

# GEORGIAN MEDICAL NEWS

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ЕЖЕМЕСЯЧНЫЙ НАУЧНЫЙ ЖУРНАЛ

Медицинские новости Грузии  
საქართველოს სამედიცინო სიახლე

## GEORGIAN MEDICAL NEWS

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**GMN: Georgian Medical News** is peer-reviewed, published monthly journal committed to promoting the science and art of medicine and the betterment of public health, published by the GMN Editorial Board since 1994. GMN carries original scientific articles on medicine, biology and pharmacy, which are of experimental, theoretical and practical character; publishes original research, reviews, commentaries, editorials, essays, medical news, and correspondence in English and Russian.

GMN is indexed in MEDLINE, SCOPUS, PubMed and VINITI Russian Academy of Sciences. The full text content is available through EBSCO databases.

**GMN: Медицинские новости Грузии** - ежемесячный рецензируемый научный журнал, издаётся Редакционной коллегией с 1994 года на русском и английском языках в целях поддержки медицинской науки и улучшения здравоохранения. В журнале публикуются оригинальные научные статьи в области медицины, биологии и фармации, статьи обзорного характера, научные сообщения, новости медицины и здравоохранения. Журнал индексируется в MEDLINE, отражён в базе данных SCOPUS, PubMed и ВИНТИ РАН. Полнотекстовые статьи журнала доступны через БД EBSCO.

**GMN: Georgian Medical News** – საქართველოს სამედიცინო სიახლენი – არის ყოველთვიური სამეცნიერო სამედიცინო რეცენზირებადი ჟურნალი, გამოიცემა 1994 წლიდან, წარმოადგენს სარედაქციო კოლეგიისა და აშშ-ის მეცნიერების, განათლების, ინდუსტრიის, ხელოვნებისა და ბუნებისმეტყველების საერთაშორისო აკადემიის ერთობლივ გამოცემას. GMN-ში რუსულ და ინგლისურ ენებზე ქვეყნდება ექსპერიმენტული, თეორიული და პრაქტიკული ხასიათის ორიგინალური სამეცნიერო სტატიები მედიცინის, ბიოლოგიისა და ფარმაციის სფეროში, მიმოხილვითი ხასიათის სტატიები.

ჟურნალი ინდექსირებულია MEDLINE-ის საერთაშორისო სისტემაში, ასახულია SCOPUS-ის, PubMed-ის და ВИНТИ РАН-ის მონაცემთა ბაზებში. სტატიების სრული ტექსტი ხელმისაწვდომია EBSCO-ს მონაცემთა ბაზებიდან.

### WEBSITE

[www.geomednews.com](http://www.geomednews.com)

## К СВЕДЕНИЮ АВТОРОВ!

При направлении статьи в редакцию необходимо соблюдать следующие правила:

1. Статья должна быть представлена в двух экземплярах, на русском или английском языках, напечатанная через **полтора интервала на одной стороне стандартного листа с шириной левого поля в три сантиметра**. Используемый компьютерный шрифт для текста на русском и английском языках - **Times New Roman (Кириллица)**, для текста на грузинском языке следует использовать **AcadNusx**. Размер шрифта - **12**. К рукописи, напечатанной на компьютере, должен быть приложен CD со статьей.

2. Размер статьи должен быть не менее десяти и не более двадцати страниц машинописи, включая указатель литературы и резюме на английском, русском и грузинском языках.

3. В статье должны быть освещены актуальность данного материала, методы и результаты исследования и их обсуждение.

При представлении в печать научных экспериментальных работ авторы должны указывать вид и количество экспериментальных животных, применявшиеся методы обезболивания и усыпления (в ходе острых опытов).

4. К статье должны быть приложены краткое (на полстраницы) резюме на английском, русском и грузинском языках (включающее следующие разделы: цель исследования, материал и методы, результаты и заключение) и список ключевых слов (key words).

5. Таблицы необходимо представлять в печатной форме. Фотокопии не принимаются. **Все цифровые, итоговые и процентные данные в таблицах должны соответствовать таковым в тексте статьи**. Таблицы и графики должны быть озаглавлены.

6. Фотографии должны быть контрастными, фотокопии с рентгенограмм - в позитивном изображении. Рисунки, чертежи и диаграммы следует озаглавить, пронумеровать и вставить в соответствующее место текста **в tiff формате**.

