Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 2, 2021, Pages. 1831 - 1841
Received 20 January 2021; Accepted 08 February 2021.

A Cytologic Study of Wound Process Dynamics in Purulent Soft Tissue Diseases with the Use of Programmed Rehabilitation Technologies

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ABSTRACT

Purpose of research:to study cytological features of healing processesin patients with soft tissue phlegmons using programmed rehabilitation technologies.

Methods: The study involved167 patients with purulent phlegmonsof soft tissuesat various locations. Patients were randomised in two groups. Conventional postoperative local treatment was provided to patients from the control group (*n*=79). Inintervention group(*n*=88),aftersurgical debridementthe wound tube drainages were used, withdrawnthroughseparateincisions;the wound was blindly sutured.Post-surgical periodincludedprogrammedrehabilitation procedurescarried out using the AMP-01device.The dynamics ofreparative processes in purulent woundswas evaluated according to the cytologic pattern of the material taken employing surface or needle biopsy method.

Results:A higher speed ofcell-mediated responses in purulent wounds is noted in the intervention group of patients.By the 9th day after surgery,the cytologic pattern corresponded to theregenerative type of cytograms. Noteworthy werestatistically significantmore rapid decrease in the number ofdegenerative formsofneutrophils and positive redistribution ofbanded and segmentonuclearneutrophils together withhigh values ofregeneration and degeneration index ($p<0.001$),indicating that the reversal ofinflammatory process speeds up. In earlier periods, astatistically significant occurrence ofmacrophages and cells ofyoungconnective tissueasfibrocytes, fibroblasts, fibrous fibers($p<0.001$) was also observed, what demonstratedactiveregeneration processes in the wound. Low intensity ofcell-mediated responses in the wound, prolonged inflammation phase, long-lastingregeneration phase, and later onset of scar reorganisationphase were found in the control group. With that,by the 9th day ofpost-surgical period,the cytologic pattern in the control groupcorresponded to theinflammatorytypeof cytograms.

Conclusion: The conductedcytologic study has proved the effectiveness of using programmed rehabilitation technologies, which facilitate shortening of inflammation phase andacceleration ofreparative processes insuppurative focusesofsoft tissue phlegmons.

KEYWORDS

Purulent Inflammatory Diseasesof Soft Tissues, Phlegmon of Soft Tissues, Programmed Rehabilitation Technologies, Cytologic Study, Reparative Process.

Introduction

Purulent inflammatory diseasesof soft tissues represent one of the most important and complex problems ofmodern surgery[1,2,3].It is related not only toa wide spread of surgical infection, but to challenges in diagnosing it, variable and persistent clinical course, complex treatment,andunpredictable prognosis.

Patients with acutepurulent inflammatory diseasesof soft tissuesamount to nearly 40% of the total number ofall surgical inpatients and outpatients [4,5].According to the national U.S. statistics, each yearemergency departments receive more than3million peoplewithskin and soft tissue infections, more than 500000 of themare hospitalized, and costs for their treatment exceedUS$ 10bln. [6,7].From the data of theDepartment of Health Monitoring, Analysis, and Strategic Development of the Ministry of Health of the Russian Federation, in 2018, 1018694 surgerieswere performed in surgical hospitals of the country for purulent diseases of skin and subcutaneous tissue, what amounted to 10.2% of surgeries in total, andmortality among inpatients with purulent diseases has increasedover the last years and amounted to1.92% in 2018 [8].

In recent years,fundamental scientific research studies inmolecular and cellular biology have made it possible to more fully understand thekey mechanisms of wound healing. It has been proved that healing processwith any injuryisgenetically determined, formed duringontogenesis and phylogenesis, an inflammation phase occurs always first, then giving way toscar regeneration and the phase of scar reorganisation and epithelization [5,9,10,11].Here is

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the essence of the biological law of healing with the samepathogenesisfor any wound process irrespective of a wound nature, origin, and location.

To solve the problems of predicting the course ofreparative processes, that underliestructural and functional restorationof altered tissues, becomes increasingly important in recent times. Hence, of relevance is aninterest in developingboth new treatment strategies andmethods for assessment of the dynamics inhealingof wound defects [12-15].

To quickly obtain the objective data on the course of reparative processes in the woundsof various origin,the use ofcytologic methodremains pertinent [5,16,17,18,19].A cytologic studyenables characterisation of different types ofthe wound process course, and adequate assessment of the effectiveness of provided treatment [5,20,21].6 cytologic pattern typesaccording toV.F.Kamaev (1954) are distinguished, that correspond to different stages ofwound process: degenerative necrotic type,degenerative inflammatory type, inflammatory type, inflammatory regenerative type, regenerative inflammatory type, regenerative type[5,22]. To fully evaluate the wound healing pattern, a regeneration and degeneration index (RDI) is computed by the formula[23]. Less than 1 value of RDI is indicative of a pronouncedinflammatory processin the wound. If the value of this indicatorbecomes equal to more than 1, it implies the transition of the wound processto the regeneration phase.

