

The Role Of Ozonated Sodium Chloride Isotonic Solution In The Correction Of Endotoxicosis

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Abstract

We studied the efficiency of [ozone therapy](#) in patients, suffering from infectious endocarditis, diffuse peritonitis and acute septic pneumonia or infective toxic shock, as a complication of the acute pneumonia. 65 patients with infectious endocarditis were enrolled in a prospective controlled study. 50 - with diffuse peritonitis and 50 - with complications set in acute pneumonia were randomised 1:1 and were enrolled in a prospective controlled study. In all groups we observed II-III degree of endotoxemia at point of departure. Ozonated Sodium Chloride Isotonic Solution and its combination with methods of Efferent therapy reduced indices of endotoxemia and revealed immunopotentialization of the T-cell-bound immunity.

Introduction

The problem of detoxication and immunocorrection in patients with Endointoxication Syndrome is an actual one as it is the basis of the grave diseases and critical conditions. The endotoxemia is universal pathological process and one of the most meaningful components of the Multiple Organ Failure Syndrome [3, 4]. For that purpose we studied the efficiency of [ozone therapy](#) in patients, suffering from infectious endocarditis, diffuse peritonitis and acute septic pneumonia or infective toxic shock, as a complication of the acute pneumonia.

Methods

65 patients with infectious endocarditis (40 - first control group and 25 - first investigation group) were enrolled in a prospective controlled study. 50 - suffering from diffuse peritonitis were randomised 1:1 (in 25 patients in the second control and investigation groups), 50 - with complications set in acute pneumonia were randomised 1:1 (in 25 patients in the third control and investigation groups) and were enrolled in a prospective controlled study.

The control and investigation groups are adequate in age, sex and APACHE II score-numbers.

Table 1. Characteristic of the groups

Group	Sex		Age	APACHE II score
	Male	Female		
1 control (Infectious Endocarditis)	30	10	14-60	16
1 investigation (Infectious Endocarditis)	16	9	14-60	16
2 control (Diffuse peritonitis)	17	8	14-60	16
2 investigation (Diffuse peritonitis)	17	8	14-60	16
3 control (Complicated Acute Pneumonia)	15	10	16-60	16
3 investigation (Complicated Acute Pneumonia)	15	10	16-60	16

Indices of endotoxemia (classification of S. Obolensky, M. Malahova, 1995) [4], biochemical and immunological indices of blood were studied in all the groups. Data were analysed using parametric (t-test) and non-parametric (Wilcoxon or Mann-Whitney tests) methods, p values ≤ 0.01 were considered significant.

The patients of control groups were treated by conventional methods.

In the investigation groups we used Ozonated Sodium Chloride Isotonic Solution with the 2 mg/l ozone concentration, 200 ml a day. That has been administered within 10 days, along with conventional therapy. In patients, suffering from diffuse peritonitis and complications set in acute pneumonia, Ozonated Sodium Chloride Isotonic Solution was used in combination with plasmapheresis on 2 and 4 days; and in the combination with extracorporeal ultraviolet irradiation of autoblood from 5 till 10 days.

Table 2. Laboratory investigations

Indices of endotoxemia	Leucocytes index of intoxication; Toxicity of serum, erythrocytes and urine (according to the levels of molecules with an average molecular weight).
Blood examination	Formed elements of blood; Differential blood count; Total blood protein; C-reactive protein; Serum bilirubin and it's fractions; Blood glucose; Blood enzymes (alanine transaminase, asparagine transaminase); Blood electrolytes; Serum urea; Serum creatinine; Haemoglobin.
Immunological indices of blood	Spontaneous E-rosette assay; EAC-rosette assay; Antigen-stimulated rosette-forming T-cells assay; Theophylline-resistance spontaneous E-rosette assay; Theophylline-sensitive spontaneous E-rosette assay; Single radial immunodiffusion technique;

Results

In all groups we observed II-III degree of endotoxemia at point of departure, irrespective of nosological form, and immunodepression or immunoexpression of T-cell-bound immunity.

