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Cytokinemia in Adhesions of the Abdominal Cavity and its Complications in Elderly and Senile Patients

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ABSTRACT

The high incidence of acute commissural small bowel obstruction and its complications in elderly patients is accompanied by an increase in postoperative mortality, which is based on immune system disorders. We set ourselves the goal of determining the degree of cytokinemia development in patients with various forms of abdominal adhesions. At the same time, among the analyzed cohorts of patients, we also identified patients with acute adhesions, small intestinal obstruction and a form complicated by peritonitis. In the blood of patients, we study the concentration of interleukins, which belong to the group of pro-inflammatory. We found that changes in the concentration of interleukins in the blood depend on the pathology being analyzed, related to intestinal obstruction or the development of peritonitis. Some of the indicators, among which we identified the tumor necrosis factor- α , have significant changes, which allows us to use it as a basis for the development of methods for predicting the development of peritonitis in patients with intestinal obstruction in the elderly and senile age.

Keywords—Adhesions of the abdominal cavity, acute adhesions of the small intestine obstruction, cytokinemia, elderly and senile age

INTRODUCTION

Among the causes of mortality in elderly and senile patients, acute intestinal obstruction stands out as high values, which, according to literature sources, can reach up to 28.9% [1]. At the same time, in the case of a comorbid course of the disease against the background of pronounced endotoxemia, generalization of infection, and the development of multiple organ failure, it can reach up to 75% [1, 2].

Literature sources indicate the importance of severe forms of endotoxemia and homeostasis disorders associ-

ated with an imbalance in this level's water and electrolyte ratio. Lethality is directly related to the frequency of repeated adhesive intestinal obstruction due to recurrent adhesion. In other words, repeated adhesions in the abdominal cavity are directly related to the increase in severe cases of the disease and the onset of death of the patient [3, 4].

Developing peritonitis in patients with adhesive intestinal obstruction also increases the chances of death of the patient by 10.8%. Even with the formation of limited forms of peritonitis in the form of abscesses, it increases

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the mortality rate by another 5.2%. In patients with adhesive intestinal obstruction, peritonitis can also be caused by the failure of the sutures of the formed anastomoses between the intestines after resection for acute adhesive intestinal obstruction, which increases the probability of death by another 6.8%. In more than half of patients, in particular 55.9%, with the development of a complication in the form of peritonitis, the wound is also accompanied by suppuration, which led to the development of wound sepsis and was the cause of death of the patient [5].

Mortality among patients with acute adhesive intestinal obstruction, in the elderly and old age, can also be associated with the development of severe sepsis with organ dysfunction or multiple organ failure. Among the most common lesions in patients with this type of pathological process are liver and kidney failure, which can develop in 63.9% of cases [6]. The lungs in multiple organ failure are affected in 8.4% of cases [7]. They are characterized by the development of pneumonia, which can develop not only due to congestion in the small circulation but also due to the translocation of microbes from the intestinal cavity. The intestinal microflora is translocated into the systemic circulation, and in case of immune system failure, pyogenic metastases formation in distant organs and tissues is possible.

Heart damage is also a common form of multiple organ failure as a result of increased blood clotting and the development of coagulopathy. Endothelial hypercoagulability, which develops as a single link in multiple organ failure, leads to the development of acute cerebral impairment and myocardial infarction [8].

Thus, the severe course of acute adhesive intestinal obstruction in elderly and senile patients is evident. The reason for this is, first of all, the comorbid course of diseases such as diabetes mellitus, obesity, non-specific lung diseases, and chronic liver and kidney diseases.

THE MAIN PART

MATERIALS AND METHODOLOGY

We analyzed the results of the examination of 46 patients with acute adhesive intestinal obstruction who were treated and examined in the emergency surgery department at the clinical base of the Tashkent State Pediatric Institute and the Republican Scientific and Practical Medical Center for Emergency Medical Care from 2021 to 2024.

All the analyzed patients were divided into three groups: control—10 patients with abdominal adhesions; comparative—15 patients with adhesions of the abdominal cavity complicated by acute small intestinal obstruction; and main—21 patients with adhesions of the abdominal cavity complicated by acute small intestinal obstruction and peritonitis.

The concentration of cytokines (pg/ml) in the blood serum (IL-1 α , IL-1 β , IL-6, IL-8 and TNF- α) was determined using special kits for enzyme-linked immunosorbent assay according to the standard procedure on the ELISA device manufactured by HUMAN (Germany). To obtain reference values, we conducted an identical blood test in 10 healthy individuals recognized by the medical commission as absolutely healthy. Patients of the control group underwent outpatient examination and treatment, and patients of the comparative and main groups were operated on in our clinic for urgent indications. The patients were over 61 years old. Male patients prevailed.

Statistical data processing was performed on a personal computer using Statistica 10.0 (StatSoft Inc., USA). Quantitative indicators are described by their average value (M). Standard error (m), qualitative indicators in the form of their fractions (%). Statistically significant differences were less than <0.05 .

RESULTS

The level of IL-1 increased in patients with abdominal adhesions by 14.1 times ($p<0.05$), equating to 248.8 ± 32.76 pg/ml. In patients of the comparative group, the level of IL-1 increased to 455.61 ± 43.72 pg/ml, which was 25.8 times higher in intensity than the reference values ($p<0.05$), and about the control group – 1.83 times ($p<0.05$). In the patients of the study group, the changes were accompanied by an increase in the level of IL-1 to 912.65 ± 62.17 pg/ml, which was 51.5-fold higher than the reference values ($p<0.001$), 3.7-fold ($p<0.05$) about the patients in the control group, and 2-fold ($p<0.05$) about the patients in the comparative group.

