NEW METHOD OF TREATMENT OF PYOINFLAMMATORY SOFT TISSUE COMPLICATIONS IN PATIENTS WITH DIABETES MELLITUS

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Diabetes mellitus (DM) is a chronic, progressive disease characterized by hyperglycemia induced by impaired insulin secretion, action or both. Regardless of the type of diabetes, it puts patient at high risk of tissue, organ and vessel damage. Unfortunately the mechanisms of these damages are still not clear [1,2,5,10]. Hyperglycemia induced pyoinflammatory processes of soft tissues occur in 40% of patients with diabetes and mortality rate remains high – 10-15%. Cellular and humoral immunity impairments lead to rapid spread of pathogens, nevertheless local signs of inflammation is not present for a long period. Because of this certain peculiarity of the disorder it becomes hard to diagnose and begin treatment of the disease at an early stage [3,4,8].

The leading factors in formation and progression of pyoinflammatory complications of soft tissues in patients with diabetes mellitus include: blood clots, vessel wall damage, changes in blood hemorheological properties, impairment of lipid peroxidation (LPO), antioxidant protection (AOP) and the oxidative modification of proteins (OMP) [6,7,9]. It is important to search for new methods for restoring the compensatory-adaptive processes, able to improve the course of morphogenetic processes in diabetic patients with pyoinflammatory complications of soft tissues.

Therefore the objective of our study is to evaluate the efficacy of intravenous application of ozone therapy as a treatment option for pyoinflammatory complications in patients with diabetes.

Material and methods. In total, 124 patients presenting with pyoinflamatory complications of soft tissue and concomitant diabetes mellitus were observed. Patients were divided into two groups according the treatment method. The study group consisted of 53 (42,7%) patients who received an intravenous ozone therapy application together with conservstive and surgery treatment (antibiotics, infusion therapy, antiplatelet agents, antispasmodics, vitamins, insulin and other). The control group consisted of 71 (57,2%) patients, who were treated only by conventional methods.

All patients from the study group received intravenous ozone saline into the ulnar vein through catheter in complex with conservative and surgical treatment. Treatment period was 6-15 days. Patients from control group received only conservative and surgical treatment.

Pyoinflammatory markers were evaluated 3 times during the study period: at the beginning, during and after termination of treatment. The list of markers and the way of their evaluation are given below.

The oxidative modification of proteins (OMP) and the products of lipid peroxidation (LPO) in plasma was determined by reaction of 2,4-dinitrophenylhydrazine with the formation of hydrazones of characteristic absorption spectrum. The OMP rate was estimated by the number of formed aldehyde and ketone groups. LPO was determined by reaction with thiobarbituric acid. The method is based on the reaction between malondialdehyde (MDA) and thiobarbituric acid, which at high temperature and acidic pH value proceeds with the formation of colored trimetine complex containing one molecule of malondialdehyde and two molecules of thiobarbituric acid. The maximum absorption of the complex is at 532 nm. MDA content was calculated on the basis of the molar extinction coefficient ($1,56x10^5 M^{-1}см^{-1}$). Ceruloplasmin (CP) was determined by the method, based on the oxidation of p-phenylenediamine involving ceruloplasmin. Enzymic reaction was stopped by adding sodium fluoride. The concentration of ceruloplasmin, determined by a modified Revin method, was judged upon by optical density value of the formed products. To calculate the results, the obtained optical density value was multiplied by conversion factor and in such way ceruloplasmin concentration rate (in mg/L of serum) was found. It constitutes 205,4±13,5 mg/liter of serum.

Determination of leukocyte index of intoxication (LII) was evaluated by Y.Y. Khalf-Khalif formula (1941): LII = (4Mn + 3Yn + 2Bn + Sn)(Pl + 1) / (L + Mn)(e + 1), where: LII- leukocyte index of intoxication; Mn – myelocytes number; Yn – young neutrophils number; Bn – band neutrophils number; Sn – segmented neutrophils number; Pl – plasma cells number; L – lymphocytes; Mn – monocytes number; e – eosinophils number. According to the author the normal LII value was 1,0±0,5.

Results and their discussion. In total, 124 patients with pyoinflammatory complications of soft tissues and diabetes were observed. During the treatment period patients underwent following surgical procedures: 33 (26,6%) patients underwent primary debridement; disarticulation of the toes was performed in 37 (29,8%) patients: in 11 (8,9%) cases – a big toe, in 10 (8,1%) cases – the 2nd toe, in 5 (4,0%) cases – a middle toe, in 4 (3,2%) cases – the 4th toe, in 7 (5,6%) cases – a little toe; opening and draining of abscesses of soft tissues occurred in 30 (24,2%) patients.

The study did not reveal any significant differences in neither treatment period between study and control groups according the changes in the activity of AOP factor – ceruloplasmin, LPO products – malonic aldehyde and OMP (Table 1).

