Causal Factors of Acute Gastroenteritis in Infants and Young Children

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Abstract

Respiratory, gastrointestinal and skin diseases represent the most common diseases in infants and young children. Causal factors of these diseases are important infectious agents and causes of pathological conditions in children, but they are also very important for their parents, as well as for people in their close environment. Greater incidence of infections in infants and young children can be explained in different ways. A cause can be insufficient maturity of their immune system, but also their exposure to infections within collective accomodations (cribs, nurseries, pre-school institutions), where they are, at the same time, exposed to a number of unknown agents. Today, a great emphasis is devoted to the ways and kinds of children's nutrition. The problem of relation between infected young organism and infectious agent itself, is also reflected in a long resistance and excretion of microorganisms in their exterior environment. It is well-known that microorganisms resist and excrete much longer in younger organisms, compared to adults, where their resistance and excretion is much shorter or very rare. Actually, adults have already formed protective immunity against particular infectious agents. It doesn't prevent infections in adults, colonization of pathogenes, nor eventual development of disease. Established immunity can shorten the time necessary for excretion of microorganisms in their exterior environment and, if disease gets developed, it is of shorter duration and slower progress.

KEY WORDS: acute gastroenteritis, infants and young children, viruses, bacteria, parasites.

Introduction

The number of infections of digestive and respiratory system in children within collective accomodatons is important, and can have the influence on their total health system. It is well-known that, during the first months of every new-born child, the possibility of their contamination and disease development is greater, compared to the older age. Their contamination and disease development can be caused even by a small number of microorganisms within inoculum, because of the fact that immune system in infants and young children is underdeveloped, or has a slower progress. Likewise, decision of parents to put their new-born child in the cribs, results in distraction of the rythm, or absolute discontinuation of nursing. This results in the direct influence on possible genesis and development of children's first infections, which is demonstrated by rotavirus or salmonella infections.

Clasification of microorganisms

VIRUSES

Hepatitis A represents a well-known disease caused by hepatitis A virus. In developed European countries, the number of seropositive individuals is gradually decreasing; examinations of 18-years-old individuals, during 1977, showed their seropositiveness in 50% of cases and, during 1997, in only 11.5% (1). This demonstrates significantly reduced presence and circulation of hepatitis A virus in examined areas, as well as the possibility for developing more severe forms of epidemies, due to daily increasing of population at risk, which is susceptible to this virus. In FB&H, during 1999, 421 cases of hepatitis A were registrated, while during 2003, only 53 individuals suffered from this disease. In FB&H, during 2000, 12 hepatitis A epidemies were registered, with 919 ill individuals. It is well-known that, in younger individuals, hepatitis A develops in much greater number as an asymptomatic form, and that the number of contaminated individuals is always greater than officialy reported number. According to the CDC's reports, more than 25% of children younger than 6, who were in contact with contaminated adults, suffer from asymptomatic infection forms (2). Some authors have estimated that hepatitis A infection ends as asymptomatic form in 60-80% of cases of very young individuals. *Hepatitis A virus (HAV)* is classified within the genus *Hepatovirus*, family *Picornaviridae*. There is only one known serotype of this virus, but its various genotypes are being discovered in different parts of the world. The virus has a spherical shape, icosahedral symmetry and the size of 27 to 32 nm. The outer lypoprotein envelope is absent. The viral capsid is composed of 32 capsomers. The virus genome is made of a single stranded RNA with the size of 7.8 kb and with other components. Hepatocytes are primarily infected with hepatitis A viruses; complete cycle of their multiplication is runing through hepatocyte's cytoplasm. The virus doesn't express significant cytocidity towards infected hepatocytes. Actually, in hepatitis A pathogenesis, immune reactions within infected organism are of predominant importance, on particular cellular level. Hepatitis A virus, as well as hepatitis E virus, only causes acute forms of hepatitis. The virus is resistant in exterior environment, it persists for 1 hour on 60°C, reserves its infectiveness for years on –20°C, and resists for only 5 minutes on 100°C. It is susceptible to UV rays influence, formaline, chlorine compounds and oxidative medium. Dry sterilization and autoclaving deactivate and destroy the virus. In exterior environment, it persists in contaminated water, feces, shells and food. The disease is diagnosed epidemiologically, clinically, according to the results of laboratory analyses (increased values of serum AST, ALT, alkaline phosphatase) and viral-serology examinations. Discovery of specific IgM anti-HAV antibodies indicates the acute phase of viral infection. After treatment, the patient has protective, practically lifelong immunity. The treatment is symtomatic and one of recommendations is resting and diet nutrition. Human immunoglobulin can be used in infected areas. In specific prevention, appropriate vaccine is available. Vaccine is being used for risk groups of populations, populations from highly-endemic areas, as well as individuals who were in contact with contaminated people, or travel to high-risk areas.

