The pediatric surgeon approach to abdominal pain

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PUB MED : K. BEN OTHMAN
ABDOMINAL PAIN IN CHILD

- High frequency
  9% in Timone children’s hospital
  3800 patients per year

- Numerous aetiologies
  Less than 5% are operated on

- Cost problems
Acute abdominal pain in general practice

The most frequent diagnosis was
- non-specific pain (20%),
- gastroenteritis (13%) appendicitis (12%),
- ulcer disease (11%) gynaecological disease (9%),
- urinary tract problems (7%)

Medical and surgical ... problems
Abdominal pain in young child

28 days – 2/3 years

• Digestive symptomatology
  abdominal pain
  vomiting, diarrhea
  no appetite…

• Non specific symptomatology
  fever
  color: grey, pale, red … yellow!
  modification of the general status
DIAGNOSIS

History

Beginning of the pain
Treatment given
Associated signs
Alimentation
Intestinal transit …

LONG!
DIAGNOSIS

HISTORY

INSPECTION

Without clothes !!

Coloration ? Cutaneous eruption?

Antalgic attitude ?
  motricity,
  abdominal mobility

ATTENTIVE !
Diagnosis

HISTORY

INSPECTION

CLINICAL EXAM

Pulmonary and ORL

Cardiac

Digestive: « the palpation »

...
SURGICAL AETIOLOGIES

• Incarcerated inguinal hernia

Diagnosis = clinical exam
SURGICAL AETIOLOGIES

• Testicular torsion

Any age
intra-vaginal torsion

Systematic exam +++
Ultrasonography = 0
Immediate surgical approach +++
SURGICAL AETIOLOGIES

• Intestinal intussusception

Acute and recurrent crisis
blood in stools: too late
Refuse any alimentation
A lot of different clinical forms (neurologic)

DIAGNOSIS = ULTRASONOGRAPHY
SURGICAL AETIOLOGIES

• Volvulus

Acute and recurrent crisis
Vomiting : green
blood in stools: too late
Altered status +++

Non specific symptomatology

DIAGNOSIS = ULTRASONOGRAPHY
Ultrasonography

• Volvulus and malrotation
  Transverse section: “whirlpool sign”
    the mesenteric vein is on the left

• Intussusception near 100% fiability

Del Pozo G. Radiographics 1999; 19:299
SURGICAL AETIOLOGIES

- Incarcerated hernias
- Testicular torsion
- Intestinal intussusception
- Volvulus
- Meckel diverticulum

Acute appendicitis
Less frequent before 5 years, rare <2 years
Important morbidity, possible mortality

non specific symptomatology :
- Gastro-enteritis and fever
- Occlusive syndrom
  - Urinary symptoms
SURGICAL AETIOLOGIES

- Incarcerated hernias
- Intestinal intussusception
- Volvulus
- Meckel diverticulum
- Appendicitis

Abdominal tumors
Diagnosis: palpation of the tumor
/ quick augmentation of the mass
/ hemorrhage
/ torsion

Nephroblastoma, Neuroblastoma, ...
Cystic lymphangioma, ovarian cyst...
Medical aetiologies

Acute Pyelonephritis

Others infections
  - Otitis
  - Meningitis
  - Pneumopathy
  - Hip arthritis

Constipation  Gastroenteritis  Esophagitis

Diagnosis = clinical exam, X rays, biol.m

Total examination +++
ABDOMINAL PAIN IN CHILD

Diagnosis

• Sex
• History
• Clinical examination
• Role of paraclinical exams ?
ABDOMINAL PAIN IN CHILD

Appendicitis... of course but...

Adnexal torsion
Testicular torsion
Intussusception
Incarcerated hernia

Meckel diverticulum
Acute cholecystitis
Acute pancreatitis
Nephrolithiasis
Genito urinary malformations
Tumors (cerebral also)
Abdominal pain

• **Medical aetiologies (1)**  

always the classical one’s:

- Gastro-enteritis
- Pneumopathy
- ORL infection
- Urinary tract infection
- Meningitis
- Acido cetosis
- Constipation
• **Medical aetiologies (2)**

Gastritis, ulceration
Mesenteric lymphadenitis
Henoch-Schonlein purpura
Inflammatory bowel disease
Diabetes
Helminthiosis ...
Diagnostic tools

• « Basic step »

Definition of the low risk

Prospective study 601 children with possible appendicitis

- vomiting = 0
- pain not in right side
- wcc < 6750 /µl

low risk of appendicitis

Sens 98,1% (95% CI : 90-99.9)
NPV 97.5% (95% CI : 86.8-99.9)
Diagnostic tools

- Second step the « Scores » :