В подписях к микрофотографиям следует указывать степень увеличения через окуляр или объектив и метод окраски или импрегнации срезов.

7. Фамилии отечественных авторов приводятся в оригинальной транскрипции.

8. При оформлении и направлении статей в журнал МНГ просим авторов соблюдать правила, изложенные в «Единых требованиях к рукописям, представляемым в биомедицинские журналы», принятых Международным комитетом редакторов медицинских журналов - <http://www.spinesurgery.ru/files/publish.pdf> и [http://www.nlm.nih.gov/bsd/uniform\\_requirements.html](http://www.nlm.nih.gov/bsd/uniform_requirements.html) В конце каждой оригинальной статьи приводится библиографический список. В список литературы включаются все материалы, на которые имеются ссылки в тексте. Список составляется в алфавитном порядке и нумеруется. Литературный источник приводится на языке оригинала. В списке литературы сначала приводятся работы, написанные знаками грузинского алфавита, затем кириллицей и латиницей. Ссылки на цитируемые работы в тексте статьи даются в квадратных скобках в виде номера, соответствующего номеру данной работы в списке литературы. Большинство цитированных источников должны быть за последние 5-7 лет.

9. Для получения права на публикацию статья должна иметь от руководителя работы или учреждения визу и сопроводительное отношение, написанные или напечатанные на бланке и заверенные подписью и печатью.

10. В конце статьи должны быть подписи всех авторов, полностью приведены их фамилии, имена и отчества, указаны служебный и домашний номера телефонов и адреса или иные координаты. Количество авторов (соавторов) не должно превышать пяти человек.

11. Редакция оставляет за собой право сокращать и исправлять статьи. Корректур авторам не высылаются, вся работа и сверка проводится по авторскому оригиналу.

12. Недопустимо направление в редакцию работ, представленных к печати в иных издательствах или опубликованных в других изданиях.

**При нарушении указанных правил статьи не рассматриваются.**

## REQUIREMENTS

Please note, materials submitted to the Editorial Office Staff are supposed to meet the following requirements:

1. Articles must be provided with a double copy, in English or Russian languages and typed or computer-printed on a single side of standard typing paper, with the left margin of 3 centimeters width, and 1.5 spacing between the lines, typeface - **Times New Roman (Cyrillic)**, print size - 12 (referring to Georgian and Russian materials). With computer-printed texts please enclose a CD carrying the same file titled with Latin symbols.

2. Size of the article, including index and resume in English, Russian and Georgian languages must be at least 10 pages and not exceed the limit of 20 pages of typed or computer-printed text.

3. Submitted material must include a coverage of a topical subject, research methods, results, and review.

Authors of the scientific-research works must indicate the number of experimental biological species drawn in, list the employed methods of anesthetization and soporific means used during acute tests.

4. Articles must have a short (half page) abstract in English, Russian and Georgian (including the following sections: aim of study, material and methods, results and conclusions) and a list of key words.

5. Tables must be presented in an original typed or computer-printed form, instead of a photocopied version. **Numbers, totals, percentile data on the tables must coincide with those in the texts of the articles.** Tables and graphs must be headed.

6. Photographs are required to be contrasted and must be submitted with doubles. Please number each photograph with a pencil on its back, indicate author's name, title of the article (short version), and mark out its top and bottom parts. Drawings must be accurate, drafts and diagrams drawn in Indian ink (or black ink). Photocopies of the X-ray photographs must be presented in a positive image in **tiff format**.

Accurately numbered subtitles for each illustration must be listed on a separate sheet of paper. In the subtitles for the microphotographs please indicate the ocular and objective lens magnification power, method of coloring or impregnation of the microscopic sections (preparations).

7. Please indicate last names, first and middle initials of the native authors, present names and initials of the foreign authors in the transcription of the original language, enclose in parenthesis corresponding number under which the author is listed in the reference materials.

