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Features of Some Markers of The Inflammatory Response in Patients with Salmonellosis

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Abstract: Objective. To study the clinical and laboratory features of the course of salmonellosis in adults.

Results. The results of the study showed that the predominant causative agent of salmonellosis in patients older than 45 years is Salmonella enteritidis (more than 75%), with an afebrile course of the disease observed in 30% of cases. Identification of the most appropriate inflammatory response markers for use in an infectious disease inpatient setting, such as C-reactive protein levels and fecal calprotectin assessed dynamically, is becoming increasingly relevant due to the detection of a group of patients with an ongoing inflammatory process. This facilitates the identification of patients who require early rehabilitation.

Conclusion. Determination of fecal calprotectin and CRR levels makes a significant contribution to distinguishing patients with a tendency toward a prolonged inflammatory process in the gastrointestinal tract in salmonellosis.

Keywords: Salmonellosis, C-reactive protein, procalcitonin, fecal calprotectin.

1.Introduction:

The diversity of the spectrum of causative agents of acute intestinal infections includes both bacteria and viruses, the simplest of various taxonomic groups with constantly changing transmission routes (food, water,

contact) with high prevalence in some countries and the variability of the course create the relevance of this nosology at the present stage, and therefore at the present stage requires constant development of new methods of prevention and treatment, especially against the background of antibiotic resistance [1].

Representatives of the genera Salmonella, Shigella, pathogenic strains of Escherichia coli, Campylobacter, Staphylococcus, Klebsiella and others are among the most common bacterial acute intestinal infections of OKI. Currently, the leading place in the etiological structure of acute respiratory viral infections is assigned to pathogens of viral acute respiratory viral infections, such as Norovirus, Rotavirus, Astrovirus, Adenovirus (intestinal type), as well as Enterovirus (enteroviruses such as Coxsackie) and others. As in the whole world, salmonellosis is the leader among the listed possible etiological causes of acute intestinal infections of bacterial etiology in our country [2, 3]. The genesis of salmonellosis includes numerous, more than 22 thousand serotypes of bacteria of the genus Salmonella, characterized by a variety of clinical manifestations from asymptomatic carriage and mild forms of gastroenteritis to severe generalized forms of the disease, occurring with pronounced intoxication and prolonged fever: typhus-like, septicopyemic forms. Salmonellosis in the adult population, due to the presence of a mass of concomitant diseases, can occur atypically, severely, or lead to the manifestation of concomitant chronic diseases [3, 4, 5]. The course of salmonellosis is usually caused by a predominant lesion of the gastrointestinal tract in the form of gastrointestinal forms such as gastritis, gastroenteritis, and gastroenterocolitis, with salmonella gastroenteritis predominant among them [6, 7, 8].

Thus, the importance of studying salmonellosis in the adult population is determined by its significance in the pathology of childhood and the urgency of the problem.

The aim of the study the clinical and laboratory features of the course of salmonellosis in adults.

2. Methods

The study included 112 (100%) patients over the age of 18 who received inpatient treatment at the clinic at the Republican Specialized Scientific and Practical Medical Center for Epidemiology, Microbiology, Infectious and Parasitic Diseases in the period 2024-2026. All patients with salmonellosis underwent a complex of studies, including an analysis of clinical manifestations in dynamics, a general blood and urine test, a coprological study, a biochemical blood test, a stool test for the intestinal group twice, urine culture for salmonella twice, stool analysis for rota and noroviruses by ELISA, blood for hemoculture (according to indications), serological methods of blood examination (according to indications), ultrasound examination (ultrasound) of the abdominal cavity and kidneys.

Of the methods used to study fecal PCR using a Rotary Gene Q - SNR0911/54 PCR analyzer manufactured in Germany to establish the etiological agent of AKI, the determination of a specific neutrophil protein in feces with the determination of the level of fecal calprotectin (ELISA method). The CRP level was set on an automatic biochemical analyzer "VITROS–350" from Ortho Clinical Diagnostics (Germany). The average level of fecal calprotectin in relatively healthy individuals was 106.9 mg/kg, procalcitonin 0.03±0.01 ng/ml. Statistical processing was carried out using an electronic program – https://medstatistic.ru/calculators.html, where the significance of the shifts obtained by comparing quantitative averages (continuous variables with a normal distribution) was determined by calculating the probability of error (p) according to the Student's criterion (t).

