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Clinical And Experimental Substantiation Of The Effectiveness Of Ozone In The Surgical Treatment Of Appendicular Peritonitis In Children

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ABSTRACT

The article examines the use of ozone in the surgical treatment of common appendicular peritonitis in children. The use of ozone in clinical medicine is based on its oxidative, antioxidant, disinfectant, bactericidal, detoxifying, immunocorrecting, antihypoxic. An experimental model of peritonitis was created on 41 white Wistar rats of both sexes. Morphological studies of the effect of ozone therapy on the course of peritonitis in experimental animals allowed us to establish the high effectiveness of this method in the treatment of purulent-inflammatory processes in the abdominal cavity and the prevention of the formation of adhesions, which was the basis for the use of ozone in clinical practice.

KEYWORDS

Appendicular peritonitis, ozone therapy, experiment, rats, spikes, children.

INTRODUCTION

Operations for acute appendicitis occupy a leading place in the structure of emergency abdominal surgical interventions performed in children, and account for 70 % [2; 10]. Despite the achievements in the diagnosis of acute appendicitis, the frequency of its destructive

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forms ranges from 20 to 74 %. In acute appendicitis, peritonitis in children develops 8 times more often than in adults, and its generalized forms develop 2 times more often than local ones [3; 8].

The number of postoperative complications in common forms of appendicular peritonitis in children remains at the level of 30-45%, and the mortality rate reaches up to 20-30% [4; 6].

Despite the introduction of the latest surgical technologies into clinical practice, the development of new antibacterial drugs, common appendicular peritonitis in children remains one of the most pressing problems of pediatric surgery [5]. In recent years, reports on the successful use of ozone in clinical practice in various groups of patients with surgical and general therapeutic profiles have increasingly appeared in the medical literature [7; 9].

PURPOSE OF THE RESEARCH

To study in an experiment the pathomorphological features of the peritoneum in peritonitis, as well as the effect of ozone on the course and results of surgical treatment of appendicular peritonitis in children.

MATERIALS AND METHODS OF THE RESEARCH

To simulate experimental peritonitis, the method of Baibekov I. M. and Khoroshaev V. A. was used. (1990) [1]. Experimental studies were conducted on 41 white Wistar rats, weighing 140-160 g. The animals were divided into 2 groups. 23 rats of the first group (control) under ether anesthesia underwent median laparotomy and drainage of the abdominal cavity from pus with sterile wipes, after which a drainage tube was left in the lower corner of the wound and the abdominal cavity was sutured. The outer end of the drainage tube was hermetically sealed and fixed on the animal's back.

Animals of the second group (main group, n=18), after draining the abdominal cavity from pus, were ozonated with an ozone concentration of 5-8 mg / l for 5 minutes with the OTRI-01 device (Russia), then a drainage tube was left and a laparotomic wound was sutured. The end of the drainage tube was fixed in the same way as in the control group. On 2-3 days after the operation, the main ozonation of the animals was carried out through a drainage tube.

On the 3rd, 7th, and 14th day after the operation, the animals of both groups were withdrawn from the experiment.

Samples of the mesentery, the parietal peritoneum in its diaphragmatic part, and the intestinal wall in the area of the formation of adhesions were subjected to light-optical and electron-microscopic examination.

Under our supervision, 402 children with advanced appendicular peritonitis were examined and treated at the 2nd clinic of the Samarkand State Medical Institute. The main group consisted of 264 (65.7%) children. The comparison group included 138 (34.3%) children who were operated on and treated according to traditional conventional approaches (without ozone therapy). 264 patients, who make up the main group, were included in the complex of surgical treatment with ozone therapy. The distribution of patients by group, age, gender, and prevalence of appendicular peritonitis is shown on the slide.

In the main group of patients with advanced appendicular peritonitis, the approaches to the management of this category of patients at all three stages (pre -, intra - and postoperative) were significantly changed, one of the

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components of which was the use of ozone therapy.

THE RESULTS OF THE RESEARCH AND THEIR DISCUSSION

To establish the pathogenetic mechanisms of the development and progression of peritonitis, the morphological substrate of the injury – the peritoneal tissue of experimental animals with simulated peritonitis-was studied. The effect of the ozone-oxygen mixture on the intensity of inflammation and spike formation in experimental peritonitis was also studied. On the 3rd day after the operation, light-optical studies showed significant inflammatory changes in various parts of the peritoneum. It was sharply thickened due to edema and polymorphocellular infiltration. In some areas, mesotheliocyte desquamation occurs, which leads to a violation of the integrity of the mesothelial lining. Microvessels with expanded lumen and filled with shaped blood elements.