In the investigation groups indices of endotoxemia significantly had reduced by the tenth day. Leucocytes index of intoxication lowered by 16% in the 1st, became five times as little - in the 2nd and lowered by 81,5% - in the 3rd investigation groups (fig.1). Total blood bilirubin lowered by 40% in the 1st and by 80% - in the 2nd investigation groups (fig. 2).

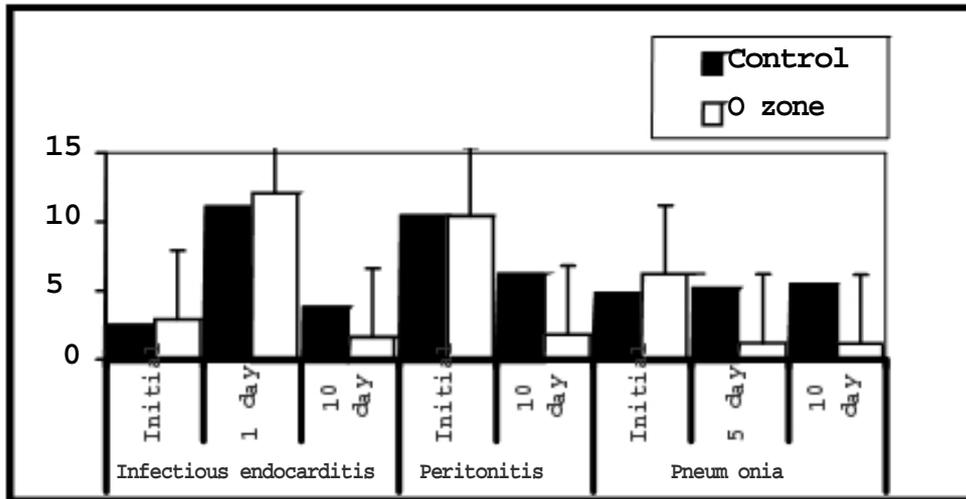


Fig. 1. Mean Leucocytes index of intoxication values in the initial point and on days 1, 5 and 10 of treatment. Leucocytes index of intoxication values were significantly different at stages of treatment in control and investigation groups ($p < 0,01$).

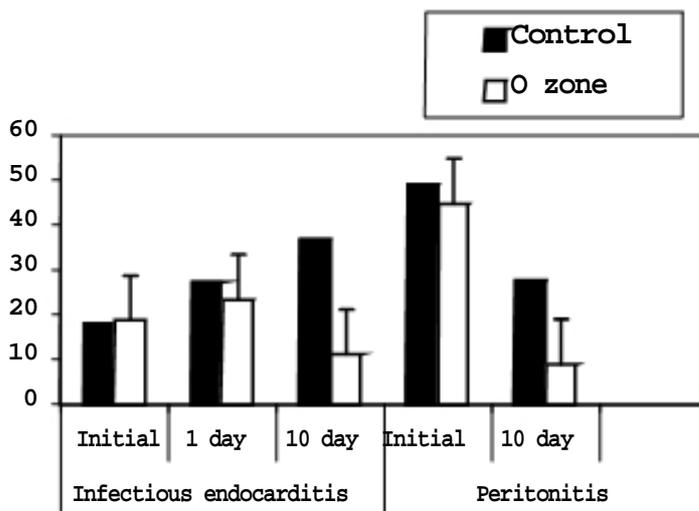


Fig. 2. Mean Total blood bilirubin values in the initial point and on days 1, 10 of treatment. Total blood bilirubin values were significantly different at stages of treatment in control and investigation groups ($p < 0,01$).

Molecules with an average molecular weight in serum (toxicity of serum) reduced by 28% in the 1st, became twice as little - in the 2nd and lowered by 32,9% in the 3rd investigation groups (fig. 3).