Assessment ofreparative responsein the wound based oncytologic verificationconstitutes an objective method for examiningthe specifics of the wound process course, which enables optimisation ofthe disease management.
Purpose:to study the results from a cytologic study of healing processes inpurulent soft tissue diseases using programmed rehabilitation technologies.

Material and Methods

Over the period from 2011 to 2019, 167 patients with purulent soft tissue phlegmonsat various locations were under the authors' supervision. The research study inclusion criteria are as follows: more than 18 years age of patients, extremity orneck soft tissue phlegmon, voluntary informed consent available. The research study exclusion criteria are: extensive skin defectswithinsurgical debridement area, signs ofanaerobic infection, pregnancy, diabetes mellitus andoncological pathology, functional abnormality of circulation organs, and type III respiratory failure.

Patients involved in the study were randomised in two groupsaccording to the postoperative techniques for rehabilitation of suppurative focuses. Control group included 79 patients: 44 men, 35 women. Following surgical debridement,patients were giventypicallocal treatmentutilisingiodophor solutions, polyethylene glycol-based ointments. Intervention group included 88 patients: 46 men and 42 women.After surgical debridement, the wound tube drainages were used, withdrawn through separate incisions; then the wound was blindly sutured. Drainages were connected tothe AMP-01 original device (patent for invention No.2539165 dated 27.11.2014), used to carry outprogrammed postoperative rehabilitation procedures.A customised program was installed onthe device control unitfor irrigation,antiseptic aspiration, and continuous vacuum cyclical processes, implementedautonomously. Programmed rehabilitation procedures, alternated with 1-hour vacuuming, were performed every 3 hours. The specified level of vacuum in purulent cavity (60-80 mm Hg) was maintained using a built-in pressure sensor. The method was applied during the first 5-6 days of treatment,with active aspiration performed afterwards.Sutures were removed on the 7-9th day. Baseline therapy was identical in both groups of patients.

To evaluate the parameters by study groups, mean values (M) and mean square deviation (M±σ), median (*Me*),first and thirdquartiles (Q1, Q3) were utilised. Mean ageof patientsfrom intervention group (M±σ) was 59±13 years; *Me*– 56, from control group – 60±11 years; *Me*– 59. Gender- and age-wise distribution of patients with soft tissue phlegmons from study groups is given in Table 1.

Table 1. Gender- and age-wise distribution of patients from study groups

Indicator		Intervention group (*n*=88)	Control group (*n*=79)	p-value ofsignificance of differences between groups
Mean age M±σ		59±13	60±11	0.857*
Gender	men (*n*, %)	46 (52.3%)	44 (55.7%)	0.845**
	women (*n*, %)	42 (47.7%)	35 (44.3%)	

Note: * t-criterion for independent samples

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** Fischer's exact test

Thus, there are no statistically significant differences between the study groups in age and gender, whatallowed inferring about homogeneity of groups.

The distribution of patients with soft tissue phlegmons in the study groups, determined according to phlegmon location, is given in Table 2.

Table 2. Nosology-related distribution of patients from study groups

Nosologicalentity	**Intervention group**		**Control group**		**Total**
	n	**%**	***n***	**%**	
Hand phlegmon	7	7.95	6	7.6	13
Forearm phlegmon	23	26.1	20	25.3	43
Shoulder phlegmon	7	7.95	8	10.1	15
Foot phlegmon	10	11.4	11	13.9	21
Lower leg phlegmon	26	29.5	19	24.1	45
Thigh phlegmon	9	10.2	9	11.4	18
Neck phlegmon	6	6.8	6	7.6	12
Total	88	100	79	100	167

Note: percentages are given as applied tothe number of patients in the study groups.

No dependence of nosology-related patients' distribution and the type of group was found (χ^2-Pearson criterion p=0.953). Thus,intervention and control groupsconstitute the parts of a singlegeneral population.

To evaluate healing of suppurative focuses, a cytologic research method has been employed in our study. A surface biopsy procedure according toPokrovskaya M.P. and Makarov M.S (1942) as modified byKamaev M.F. (1954) has been applied.In control group, the material was sampled by gently scraping the wound surface layer witha specialspreader ora surgicalscalpel handle. The obtained material wasapplied on the glass,fixed, and stainedaccording to theMay-Grunwald-Romanowski-Giemsa stain method. In the intervention study group,cellular tissue elements were sampled using "needle biopsy" method (Kaem R.I., Karlov V.A., 1977; Sergel' O.S., Goncharova Z.N., 1990).4-5 smears were taken sequentially from one and the same wound segment. Cytologic examination of smears from the surface of wounds was made during the 1st day and further on the 3, 5, 7, 9th day.Smears were examinedusing a microscope with photographic lens×63, formed elements were therewith counted, and a mean value for 10 fields of view was derived. The obtained value was expressed as a percentage per 100 countedcells. Alight microscopeAxio A1 (Zeiss, Germany) with a set of accessories was utilised. Photographs were captured withAxioCam 105 colorcamera (Zeiss, Germany) using ZEN 2 blue edition software (Zeiss, Germany), calibratedemployingstage-micrometer for transmitted light(SMT) with 0.005mm sensitivity.

