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Results of Planimetric Studies in Treatment of Long-Term Non-Healing Purulent Wounds of Soft Tissue

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Keywords: surgery, long-term non-healing purulent soft tissue wound, method of chemo-photodynamic therapy, dynamics of the regenerative process

Introduction. Treatment of long-term non-healing purulent wounds (DNHR) of various etiology has a long history and is still an urgent problem of surgery. Most experts agree that the treatment of purulent wounds should be comprehensive, taking into account the clinical manifestations of the disease, the presence of background pathology, indications and contraindications for the appointment of surgical and drug treatment. Treatment and prophylaxis for soft tissue GADG is usually aimed at preventing ulcer infection, removing excess secretions, maintaining a moist wound environment, controlling swelling, and relieving pain caused by nerve and tissue damage. One of the principles of DNGR treatment is the use of antibacterial drugs of various groups, which cannot guarantee reliable prevention of infectious complications, due to the rapid adaptation of the wound microflora, which results in the formation of antibiotic resistance of microorganisms. It is necessary to take into account the decrease in the body's immunological response and the disturbance of the intestinal flora after the use of drugs of this group [1, 2, 3, 4, 5].

To date, the principle of treatment of purulent wounds involves wide disclosure of a purulent focus followed by open treatment. The disadvantages inherent in this method include the impossibility of carrying out frequent changes of gauze dressings during the day, damage to the forming granulation tissue when changing the dressing. This creates the prerequisites for increasing the duration of treatment, creating economic losses for the patient and the state due to a long period of incapacity for work. The most important condition for local treatment of wounds is drainage, the task of which is to remove wound exudates and wound exudate products, to apply modern wound dressings, such as sorption, protective, containing various antiseptic preparations [3, 6, 7, 8, 9, 10].

Purpose of the study. Study of the dynamics of indicators of regenerative processes in the treatment of long-term non-healing purulent wounds of soft tissues.

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Material and research methods. The material of the study was 132 patients with long-term non-healing purulent wounds of soft tissues, treated in the purulent surgical department of the clinic of the Andijan State Medical Institute in 2016-2020.

To solve the set tasks, all patients were divided into three groups, according to the method of treatment of DNGR. Two comparison groups were formed. Comparison group No. 1 - 54 patients in whom the analysis of the results for the comparative study was carried out retrospectively. A prerequisite for inclusion in this group was the compliance of the clinical course of DNGR, as well as other indicators (age, sex, concomitant pathology, causes of wound formation, etc.) to patients in other groups, as well as the availability of all the necessary data for comparative analysis. DNGR treatment in this group was carried out according to the traditional method.

The main group included 38 patients in whom the treatment of DNGR was carried out according to the proposed method. The domestic drug "FarGALS" was used as an antiseptic and wound-healing agent, as well as a photosensitizer for PDT. As a source of radiation for PDT, we used the laser apparatus "Matrix". It uses a semiconductor emitter with a radiation power of 3 mW, a spectrum of 337 nm. Radiation is pulsed with a frequency of 100 Hz. The device is equipped with a light guide with a diameter of 500 μm, a power meter and a timer with discrete time values from 10 sec to 3 min.

The absorption spectrum of "FarGALS" completely coincides with the radiation of the laser apparatus "Matrix". A domestic highly effective antimicrobial drug showed an absorption spectrum in the 350-550 nm mode, with a second slight rise in the curve in the 800 nm spectrum.

Comparison group No. 2 included 40 patients. For an objective picture in assessing the results, in this group, patients were treated only with the use of the drug "FarGALS".

The age of the patients included in the study ranged from 25 to 75 years. Most of the patients corresponded to the age group from 45 to 60 years. There were 25 female patients in comparison group No. 1 (46.3%), men - 29 (53.7%). In comparison group No. 2 there were 19 women (47.5%), men - 21 (52.5%). In the main group, there were 20 women (52.6%), men - 18 (47.4%).

