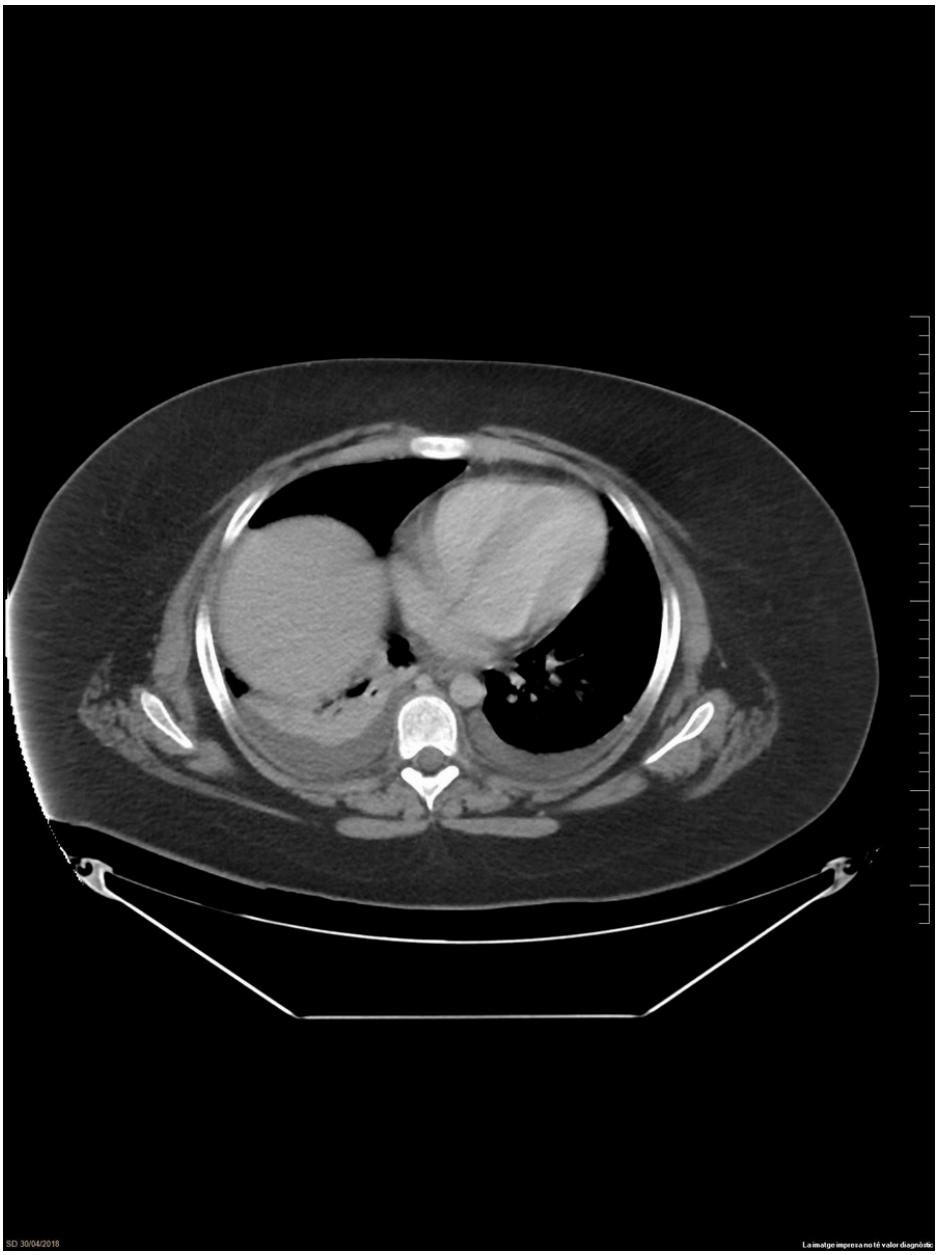

Fig. 7: Bilateral pleural effusion and left lower lobe consolidation.

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MODIFIED–CTSI(MORTELE)	
PANCREATIC INFLAMMATION	Points
Normal pancreas	0
Intrinsic pancreatic abnormalities with inflammatory changes in peripancreatic fat	2
Pancreatic or peripancreatic fluid collection or peripancreatic fat necrosis	4
PANCREATIC NECROSIS	
None	0
< 30 %	2
>30%	4
EXTRAPANCREATIC COMPLICATIONS	
One or more of pleural effusion, ascites, vascular complications, parenchymal complications, or gastro-intestinal tract involvement	2

Fig. 8: Modified-CTSI Mortele Index.

SEVERITY	POINTS
Mild	0-2
Medium	4-6
Severe	8-10

Fig. 9: Modified-CTSI Mortele Index.

Age (years)	Size (mm)
1-6 y	>1.5 mm
7-12 y	>1.9 mm
13-18 y	>2.2mm

Fig. 10:

Conclusion

The acute pancreatitis is an important challenge for the different medical specialties that are involved in its management, since the current practice is based completely on the historical approach and the extrapolation of adult studies.

Pancreatic alterations in children are relatively frequent. Previous knowledge of the embryological development and the normal anatomy of the pancreas and the morphologic characteristics of the pediatric age are essential to diagnose acute pancreatitis.

Personal information

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