Rotaviruses (lat. Rota – wheel) are classified within the family *Reoviridae*, genus *Rotavirus*. Those are ubiquitous viruses in human environment. They can contaminate water-pump systems, sewages, food or nearest environment. During the period of baby-nursing, over 80% of cases get contaminated with rotaviruses, which means that they are the most frequent causal factors of acute gastroenteritis in this, as well as in infant population of pre-school age. Initial virus infection resigns as diarrhea, the next contact is the cause of mild distraction, while the next, third infection, resigns unknowingly (3). In the life of young population, important source of rotaviruses are malnourished or immunosuprimed children who are, after completed treatment, asymptomatic agents of the virus, for one to three weeks. Asymptomatic virus

carriers can also include inapparent infected children or adults who were in contact with contaminated children. Along with the human representatives, those of animal rotaviruses are also well-known. They all belong to the group of RNA viruses, whose genome is made of double stranded RNA with 11 segments. RNA encodes synthesis of 6 structural an 5 non-structural proteins. VP6 determines classification of human rotaviruses to A, B and C groups. Most of the human rotaviruses species belong to the group A, while, in China, group B is being determined in the cases of epidemiologic disease forms, and group C in sporadic infections of different parts of the world. VP7 glycoprotein determines the serotype (G) rotavirus classification, while glycoprotein VP4 is responsible for their P serotype classification. Group A human rotaviruses are divided in the subgroup I and II. They are consisted of more than 10 serotypes G. Human serotypes 1, 2 and 4 are causes of infections in more than 95% of cases, while serotypes 3, 8 and 9 are rarely found (4). Infected organism synthesizes neutralizing antibodies against viral antigens VP4 and VP7. Along with the human rotavirus representatives, monkey and veal rotaviruses can also be pathogenic for people. Size of the rotavirus is approximately 70 nm. The inner capside lamina is made of 32 capsomers. Viruses have characteristic shape which can be immediately noticed on the electronic microscope image. Viral infections are possible during the whole year, but they are the most frequent during cold seasons. Hospital infections are registrated in new-born children's departments (5). Nosocomial infections, caused by rotaviruses, have one of the most important positions in total number of these infections, since their number is increasing every day. Important source of viruses within hospital departments are asymptomatic carriers; in hospital departments for children's bronchiolitis treatment, rotaviruses are found in 5%, by accidentaly analysing feces (1). The same possibilities of rotavirus transmission to the healthy population of children can occur within the institutions for their collective custody, cribs or other interior environments. In the case of every smaller or greater acute gastroenteritis epidemy, it is very important to determinate a casual factor, so that appropriate sanitary and other precautions, as well as preventing the casual factors from transmission from children to adults and in the opposite way, can be performed on time. Today, the values of Rhesus rotavirus tetravalent active vaccine (RRV-TV) (RotaShield, Wyerst-Ayerst Pharmaceuticals, Wayne, Pa), which is composed of RRV mixture (Rhesus rotavirus, serotype G3) and three types of genetically modified monkey-human virus types (reasortant), type G1, G2 and G4, is being intensively clinically examined. The vaccine would be ordinated per os, in the new-born children aged 6 weeks, in three doses and with the distance of 3 weeks. It would also protect infected individual from development of severe gastroenteritis forms. **Reoviruses** are classified within the family *Reoviridae*, genus *Reovirus*. There are three known antigen types of this virus, type 1, 2 and 3. Virus types have common, as well as different antigen characteristics, which can be demonstrated by reactions of neutralization or inhibition hemagglutination. All reovirus serotypes agglutinate human "O" blood group-eritrocytes, and type 3 agglutinates beef and sheep eritrocytes. The viruses have a rounded shape, the size of 80 nm, and virus genome which is composed of 10 double stranded RNA-segments. They have double-laminated capsid, but the outer lypoprotein envelope is absent. In infected cells of digestive system, infection development is slow, the time of virus multiplication is long, and multiplied viruses leave the cell after the cellular lysis and go to intercellular area. In intestinal cells, reovirus serotype 1 is the best multiplied. Multiplied virus' capability of spreading into Peyer's plates and mesenterial lymph nodes, depends on activity of their hemagglutinines (6). Reovirus infections in children have been found in different parts of the world, but they can also be discovered in water-pump systems and canalization water. They are transmitted to humans by the faecal-oral route. It is demonstrated, by epidemiological studies, that these viral infections occur in childhood, and that examined individuals, aged to 3 years, show seropositivness in approximately 70% of cases. Viral infections can resign inapparently, or manifest through the symptoms of digestive system infections. Digestive problems are caused by serotype 1 and sometimes serotype 2. Diarrhea is mild, lasting 2-3 days, often ending without any therapy. If the treatment is necessary, virus etiology methods are used, as in cases of other diarrheal conditions. Reovirus serotype 3 infects upper parts of the respiratory system. There is no specific prevention from these viral infection; general sanitary preautions are available. **Coronaviruses** are classified within the family Coronaviridae. They are named by their morfology, lat. corona = crown. They belong to RNA virus group. RNA is single stranded and non-segmented. Their size is approximately 160 nm. On the outer viral lypoprotein envelope, there are glycoprotein grafts with antigen and hemagglutining characteristics. The grafts look like flower lobes, through which viruses communicate or adsorb to receptors of sensitive cells. They multipy in the cy-