According to the classification of surgical soft tissue infections proposed by Ahrenholz D.H. in 1991, all patients included in the study were assigned to the second level with lesions of the subcutaneous tissue (abscess, phlegmon, etc.) and the third level with lesions of the superficial fascia (necrotizing fasciitis).

The distribution of patients according to the recommendations of the Russian Association of Specialists in Surgical Infections showed that all cases were attributed to secondary infections

with a complicated course, the causes of which were: bites with an outcome in infected wounds, infection of the surgical site, infected trophic ulcers, bedsores, and infected burn wounds.

According to the localization of wounds, the patients were distributed as follows: wounds of the medial malleolus accounted for the majority of cases both in the main (44.7%) and in comparison groups No. 1 and No. 2 (48.1% and 45.0%). Next in frequency of occurrence are wounds of the soft tissues of the lower leg, sacrum region, buttocks, feet and forearm.

According to the presence of combined pathology in patients, there were no significant differences between the main and comparison groups No. 1 and No. 2. Most often, both in the main (34.2%; 13 out of 38 patients) and in comparison groups No. 1 (27.8%; 15 out of 54) and No. 2 (27.5%; 11 out of 40), arterial hypertension. Concomitant pathology of the gastrointestinal tract was observed in 4 (10.5%) patients in the main group, 5 (9.3%) in comparison group No. 1 and 5 (12.5%) in group No. 2. The diagnosis of concomitant diabetes mellitus was established with a frequency of 10.5% (4 out of 38), 5.6% (3 out of 54) and 7.5% (3 out of 40) in the study and comparison groups No. 1 and No. 2, respectively. Various forms of coronary heart disease as a concomitant pathology were identified in 13.2%, 11.1% and 10.0% of cases in the main and comparison groups No. 1 and No. 2, respectively. Concomitant pathologies of the kidneys and lungs were detected with a relatively lower frequency.

In the study groups, in patients after PCO, wounds with an area of 401 to 600 mm2 were most often observed, 48.1% - in comparison group No. 1, 50% - in group No. 2 and 55.3% - in the main group. Further, according to the frequency of detection, wounds with an area of 201-400 mm2 were noted: in 28.9%, 37.0% and 35.0% - in the main, comparison groups No. 1 and No. 2, respectively. Extensive wounds, more than 600 mm2, were detected in only 4 (10.5%) patients in the main group, 6 (11.1%) in group No. 1 and 4 (10%) in comparison group No. 2.

Research results. Comparative analysis of the dynamics of the area of the wound surface showed that in the first (393.9 ± 23.2 mm2) and in the second comparison group (420 ± 29 mm2), the mean values 3 days after the start of treatment did not have significant differences in relation to the outcome, then as in the main group of patients, by this time a significant reduction in the wound area was noted - from 437.3 ± 24.3 to 351.2 ± 19.6 mm2 (Table 1). In general, positive dynamics was observed in all groups, the average values after four weeks of treatment were 7.5 ± 3.0 mm2, 45.1 ± 5.7 mm2 and 20.8 ± 4.7 mm2 in the main, first and second groups, respectively.