3. Results

The first group of patients with salmonellosis (n=112) consisted of 58 (51.8%) patients with salmonellosis aged 45 to 59 years, with an average age of 53.4±0.7 years; the 2nd group consisted of 54 (48.2%) patients aged 60 years and above, with an average age of 62.9±0.7 years old. Women were sick more often than men (62/55.4% and 50/44.6%, respectively). 73 (65.2%) people were among the sick urban residents.

The leading route of infection was food (92/82.1%) with the main transmission factors in the form of dairy products (43/46.7%), chicken meat (19/20.7%) and eggs (12/6.5%) without sufficient heat treatment. Infection by household contact was observed in 6 (6.5%) patients, mainly in patients over 60 years of age (80.4%). In 12 (13.0%) people, epidemiological history data could not be determined.

5 (8.6%) patients of group 1 and 8 / 14.8% of group 2 were diagnosed with severe forms of salmonellosis due to severe intoxication and dehydration, as well as exacerbation of chronic concomitant diseases. No generalized forms of salmonellosis were detected during the observation period. Of the identified concomitant pathologies, 13/22.4% of patients from the first group and 18/33.3% of patients from the second group had diseases of the gastrointestinal tract such as

chronic cholecystopancreatitis. 6/10.3% of patients from the first group and 9/16.7% of patients from the second group had chronic gastritis and two patients in each group had duodenal ulcer.

4/6.9% of the first group and 9/16.7% of the second group had kidney pathology, 3/5.2% of the first group and 4/7.4% of patients from the second group had anemia.

In patients of groups 1 and 2, diseases of the cardiovascular system, chronic tonsillitis and neurological disorders were observed in 32.8%; 27.6%; 36.2% and 51.9%; 33.3%; 35.2% of patients, respectively.

Patients were admitted to the hospital on day 3.26 ± 0.16 with complaints of general weakness and lethargy, fever, nausea, vomiting, loose stools, abdominal pain, decreased appetite.

The duration of the fever period was 3.27 ± 2.5 days. An increase in body temperature was noted in 75/66.9% of patients. Of these, subfebrile fever was recorded in 51/68% of patients, febrile fever in 24/32% of patients. Hectic fever has not been reported in patients. No increase in body temperature was observed in 37 (33.0%) children.

In all patients with salmonellosis, the disease began acutely with a pronounced intoxication syndrome in the form of lethargy, weakness, decreased or lack of appetite, and in all cases nausea and pain in the epigastric region. Vomiting in 12 (10.7%) was toxic, that is, it was at the height of fever, while the rest had gastritic vomiting. The duration of vomiting in patients with salmonellosis averaged 1.62 ± 0.1 days. Complications in the form of reactive pancreatitis were observed in 18/31.03% of patients from the first group and 26/48.2% from the second group, where reactivation of chronic pancreatic lesion occurred in 5 / 8.6% of patients from the first group and 8 / 14.8% from the second group.

The data obtained show that salmonellosis in most patients is characterized by a predominantly widespread lesion of the gastrointestinal tract in the form of gastroenteritis and gastroenterocolitis, which accounted for 45/77.6% and 13/22.4% of patients in group 1, respectively, and 38/70.4% and 16/29.6% of patients in group 2, respectively.

We did not notice an isolated gastritis variant. All patients had diarrheal syndrome with a stool frequency of 8.3 ± 0.2 times and a duration of 4.6 ± 0.2 days. Abdominal pain, more pronounced along the colon in the gastroenterocolitic form of salmonellosis, occurred in 38/70.4% of patients in group 1 and 16/29.6% of patients in group 2, in all 112/100% of patients, abdominal pain was localized in the epigastric region and around the navel.

The phenomena of flatulence were detected in 85/75.9% of patients, mainly in the second group. We did not diagnose hepatosplenomegaly.

The diagnosis of salmonellosis in all patients was verified by bacteriological method: S. enteritidis was isolated in 87 (77.7%) patients, S. typhimurium – in 13 (11.6%), the rest of Salmonella spp. Thus, during the study period, S. enteritidis prevailed in the etiological structure of salmonellosis in the adult population.

In 26 (23.2%) adult patients, salmonellosis occurred in combination with bacterial pathogens and viruses. The combined course was mainly observed with pathogenic Escherichia coli, registered in 3 (2.7%), campylobacteria - 2 (2.7%), rotaviruses - 9 (8.0%), noroviruses - 5 (4.5%), enteroviruses - 4 (3.6%), adenovirus - 3 (2.7%).