8. Please follow guidance offered to authors by The International Committee of Medical Journal Editors guidance in its Uniform Requirements for Manuscripts Submitted to Biomedical Journals publication available online at: [http://www.nlm.nih.gov/bsd/uniform\\_requirements.html](http://www.nlm.nih.gov/bsd/uniform_requirements.html)  
[http://www.icmje.org/urm\\_full.pdf](http://www.icmje.org/urm_full.pdf)

In GMN style for each work cited in the text, a bibliographic reference is given, and this is located at the end of the article under the title "References". All references cited in the text must be listed. The list of references should be arranged alphabetically and then numbered. References are numbered in the text [numbers in square brackets] and in the reference list and numbers are repeated throughout the text as needed. The bibliographic description is given in the language of publication (citations in Georgian script are followed by Cyrillic and Latin).

9. To obtain the rights of publication articles must be accompanied by a visa from the project instructor or the establishment, where the work has been performed, and a reference letter, both written or typed on a special signed form, certified by a stamp or a seal.

10. Articles must be signed by all of the authors at the end, and they must be provided with a list of full names, office and home phone numbers and addresses or other non-office locations where the authors could be reached. The number of the authors (co-authors) must not exceed the limit of 5 people.

11. Editorial Staff reserves the rights to cut down in size and correct the articles. Proof-sheets are not sent out to the authors. The entire editorial and collation work is performed according to the author's original text.

12. Sending in the works that have already been assigned to the press by other Editorial Staffs or have been printed by other publishers is not permissible.

**Articles that Fail to Meet the Aforementioned  
Requirements are not Assigned to be Reviewed.**

## ავტორთა საქურაღებოლ!

რედაქციაში სტატიის წარმოდგენისას საჭიროა დაიცვათ შემდეგი წესები:

1. სტატია უნდა წარმოადგინოთ 2 ცალად, რუსულ ან ინგლისურ ენებზე დაბეჭდილი სტანდარტული ფურცლის 1 გვერდზე, 3 სმ სიგანის მარცხენა ველისა და სტრიქონებს შორის 1,5 ინტერვალის დაცვით. გამოყენებული კომპიუტერული შრიფტი რუსულ და ინგლისურენოვან ტექსტებში - **Times New Roman (Кириллица)**, ხოლო ქართულენოვან ტექსტში საჭიროა გამოვიყენოთ **AcadNusx**. შრიფტის ზომა – 12. სტატიას თან უნდა ახლდეს CD სტატიით.

2. სტატიის მოცულობა არ უნდა შეადგენდეს 10 გვერდზე ნაკლებს და 20 გვერდზე მეტს ლიტერატურის სიის და რეზიუმეების (ინგლისურ, რუსულ და ქართულ ენებზე) ჩათვლით.

3. სტატიაში საჭიროა გაშუქდეს: საკითხის აქტუალობა; კვლევის მიზანი; საკვლევი მასალა და გამოყენებული მეთოდები; მიღებული შედეგები და მათი განსჯა. ექსპერიმენტული ხასიათის სტატიების წარმოდგენისას ავტორებმა უნდა მიუთითონ საექსპერიმენტო ცხოველების სახეობა და რაოდენობა; გაუტკივარებისა და დაძინების მეთოდები (მწვავე ცდების პირობებში).

4. სტატიას თან უნდა ახლდეს რეზიუმე ინგლისურ, რუსულ და ქართულ ენებზე არანაკლებ ნახევარი გვერდის მოცულობისა (სათაურის, ავტორების, დაწესებულების მითითებით და უნდა შეიცავდეს შემდეგ განყოფილებებს: მიზანი, მასალა და მეთოდები, შედეგები და დასკვნები; ტექსტუალური ნაწილი არ უნდა იყოს 15 სტრიქონზე ნაკლები) და საკვანძო სიტყვების ჩამონათვალი (key words).

5. ცხრილები საჭიროა წარმოადგინოთ ნაბეჭდი სახით. ყველა ციფრული, შემაჯამებელი და პროცენტული მონაცემები უნდა შეესაბამებოდეს ტექსტში მოყვანილს.

6. ფოტოსურათები უნდა იყოს კონტრასტული; სურათები, ნახაზები, დიაგრამები - დასათაურებული, დანომრილი და სათანადო ადგილას ჩასმული. რენტგენოგრამების ფოტოასლები წარმოადგინეთ პოზიტიური გამოსახულებით **tiff** ფორმატში. მიკროფოტოსურათების წარწერებში საჭიროა მიუთითოთ ოკულარის ან ობიექტივის საშუალებით გადიდების ხარისხი, ანათალების შედეგების ან იმპრეგნაციის მეთოდი და აღნიშნოთ სურათის ზედა და ქვედა ნაწილები.