toplasm of infected cells, and maturate budding on the Golgy device and endoplasmatic reticulum. This group of viruses doesn't have the possibility of budding on the cellular membrane itself. New-multiplied viruses are self-protecting from cytoplasmatic enzyms, by agglomerating within cellular vesicula, which they leave after their fusion with the inner side of cellular membrane. Coronaviruses transmit to the susceptible organism by respiratory, faecal-oral or mechanical route, and infect susceptible cells of respiratory, digestive or nerve systems. They are prevalent in all parts of the world, with possibility of infection in all age- and sex-groups of population. In pre-school aged children, infections of gastrointestinal system are the most frequent and discovered during the whole year. The infection is manifested by diarrhea and, in new-born children, necrotizing enterocolitis can also develop. In feces samples, viruses are demonstrated by EM or immunoelectronic microscopy (IEM). The treatment is symptomatic. There is no specific prophylaxis; general sanitary precautions are available. Representatives of human calciviruses, virus **Norwalk** and morphologicaly similar viruses (**Norwalk-like, Hawaii, Snow Mountain, Tounton Cokle, Paramatta**) are classified within the family Calciviridae. All these viruses can infect susceptible organism and cause acute gastroenterits in young children and infants. Calciviruses belong to the group of RNA viruses. Viral capsid is composed of 32 capsomers which are concave and cup-shaped (lat. Calix-cup). This is the group of viruses without lypoprotein envelope. On the EM image, they have characteristic morphology and the size of 35 to 40 nm. They multiply in the cytoplasm of infected cells and leave them after cellular lysis. They infect new-born children, aged from one month to one year. Disease has a short incubation period (48-72 hours), with diarrhea, lasting from 1 to 11 days. Infections occur during the whole year, but they are more frequent in winter. Viruses are transmitted within the population by the faecal-oral route, with more frequent occuring disease within internal collectives, institutions, colleges, schools and hospitals. In feces samples, the viruses can be demonstrated by EM, IEM or ELISA method. Viruses excreted through feces can contaminate water, food or objects of general use. The treatment is not specific, there is no specific prophylaxis. General principles are used in treatment, and general sanitary precautions in prevention from infection are recommended. Norwalk and similar viruses are classified within the family Calciviridae. Norwalk virus is discovered in Norwalk, Ohio, SAD, as well as in other parts of the world. Similar particles are discovered later. Norwalk virus' size is 27 nm. It has single stranded RNA. Based on his morfology, antigen and serology characteristics, it is different from other members within the family. Also, individual members of this group of viruses can be differentiated by serology methods. Infection in young and non-immune organism leads to development of acute gastroenteritis with short incubation period (around 24 hours). The disease occurs suddenly and shows general infective symptoms. Viruses are excreted from infected organism through feces, and transmitted to susceptible organism by the faecal-oral route. Along with infected and ill individuals, contaminated water and food can also be the source of these viruses. After treatment, short protective serotype immunity remains. General-accepted principles are recommended in treatment. There is no specific prophylaxis. Norwalk-like, Hawaii, Snow Mountain, Taunton Cokle, Paramatta and other Norwalk-like particles can cause disease with similar clinical and epidemiological characteristics. They can be differentiated and identified by IEM. **Adenoviruses type 40 and 41** belong to the genus **Mastadenovirus**, within a large family **Adenoviridae**. All members of this genus primarily infect humans, playing important role in their total health. There are a few groups and 50 known adenovirus serotypes. They all have double stranded DNA, whose genome is capable for encoding proteins, thanks to 30 and 40 included genes. Their size is from 70 to 90 nm, they have icosahedral symmetry, with the capsid composed of 252 capsomers. They don't have lypoprotein envelope. They have penton, hexon and fibrous antigens (with hemagglutinational capabilities). Viruses are connected to specific receptors of sensitive cells via fibrous antigens. They infect epithelial cells of susceptible organism, multiplying in their nucleus and cytoplasm. New-multiplied viruses leave the infected cells after cellular lysis. Human adenovirus types can infect susceptible organism, causing various clinical entities. Diseases can be caused by one or more different adenovirus serotypes, but different diseases can also be caused by the same virus types. Some adenovirus types (type 40 and 41, 31 rare) infect epithelial intestinal cells, where they multiply and excrete to exterior environment through feces. 40 and 41 adenovirus types are causes of acute gastroenteritis in infants and young children, with similar clinical and epidemiological characteristics, as in the case of rotavirus infections. In the therapy and prophylactic sense, there is no difference compared to other viral infections. **Astroviruses** are classified within the family **Astroviridae**. They are the causes of easier infection forms and