A more intensive increase in the concentration of IL-6 was noted when compared with the reference values (2.85 ± 0.13 pg/ml). Thus, in comparison with the reference values in the patients of the control group, the increase in cytokine IL-6 in the blood was 1.3-fold (3.57 ± 0.32 pg/ml; $p<0.05$) in the patients of the comparative group – 14.7-fold (41.93 ± 9.84 pg/ml; $p<0.05$), and in the patients of the study group – 21.9-fold (62.4 ± 11.43 pg/ml; $p<0.001$). The tendency to increase this indicator was noted in the indicators of patients of the leading group.

Evidence for this judgment can be found in the difference in the concentration of IL-6 in the blood compared to patients with adhesive intestinal obstruction. Compari-

son of these values showed an increase of 11.7 times ($p<0.05$) in the patients of the comparison group compared to the patients of the control group and 17.5 times ($p<0.001$) in the patients of the study group.

Thus, the intensity of changes in the production of cytokine IL-6 in the blood is characterized by an increase in its value as the intensity of the inflammatory process increases, leading to the development of a cascade reaction of cytokinemia.

The mean level of cytokine IL-8 in the blood of patients with abdominal adhesions averaged 221.53 ± 89.31 pg/ml, which was 37.8 times higher than the reference values ($p<0.001$). This was apparently due to the importance of IL-8 as one of the main pro-inflammatory chemokines formed by macrophages, epithelial and endothelial cells.

Within the group of patients, comparative changes in the intensity of IL-8 formation were not as pronounced as compared to the reference values (5.86 ± 0.23 pg/ml). Thus, in the patients of the comparative group, the increase in the concentration of cytokine IL-8 in the blood (237.51 ± 28.64 pg/ml) was only 2.7-fold more significant than in the patients of the control group (87.55 ± 18.53 pg/ml) ($p<0.05$), and in the patients of the study group – 3.9-fold (339.56 ± 31.56 ; $p<0.05$).

Among the examined patients who were designated as the control group, the level of tumor necrosis factor-alpha increased approximately 2.5-fold and amounted to 12.93 ± 0.98 pg/ml. Meanwhile, when we checked the patients who were assigned to the study group, the concentration of this biomarker increased by 16.9 times and was at an average level of 88.75 ± 19.64 pg/ml; ($p<0.001$). When we compared these data with the norm, we found an increase in its concentration by 24.7 times ($p<0.001$).

Relative to the difference in the values of TNF- α in the blood between the patients of the comparative and study groups was 1.5 times ($p<0.05$), which was the lowest among all the analyzed parameters of the detected changes in this marker of generalization of the inflammatory process.

DISCUSSION

The activity of expression of cellular immunity indicators is determined by the degree of disproportion of pro-inflammatory and anti-inflammatory cytokines in the blood [9].

As our studies have shown, the intensity of production of IL-1 cytokines only increased, which could also affect the changes in the entire link of the immune sys-

tem. At the same time, the intensity of these changes depended on the form of the development of adhesions and the presence of purulent-septic complications (peritonitis). Thus, the proportion of IL-1 in the blood of patients with adhesive intestinal obstruction was 15.7%, in the development of acute adhesive small intestinal obstruction – 13.8%, and in the development of peritonitis – 10.5%.

In addition, another type of pro-inflammatory cytokine, such as IL-8, also changed statistically significantly, which affected the immune response. As is known, the pro-inflammatory cytokine IL-8 plays an important role in the innate immune system [10].

The pro-inflammatory cytokine IL-8 belongs to the chemokines of the CXC subfamily [11]. On target cells, the pro-inflammatory cytokine IL-8 binds to two receptors, CXCR1 and CXCR2, the first of which is more efficacious [12]. All this causes an increase in IL-8 in the blood compared to the reference values in the patients of the control group by 14.9 times ($p<0.001$), in the patients of the comparative group – by 40.5 times ($p<0.001$) and in the patients of the study group – by 57.9 times ($p<0.001$).

Pro-inflammatory cytokines play a pivotal role in the pathogenesis of abdominal adhesion progression, and their intensity can express the degree of the inflammatory process [13].

The intensity of the inflammatory response, at the level of a step-by-step release of cytokines first into the local and then into the systemic circulation, determines the diagnostic significance of the above markers of immune system disorders [14].

As most clinicians point out, the diagnostic significance of cytokinemia becomes important only when it is massively (uncontrolled) discharged into the systemic circulation [15].

However, this phenomenon has already delayed the prediction of ongoing pathological processes. An analysis of changes should be carried out that would help clinicians to detect disorders at the early stages of cytokinemia and to take preventive measures both to control these changes and to possibly prevent the recurrence of adhesions, especially in elderly and senile patients.

CONCLUSION

In general, patients with abdominal adhesions have significant changes in the system of pro-inflammatory cytokines. In the development of acute commissural small bowel obstruction, there is an increase in the level of cytokines IL-1, IL-6, IL-8 and TNF- α , which, in terms

of the intensity of formation, exceed the values of patients without impaired passage of food by an average of 4.5 times. A separate analysis of pro-inflammatory cytokines revealed a relatively more significant formation of TNF- α , the proportion of which was equal to 74%, which indicates the pronounced importance of this marker of the inflammatory process in the context of the development of its purulent inflammatory complications. An in-depth study in this direction may make it possible in the future to develop adequate response measures aimed at reducing the incidence of relapse and adhesions, including among elderly and senile patients.

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