Table 1. LPO, OMP and AOP rates in diabetic patients with pyoinflammatory complications (M±m)

Rates	Main group n=53			Control group n=71			
	before treatment	during treatment	after treatment	before treatment	during treatment	after treatment	p
Ceruloplasmin (E/g of plasma)	5,2±0,10	5,1±0,30	5,1±0,10	5,3±0,30	5,5±0,7	5,5±0,50	>0,05
Malonic aldehyde (mmol/l)	0,23±0,06	0,24±0,05	0,20±0,05	0,22±0,03	0,23±0,05	0,19±0,06	>0,05
OMP rate (ΔE/ml of plasma)	2,2±0,05	2,2±0,04	2,0±0,06	1,5±0,05	1,4±0,03	1,6±0,04	>0,05

These changes can be considered as favorable biochemical attributes for the application of this treatment in diabetic patients with inflammatory complications.

We evaluated the dynamic of toxicity markers - leukocyte index of intoxication (LII), hematological toxicity index (HTI) and sorption capacity of red blood cells (SCE) in both study groups.

Study showed that baseline values of LII did not differ between the groups (p>0.05). At the beginning of the treatment mean LII in study group patients was 3.6±0.3 (Figure 1). In the same group mean LII was 2.9±0.2 on the 7th day, and 1.9±0.1 on the 16th day of treatment (r≤0.01). At the beginning of the treatment mean LII in control group was 3.6±0.2, 3.7±0.2 on the 7th day and 2.7±0.1 on the 16th day of treatment (r≤0.01).

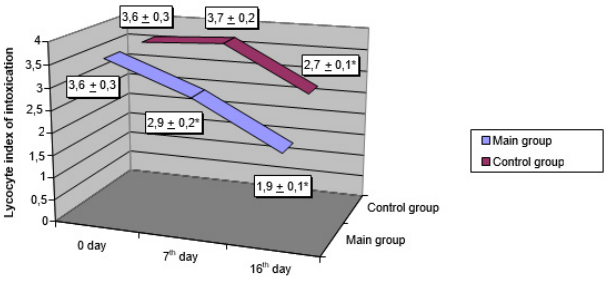

Fig. 1. LII dynamics in diabetic patients with pyoinflammatory complications of soft tissues

HTI dynamics in patients with pyoinflammatory complications and diabetes mellitus are shown in figure 2. Baseline levels of HTI did not differ between the groups (p>0.05). Mean baseline levels of HTI in the study group was 8.6±0.4 and significantly decreased on 7th and 16th days after treatment (mean value was 4.8±0.4 and 3.5±0.4, respectively; p≤0.01). The trend of mean HTI in the control group was 7.9±0.4 at baseline, slightly increased on 7th day after surgery (reaching 9.0±0.4) and decreased to 5.6±0.3 on 16th day (p≤0.001).

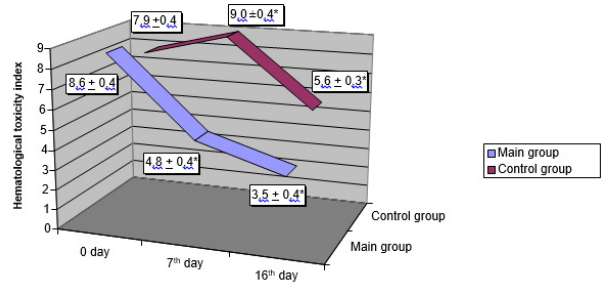

Fig. 2. HTI dynamics in patients with puyoinflammatory complications of soft tissues and diabetes mellitus

Normal values of HTI in healthy individuals is 0,620±0,068. Increasing level of HTI indicates the presence of pathological process in the body that causes development of intoxication syndrome, while decreasing levels indicate the reduction of endogenous intoxication. This index normilizes later than LII, hence it is more specific value of endogenous intoxication.

SCE dynamics in patients with pyoinflammatory complications and diabetes mellitus are shown in figure 3. In healthy individuals red blood cells absorb up to 37.1±1.43% of dye from 0,025% methylene blue solution. Mean baseline levels of SCE in study group reached 47.3±0.8%. In our study, baseline levels of SCE did not differ between the groups (p>0.05).On the 7th day and 16th days after treatment SCE decreased to 43.1±0.7% and 39.1±1.0%, respectively. Mean baseline level of SCE in the control group was 46.9±0.7%; As like LII and HTI, SCE also showed a small increase on 7th day and decreased on 16th day after surgery (mean values were 47.4±0.6% and 42.1±0.6%, respectively).

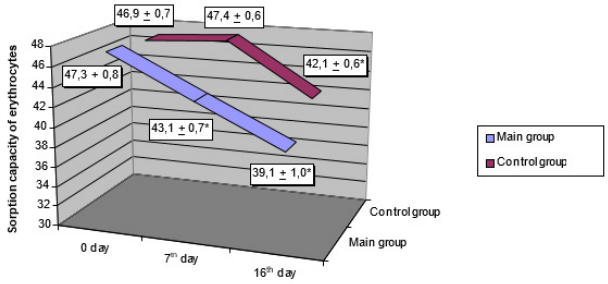

Fig. 3. SCE dynamics in patients with pyoinflammatory complications of soft tissues and diabetes mellitus

Conclusion. Our study demonstrated that implementation of ozone therapy in patients with pyoinflammatory complications and diabetes mellitus is not accompanied by negative injury responses at the level of hemostasis parameters and blood biochemical characteristics. The use of intravenous ozone therapy in complex treatment of patients with diabetes and purulent inflammation of soft tissues positively effects on the postoperative wound healing process. Therefor, ozone therapy can be used in addition to conventional therapy in patients with pyoinflammation complications of soft tissue and diabetes mellitus.

