

Identifying Etiologic Agents in Acute Diarrhea in Children. Therapy with Antibiotics or Probiotics?

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*In infants and toddlers, acute diarrhea is the most common gastrointestinal disorder. Recent literature has shown that viruses are the most common cause and of these, Rotavirus is a major causative agent of diarrhea in children under five years old, representing a major cause of mortality in this age. Since there is no etiologic treatment for viral diseases, hydro-electrolytic rebalancing is the standard therapy and vaccination is the most effective way to prevent these diseases. The study is a retrospective one and aims at establishing the etiology and correlation with origin environment (urban or rural) of children with acute diarrhea in Sibiu area. The study included 3135 children aged 1 month - 18 years old, admitted to the Pediatric Clinic, Sibiu, between January 1, 2014 - December 31, 2016. Laboratory tests were used to determine viral and /or bacterial etiology of acute diarrhea. Viral etiology was the most common, being confirmed in 34.1% of cases, and the bacterial one was confirmed in 10.8% of cases, of which the most frequent etiological agent involved was *Campylobacter jejuni* (40.0%). The most frequent aetiology of acute diarrhea in children in the Sibiu area are the viral infections, Rotavirus being the first, and of bacterial aetiology, rare in frequency, *Campylobacter jejuni* is the leader followed by *Salmonella* spp., and *Shigella* spp. Children in urban areas were more frequently affected by acute diarrhea than those in rural areas, unlike data from the literature.*

Keywords: children, diarrhea, viral infection, bacterial infection

Globally, infectious diarrhea is the fifth leading cause of death, approximately 2.16 million deaths per year, of which 1.5 million deaths are among children. Children under 5 years old are most affected, the disease being an important cause of morbidity and mortality in both the developed and the underdeveloped countries, more frequent in poor countries [1-3]. Children under five years old are the most vulnerable segment of society to diarrheal infections [4].

The most frequent cause of acute diarrhea is represented by infectious agents: viruses, bacteria and parasites.

Approximately 70% of the cases of diarrhea in developing countries are of viral origin (40% is given by the presence of Rotavirus), 10-20% of the infections are bacterial, and <10% are of parasitic origin. In developing countries, 50-60% of cases of diarrhea are caused by bacteria, 35% of cases are viral (15-25% being given by Rotavirus) and in many cases, the cause is mixed or unidentified [2].

The most important etiologic agents of bacterial diarrhea worldwide are Rotavirus and Adenovirus (viral etiologies) and *Campylobacter jejuni*, *Salmonella* spp., *Escherichia coli*, *Shigella* spp., *Yersinia enterocolitica*, EHEC (*Enterohemorrhagic Escherichia coli*), EPEC (*Enteropathogenic Escherichia coli*), *Klebsiella*, *Pseudomonas Aeruginosa*, *Stafilococcus Aureus* (bacterial etiologies). Another cause of acute diarrhea in young children can be represented by errors in nutrition (excessive consumption of fruits that have large contents of fructose and sorbitol).

Regardless of etiology, diarrheal disease causes severe dehydration, usually requiring hospitalization of children [3, 5].

The etiological diagnosis depends largely on the technical possibilities of the laboratory to identify the microorganisms involved and the quality of the sampling and correct interpretation of results, observing the reference limits, which help clinicians in making correct decisions [6, 7].

In our country, most microbiology laboratories, whether public or private, detect of viruses only the Rotavirus and the Adenovirus, and of bacterial etiology, only the *Salmonella* spp., *Shigella* spp. Knowing the incidence of the microorganisms involved in microbial aetiology is useful for the isolation of *Campylobacter jejuni*, as well (which, globally, ranks first in diarrheal episodes, as well as EHEC and EPEC).

Highlighting diarrheal disease etiology is important to determine the optimal treatment because in the case of viral etiology antibiotics should not be given, but only fluids and electrolytes rebalancing and symptomatic treatment. In diarrhea of bacterial etiology, additional antibiotic therapy is given plus probiotics to restore the intestinal flora destroyed by antibiotics. Naturally, these probiotics are found in some foods, but are also found in food supplements. Bifidobacteria and lactobacilli are the most common probiotics used, which help in maintaining the intestinal microbial balance [8, 9].

The fight against diseases also includes programmes for prevention and control [10] nationally, as well as physicians' information on the most common etiologies and the main risk factors involved in the disease in areas where they operate, for a more effective therapy.