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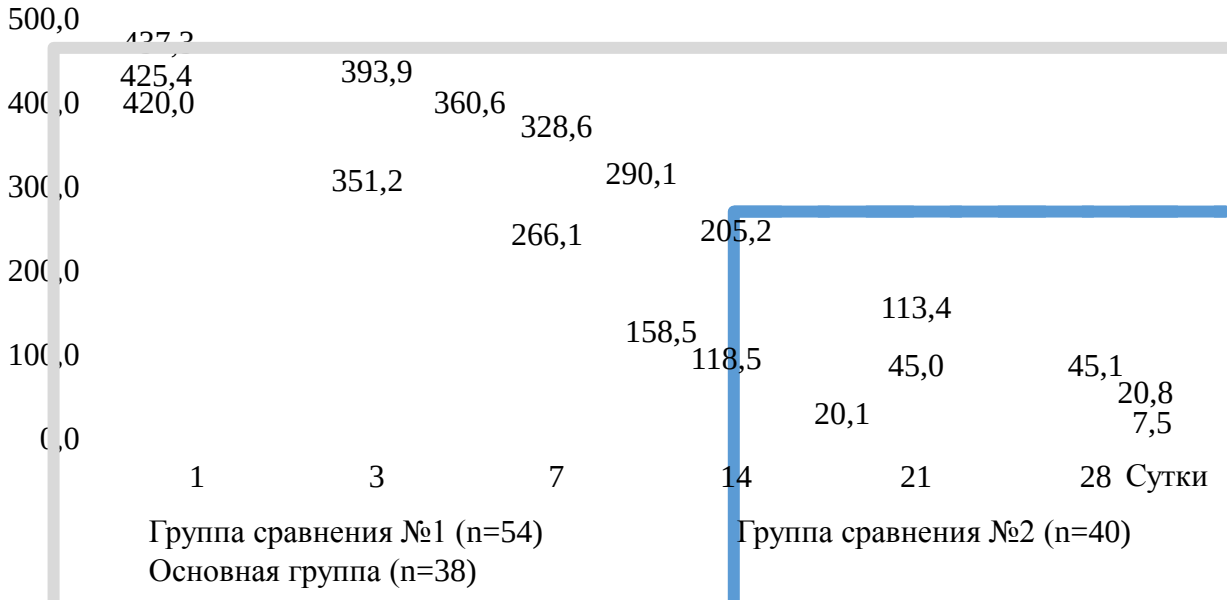
Table 1. Dynamics of the wound surface area (mm^2)

Group / indicator		Day					
		1	3	7	14	21	28
Comparison group №1 (n=54)	M	425,4	393,9	328,6	205,2	113,4	45,1
	δ	183,5	170,7	146,6	89,0	72,2	41,9
	m	25,0	23,2	20,0	12,1	9,8	5,7
Comparison group №2 (n=40)	M	420,0	360,6	290,1	158,5	45,0	20,8
	δ	183,2	157,9	126,0	82,7	49,9	29,7
	m	29,0	25,0	19,9	13,1	7,9	4,7
Main group (n=38)	M	437,3	351,2	266,1	118,5	20,1	7,5
	δ	149,7	121,0	91,7	63,5	35,8	18,6
	m	24,3	19,6	14,9	10,3	5,8	3,0



Value / day	1	3	7	14	21	28
t-test 1 and 2 * (p)	-0,14; p>0,05	-0,98; p>0,05	-1,37; p>0,05	**-2,62; p<0,001**	**-5,43; p<0,001**	**-3,29; p<0,001**
t-test 2 and 3 * (p)	0,46; p>0,05	-0,29; p>0,05	-0,96; p>0,05	**-2,40; p<0,01**	**-2,55; p<0,01**	**-2,39; p<0,05**
t-test 1 and 2 * (p)	0,34; p>0,05	-1,40; p>0,05	**-2,51; p<0,001**	**-5,45; p<0,001**	**-8,18; p<0,001**	**-5,83; p<0,001**

Note: * 1 - comparison group No. 1; 2 - comparison group No. 2; 3 - main group

Figure 1. Regression of the wound surface area (mm^2)

As can be seen from Figure 1, in a comparative aspect, the regression of the wound surface area had a significant statistical difference in indicators between the groups by the 14th day after the start of treatment. Thus, in the main group of patients, the average wound surface area decreased from 437.3 mm^2 to 118.5 mm^2, which turned out to be significantly less than in both comparison groups (t-test 2.40-5.45; p <0.01-0.001). At the same time, between the main and comparison group No. 1, a statistically significant difference (t-test 2.51; p <0.001) was noted as early as a week after the start of treatment. In the future, this trend continued.