Light-optical electron microscopy revealed that cells migrate to the surface of the peritoneum from the expanded gaps between mesotheliocytes. The revealed violations of contacts between mesotheliocytes, the expansion of intercellular gaps leads to the appearance of demesothelized areas. On the 7th day of the experiment, changes in the acute manifestations of the inflammatory process were slightly reduced. In all parts of the peritoneum, both in the mesentery and in the diaphragmatic part of the peritoneum, there were fewer dilated vessels with blood clots.

On the 7th-14th day after modeling of peritonitis, the presence of formed powerful adhesions was noted in the areas of impaired integrity of both the serous cover of the intestine and the mesothelium of the peritoneum. In the abdominal cavity, there was a decrease in the amount of effusion. The swelling of the peritoneum, its thickening, due to edema and inflammatory infiltration is preserved.

Ozone therapy performed in the main group of animals led to a significant reduction in postoperative complications. A small amount of translucent effusion was observed in the abdominal cavity on the 3rd day after the operation and 3-fold ozone therapy. The peritoneum is smooth and slightly thickened. On the surface, individual spans of fibrin and single thin, loose, short adhesions that do not deform the intestine were determined. On the 7th – 14th day of observation, the peritoneum was macroscopically smooth and shiny. No abdominal effusion was detected. Single gentle adhesions, did not deform the intestine. No adhesions were detected in 78.9% of the animals. Light-optical studies conducted during these periods showed that ozone therapy leads to a pronounced reduction of changes caused by bacterial peritonitis. Transmission electron microscopy studies have shown that ozone therapy leads to a significant reduction in pathological changes in ultrastructures caused by bacterial experimental peritonitis.

In the early stages of observation, mesotheliocytes are in close contact with each other, and they are all located on the basement membrane, forming a continuous lining. On the surface of the cells are long and thin microvilli. In the cytoplasm of mesotheliocytes, there are quite a lot of mitochondria and profiles of the granular endoplasmic network. The vessels are moderately dilated. Endotheliocytes are flattened with a smooth lumen surface in the cytoplasm of a small number of membrane structures.

Thus, the morphological picture after ozone therapy was characterized by a decrease in the synthetic activity of fibroblasts, which indicates a decrease in the intensity of the

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processes of inflammation and adhesion formation.

The conducted experimental studies of the effect of ozone therapy on the course of peritonitis and the formation of adhesions allowed us to show the high effectiveness of this method of physico–chemical medicine in the treatment of peritonitis and the prevention of the formation of adhesions.

The results of experimental studies of the effect of ozone therapy on the course of peritonitis have become the basis for its application in clinical practice. Of the 402 children with advanced appendicular peritonitis, 264 (65.7%) patients formed the main group, in which the approaches to the management of this category of patients at all three stages (pre-, intra - and postoperative) were significantly changed, one of the components of which was the use of ozone therapy in the complex of surgical treatment.

In this group of patients, in addition to intraoperative ozonation of the abdominal cavity, postoperative ozone therapy with an ozone-oxygen gas mixture was performed through an established intraabdominal micro-drainage. Ozone therapy of the abdominal cavity was carried out by blowing it with an ozone-oxygen mixture with an ozone concentration of 5-8 mg/l/min with the OTRI-01 device (Russia) for three days. Ozonated solutions for intravenous administration were obtained by bubbling an ozone-oxygen mixture of saline solution at the rate of 5-8 mg/l / min of a gas mixture per 100 ml of solution for 10 minutes. Similar solutions were used to wash the lumen of the small intestine through the appendico-or cec-enterostomy in the postoperative period.

The conducted ozone therapy showed high efficiency not only in the elimination of existing, but also in the prevention of re - and superinfection of Pseudomonas aeruginosa-in none of the observations in the main group did we detect the presence of Pseudomonas aeruginosa in the discharge from suppurated wounds and exudate from the abdominal cavity (table 1).