  - **Score Alvarado « MANTRELS »**
    Retrospective series of adults

  - **Score Samuel : Pediatric Append. S. (PAS)**
    Prospective series of children (4-15)
<table>
<thead>
<tr>
<th>Symptom</th>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Migration of the pain</td>
<td>0-1</td>
<td></td>
</tr>
<tr>
<td>Anorexia</td>
<td>0-1</td>
<td></td>
</tr>
<tr>
<td>Nausea, Vomiting</td>
<td>0-1</td>
<td>possible appendicitis</td>
</tr>
<tr>
<td>Tenderness FID</td>
<td>0-2</td>
<td>score 7-8</td>
</tr>
<tr>
<td>Rebound tenderness</td>
<td>0-1</td>
<td>probable appendicitis</td>
</tr>
<tr>
<td>Fever</td>
<td>0-1</td>
<td>score 9-10</td>
</tr>
<tr>
<td>Leucocytosis</td>
<td>0-2</td>
<td>high risk of appendicitis</td>
</tr>
<tr>
<td>Shift to the left (PNN&gt;75%)</td>
<td>0-1</td>
<td>sens 75% spec 79%</td>
</tr>
</tbody>
</table>

**Alvarado:**

**Migration of the pain** 0-1
**Anorexia** 0-1  score 5-6
**Nausea, Vomiting** 0-1  = possible appendicitis
**Tenderness FID** 0-2  score 7-8
**Rebound tenderness** 0-1  = probable appendicitis
**Fever** 0-1
**Leucocytosis** 0-2  = high risk of appendicitis
**Shift to the left (PNN>75%)** 0-1  sens 75% spec 79%


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<td>0-1</td>
<td></td>
</tr>
<tr>
<td>Anorexia</td>
<td>0-1</td>
<td>PAS&lt; 5</td>
</tr>
<tr>
<td>Nausea, Vomiting</td>
<td>0-1</td>
<td>no Appendicitis</td>
</tr>
<tr>
<td>Tenderness FID</td>
<td>0-2</td>
<td>PAS&gt; 6</td>
</tr>
<tr>
<td>Pain during coughing or percussion</td>
<td>0-2</td>
<td>probable Appendicitis</td>
</tr>
<tr>
<td>Fever</td>
<td>0-1</td>
<td></td>
</tr>
<tr>
<td>Leucocytosis &gt; 10000</td>
<td>0-1</td>
<td>sens 100% spec 92%</td>
</tr>
<tr>
<td><strong>Shift to the left (PNN&gt;75%)</strong></td>
<td>0-1</td>
<td>VPP 96% VPN 99%</td>
</tr>
</tbody>
</table>

**Samuel:**

**Migration of the pain** 0-1
**Anorexia** 0-1  PAS< 5
**Nausea, Vomiting** 0-1  = no Appendicitis
**Tenderness FID** 0-2  PAS> 6
**Pain during coughing or percussion** 0-2  = probable Appendicitis
**Fever** 0-1
**Leucocytosis > 10000** 0-1  sens 100% spec 92%
**Shift to the left (PNN>75%)** 0-1

**J Ped Surg 2002; 37:877-81**

1254 patients with acute abdominal pain
The ability of a score to fulfill criteria:
- initial negative appendicectomy rate of < 15%
- potential perforation rate of 35% or less,
- initial missed perforation rate of 15% or less,
- missed appendicitis rate of 5% or less.  
**The Alvarado score fulfilled all four criteria**

588 children 3-21 ans (mean 11,9 ans)

Alvarado $\geq 7$ Sens 72% Spec 81% VPP 65% VPN 85%

PAS $\geq 6$ Sens 82% Spec 65% VPP 54% VPN 88%

Results not as good under the age of 10
Diagnostic tools

• Third step: ex MET AP

Table 1 – Clinical attributes used in the MET-AP system

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Possible values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>&lt;5 years, ≥5 years</td>
</tr>
<tr>
<td>Gender</td>
<td>Male, female</td>
</tr>
<tr>
<td>Duration of pain</td>
<td>≤24 h, &gt;24 h and ≤7 days, &gt;7 days</td>
</tr>
<tr>
<td>Site of maximal pain</td>
<td>RLQ, lower abdomen, other</td>
</tr>
<tr>
<td>Type of pain</td>
<td>Continuous, intermittent</td>
</tr>
<tr>
<td>Shifting of pain</td>
<td>Yes, no</td>
</tr>
<tr>
<td>Vomiting</td>
<td>Yes, no</td>
</tr>
<tr>
<td>Previous visit to the ER for this AP</td>
<td>Yes, no</td>
</tr>
<tr>
<td>Temperature</td>
<td>&lt;37°C, ≥37°C and ≤39°C, &gt;39°C</td>
</tr>
<tr>
<td>Site of maximal tenderness</td>
<td>RLQ, lower abdomen, other</td>
</tr>
<tr>
<td>Localized involuntary guarding</td>
<td>Absent, present</td>
</tr>
<tr>
<td>Rebound tenderness</td>
<td>Absent, present</td>
</tr>
<tr>
<td>White blood cell count</td>
<td>≤4000, &gt;4000 and &lt;12,000, ≥12,000</td>
</tr>
</tbody>
</table>

Farion KJ
Intern J Med Informatics
2008; 77: 208
• **All the diagnostic scores:**

  – **Goal:** going faster to surgical indication
  – **Limits:** the only help are biological markers
  – **Main interest:** indication of others paraclinic exams
Does this child have appendicitis?


