

## POST-OPERATIVE EVOLUTION OF INTRA-ABDOMINAL INFECTIONS TREATED BY CARMELI SCORE

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### Summary:

Acute appendicitis is the most frequent indication of abdominal surgery on pediatric population, and the appendicular perforation is a frequent complication of this condition. In order to avoid the abusive use of some last generation antibiotics and the occurrence of resistant germ strains, it was recently introduced a new intra-abdominal treatment scheme, according to Carmeli score. This study aimed to identify the risk factors of a potential adverse development and compare post-operative results depending on the received antibiotherapy. Thus a study was done on 53 patients with intra-abdominal infections by acute appendicitis or appendicular peritonitis who were treated in the Pediatric Surgery and Orthopedic Clinics of the "Sf. Maria" Emergency Clinic Hospital for Children, Iassy. The results of this study demonstrated that early age, male sex, associated conditions and a higher than 1 Carmeli score are poor prognosis factors in intra-abdominal infections in pediatric age patient.

**Key words:** acute appendicitis, intra-abdominal infections, Carmeli score, antibiotherapy.

### Introduction

Acute appendicitis in a child is one of the most common surgical emergencies and the appendectomy has become the golden standard of therapy in this condition, associated or not to the antibiotherapy. Fitz et al. diagnosed and described for the first time the acute appendicitis in 1886, and McBurney did the first appendectomy in 1894. Since then, the appendectomy became the standard treatment of this condition (1), however 2-7% of the patients present complications such as peri-appendicular abscesses, appendicular insets or generalized peritonitis (2).

In emergency surgical interventions, due to local inflammation, adherences, peri-appendicular liquid collections or generalized peritonitis, the surgical wound healing process is delayed and many other complications may appear, in up to 26% of the these patients (3,4). The management strategy of patients with intra-abdominal infections is controversial, the aim of this study being that of identifying risk factors of adverse development and comparing patients' post-operative evolution depending on the received antibiotherapy.

### Material and methods

For carrying this study there were taken in evidence 53 patients with intra-abdominal infections through acute

appendicitis or appendiceal peritonitis treated in the Pediatric Surgery and Orthopedic Clinics of the "Sf. Maria" Emergency Clinic Hospital for Children, Iassy, for three months, from November 1st, 2010 to January 1st, 2011. The patients were monitored prospectively, being divided in two study groups depending on Carmeli score, receiving thus antibiotherapy in triple association, Cefort + Gentamicin + Metronidazole or Invanz ± another antibiotic, depending on the particularity of each case. There were analysed patients' data from the points of view of age, sex, disease severity, surgical approach, hospitalization duration, need for and duration of peritoneal drainage, post-operative complications and associated complications.

The obtained data were compared among them, not only regarding the differences between the two study groups, but also inside each group, depending on sex, age, associated affections, being used the *t* Student test, Chi square, multifactor analysis methods. The data were expressed as means ± standard deviations or as frequencies. The used threshold for statistical significance was  $p \leq 0.05$ . In order to achieve a permanent statistic analysis on the obtained data series, there were used specialised software applications, Statistics and Microsoft Excel.

### Results

Of the 74 hospitalized and treated patients in our clinic during the three months for acute appendicitis, in 21 patients the post-operative diagnosis was that of acute catarrhal appendicitis or acute phlegmatic appendicitis, but which did not require antibiotherapy, thus being removed from the study. The remaining 53 patients were considered having post- acute appendicitis intra-abdominal infections and 49 of them fit in Carmeli Class 1, being treated with usual antibiotics, Cefort + Gentamicin + Metronidazole in adapted dosages to age and body weight. Four of the patients who previously received antibiotherapy for respiratory or digestive infections fit in Carmeli Class 2 and received Invanz (Ertapenem) in association to another antibiotic, depending on the associated affections.

Of the 49 patients with Carmeli score 1, 16 were girls aged from 5 to 17, with an average of  $13.06 \pm 3.4$  years old, and 33 were boys aged from 3 to 18, with an average of  $10.84 \pm 3.7$  years old (Fig. 1). For a  $p \leq 0.05$  the age difference is significant from a statistic point of view. All in all, the patients' average age in the first class was of  $11.57 \pm 3.7$  years old.

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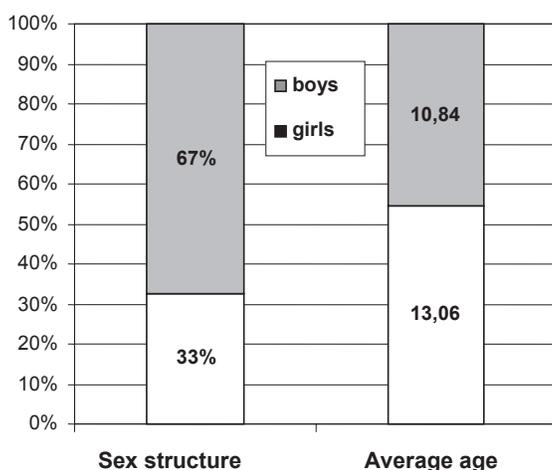


Fig 1. Carmeli score 1 patient distribution by age and sex.