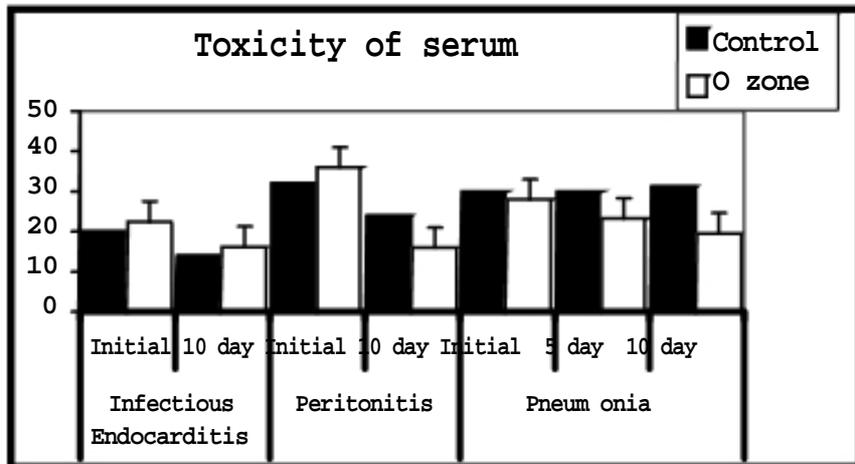


Fig. 3. Mean Toxicity of serum values in the initial point and on days 1, 5 and 10 of treatment. Toxicity of serum values were significantly different at stages of treatment in control and investigation groups ($p < 0,01$).

Molecules with an average molecular weight on erythrocyte's membranes (toxicity of erythrocytes) lowered by 23% in the 1st, became twice as little - in the 2nd and reduced by 31,8% at the 3rd investigation groups (fig. 4).

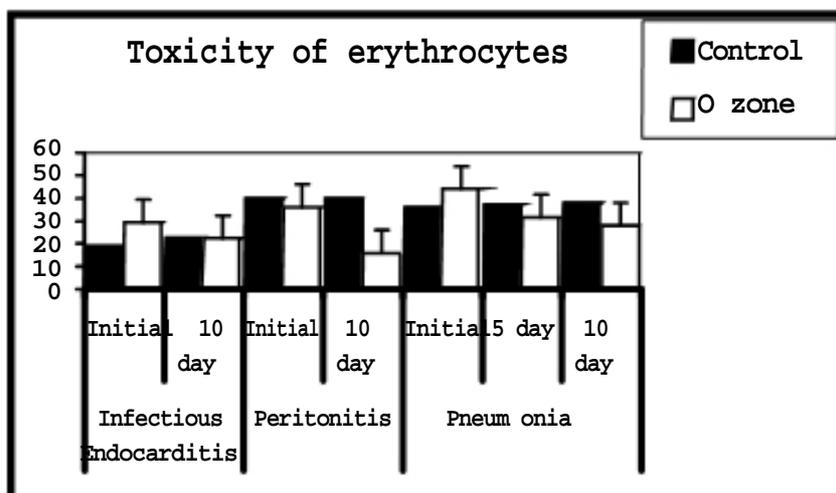


Fig. 4. Mean Toxicity of erythrocytes values in the initial point and on days 1, 5 and 10 of treatment. Toxicity of erythrocytes values were significantly different at stages of treatment in control and investigation groups ($p < 0,01$).

Molecules with an average molecular weight in urine (toxicity of urine) became 3,5 times as much in the 1st, became twice as much in the 2nd and increased by 71,8% in the 3rd investigation groups (fig. 5).