diseases in pre-school aged children. Except human, there are also animal infections (calfs, lambs, poultry, dogs). Viral particle has the size of 27 to 30 nm, single stranded RNA is placed within nucleus. Viruses have four structural proteins. Based on antigen morphology, there are eight discovered human astrovirus serotypes. Acute gastroenteritis in infants and young children is characterized by occurence of abdominal cramps, nausea, high temperature and diarrhea. Diarrhea lasts between 3 and 14 days, feces is liquid and mucous. Easier form of dehydratation is present. Viruses are excreted in exterior environment through feces, and transmitted to a susceptible organism by the faecal-oral route. Intrafamiliar infections are recorded in the case of these viruses. In feces samples, viruses can be demostrated by IEM and ELISA method. In the treatment of ill individuals and prevention from infections, generally-accepted priciples are in use, since there is still no specific medicines nor preventive precautions. **Echo viruses** (32 serological types) represent potential infective agents in infants and young children. They are classified within the family Picornaviridae, genus Enterovirus. This is a group of RNA viruses, sized from 24 to 25 nm, with icosahedral symmetry. They multiply in the cytoplasm of infected cells, which they leave after cellular lysis. They express significant selectivity and tropism. Since they are resistant viruses, they persist very long outside of infected organism. They are excreted through feces, and transmitted by the faecal-oral route. During the infection of susceptible cells in upper part of respiratory system, they spread towards the cells of digestive system, from which they can get to target cells through blood, causing easier forms of serose meningitis (6). Infections in young individuals can be manifested by febrile rash condition, as well as by development of respiratory and digestive problems. Isolation and identification of Echo viruses is performed in GMK cells, which is exception compared to above described viruses. After treatment, type specific, opposite and short immunity is developed. There is still no specific medicine, nor vaccine for these viral agents.