Table 1

The nature of microflora in the discharge from suppurated wounds and exudate from the abdominal cavity in common appendicular peritonitis in children before and after treatment

Microorganisms	Stages of treatment	Control group (n=138)		Main group (n=264)		χ^2	P
		n	%	n	%		
Gram-negative aerobes							
Escherichia coli	Before	130	94,2	201	76,1	20,34	<0,001
	After	22	15,9	18	6,8	8,42	<0,01
Pseudomonas aeruginosa	Before	1	0,7	3	1,1	0,16	>0,05
	After	23	16,7	0	0	46,67	<0,001
Proteus	Before	2	1,4	6	2,3	0,32	>0,05
	After	0	0	0	0	-	-
Klebsiella	Before	0	0	3	1,1	1,58	<0,001

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	After	0	0	0	0	-	-
Enterobacter	Before	2	1,4	4	1,5	0,00	>0,05
	After	0	0	0	0	-	-
Gram-positive aerobes							
Staphylococcus	Before	38	27,5	64	24,2	117,18	<0,001
	After	3	2,2	5	1,9	199,91	<0,001
Str.enterococcus	Before	25	18,1	43	16,3	2,85	<0,001
	After	1	0,7	2	0,8	250,87	<0,001
Gram-negative anaerobes							
Bacteroides	Before	36	26,1	63	23,9	17,14	<0,001
	After	3	2,2	7	2,7	36,88	<0,001
Fusobacterium	Before	2	1,4	6	2,3	2,42	>0,05
	After	0	0	0	0	-	-
Specific microflora							
Str. pyogenes	Before	15	10,9	27	10,2	12,55	<0,001
	After	1	0,7	2	0,8	20,92	<0,001
Mycobacterium tuberculosis	Before	0	0	2	0,8	0,19	>0,05
	After	0	0	0	0	-	-
No growth	Before	13	9,4	21	8,0	0,25	>0,05
	After	0	0	0	0	-	-
Associations	Before	26	18,8	44	16,7	0,30	>0,05
	After	0	0	0	0	-	-

The positive dynamics of biochemical parameters proved the elimination of the syndrome of endogenous intoxication and systemic inflammation in children of the main group. The level of proinflammatory cytokines was significantly lower in the children of the main group compared to the comparison group, which indicates the restoration of adequate immunoregulation. The concentration of malondialdehyde (MDA), medium molecular weight peptides (MMWP), and IL-1β decreased to the control level, which was not observed in the children of the comparison group (table 2).

Table 2

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Parameters of proinflammatory cytokines before and after treatment for common appendicular peritonitis in children

Indicator	Control group, n=40	Pre-treatment parameters		Post-treatment parameters	
		Diffuse peritonitis, n=64	Spilled peritonitis, n=70	Main group, n=78	Comparison group, n=56
MDA, nmol/l	7,1±0,1	12,8±0,4	13,6±0,1	8,1±0,2	11,1±0,5
MMWP, UD	0,250±0,025	0,501±0,026	0,581±0,009	0,261±0,030	0,401±0,019
СОД, E / mg of protein	4,20±0,04	0,71±0,05	0,68±0,01	1,11±0,04	0,83±0,04
Catalase, mkat/l	23,5±1,6	12,9±0,7	13,9±0,2	26,8±0,16	17,2±0,8
IL-1β pkg/ml	18,7±0,7	46,2±0,95	45,8±1,1	21,6± 0,2	28,6±0,4
TNF-α, pkg/ml	9,4±0,3	34,1±0,6	35,1±0,8	16,6± 0,3	30,3±0,1

Improved management of children with advanced appendicular peritonitis contributed to a reduction in the frequency of both specific and general postoperative complications. Thus, in the main group of patients, suppuration of the postoperative wound was significantly less frequent (37,5 vs 49,3%) and eventration (2,3 vs 9,4%).

At the same time, the children of the main group showed a significant decrease in the cases of continuing peritonitis by 4.6% (from 8.0 to 3.4%) and early adhesive intestinal obstruction by 4.9% (from 7.2 to 2.3%). In addition, in this group of patients, there was more than a twofold decrease in the frequency of abdominal abscesses (from 11.6 to 5.3%).

A significant decrease in the frequency of eventration and intra-abdominal complications was reflected in the performance of relaparotomies, so in the comparison group they were performed in 37.0% of patients, and in the main group in 16.3%.

CONCLUSIONS

Thus, the use of ozone in the complex treatment of common appendicular peritonitis in children made it possible to improve the clinical condition of the patient at an earlier time, prevent severe intra-abdominal complications and, thereby, significantly reduce the recovery time.

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