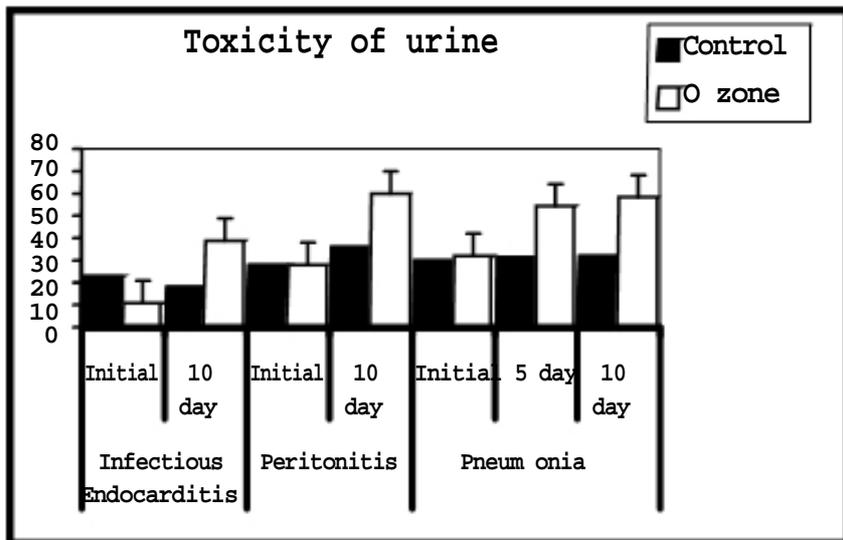


Fig. 5. Mean Toxicity of urine values in the initial point and on days 1, 5 and 10 of treatment. Toxicity of urine values were significantly different at stages of treatment in control and investigation groups ($p < 0,01$).

T-active lymphocytes significantly increased by 4% in the 1st, became twice as much in the 2nd and by 45% in the 3rd investigation groups (fig. 6).

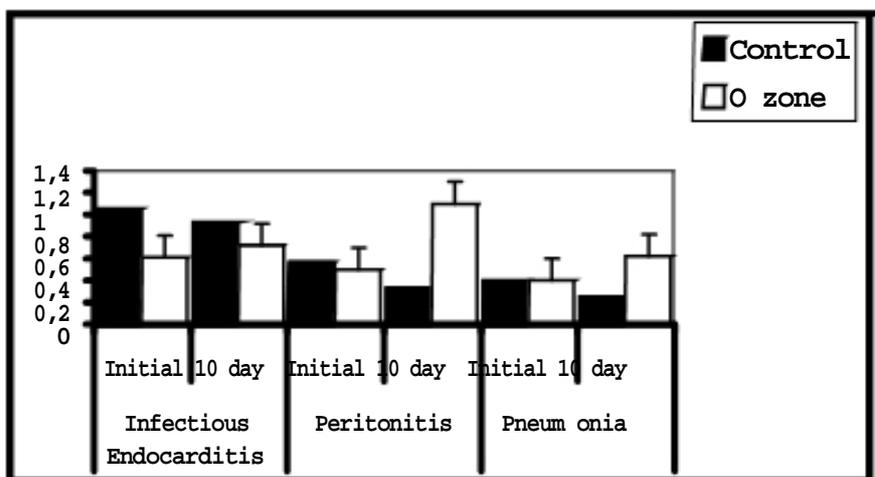


Fig. 6. Mean T-active lymphocytes values in the initial point and on 10 days of treatment. T-active lymphocytes values were significantly different at stages of treatment in control and investigation groups ($p < 0,01$).

T- lymphocytes significantly increased by 11% in the 1st and became twice as much in the 2nd and in the 3rd investigation groups (fig. 7).