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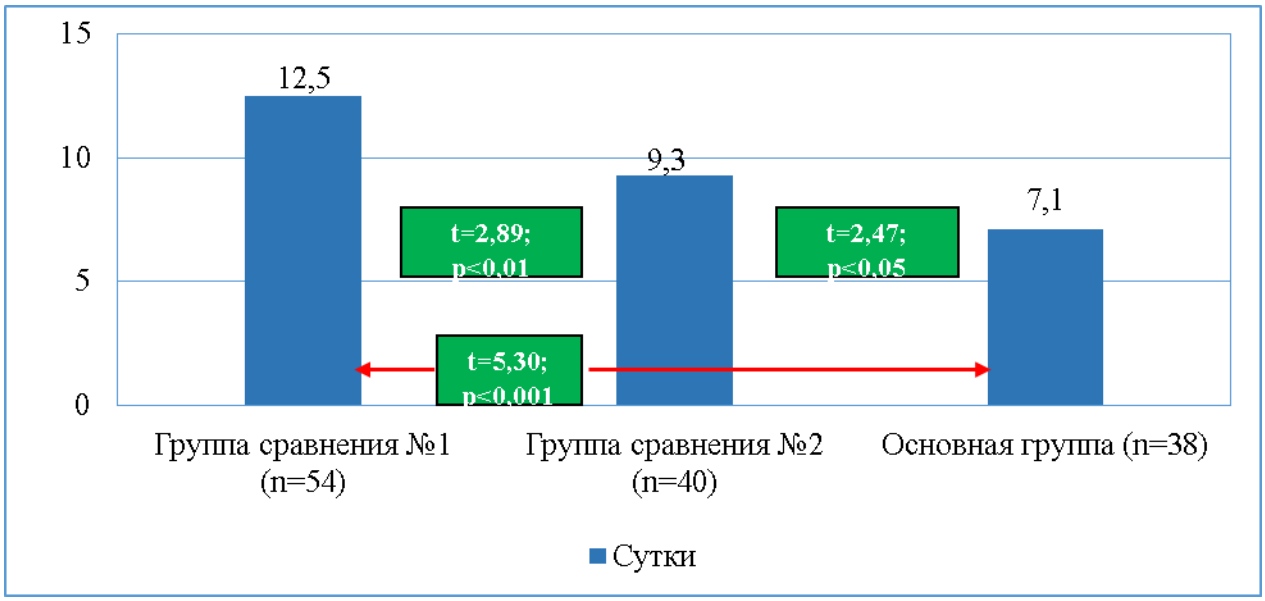

Figure 2. Average period of wound cleansing (days)

With regard to the average period of wound cleansing (Fig. 2), the best results were obtained in the main (7.1 ± 0.5 days) and comparison group No. 2 (9.3 ± 0.7 days), and had a statistically significant difference in relation to to the indicator in comparison group No. 3 (12.5 ± 0.9 days; t = 2.89-5.30; p <0.01-0.01).

Analysis of the dynamics of the area of wound epithelialization (Table 2, Fig. 3) showed its increase by the 7th day of treatment by 39.1 ± 0.3% in the main group of patients, by 22.8 ± 0.7% - in comparison group No. 1 (t = 22.74; p <0.001) and by 30.9% - in comparison group No. 2 (t = 16.76; p <0.001).

Table 2. Dynamics of the area of wound epithelialization (% of the area of the wound)

Group / indicator		Days				
		3	7	14	21	28
Comparison group No. 1 (n=54)	M	7,4%	22,8%	51,8%	75,7%	90,9%
	δ	1,4%	4,8%	0,7%	11,7%	7,4%
	m	0,2%	0,7%	0,1%	1,6%	1,0%
Comparison group No. 2 (n=40)	M	14,1%	30,9%	64,6%	91,6%	96,1%
	δ	2,2%	2,5%	12,1%	8,5%	5,1%
	m	0,3%	0,4%	1,9%	1,3%	0,8%
Main group (n=38)	M	19,7%	39,1%	75,0%	96,6%	98,7%
	δ	2,4%	1,8%	11,0%	5,8%	2,9%
	m	0,4%	0,3%	1,8%	0,9%	0,5%