Experimental part

The study was a retrospective one and included a group of 3135 children who experienced episodes of acute diarrhea, hospitalized in the Sibiu Pediatric Clinic between 2014-2016 and included all results of the parameters followed in the study. The results were taken from the electronic archives of the Sibiu Pediatric Hospital. In all patients, there was measured in the faeces: the presence/absence of Rotavirus and Adenovirus antigens and stool analysis for *Campylobacter jejuni*, *Salmonella* spp., *Escherichia coli*, *Shigella* Spp., *Yersinia enterocolitica*,

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Klebsiella, *EHEC*, *EPEC*, *Pseudomonas Aeruginosa* and *Stafilococcus Aureus*.

For the identification of infectious viral agents, there have been used immunochromatographic rapid qualitative tests for the identification of Rotavirus and Adenovirus antigens and for the identification of bacterial germs, there have made special culture media plating.

In the studied cases, the following were considered: the etiology of the disease, disease evolution, gender and age distribution, origin environment, and the time of the year when the disease occurred. The data was processed using the SPSS statistical functions.

Results and discussion

Regarding the distribution by area of origin, there is a predominance of cases in urban areas (68.0%), patients in rural areas were found in a ratio of 32.0% (fig. 1).

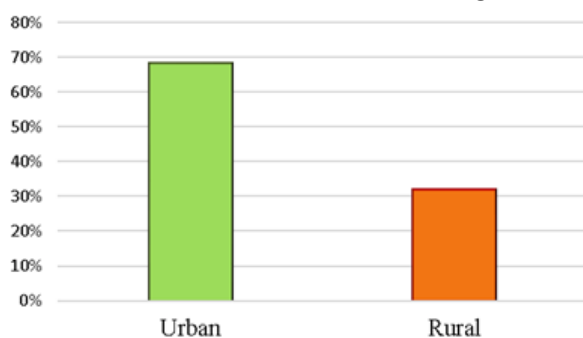


Fig. 1. Repartition of positive tests according to the origin environment



Fig. 2. Repartition of positive tests according to gender

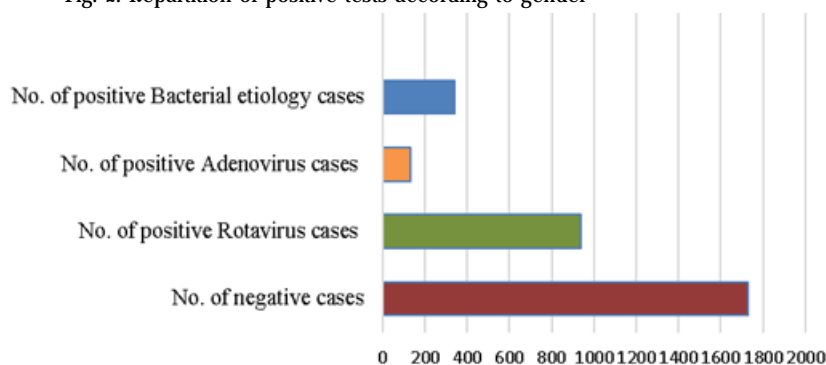


Fig. 3. The proportion of cases of diarrhea.

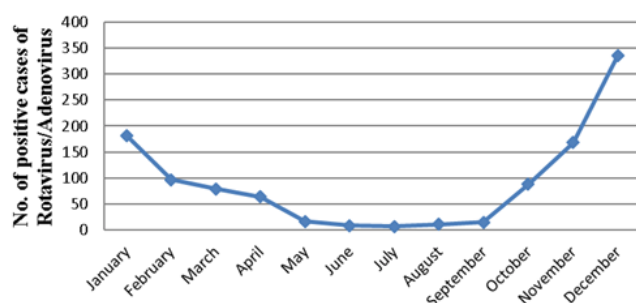


Fig. 4. Monthly repartition of Rotavirus/Adenovirus diarrhea cases

Repartition on origin environment in our study showed a predominance of cases in urban areas (68.0%) as opposed to literature, where most cases are in rural areas due to poor hygiene, low education level, unbalanced food with low protein intake and predominantly carbohydrate intake. This can be explained by the fact the patients included in the study come from a more developed rural area.

Regarding gender distribution, it appears that both genders were affected in roughly equal proportions (males = 51%, females = 49%), so we can say that gender is not a disease favouring factor (fig. 2).

The distribution of cases by gender of the patients found that gender is not a disease contributing factor as both genders were affected in approximately equal proportions.

The Rotavirus /Adenovirus etiology was detected in 1070 (34.1%) of the 3135 studied cases, affecting mainly infants between the ages of 0-3 years. Of these, Rotavirus infection was detected in 937 (87.7%) of cases, and infection with Adenovirus in 132 (12.3%) patients. Bacterial etiology was detected in 339 (10.8%) of cases (fig. 3).

The seasonal incidence in the study group showed an increased frequency of cases of Rotavirus /Adenovirus in the cold season, during the months from November to April, the peak being in the months from December to January (fig. 4), while the frequency of bacterial infections was recorded in summer, spring - autumn, with a peak in July (fig. 5).