At the time ofrandomisation, patients with soft tissue phlegmons from both study groupshad a cytologic pattern inherent inthe degenerative necrotic type of cell-mediated response. Degenerate neutrophils (DN)predominated (64.5±9.2%) among cell elements, with very few intact leucocytes. Regeneration and degeneration index (RDI)was well below 1 (0.2±0.1). Mostly extracellular microflora was abundant;however, intracellular microflora could be sometimes found in the state ofincomplete or degeneratephagocytosis. Accumulation of necrotic masses and amorphous gelatinous intermediate substance were seen in specimens. Figure 1 presents afragment ofPap smearfrom the wound surfacein patients with soft tissue phlegmons at the moment of randomisation on the 1st day of examination.

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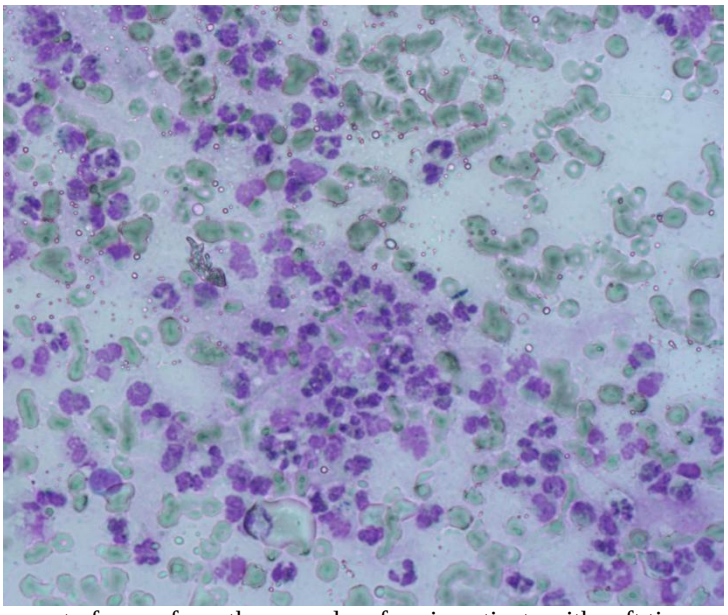

Fig. 1. Cytogram fragment of smearfrom the wound surface in patients with soft tissue phlegmons on the 1st day.Degenerative-modifiedpolymorphonuclear leukocytes predominate, mostly extracellular microflora is abundant;accumulation of necrotic masses and amorphousgelatinous intermediate substance are seen. Romanowski-Giemsa stain. Photographic lens ×40

Cell composition of Pap smears in patients with soft tissue phlegmons in study groups at the moment of randomisation is presented in Table 3.

Table3. Cell composition ofPap smearsin patients with soft tissue phlegmons in study groups at the time of randomisation, in % per 100 cells

Types of cells	Intervention group		Control group		p-value of t-criterion	p-value ofthe Mann-Whitney test
	M±σ, in % per 100 cells	Me[Q1;Q3]	M±σ, in % per 100 cells	Me[Q1;Q3]		
BN	1.8±0.2	1.82 [1.77;1.87]	1.7±0.2	1.74[1.64;1.81]	0.682	536,500
SNN	15.2±0.6	15.19[15.07;15.32]	16.2±0.4	16.16[16.07;16.25]	0.647	502,500
DN	64.5±9.2	65.89[63.65;68.13]	62.2±6.2	68.84[67.57;70.09]	0.022	414,000
RDI	0.2±0.1	0.18 [0.16;0.21]	0.2±0.1	0.18 [0.16;0.21]	0.976	558,000
L	0.4±0.2	0.39 [0.35;0.43]	0.2±0.1	0.17 [0.15;0.19]	0.000	69,000

Note: BN - bandedneutrophils, SNN - segmentonuclearneutrophils, DN - degenerateneutrophils, RDI - regeneration and degeneration index, L–lymphocytes.

Most parameters of statistical assessment of Pap smear cell composition on the first observation day in both study groups had similar values ($p>0.05$),what allowed inferring about homogeneity of groups. However,DN and Lindices were not proved to be statistically homogeneous, what can be accounted for a small size of sampling. On the whole, it is not essential and has not any effect on achievingadequate results of the research study.

The work has been carried out as a simple randomised comparative controlled study in parallel groups.SPSSStatistics 25 (IBM) software was used to statistically process the obtained data. To examine interrelationshipbetween quality-related attributes,contingency tables were compiled, andχ^2-Pearson criterion orFischer's exact test were computed.If interrelationship between quality-related attributesexists, parts of attributes were further compared usingz-criterion ofequal parts. A significance of differences between groupsby quantity-related attributes wasestimated applyingparametric t-criterion of Student and non-parametric Mann-Whitney criterion forindependent groups. For dependent groups, a parametric t-criterion for dependent samplesand non-parametricWilcoxon signed-rank test were used. Avariance analysiswith repeated measurements, specifying a factor of time and group, was employed to

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evaluate changes in the dynamics of quantity-related attributes. The results ofvariance analysis with repeated measurements were used to verify the following hypotheses: whether the change in indices over time is significant,whether there is a difference between groups, and whether thestatistically significant interaction between factors of time and group exists. The last hypothesis allowed the difference in a time-wise changein controllable indicesdepending on the group to be proved.The differences with less than 0.05 probability anda two-tailed critical area were considered statistically significant.