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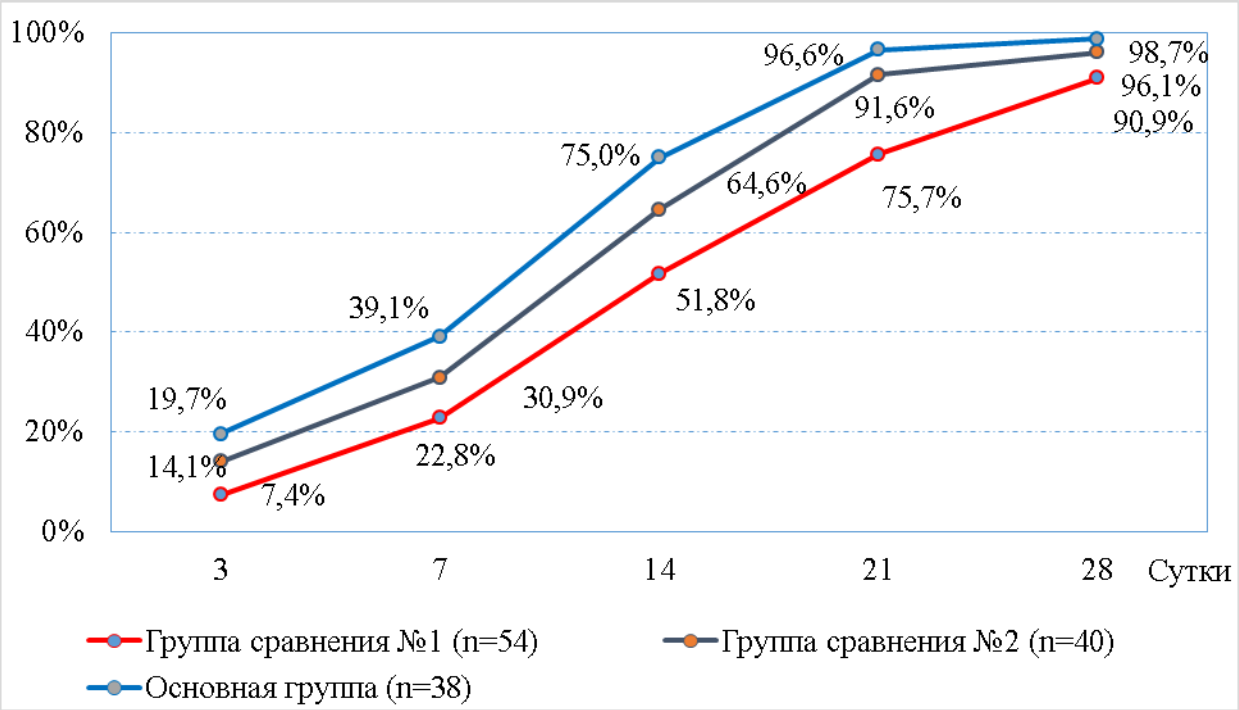

Value / day	3	7	14	21	28
t-test 1 and 2 * (p)	**17,27; p<0,001**	**10,55; p<0,001**	**6,69; p<0,001**	**7,63; p<0,001**	**4,07; p<0,001**
t-test 2 and 3 * (p)	**10,67; p<0,001**	**16,76; p<0,001**	**3,98; p<0,001**	**3,06; p<0,001**	**2,83; p<0,001**
t-test 1 and 3 * (p)	**28,28; p<0,001**	**22,74; p<0,001**	**12,95; p<0,001**	**11,33; p<0,001**	**7,11; p<0,001**

Note: * 1 - comparison group No. 1; 2 - comparison group No. 2; 3 - main group

Figure 3. Increase in the area of wound epithelialization (%)

In the main group, the increase in the area of epithelialization of the wound surface reached 75.0 ± 1.8% by 14 days of treatment, which was also statistically the best results among the study groups (t = 12.95; p <0.001 to group No. 1; t = 3, 98; p <0.001 to group No. 2). As can be seen from Fig. 3, four weeks after the start of treatment in the main group of patients, the process of wound epithelialization was almost completed and reached 98.7 ± 0.5% (t = 2.83-7.11; p <0.001).