BACTERIA

Salmonellae are the group of bacteria which can cause infections and diseases in children older than 5. In examined areas of the world, the most frequent isolated salmonellae from examined group belong to particular serotypes (*S. enteriditis*), which depends on epidemiological situation within examined region. Salmonella infections in infants younger than 5, result in development of bacteria-carrier occurence, which can last longer than three months (1). This date is important in the case of accomodating asymptomatic salmonella-carriers in institutions of collective accomodation, since these infectious agents transmit to susceptible individuals by the alimentary route, via contaminated hands or objects from their nearest environment. This is the reason why various salmonella types become important causal factors of epidemic acute gastroenteritis type, within the institutions for retenting children aged to one year, or within the institutions for accomodating individuals with decreased resistance towards infectious agents. With the purpose of prevention from occuring particular infections and diseases, continuous systematic studies and discovering asymptomatic carriers of particular kinds of microorganisms are necessary, as well as performing particular contraepidemic precautions within the institutions for accomodating pre-school aged children. Bacteria within the genus *Salmonellae* belong to the family **Enterobacteriaceae**, as well as the genus *Shigellae*. Salmonellae are Gram-negative, mostly mobile bacilli, which have somatic-O, flagellar-H and envelope-Vi antigens. They don't have a capsule and do not form spores. H-flagelar antigen occurs in two forms, as phase 1 and phase 2. Salmonellae which have a phase 1 antigens are marked as monophasant, compared to biphasant salmonellae, with phase 1 and 2 antigens. Phase 1 and 2 H-antigens enable division of salmonellae to particular serotypes. Today, there is around 2300 known salmonella serotypes which can infect humans and various animal species. Several various salmonella serotypes can have some of the common flagellar antigens. O or somatic antigens are composed of lypopolisaccharides of the cellular wall. They have complex constitution, in one of their parts they have components with characteristics of bacterial endotoxins. Based on O antigen, all known salmonella serotypes are divided into particular groups. It is well-known that, within the first five groups, there are representatives of salmonellae pathogenic for humans. Vi or envelope-antigen represents the surface antigen, which can cover O antigen. Vi antigen has limited number of salmonellae. All salmonellae are cultivated on Salmonella-Shigella (SS), Wilson-Blair, dezoxicholat-cytrat agar or other media. Human infections with particular salmonella species can cause development of general cyclic infectious diseases (abdominal tiphoid and paratiphoid A and B), alimentary toxic-infections or enteritis. As causal factors of diseases in infants and young children, salmonellae are also important as infective agents of salmonellosis, as well as of alimentary toxic-infections. In ill children, diarrhea can endanger their general health condition, with pos-

sible development of septicaemia. It is necessary to pay a special attention to asymptomatic carriers as the source of infectious agents in children' and adults' population, as well as to their relation towards this infection (1, 7). In FB&H, during 2002, 4195 individuals were registered with clinical diagnosis of enterocolitis, as well as 351 cases of salmonellosis and 19 salmonellosis carriers. From the data source, information about the age of ill individuals or carriers is not available, nor about their geographic distribution. Also, during 2002, 1021 cases of alimentary toxic-infection were registered. In FB&H, during 2003, 4199 individuals were registered with clinical diagnosis of enterocolitis, as well as 419 cases of salmonellosis and 29 carriers. During the same year, 1024 alimentary toxic-infections were registered, but without indicated age of infected and ill individuals.

Shigellae. Infections by this bacteria species in preschool children, can end with development of severe infection form and with damaging colonal mucous cells, with possible complications and particular number of deaths (1). Compared to salmonella infections, shigella infections are limited to epithelial cells of colonal mucous and the surface side of lamina propria. Practically, there is no penetrating of these bacteria into the blood (8). Infections by this bacteria group are possible within internal children' collectives. Around 50% of infected and ill children gets hospitalized. It is important to emphasize that all infection cases should be evidented and reported to appropriate institution. Occurence of only one shigellosis case requires systematic research, which includes discovering asymptomatic or mild-infected individuals. In particular cases of children' infections, the disease can develop a form of acute dysentery syndrome, which is manifested through hemorrhadic inflammation of the colon mucous, with occuring mucous-bloody feces, thenesis and cramps. Shigellae are transmitted by the faecal-oral route, via contaminated hands and objects, or through contaminated excrements of ill individuals. Ill individuals and carriers are important source of infective agent, and flies play an important role as the way of their spreading, through contaminated food and water. Carying is rare, of short duration, for only few weeks, with rare exceptions for more than a year. Developed disease form, along with the hospitalization, also requires rehydratation and diet nutrition, as well as antibiotic therapy when necessary. It is important to emphasize that, in children' institutions, rigorous sanitary precautions should be performed, and in the case of disease occurence, particular objects and institutions should be closed. Bacteria from *Shigella* genus are Gram-negative and immobile bacilli, which do not form any spores, nor sinthesize the capsule. They have fimbrions. Based on their biochemical and antigen characteristics, they are classified in four subgroups (A, B, C, D). The subgroup A (*Sh. dysenteriae*) includes 12 serotypes, subgroup B (*Sh. flexneri*) 6 serotypes and 2 varieties, while there are 18 serotypes in the subroup C (*Sh. boydii*). Only one serotype with two phases of occurence belong to the subgroup D (*Sh. sonnei*). All mentioned bacterial serotypes can cause acute disease or bacillar dysentery. The disease is manifested as a local illness with intracellular multiplication of bacteria, development of inflammatory changes, celullar necrosis, occurence of ulceration and hemorrhage. Sh. dysenteriae type 1 excretes Shiga toxin, enterotoxin and cytotoxin. Disease diagnosis is determined based on the clinical findings, epidemiological data and laboratory examination of feces samples (coproculture). Except microscopic analysing, feces is cultivated on the blood, endo and Salmonella-Shigella agar. Media are incubated on 37°C for 24 hours. Grown bacterial colonies undergo biochemical and serology typing, to the subgroup or serotype level. In FB&H, during 2002, 20 cases of bacillar dysentery were registered, without available data about the age of ill individuals, type of isolated bacteria, or their regional distribution. During 2003, only 17 cases of infection with these bacteria were registered in FB&H.