The average bed-day inpatient stay with mono infection was 5.2 ± 0.1 days, with mixed forms of salmonellosis, there was a significant increase in the length of stay to 7.8 ± 0.16 days ($p<0.05$).

It was found that reactivation of chronic pancreatic lesion, observed in 5 / 8.6% of patients from the first group and 8 / 14.8% from the second group, was confirmed and elevated levels of blood amylase, which was confirmed by ultrasound examination of the abdominal organs by the type of detection of diffuse changes in the pancreas.

The detection of elevated levels of fecal calprotectin in patients of the 2nd group (242.3±35.4 micrograms/g) established its unreliable prevalence ($p>0.05$) relative to patients of the 1st group (215.7±42.1 micrograms/g). A significant decrease in the level of fecal calprotectin was found in the dynamics of the disease in patients of group 1 (113.2 ± 9.6 mcg /g) than in group 2 (146.3 ± 9.3 mcg/g), which indicates the presence of a more pronounced and prolonged persistence of inflammation in the gastrointestinal tract in this category of patients.

The level of C-reactive peptide (CRP) in patients of groups 1 and 2 did not significantly differ, but in the severe form of salmonellosis, the level of C-reactive peptide was 76.8±1.6 mg/l, and was significantly lower in the moderate form of salmonellosis - 40.8±1.7 mg/l.

It has been established that elevated CRP levels in patients with severe acute intestinal infection are a potential predictor of disease progression. Thus, the dynamics of CRP levels in patients with salmonellosis was unstable, fluctuating, with an increase with worsening of the patient's condition, accompanied by severe intoxication and the presence of hemocolitis and a decrease with a decrease in intoxication syndrome. In the last days of hospitalization, 42 (31.8%) patients with salmonellosis (group 1 n=14, group 1 n=28) had high levels of C-reactive peptide, averaging 18.4±1.2 mg/l. This indicated the persistence of the inflammatory process during the early rehabilitation period. All patients, with the exception of the contingent with hemocolitis, were prescribed oral rehydration and, as indicated, infusion therapy. Patients with moderate forms were treated with nifuroxazide, and those with severe forms were treated with antibacterial drugs. Enterosorbents, as well as bacteriophages and probiotics, were prescribed to patients as pathogenetic therapy.

4. Discussion

The results of the study showed that the dominant causative agent of salmonellosis is Salmonella enteritidis (77.7%).

Salmonellosis remains relevant among the adult population, becoming particularly important in people over 60 years of age. Salmonellosis in the adult population manifests as a febrile intoxication syndrome with a maximum increase in body temperature on the first day of the disease, while in 33.0% of cases, an afebrile course of the disease is noted.

The detection of a more pronounced increase in the level of fecal calprotectin in dynamics was noted in patients over the age of 60, which confirmed the prolonged course of salmonellosis with prolonged colon repair. The long-term persistence of elevated CRP levels in 31.8% of patients with salmonellosis, especially in patients over 60 years of age, as well as the level of fecal calprotectin reflect prolonged tissue damage and prolongation of the severity of the inflammatory process, and, therefore, can serve as a diagnostic and prognostic marker of the need to continue therapy during early convalescence in order to avoid the development of complications in patients and early and long-term rehabilitation. Establishing the level of CRP and fecal calprotectin with a low number of false positive results can be used to determine the severity and as an indicator of the persistence of inflammation in the gastrointestinal tract in this category of patients. The established higher level of C-reactive peptide and fecal calprotectin in patients with severe salmonellosis compared with the moderate form is due to the fact that severe forms of the disease reflect more pronounced inflammation in the intestine, which was expressed in a significantly frequent detection of hemocolitis in patients.

5. Conclusions

The etiological structure is still dominated by salmonella of group D, which includes S. enteritidis, whose specific gravity was 77.7%. The determination of the level of fecal calprotectin and the level of C-reactive peptide in the dynamics of salmonellosis is a marker of more pronounced and prolonged inflammation in the gastrointestinal tract, observed significantly more often in its severe form in patients over 60 years of age. Maintaining the dynamics of elevated fecal calprotectin and C-reactive peptide levels is a fundamental indicator for continued diagnosis of this contingent, in order to predict the chronization of the process, as well as for timely therapy and rehabilitation of patients. These indicators also serve as one of the methods for diagnosing the effectiveness of therapy in patients with salmonellosis.

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