Results

A cytologic pattern of smears in intervention group on the 5th day after randomisation corresponded to inflammatory or inflammatory regenerative type of cell-mediated response. Astatistically significant decrease in the number of degenerate neutrophils(DN) (16.7±2.2%), an increase in the number of intact neutrophils: segmentonuclear(SNN)(41.6±3.8%)and bandedneutrophils(BN) – 6.2±0.8% ($p<0.001$) were seen.Astatistically significant increasein regeneration and degeneration index (RDI)– 2.9±0.4 ($p<0.001$) was noted. Plasma cells,histiocytes appeared. A statistically significantincrease in the number ofactivemacrophages –4.6±0.6%, lymphocytes –5.8±0.6%, fibroblasts–4.2±0.5%($p<0.001$) was observed. Groups ofyoung connective tissue cells in the form of fibrocytes, fibroblasts, fibrous fibers were found.Little microflora in the phase ofcomplete phagocytosis was identified.

On the 5th day of treatment, in control group a cytologic pattern in smears was characterised by a neutrophil response:the number of intact neutrophilsincreased: SNN– 42.6±3.8%, BN–6.2±0.8%. The number of degenerate forms decreased: 56.7±2.2%.RDIwas close to 1:0.9±0.2. Extracellular and intracellular microflora was found, however, with more frequent cases of complete phagocytosis. The number ofyoung neutrophilsincreased;poorly differentiated mononuclear cells appeared. Single actively phagocytizing leucocytes, macrophages, lymphocytes were encountered in the cellular component of the wound wall. Granulation tissue elements were occasional. A cytologic pattern corresponded toinflammatorytypeof cell-mediated response.Figures2 and 3present the fragments ofPap smears from the wound surface on the 5th day in study groups.

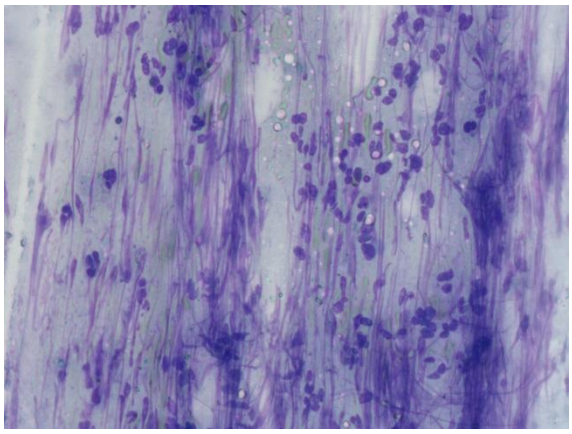

Fig.2. Cytogram fragment ofsmear from the wound surface on the 5th day, intervention group.Fibrocytes, fibroblasts, fibrous fibers were found among neutrophils and polyblasts. Romanowski-Giemsastain. Photographiclens×40

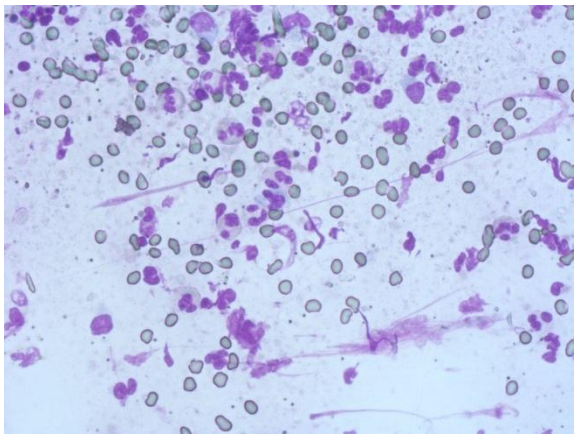

Fig.3. Cytogram fragment of smear from the wound surface on the 5th day, control group.Sporadicactivelyphagocytizing leucocytes, macrophages, lymphocytes are seen. Granulation tissue elements areoccasional. Romanowski-Giemsastain. Photographiclens×40

A significantdifference between study groupswas found when evaluating the dynamics of cell composition of Pap smears on the 5th day after surgery.Fromvariance analysiswith iterativemeasurements,it was proved that there are statistically significant changes in the cell composition of cytograms in both groupson the 5th day after surgery ($p<0.001$).Astatistically significant interaction has been proved between factors of time and group ($p<0.001$).

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On the 9th day after surgery, in intervention group, astatistically significant decrease in DN(3.8±0.5%) was seen, intactneutrophils predominated –SNN(28.2±1.4%), BN–2.4±0.4%(p<0.001).Of note was astatistically significant increase inRDIvalues – 8.1±0.4, in the number ofmacrophages–15.8±1.6%, and fibroblasts–8.4±0.8% (p<0.001).Young elements of connective tissue, polyblastspredominated over neutrophils andlocated amongfibrous structures of intermediate substance. Epitheliumwas represented in smears as layers of cells. There was no microflora. A cytologic pattern corresponded to regenerative inflammatory or regenerative type of cell-mediated response.