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SUMMARY

NEW METHOD OF TREATMENT OF PYOINFLAMMATORY SOFT TISSUE COMPLICATIONS IN PATIENTS WITH DIABETES MELLITUS

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Our study evaluated the levels of peroxide oxidation of lipids, oxidative modification of proteins, antioxidant protection and dynamic changes in markers of toxicity in patients with diabetes mellitus and purulent-inflammatory complications. In total, 124 patients were enrolled in the study and were divided into two groups according the treatment methods. Study group consisted of 53 patients, who received intravenously ozonized saline in addition to conservative treatment. The control group consisted of 71 patients who received only conventional therapy. The study period was 6-15 days. The results showed that the use of ozone therapy is not accompanied by negative injury responses at the level of hemostasis parameters and blood biochemical characteristics. Furthermore, ozone therapy may have a favorable effect on treatment outcome in patients with purulent-inflammatory complications and daibetes mellitus.

Keywords: diabetes, pyoinflammatory complications, ozone therapy, intoxication markers.

РЕЗЮМЕ

НОВЫЙ МЕТОД ЛЕЧЕНИЯ ГНОЙНО-ВОСПАЛИТЕЛЬНЫХ ОСЛОЖНЕНИЙ МЯГКИХ ТКАНЕЙ У ПАЦИЕНТОВ С САХАРНЫМ ДИАБЕТОМ

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Изучена динамика изменений показателей перекисного окисления липидов, окислительной модификации белков, антиоксидантной защиты и маркеров интоксикации у больных сахарным диабетом с гнойно-воспалительными осложнениями. В исследовании приняли участия 124 пациента. Пациенты с учетом метода лечения были разделены на две группы. Основную группу составили 53 пациента, которым помимо консервативного и хирургического лечения проводили внутривенное введение озонированного физиологического раствора через катетер в локтевую вену, курс лечения 6-15 дней. Контрольная группа включала 71 пациента, которые получали только традиционное лечение. Результаты исследования показали, что применение озонотерапии не сопровождается развитием реакций повреждения на уровне параметров гемостаза и биохимических показателей крови. Авторы статьи, опираясь на полученные в результате исследования данные рекомендуют применение озонотерапии в комплексном лечении больных СД с гнойно-воспалительными осложнениями.

რეზიუმე

რბილი ქსოვილების ჩირქოვან-ანთებითი გართულებების მკურნალობის ახალი მეთოდი პაციენტებში შაქრიანი დიაბეტით

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უკრაინის უმაღლესი სახელმწიფო სასწავლო დაწესებულება "ბუკოვინის სახელმწიფო სამედიცინო ინუვერსიტეტი", ჩარნოვცი, უკრაინა

კვლევის მიზანს წარმოადგენდა რბილი ქსოვილების ჩირქოვან-ანთებითი გართულებების ოზონოთერაპიით მკურნალობის ეფექტურობის შეფასება შაქრის დიაბეტით ავადმყოფებში.

შესწავლილია ლიპიდებზე ზეჟანგის ზემოქმედების, ცილების მჟავითი მოდიფიკაციის და ანტიოქსიდანტური დაცვითი მაჩვენებლების და ინტოქსიკაციის მარკერები შაქრიანი დიაბეტით ავადმყოფებში ჩირქოვან-ანთებითი გართულებებით. კვლევაში მონაწილეობდა 124 პაციენტი. პაციენტები მკურნალობის მეთოდის გათვალისწინებით გაყოფილი იყო ორ ჯგუფად: ძირითადი ჯგუფი შეადგინა 53 პაციენტმა,რომლებსაც კონსერვატულ და ქირურგიულ მკურნალობასთან ერთად უტარდებოდა ოზონოთერაპია, ოზონირებული ფიზიოლოგიური ხსნარის ვენაში კათეტერის მეშვეობით შეყვანით. საკონტროლო ჯგუფი შედგებოდა 71 პაციენტისგან, რომლებსაც ჩაუტარდა მხოლოდ ტრადიციული მკურნალობა.

მკურნალობის შედეგად გამოვლინდა,რომ ოზონოთერაპიის გამოყენება არ იწვევს დაზიანებით რეაქციებს ჰემოსტაზის და სისხლის ბიოქიმიური პარამეტრების დონეზე. მიღებულ შედეგებზე დაყრდნობით ავტორებს გამოტანილი აქვთ დასკვნა, შაქრიანი დაიბეტით და თანმხლები ჩირქოვან-ანთებითი გართულებებით პაციენტებში ოზონოთერაპიის გამოყენების მიზანშეწონილობის შესახებ.