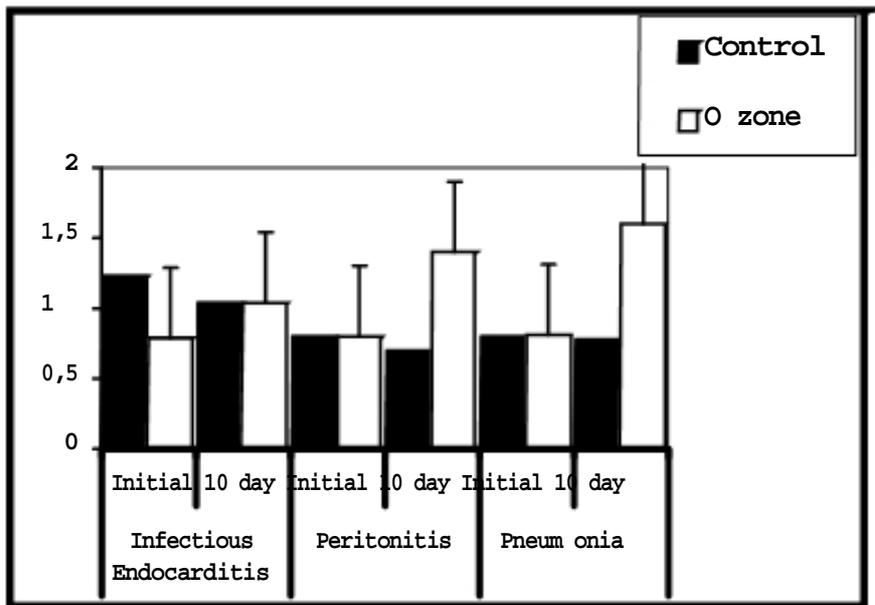


Fig. 7. Mean T- lymphocytes values in the initial point and on 10 days of treatment. T- lymphocytes values were significantly different at stages of treatment in control and investigation groups ($p < 0,01$).

T-helpers not significantly increased in the 1st investigation group (fig. 8) and became significantly twice as much in the 2nd and in the 3rd investigation groups (fig. 9).

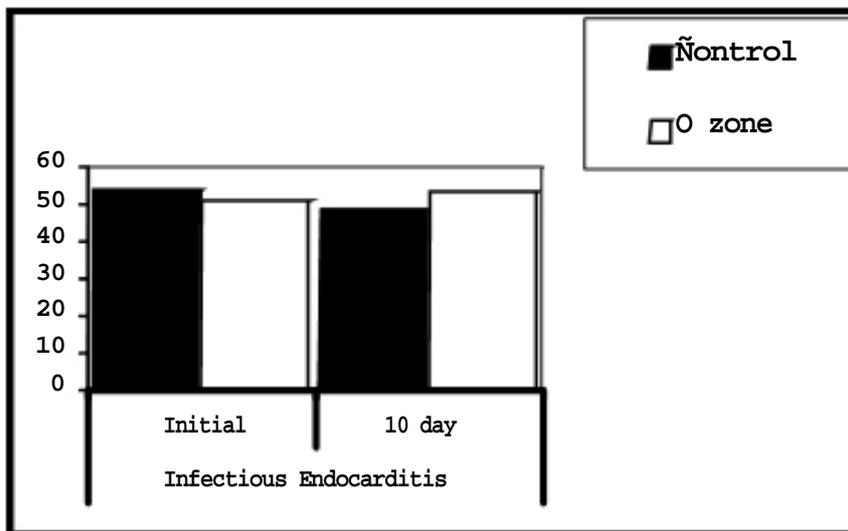


Fig. 8. Mean T-helpers values in the initial point and on 10 days of treatment in the 1st groups.

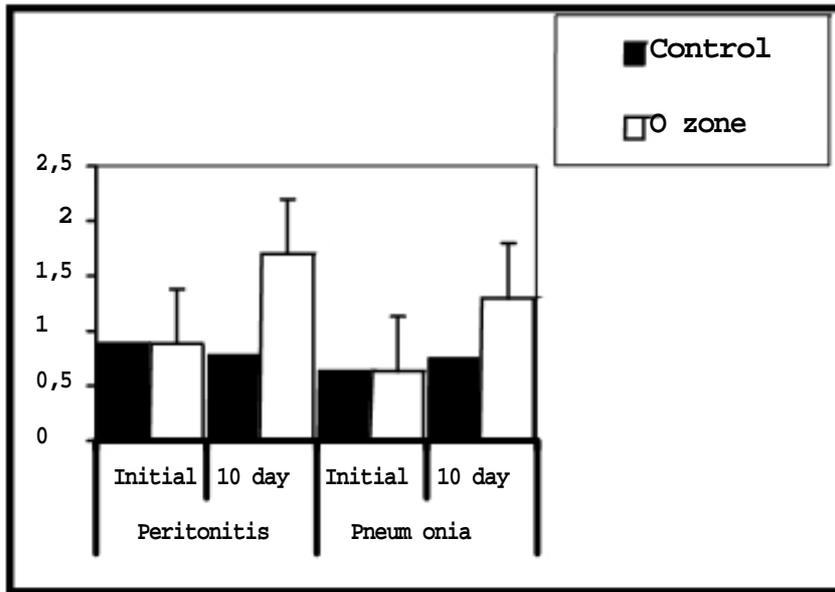


Fig. 9. Mean T-helpers values in the initial point and on 10 days of treatment in the 2nd and 3rd groups. T-helpers values were significantly different at stages of treatment in control and investigation groups ($p < 0,01$)

T-suppressants significantly increased by 19% in the 1st investigation group (fig. 10) and became significantly four times as much in the 2nd and became significantly twice as much in the 3rd investigation groups (fig. 11).