By the 9th day, a cytologic pattern in the control group started to take the features,inherent in regenerative processes. There was a statistically significant decrease in the number of DN–12.4±0.5%, and more intact forms appeared: SNN–24.2±1.4%, BN– 6.2±0.4% (p<0.05).RDIconsistentlyexceeded 1: 2.5±0.4. Few intracellular microbes were identifiedin the phase of complete phagocytosis. The number ofmononuclear cells substantially declined, and their derivative formscame to be regularly found while differentiating: the number of polyblasts rose, with morefibroblasts – 3.2±0.5%;the number of macrophages increased 6.7±0.8%. Delicate fibers of intermediate substance were observed along with cell elements. A cytologic pattern of smears corresponded toregenerative inflammatory type of cytograms.Figures 4 and 5 present the fragments of Pap smears from the wound surface on the 9th day in study groups.

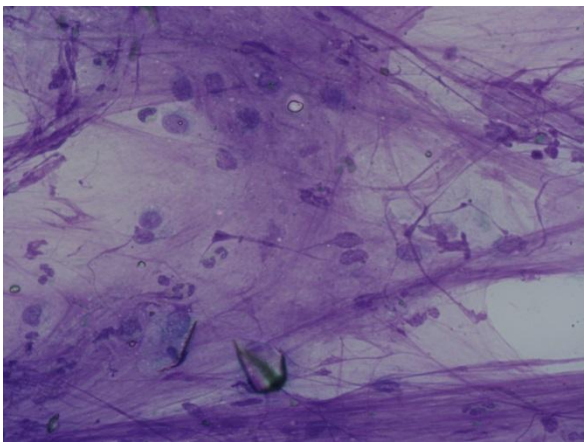

Fig.4. Cytogram fragment ofsmear from the wound surface on the 9th day, intervention group.Young elements of connective tissue, fibroblasts, polyblasts, macrophagesare amongfibrousstructures of intermediate substance. Epithelium is represented as layers of cells. Romanowski-Giemsa stain. Photographic lens ×40

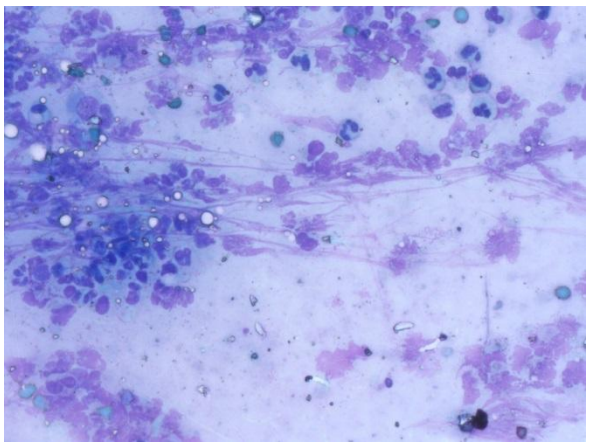

Fig.5. Cytogram fragment of smear from the wound surface on the 9th day, control group.Number ofmononuclear cells decreased, amount ofpolyblasts, fibroblasts, macrophages increased. Delicatefibrousstructures ofintermediate substance were observed. Romanowski-Giemsa stain. Photographiclens×40

Cell composition of Pap smears in patients with soft tissue phlegmons from study groups is presented in Table4.

Table4. Cell composition of Pap smears in patients with soft tissue phlegmons from study groups (M±σ), in % per 100 cells

Types of cells	Intervention group		Control group	
	5th day	9th day	5th day	9th day
DN	16.58±1.32	3.79±0.29	56.76±1.24	12.52±0.43
BN	6.26±0.49	2.44±0.25	6.28±0.49	6.16±0.19
SNN	41.94±2.28	28.25±0.83	42.38±2.39	24.18±0.92
RDI	2.94±0.29	8.15±0.11	0.86±0.05	2.43±0.11
L	5.86±0.39	7.60±0.59	2.76±023	4.33±0.70
MP	4.62±0.36	16.06±0.82	2.21±0.19	6.70±0.48
F	4.62±0.36	16.06±0.82	2.21±0.19	6.70±0.48

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Note 1. DN - degenerateneutrophils, BN - banded neutrophils, SNN - segmentonuclearneutrophils, RDI - regeneration and degeneration index, L – lymphocytes, MP – macrophages, F–fibroblasts.

For both groups,statistically significant changes incell composition in cytogramson the 1st and 9th day after surgery have been proved:a decrease in the number of DN in intervention group (M±σ) from64.5±9.2% to 3.8±0.3%, in control group from68.8±6.2% to12.5±0.4% ($p<0.001$); an increase in SNNin intervention group(M±σ) from15.2±0.6% to 28.3±0.8%, in control group from 16.2±0.4% to 24.2±0.9% ($p<0.001$);an increase inRDIvalue - in intervention group (M±σ) from 0.2±0.1% to8.2±0.1%, in control group from0.2±0.1% to2.4±0.1% ($p<0.001$).