The hospitalization duration varied between 4 and 13 days, with an average of  $6.67 \pm 2.4$  days and a median of 6 days, varying for girls with  $6.5 \pm 1.8$  from  $6.75 \pm 2.6$  for boys (a statistically insignificant difference for  $p \leq 0.05$ ). Only 3 of 16 girls were diagnosed with peritonitis, while in boys the

proportion was of 15 to 33 (Fig. 2). The days of peritoneal drainage were in an average of  $6 \pm 1.4$ , varying from 4 to 9 days and applying to 42.8% of the patients in this group. Only 31.2% of the girls required peritoneal drainage, to 48.4% of the boys.

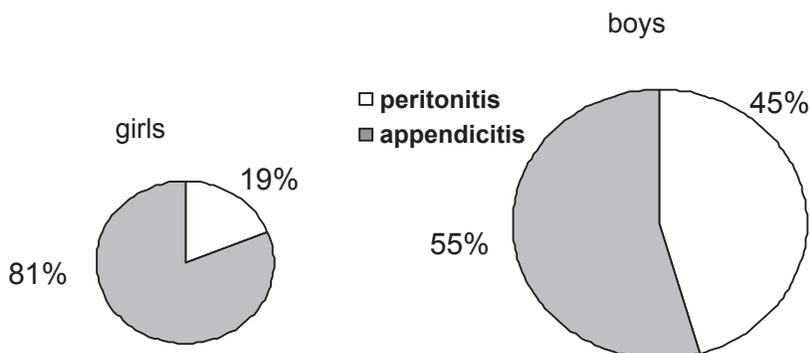


Fig 2. Carmeli score 1 patient distribution on disease severity.

In what concerns the Carmeli score 2 patients the average age was of  $7.87 \pm 5.9$  years old, a 3 year old boy and 3 girls, one aged 2.5 and the other two aged 13, respectively. The average hospitalization period was of  $14.75 \pm 8.3$  days, obviously longer than in the first patient group, all of them presented themselves with peritonitis and needed peritoneal lavage and drainage, on the other hand the drainage period did not differ significantly ( $6.5 \pm 2.5$  days). In 3 of these 4 patients the evolution was difficult, 3 of the boys developing fever, 2 of them with suppuration of the operative wound and 1 requiring secondary suture.

In 49 of the 53 total patients (92.5%) there were surgical interventions by McBurney incision and in 4 of them by median laparotomy, the latter ones' diagnosis being that of localized peritonitis (2 patients) or generalized peritonitis (2 patients). Three of these patients (all boys) had Carmeli score 1 and one girl patient had Carmeli score 2.

The average hospitalization period was of 8.7 for boys, and the girl had 22 hospitalization days, this one suffered another surgery for a retro-uterine abscess with rectal wall perforation, being put in colostomy. The evolution was difficult in 3 of the 4 patients with wound suppuration in the re-operated patient for retro-uterine abscess, with dehydration syndrome through vomiting in a small age patient (3 years) and because of a iatrogenic burn at the scrotum level (through electrocautery plaque) in another patient. All 4 patients needed lavage and drainage of the peritoneal cavity, but the drainage duration was comparable to that of the other patients, being of 6 days in average. In 2 patients, the peritoneal fluid culture was positive, *Pseudomonas* and *Enterobacter*, *Escherichia coli*, respectively, isolating themselves.

Ten patients also had other associated conditions, 6 boys and 4 girls, 3 of them were boys with Meckel

diverticulum discovered intra-operatively, but whose excision was delayed, one girl with right ovarian cyst which was punctured and evacuated, one girl with intestinal parasites and another one with ichthyosis. The last two ones belong to Carmeli score 2 patient group. The average age of patients with associated conditions was of 10.5 years, with variations between 2.5 and 16 years, and the average hospitalization period was of  $9.8 \pm 6.5$  days. Seven of the 10 patients needed peritoneal drainage, the average drainage duration being of 6.14 days. Four of the patients had a difficult evolution, with fever and suppuration of the operative wound in 3 of them.