256 full-text articles examined: 1966-March 2007

42 studies were assigned a quality level of 3 or better.

**Fever increases the likelihood of appendicitis**
(LR, 3.4; 95% CI, 2.4-4.8)

**Rebound tenderness triples the odds**
(LR, 3.0; 95% CI, 2.3-3.9)

**A WBC of less than 10,000/microL decreases**
the likelihood of appendicitis (LR, 0.22; 95% CI, 0.17-0.30)
as does an absolute neutrophil count of 6750/microL or lower
(LR, 0.06; 95% CI, 0.03-0.16)
Meta-analysis of the clinical and laboratory markers in the diagnosis of appendicitis.

The discriminatory power of the **inflammatory variables** (granulocyte count, proportion of polymorphonuclear blood cells, white blood cell Count and C-reactive protein concentration) was particularly strong for perforated appendicitis with ROC areas of 0.85 to 0.87. Appendicitis was likely when two or more inflammatory variables were increased and unlikely when all were normal.
- **C-reactive protein with WBC is useful** in distinguishing appendicitis from other diagnoses in paediatric subjects presenting to the ED.

- **White blood cell count** greater than >12 cells × 1000/mm(3) and CRP greater than 3 mg/dL increases the likelihood of appendicitis.

- **D-Lactate is not** a useful laboratory adjunct.

Biological markers

-Serum IL-6 concentration (77.6%; 67.1-86.1%, ROC)

-White blood cell count (68.4%; 57.2-78.3%, ROC)

-C-reactive protein (63.7%; 52.1-74.3%, ROC)

Clinical and laboratory methods in diagnosis of acute appendicitis in children.

Receiver operating characteristic [ROC] curve analysis
Van den Ende ED and al. Diagnostic surplus value of echography in children with acute abdominal pain

The sensitivity of the clinical findings was 88% and the specificity 70%. Together with US it was 88% but specificity increases 91%. The PPValue of the clinical findings alone was 69% and of the clinical findings together with ultrasonography 88%.
• Ultrasonography achieved a specificity of 95.2% a positive (93.8%) and negative (93.3%) predictive values whereas clinical signs showed the highest sensitivity (93.9%).

Appendicitis in children: impact of US and CT on the negative appendectomy rate.

The total number of appendectomies during 1991, 1994, 1997, and 2000 was 406, 334, 407, and 397. The negative appendectomy rate for the same years was 23%, 8.7%, 8.0%, and 4.0%. The overall rate of perforations and the perforation rate after admission was 32% and 12%, 34% and 7.3%, 34% and 13%, and 29% and 2.1% respectively. The rate of patients who underwent US and CT during each period was 1.0% and 0.0%, 41% and 0.0%, 91% and 21%, 98% and 59%, respectively.
The Role of Abdominal Ultrasound in the Management of Appendicitis in Children

Haxhija EQ, Komoni A, Bäumel D, Höllwarth ME

Dept. of Pediatric and Adolescent Surgery, Medical University Graz, Austria, 2010
The Role of Abdominal Ultrasound in the Management of Appendicitis in Children

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Our results strongly support the regular use of abdominal ultrasound examination in children suspected for appendicitis.
Decision making in patients with acute abdominal pain at a university and at a rural hospital: does the value of abdominal sonography differ?


161 patients were prospectively examined clinically. Blood tests and sonography performed in all patients. Sensitivity, specificity and accuracy of sonography were high: 94%, 88% and 91%.

At the UH, management after sonography changed in only 14% of cases, compared to 27% at the RH. Additional tests were more frequently added at the UH (30%) than at the RH (18%), but had no influence on the decision making process whether to operate or not.
The diagnosis of acute appendicitis in a pediatric population: to CT or not to CT


5-year retrospective review database of 283 patients. The sensitivity of the CT scan was 94.6%, and the PPV was 95.6%.

In girls older than 10 years, CT imaging was not significantly more accurate in predicting appendicitis than examination alone (93.9% v. 87.5%; P = .46).
In paediatric practice, in the interest of radiation protection **CT scanning should be reserved for complex problems, or for fat patients** who preclude adequate ultrasound examination.


**Non-contrast spiral CT** can usually be performed using a low-dose technique without sacrificing diagnostic accuracy. Meaghar T and al J Clin Radiol 2001;56:873–876
The combination of US followed by limited CTRC in equivocal cases was found to increase overall sensitivity from 44% to 94%.

Abdominal pain

• Every year since more than 25 years we see in our emergency department near 3000 patients with abdominal pain

• Less than 250 will be operated on and only 80 had an appendicitis

• Even with this experience 10 to 15 patients per year are operated too late or with a wrong diagnosis
Abdominal pain

• **Clinical exam +++**
  More the child is younger more it is important

• **Oriented paraclinic exams**
  – biological markers
  – **US +++**
  – CT in special cases

• **Repetition of the clinical exam**
Thank you