In intervention group, where programmed rehabilitation technologies were employed, the number of degenerate neutrophils had decreased more rapidly, there appeared more intact neutrophils, RDI increased more quickly,and the differences between groups were generally statistically significant throughout the entire follow-up period($p<0.001$).

Asignificant interaction betweenfactors of time and group($p<0.001$) was also identified;by the 9th day, in intervention groupthe number of degenerate forms was substantially lower:3.8±0.3% as opposed to control group (12.5±0.4%);there were more intact neutrophils: 28.3±0.8% and 24.2±0.9%,respectively. A quicker increase inRDIvalues in intervention groupon the 9th day (8.2±0.1) as compared with control group (2.4±0.1) was observed.It demonstrated more active phagocytosis,rapidcleansing ofpurulent cavity.The dynamics of mean values for degenerate neutrophils and values of regeneration and degeneration index in Pap smears of patients with soft tissue phlegmons from both study groups is presented in Figures 6 and 7.

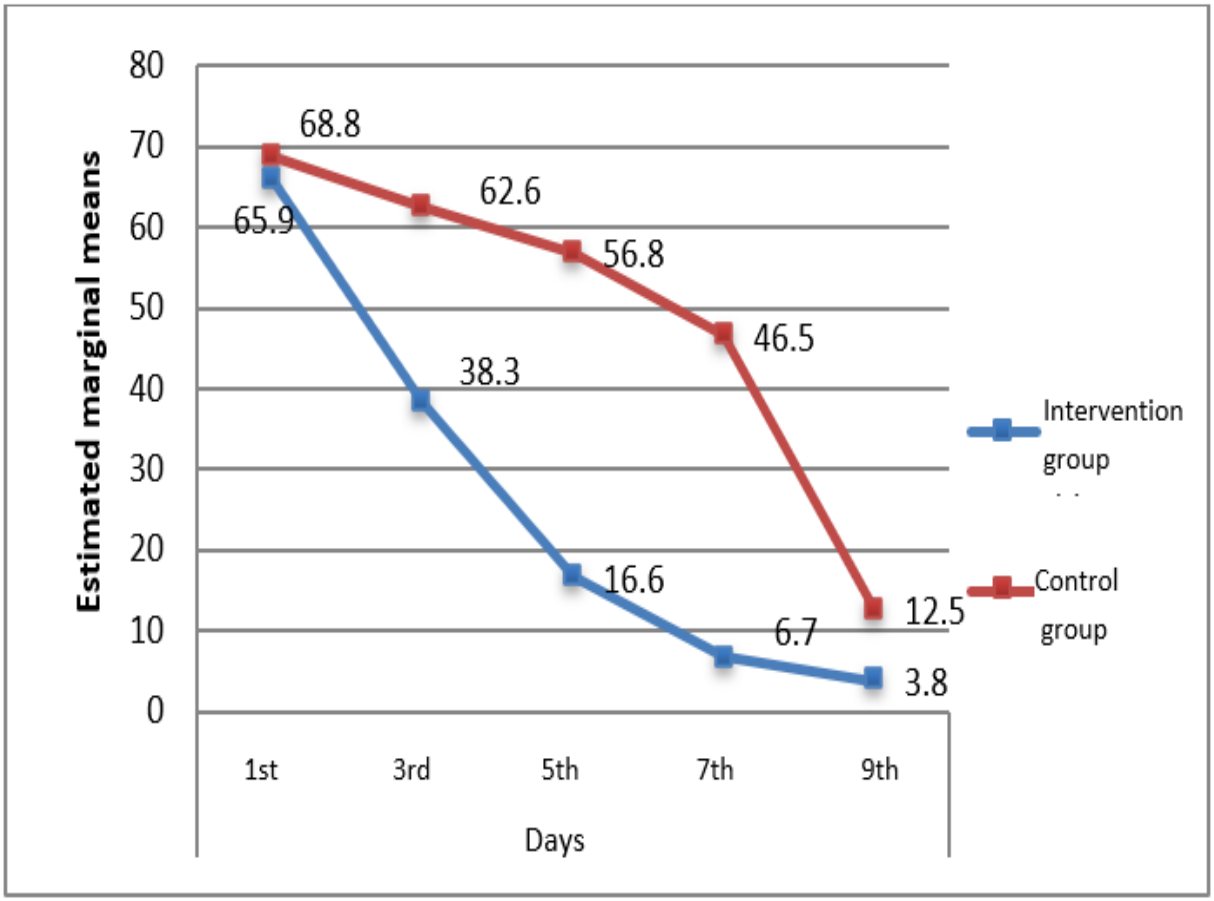

Fig.6. Dynamics of mean values of degenerate neutrophils in cytograms of patients with soft tissue phlegmons from both study groups