Regarding the bacterial etiology of acute enterocolitis, the most frequently involved were *Campylobacter jejuni* (40.0%), *Salmonella spp.* (28.9%), *Shigella spp.* (12.7%), *Yersinia* (7.1%), *E. coli* (4.1%), *Staphylococcus aureus* (3.2%), *Pseudomonas aeruginosa* (2.1%), *EHEC* (0.6%) and *EPEC* (1.2%) (fig. 6).

This is consistent with data from the literature which considers *Campylobacter jejuni*, *Salmonella spp.*, *Shigella spp.* as the etiologic agents most frequently involved in child enterocolitis.

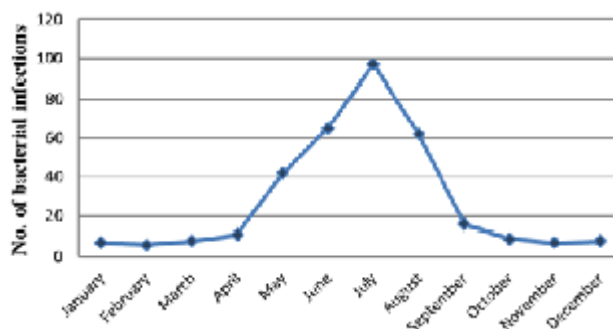


Fig. 5. Monthly repartition of bacterial infectious diarrhea

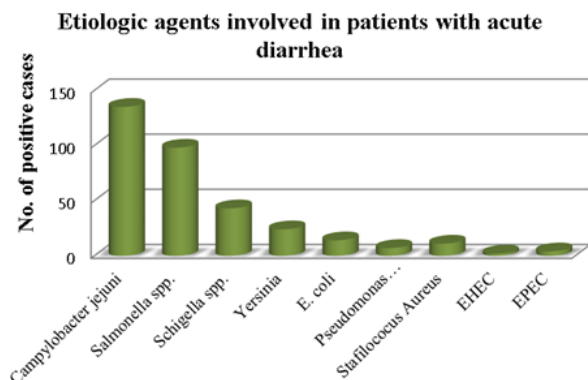


Fig. 6. Etiologic agents isolated from stool cultures

Stool culture for *Campylobacter jejuni* is not performed in many laboratories in our country, although it is most commonly involved in infectious enterocolitis.

In patients with *Salmonella* (fig. 7), the most frequently encountered was *Salmonella* D group (74.4%), followed by *Salmonella* Group B (19.2%) and Group C *Salmonella* (6.4%).

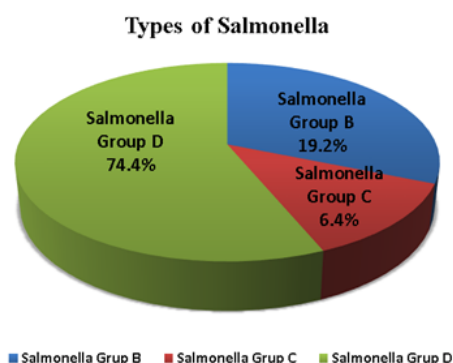


Fig. 7. Types of *Salmonella* isolated from stool cultures

In all positive tests, antibiograms were carried out to determine the resistance /sensitivity to antibiotics. Antibiotic susceptibility testing was performed using the disk diffusion method.

It has been found that the group D *Salmonella* was sensitive, for all samples, to ciprofloxacin, ceftazidime, trimethoprim and nalidixic acid, 2 samples were resistant to ampicillin.

Salmonella Group B and Group C showed sensitivity to ampicillin, ceftazidime, ciprofloxacin, and nalidixic acid trimethoprim to all samples.

Shigella spp., *Yersinia spp.*, and *E. coli spp.*, have shown susceptibility to ciprofloxacin, ceftazidime, ampicillin, nalidixic acid and trimethoprim.

Conclusions

The most common were viral infections due to Rotavirus. With regard to the bacterial etiology, it was found the presence of a relatively high number of cases of

Campylobacter jejuni (40.0%), *Salmonella spp.* (28.9%), *Shigella spp.* (12.6%), which were the most important causes of acute bacterial diarrhea.

Regarding etiology versus seasonal variations, the statistical correlation is obvious: bacterial etiology is predominant in spring-summer period, compared with viral etiology prevailing during autumn - winter.

Certain strategies can reduce diarrheal infections, such as washing hands, promoting widely Rotavirus vaccination, and improving water treatment and storage.

The findings of this study were presented to the physicians in the Sibiu area with a view to guide diagnosis and speed therapeutic intervention appropriate to etiology.

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