Complete wound regeneration (Fig. 4) 28 days after the start of treatment was noted in 84.2% (32 of 38 patients) cases in the main group, which was statistically significant and a better indicator than in comparison group No. 1 (40.7 %; 22 out of 54) - χ^2 = 17.385; df = 1; p <0.001; and comparison group No. 2 (62.5%; 25 out of 40) - χ^2 = 4.669; df = 1; p = 0.031.

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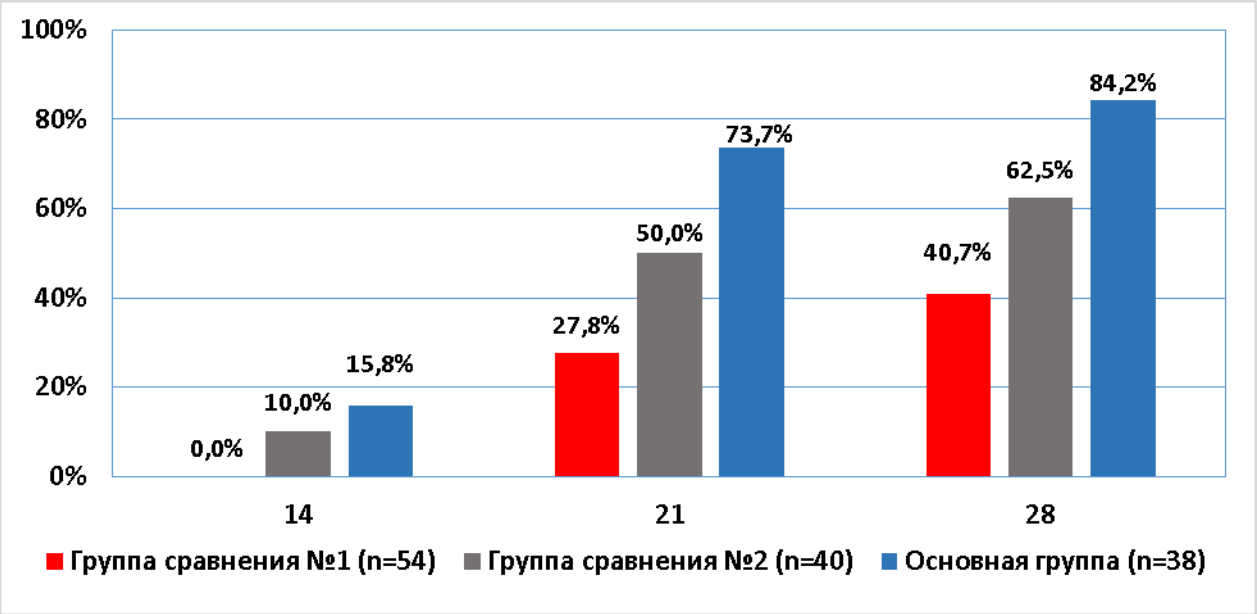

importance	14 days	21 days	28 days
X^2 test between 1 and 2	5,640; df=1; p=0,018	4,856; df=1; p=0,028	4,352; df=1; p=0,037
X^2 test between 1 and 2	0,584; df=1; p=0,445	4,618; df=1; p=0,032	4,669; df=1; p=0,031
X^2 test between 1 and 2	9,121; df=1; p=0,003	18,882; df=1; p=p<0,001	17,385; df=1; p<0,001

Figure 4. Proportion of patients with complete wound regeneration

Findings. The introduction of a new method of combined local chemo-photodynamic therapy of long-term non-healing purulent wounds of soft tissues, aimed at the induction of anti-inflammatory and reparative action, made it possible to accelerate the average period of wound cleansing in the main group to 7.1 ± 0.5 days (9.3 ± 0.7 days in comparison group No. 2, t = 2.47; p <0.05; 12.5 ± 0.9 days in comparison group No. 1, t = 5.30; p <0.001).