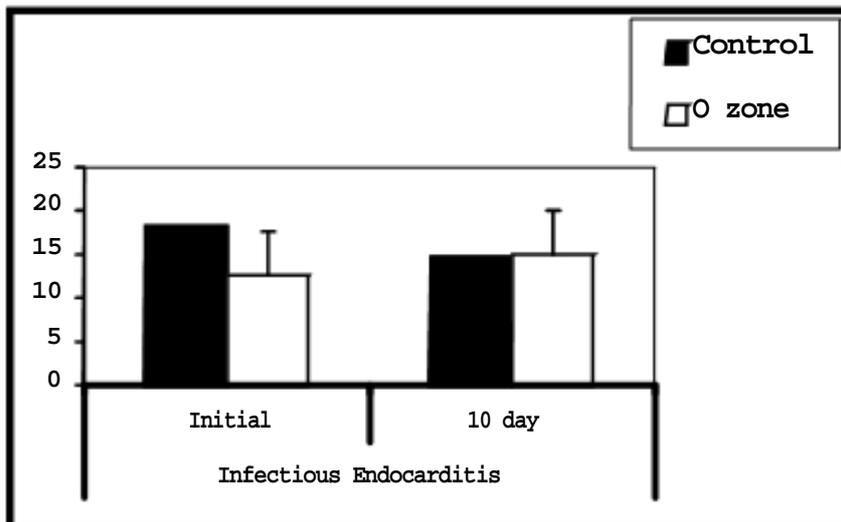


Fig. 10. Mean T- suppressants values in the initial point and on 10 days of treatment in the 1st groups. T- suppressants values were significantly different at stages of treatment in control and investigation groups ($p < 0,01$).

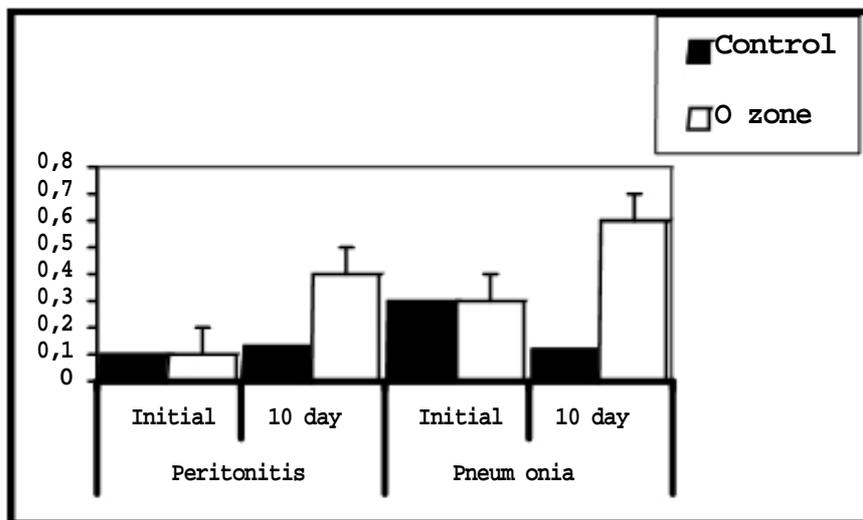


Fig. 10. Mean T- suppressants values in the initial point and on 10 days of treatment in the 2nd and 3rd groups. T- suppressants values were significantly different at stages of treatment in control and investigation groups ($p < 0,01$).

The combination of Ozonated Sodium Chloride Isotonic Solution with extracorporeal ultraviolet irradiation of autoblood activated functional activity of B- lymphocytes, which was proved by the increase of Ig M by 76% in the 3rd group and normalization of Ig M and Ig G in the 2nd one.