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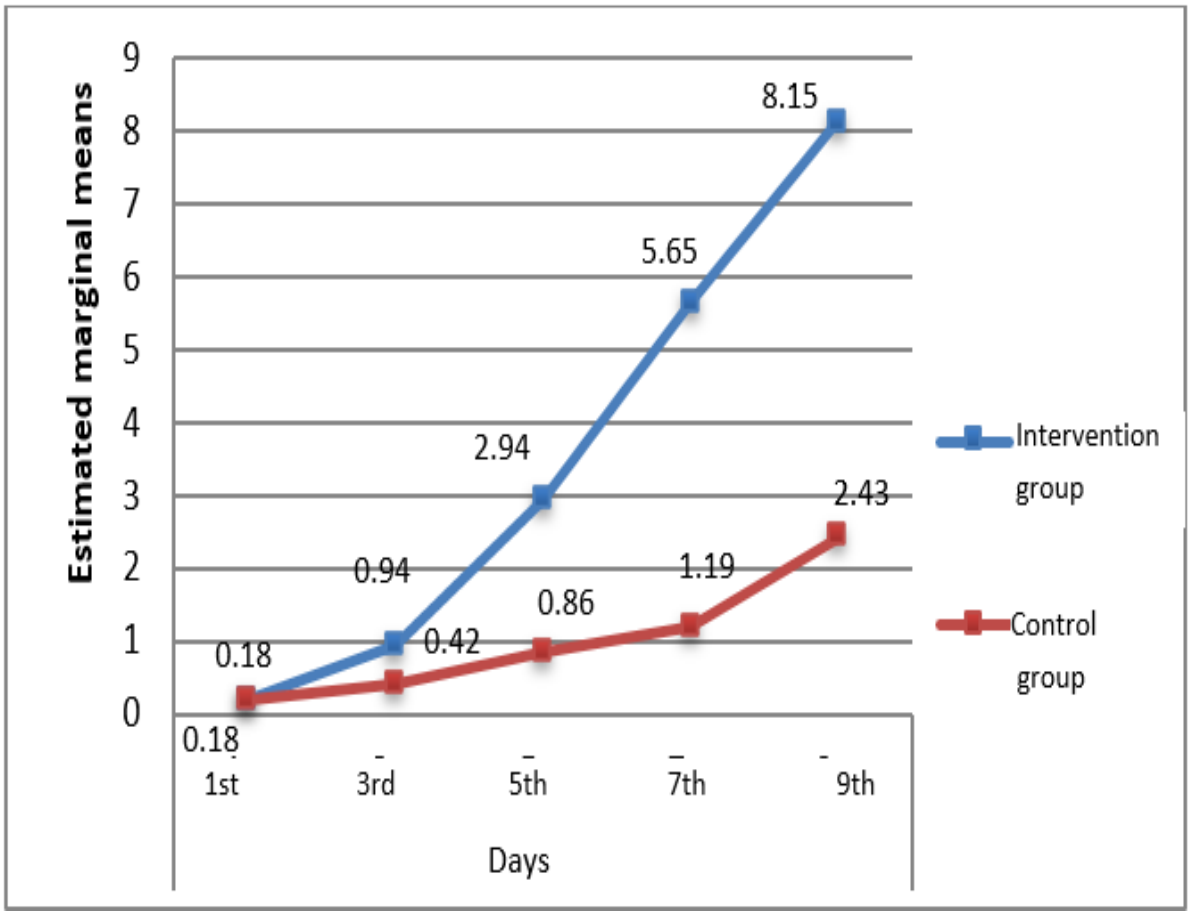

Fig.7. Dynamics of mean values ofregeneration and degeneration index (RDI) in cytograms of patients with soft tissue phlegmons from both study groups

To evaluate reparative capacity of purulent wounds,a cytologic assessment was made of quantitative composition of lymphocytes,macrophages, andfibroblasts in the study groups on the 1st and 9th day after surgery. For both groups, there have been proved a statistically significant increase in the number of lymphocytes:in intervention group(M±σ) from 0.4±0.2% to 7.6±0.6%, in control group from 0.2±0.1% to4.3±0.7% ($p<0.001$);and statistically significantincrease in the number of active macrophages: in intervention group (M±σ) to 16.1±0.8%, in control group to6.7±0.5% ($p<0.001$). On the 9th day, astatistically significant increase in the number of fibroblasts:inintervention group(M±σ) to16.1±0.8%, in control group to6.7±0.5% ($p<0.001$) has also been seen.

In intervention group, whereprogrammed rehabilitation technologies were employed, the number of lymphocytes increased more rapidly, earlier occurrence ofmacrophages and cells of young connective tissue in the form of fibrocytes, fibroblasts, and differences between the groups were generally statistically significant throughout the entire follow-up period ($p<0.001$).

A significantinteraction between factors of time and group($p<0.001$) was also identified; in intervention group by the 9th day, the number of lymphocytes was considerably higher: 7.5±0.6% as distinguished from control group (2.5±0.6%), the number ofmacrophages was higher:12.17±0.68% and2.21±0.19%, respectively. In intervention group, there was noted an earlier occurrenceof young connective tissue cells in the form of fibrocytes, fibroblasts, andan increase in their number by the 9th dayto6.44±0.38%, as opposed to the control group–1.39±0.13%.It demonstrated active regeneration processes in the wound in the intervention group of patients, and the structure of

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cytograms was regenerative.The dynamics of mean values formacrophages and fibroblasts in Pap smears of patients with soft tissue phlegmons from both study groups is presented in Figures 8 and 9.