Compylobacter jejuni. In the countries with the low, as well as the high sanitary standard, compylobacteria are quite frequent causal factors of diarrheal diseases in infants and young children. Infections can resign as asymptomatic or severe disease forms. Enteritises caused by these bacteria are included in the group of zoonosis, since animals (poultry, cows, dogs) and their products, milk and meat, represent the source of infection. Interhuman transmission of these bacteria is possible within departments for new-born or young children, or within families. The disease occurs during warmer months. Morfologically, there is no difference between *C. jejuni* and *C. coli*, *C. fetus* and other species, which are one of 15 known species and subspecies within the genus (9). They are Gram-negative, bent and thin little rods. They have flagelli, do not form any spores. They are cultivated on special selective media (Skirrow) in microaerofil conditions and 42°C. Grown colonies express the poor biochemical activity. For humans, pathogenic compylobacter species, oxidase and catalase are positive. Some *C. jejuni* species excrete cytotoxin, and all species have endotoxin and excrete enterotoxin. Infection in newborn and young children can be manifested as acute enterocolitis. In the cases of severe disease forms, development of dehydratation is present, which requires

hospitalization. Carying is possible, of short duration, for only several weeks. The therapy is symptomatic, compensation of lost liquid and electrolites is recommended, as well as diet nutrition. Severe cases require hospitalization, as well as antibiotic treatment (erithromycine). Except *C. jejuni*, it is also possible to isolate *C. coli* from feces samples. Its presence in causing the disease varies between 5 and 10%, although there are reports about its more frequent isolation. According to the reports from our neighborhood about acute enterocolitis causal species, compylobacter is found in 3.86%. *C. jejuni* is isolated in 75% of cases (9). There is no possibility for specific disease prevention; general sanitary precautions are available, along with sanitary controling the water and food product quality. In our region, **Escherichia coli** still participates as an important etiological factor, causing diarrheal diseases in pre-school aged children. In developed countries, the importance of *E. coli* in causing acute gastroenteritis in new-born children is minimal, but it is significant in infant's infections with enterohemorrhadic *E. coli*. In the case of diarrhea, caused by enterohemorrhadic *E. coli* (O157), it is necessary to perform all required examinations, to analyse available feces samples from environment and perform appropriate precautions. This infection is important especially within nurseries or internal children' collectives. The members of the genus are Gram-negative and mobile bacilli which have O, H i K antigens. Most of the *E. coli* species isolated from feces samples, are included in facultative anaerobic flora of the human digestive system, but only small number of isolates can be associated to the human infections. All types of these bacteria have fimbrions or pili, which provide their adhesional capability. Most of the isolated species are successfully cultivated on in vitro media (blood and endo agar), they are biochemically active and belong to the group of lactose-positive bacteria. Most of them ferment carbohydrates to the acid and gas. *E. coli* isolates can have characteristics of enteropathogenic E. coli (EPEC), enterotoxigenic *E. coli* (ETEC), enteroinvasive *E. coli* (EIEC), enterohemorrhadic *E. coli* (EHEC) and enteroaggregative *E. coli* (EAEC). Enterotoxigenic E. coli, with the enterotoxin, causes diarrhea in new-born and young children in developing countries. Enterohemorrhadic *E. coli*causes sporadic and epidemic forms of hemorrhadic colitis, through the local excretion of Shiga like toxin 1 and toxin 2. A special attention should be paid on the patients from which *E. coli* O157: H7 is isolated. Actually, this bacterial infection in these patients can develop hemolitic uremic syndromme.