Discussion

Levels of indices of endotoxemia (Leucocytes index of intoxication, Total blood bilirubin, Toxicity of serum, erythrocytes and urine) were revealed II-III degree of endotoxemia at point of departure in all groups, according to classification of S. Obolensky, M. Malahova, 1995 [4]. The study of immunological indices showed the immunodepression or immunoexpression of T-cell-bound immunity.

According to our results in control groups (in which Ozonated Sodium Chloride Isotonic Solution and its combination with methods of Efferent therapy did not use) II-III degree of endotoxemia was observed on the 10th day. While using Ozonated Sodium Chloride Isotonic Solution, indices of endotoxemia had reduced significantly by the tenth day of treatment. It is important, that Ozonated Sodium Chloride Isotonic Solution significantly lowered Toxicity of erythrocytes. That is the reason of the use of the combination of Ozonated Sodium Chloride Isotonic Solution with Plasmapheresis. According to the scientific data, Plasmapheresis lowered only Toxicity of serum [2,3]. But when Ozonated Sodium Chloride Isotonic Solution was combined with Plasmapheresis, the reduction of Toxicity of serum was clearly more evident. And Toxicity of erythrocytes was lowered too. So, the combination of Ozonated Sodium Chloride Isotonic Solution with Plasmapheresis increases the efficiency of Plasmapheresis.

Ozonated Sodium Chloride Isotonic Solution significantly increased T-active lymphocytes, T-lymphocytes, T- helpers and T-suppressants, which proved that Ozonated Sodium Chloride

Isotonic Solution revealed immunopotentiality of the T-cell-bound immunity. While using the combination of Ozonated Sodium Chloride Isotonic Solution with extracorporeal ultraviolet irradiation of autoblood, T-helpers values increased greatly. This is in accordance with data from Puga R., Rodrigues R. et. al., 1997, who showed the immunopotentiality of cell-bound and humoral immunity [5]. According to Karandashov V.I. and Petuhov., 1997 [1], extracorporeal ultraviolet irradiation of autoblood increases immunoglobulines A,M,G. The increase of Ig M proves the activation functional activity of B- lymphocytes. The combination of Ozonated Sodium Chloride Isotonic Solution with extracorporeal ultraviolet irradiation of autoblood activated functional activity of B- lymphocytes, which was proved by the increase of Ig M by 76% in the 3rd group and normalization of Ig M and Ig G in the 2nd one.

Conclusion

Ozonated Sodium Chloride Isotonic Solution and its combination with methods of Efferent therapy reduced indices of endotoxemia and revealed immunopotentiality of the T-cell-bound immunity. The combination of Ozonated Sodium Chloride Isotonic Solution with extracorporeal ultraviolet irradiation of autoblood activated functional activity of B- lymphocytes. The above-mentioned permits to recommend the use of ozone in the correction of endotoxemia.

References

1. Karandashov V.I., Petuhov. Extracorporeal Ultraviolet Irradiation Of Autoblood: Moscow, Medicine, Russia: (1997), p. 224.
2. Kostuchenko A.L., Gurevitch K.,Ya., Belskih A.N., Vlasenko A.N., Sokolov A.A., Sheluhin V.A. Efferent Therapy: St.-Petersburg, Foliant, Russia: (2000), p. 425, ISBN 5-86581-040-5.
3. Lopatkin N.A., Lopuhin Y.M. The Efferent Methods In Medicine (Theoretical And Clinical Aspects of Extracorporeal Methods Of Treatments): Moscow, Medicine, Russia: (1989), p. 352.
4. Malahova M.Ya. Method Of Registration Of Endogenic Intoxication: St.-Petersburg, St.-Petersburg Medical Academy of Post-Graduate Studies: Russia: (1995), p. 34.
5. Puga R., Rodrigues R., Gonzales C., Munoz J. Ozone Therapy In Treatment Of Patients With Secondary Immunodeficiencies. 2nd International Symposium on Ozone Applications, Havana, Cuba: p. 54-55 (1997), abstract.