There was also an increase in regression of the wound surface area and an increase in epithelialization processes by the 7th day of treatment to 39.1% (in the main group) (from 22.8 ± 0.7% in comparison group No. 1, t = 22.74; p <0.001 and 30.9% in comparison group No. 2, t = 16.76; p <0.001), by 14 days from 51.8% and 64.8% to 75.0% (t = 12.95; p <0.001 and t = 3.98; p <0.001, respectively, for groups No. 1 and No. 2), by day 21 from 75.7% and 91.6% to 96.6% (t = 11.33; p <0.001 and t = 3.06; p <0.001) and by day 28 from 90.9% and 96.1% to 98.7% (t = 7.11; p <0.001 and t = 2.83; p <0.001).

In general, the proposed method provided complete wound regeneration on day 21 of treatment in 73.7% of patients (versus 27.8% in group No. 1, $\chi 2$ = 18.882; df = 1; p <0.001 and 50.0% in group No. 2, $\chi 2$ = 4.618; df = 1; p = 0.032), and on the 28th day in 84.2% of patients (versus 40.7% in group No. 1, $\chi 2$ = 17.385; df = 1; p <0.001 and 62.5% in group No. 2, $\chi 2$ = 4.669; df = 1; p = 0.031).

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Summary

Objective: to study the dynamics of indicators of regenerative processes in the treatment of long-term non-healing purulent wounds of soft tissues.

Material and methods. The study was based on the results of treatment of 132 patients with long-term non-healing purulent soft tissue wounds treated in the clinic of the Andijan state medical institute in 2016-2020. The retro-prospective study was conducted with the distribution of patients into 3 groups: the 1st comparison group– 54 patients with treatment according to the traditional method (retrospective analysis); the 2nd comparison group– 40 patients, treatment was carried out only with the use of the drug “FarGALS”; the main group – 38 patients, treatment was carried out according to the proposed method of chemo-photodynamic therapy with local use of the domestic drug “FarGALS” and laser irradiation of the wound. The following

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indicators were studied: the period of wound cleansing, regression of the wound surface area, increase in epithelization processes and the time of wound regeneration. The reliability of the obtained results is justified by statistical methods.

Results. The average period of wound cleansing in the main group was 7.1±0.5 days (9.3±0.7 days in the 2nd comparison group, $p<0.05$; 12.5±0.9 days in the 1st comparison group, $p<0.001$). The marked increase in the regression of the wound area surface and the increment of epithelialization to 7 days of treatment to 39.1% (in main group) (from 22.8±0.7% in the 1st comparison group $p<0.001$ and 30.9% in the 2nd comparison group, $p<0.001$) by 14 days from 51.8% and 64.8% to 75,0% ($p<0.001$ and $p<0.001$ respectively to the 1st and 2nd groups), to 21 days from 75.7% and 91.6% to 96.6% of ($p<0.001$ and $p<0.001$) and 28 day of 90.9% and 96.1% of 98.7% ($p<0.001$ and $p<0.001$). Complete wound regeneration in patients of the main group occurred on 21 days of treatment in 73.7% of patients (compared to 27.8% in the 1st group, $p<0.001$ and 50.0% in the 2nd group, $p=0.032$).

Conclusion. The introduction of a new method of combined local chemo-photodynamic therapy of long-term non-healing purulent soft tissue wounds, aimed at inducing anti-inflammatory and reparative action, allowed to accelerate the average period of wound cleansing, increase the regression of the wound surface area and increase the epithelialization processes.