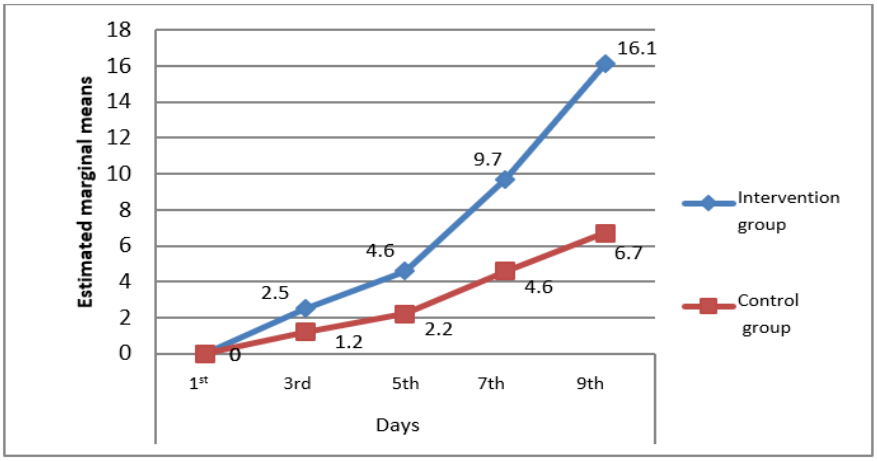

Fig.8. Dynamics of mean macrophage values in cytograms of patients with soft tissue phlegmons from both study groups

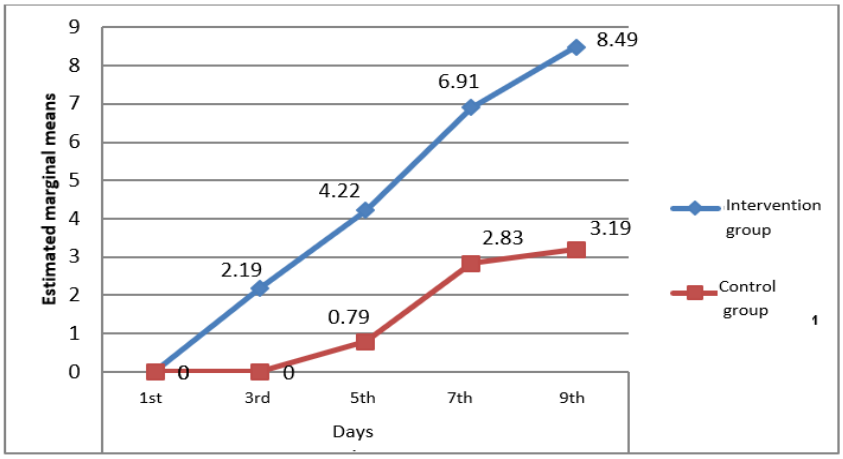

Fig.9. Dynamics of mean fibroblast values in cytograms of patients with soft tissue phlegmons from both study groups

Discussion

The analysis of the dynamics of cytologic pattern in patients with soft tissue phlegmons in the study groups has shown that,in the control group,a low intensity of cell-mediated responses in the wound and prolonged inflammation phasewere identifiedwith conventional treatment, and inflammatory type of cytograms was observedonly 9 days after surgery. Sluggish reparative processesin the wound were also seen in the control group, definingvery prolonged regeneration phase andlater onset of scar reorganisation phase. It resulted in longer healing time.

The use ofprogrammed rehabilitation technologiesallowed creating conditions for enhancedrehabilitation of suppurative focus, resulted in shortening of all wound process phases. Surgical debridement of suppurative focus, prolonged postoperative lavage ofwound cavity, drain process software made it possible to promptlyremovedevitalised tissues, toxins, and proteolytic enzymes from the wound, having decreasedmicrobial contamination therein. It extremely decreased the duration of necrotic tissue rejection stage.Early closure of the wound with sutures,employingactive drainagein conditions ofminorinflammatory response in the wound,greatlyacceleratedreparative processes, facilitating development and completion of regeneration phase.

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 2, 2021, Pages. 1831 - 1841
Received 20 January 2021; Accepted 08 February 2021.

Conclusion

A higherspeed of cell-mediated responses in the wound was identified during the cytologic study of smears in patients with soft tissue phlegmons usingprogrammed rehabilitation technologies. Astatistically significantmorerapid decrease in the number ofdegenerative forms ofneutrophils, positive redistribution ofbanded andsegmentonuclear neutrophilstogether with the increasedregeneration and degeneration index were therewith noted, which are indicative of a quicker reversal of inflammatory process. Also observed with certainty in earlier periods was an occurrence of macrophages and cells of young connective tissue in the form of fibrocytes, fibroblasts, fibrous fibers, what demonstrated active regeneration processes in the wound.
The use of programmed rehabilitation technologies will make it possible to optimise the management of patients with purulent inflammatory diseasesof various origin and at different locations, to enhancetreatment resultsandquality of patients' life.

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