It was also analysed early age patients' evolution, under 6, comparatively to the others, the results being the following: 6 patients (11%) aged under 6 ( $4.08 \pm 1.42$ ) in average compared to the rest of 47 (89%), with an average age of  $12.21 \pm 3.21$  years. The hospitalization period was of 9.83 days versus 6.95 days, 83% needed peritoneal drainage versus 42.5 %, with an average duration of 6.4 towards 6 days. Four of the 6 patients had a difficult evolution (66.6%) comparatively to 6 of 47, representing 12.7%. We mention that 2 of the 6 early age patients obtained a Carmeli score 2.

#### Discussions

Acute appendicitis is the most frequent recommendation for abdominal surgery in pediatric population, and the appendicular perforation is a frequent complication of this condition. The main objectives of the surgical management in these cases are minimizing morbidities, costs, hospitalization period and re-interventions. Post-appendectomy infectious complications are strongly related to all these parameters, on which the chosen antibiotic regime has a major influence. Broad-spectrum antibiotics are traditionally recommended, usually in triple association (5), although lately more and more authors prefer mono-antibiotherapy (6) in order to reduce costs and simplify the treatment (7). Yet, the occurrence of postoperative infectious complications has a multifactor determinism, depending on the patient, the peri-operator factors and the received antibiotics; this is why the research regarding the best treatment scheme continues (8).

For avoiding the abusive use of some last generation antibiotics and the occurrence of resistant germ strains, it was lately introduced a new infection treatment scheme, depending on Carmeli score (9). Thus, for knowing what

antibiotic should be administered to each patient, the evaluation depending on this score is done. This one cannot have but the value of 1 if the patient obtained only answers rated 1, the value of 2 if the patient achieved one or more rated 2 criteria, or the value of 3 if he achieved at least one rated 3 criterion. So, the score value is offered by the maximum obtained value, and not by summing up the results. The meaning is the following: if the score value is 1, then the infection is considered to be communitarian and the patient will receive an usual antibiotic, here included fluorochinolone for respiratory infections; if the score is 2 means that the patient had previously got in touch with the health care system or received antibiotics in antecedents and now he will receive a superior class antibiotic, for example Ertapenem, Linezolid, Vancomycin; if the score is 3, this means an nosocomial infection, which will have to be treated with Imipenem, Meropenem, or an association of other antibiotics.

#### Risk evaluation - Carmeli score

- A. Contact with the health sector
  - 1) Without contact
  - 2) Contact with no invasive procedures
  - 3) Repeated contacts with invasive procedures
- B. AB treatment:
  - 1) Without AB
  - 2) With AB in antecedents
- C. Patient characteristics:
  - 1) Young- without comorbidities
  - 2) Elderly with comorbidities
  - 3) Immunocompromised patients (AIDS, BPOC, BMT, Cancer)

From the analysis regarding the first patient group in the present study one may notice the fact that acute appendicitis occurrence frequency is higher in boys and occurs at an early age, two thirds of the patients being boys with an average age of 10.84 years old, compared to one third girls aged 13.06. There are also differences concerning the condition severity, 45.5% of the boys developing acute peritonitis to 19% of the girls; 48.4% of the boys needed peritoneal drainage compared to 31.2% of the girls. The hospitalization period was not influenced by the sex variable, being of 6.67 days in average (Table 1).

Tabel no.1. Patients' evolution on disease severity.

Disease category	% of total	Average age(years)	Average hospitalization period (days)	Peritoneal drainage necessity (%)	Average drainage period (days)	Difficult evolution (%)
	49	11,2	5,7	8,3	4,5	4,2
Phlegmatic appendicitis	14	12,7	5,3	28,6	5,0	0,0
Localised peritonitis	25	12,2	8,4	91,7	6,1	33,3
Generalised peritonitis	12	10,6	8,6	100,0	6,7	33,3

From the data analysis after patients division into diagnosis groups one may notice, naturally, the raise of the hospitalization and peritoneal drainage periods once with the increased condition severity, but not necessarily associated with an increase of the frequency of complications or a difficult evolution. It can also be noticed the raise of the hospitalization period and the necessity of peritoneal drainage in patients who presented a series of associated affections, these being thus factors of negative prognosis.

It is evident a difficult evolution of patient with Carmeli score 2, this fact being explained by the early age, the peritonitis stage diagnosis in all these patients, the association of other pediatric conditions, the previous contact with health services or the recently administered

antibiotherapy. The difficult evolution is reflected in a prolonged hospitalization, the necessity of lavage and of the peritoneal drainage in all cases, although the drainage duration did not differ significantly from the first patient group.

It is also observed that early age is an important factor in determining difficult evolution, with prolonged hospitalization periods and frequent postoperative complications.

**Conclusions**

Early age, male sex, associated affections and Carmeli score higher than 1 are unfavourable prognosis factors in intra-abdominal infections in pediatric age patient.

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