PARASITES

Giardia intestinalis represents one of the causal factors of acute gastroenteritis in pre-school aged children. After the first contact between a non-immune person and this parasite, short diarrhea can develop, which can be treated and properly cured. Lamblyase is cosmopolit disease, whose causal factor is isolated from analysed feces samples in 2-7% of examined individuals from Northern and Central Europe, and in 10% from Southern Europe (8, 10). Vegetative or, more frequent, cystic parasite forms can be found in feces. *L. intestinalis* cysts are transmitted by the faecal-oral route, contaminated water or food. Hydric epidemies are also discovered. In infants and young children, cysts can also be transmitted via contaminated hands. If disease is suspected, diagnosis is based on laboratory analysis of cysts or vegetative parasite forms from feces samples or from duodenum contents. There is no specific prevention, general precautions are available, as well as recommendations about the use of microbiologically clean water and personal sanitary precautions, such as washing hands or fruits and vegetables.

Conclusion

Causal factors of acute gastroenteritis in infants and young children are viruses, bacteria and parasites. Acute gastroenteritis of viral etiology in infants and young children is caused by hepatitis A viruses, rotaviruses, calciviruses, *Norwalk* and *Norwalk-like* viruses, adenoviruses, astroviruses, coronaviruses, as well as Echo viruses. Acute gastroenteritis of bacterial etiology is caused by several salmonella and shigella serotypes, but also by Compylobacter jejuni and different types of *Escherichia coli* and, when we talk about parasites, by *Giardia intestinalis*. Etiologic role of these causal factors in causing diseases must be laboratory-demonstrated, since this is not possible to perform based on clinical image of disease or epidemiological data. This requires knowledge and the use of available laboratory diagnostic methods in virusology, bacteriology, parasitology and immunology domain. Each year, a certain number of infected and ill individuals that suffer from hepatitis A is registrated in Federation of Bosnia and Herzegovina and, during 2000, 12 hepatitis A epidemies with 919 ill individuals were also registrated. Rotavirus infections are not being officially registrated, as well as other virus infections, but, according to the reports from several hospital centres, they are being discovered and described in their reports and published works. In the Clinic for Infective Diseases in Tuzla, between 1999-2000, rotaviruses are demonstrated as etiology agents in 23.9%, enteric adenoviruses in 1.5%,

and mixed infection in 1% of individuals infected by rota and Shigella sonnei, and 0.5% by rota and EPEC (enteropatogenic Escherichia coli) (11). In FB&H, during 2002, 4195 individuals with clinical diagnosis of enterocolitis, 351 cases of salmonellosis and 19 salmonella carriers were registrated. Information about the age of ill individuals or carriers is not available from the source. Also, during 2002, 1021 cases of alimentary toxicoinfection were registrated. In FB&H, during 2003, 4199 individuals with clinical diagnosis of enterocolitis were registrated, as well as 419 cases of salmonellosis and 29 carriers. During the same year, 1024 alimentary toxicoinfections were registrated, but without indicated age of infected and ill individuals. In FB&H, during 2002, 20 cases of bacillar dysentery were registrated, without available data about the age of ill individuals, the type of isolated Shigella or their regional distribution. During 2003, 17 cases of infections by these bacteria were registrated in FB&H. We do not have any data about other bacterial or parasite causal factors of these diseases. In specific prophylaxis of diseases, appropriate vaccine is developed for several causal factors. For other causal factors, specific vaccines are being investigated, but they all should:

- give specific protection to new-born children against infective agent, even in the first weeks of their life,
- decrease patogenic influence of microorganisms, prevent development of severe disease forms,
- provide development of local protective immunity,
- provide specific protection towards all serotypes of specific infective agents.

Along with specific prophylaxix, supervisions of collective accomodation objects for young children are also important, as well as performing rigorous sanitary procedures, individual or collective.

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