7. სამამულო ავტორების გვარები სტატიაში აღინიშნება ინიციალების თანდართვით, უცხოურისა – უცხოური ტრანსკრიპციით.

8. სტატიას თან უნდა ახლდეს ავტორის მიერ გამოყენებული სამამულო და უცხოური შრომების ბიბლიოგრაფიული სია (ბოლო 5-8 წლის სიღრმით). ანბანური წყობით წარმოდგენილ ბიბლიოგრაფიულ სიაში მიუთითეთ ჯერ სამამულო, შემდეგ უცხოელი ავტორები (გვარი, ინიციალები, სტატიის სათაური, ჟურნალის დასახელება, გამოცემის ადგილი, წელი, ჟურნალის №, პირველი და ბოლო გვერდები). მონოგრაფიის შემთხვევაში მიუთითეთ გამოცემის წელი, ადგილი და გვერდების საერთო რაოდენობა. ტექსტში კვადრატულ ფხიხლებში უნდა მიუთითოთ ავტორის შესაბამისი N ლიტერატურის სიის მიხედვით. მიზანშეწონილია, რომ ციტირებული წყაროების უმეტესი ნაწილი იყოს 5-6 წლის სიღრმის.

9. სტატიას თან უნდა ახლდეს: ა) დაწესებულების ან სამეცნიერო ხელმძღვანელის წარდგინება, დამოწმებული ხელმოწერითა და ბეჭდით; ბ) დარგის სპეციალისტის დამოწმებული რეცენზია, რომელშიც მითითებული იქნება საკითხის აქტუალობა, მასალის საკმაობა, მეთოდის სანდოობა, შედეგების სამეცნიერო-პრაქტიკული მნიშვნელობა.

10. სტატიის ბოლოს საჭიროა ყველა ავტორის ხელმოწერა, რომელთა რაოდენობა არ უნდა აღემატებოდეს 5-ს.

11. რედაქცია იტოვებს უფლებას შეასწოროს სტატია. ტექსტზე მუშაობა და შეჯერება ხდება საავტორო ორიგინალის მიხედვით.

12. დაუშვებელია რედაქციაში ისეთი სტატიის წარდგენა, რომელიც დასაბეჭდად წარდგენილი იყო სხვა რედაქციაში ან გამოქვეყნებული იყო სხვა გამოცემებში.

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## INFLUENCE OF A VARIETY OF SUTURE MATERIAL ON THE ANAL CANAL WOUNDS HEALING AFTER COMBINED OPERATIONS CONCERNING THE COMBINED ANORECTAL PATHOLOGY WITH USING OF MODERN TECHNOLOGIES

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### Abstract.

The urgency of the problem of combined pathology of the anal canal and rectum is quite high due to the lack of a unified approach to surgical treatment of this category of patients.

The aim of the study was to conduct a comparative morphological assessment of postoperative wound healing in patients with combined anorectal pathology after combined operations using different types of suture material, as well as modern high-frequency electrosurgery and radio-wave surgery devices.

The dynamics of the wound process under the influence of Caprosyn (3/0) and Polysorb (3/0) was performed on 60 patients from the first and second study groups, where radio-frequency device "Surgitron" and high-frequency electrosurgery device "KLS Martin" were used for surgical treatment, as they had approximately the same depth of coagulation tissue necrosis, by cytological examination of smears-imprints from the surface of postoperative wounds on 3, 5, 7, 14 and 21 days.

Despite all differences in the early stages of wound healing between groups of patients using two different types of suture material, the formation of scar connective tissue occurred almost equally on 14-17 days with the formation of bundles of collagen fibers with cellular elements between them. Epithelialization processes, which were characterized by the appearance of cells of mature multilayered squamous epithelium, in two groups of patients using suture material Caprosyn (3/0) and Polysorb (3/0) also occurred simultaneously on 19-22 days.

Using of radio-wave surgery device "Surgitron" and high-frequency electrosurgery device "KLS Martin" and suture material Caprosyn (3/0) and Polysorb (3/0) was not accompanied by complications such as bleeding, suppuration of postoperative wounds, anal strictures, and recurrence of diseases.

**Key words.** Wound healing, morphological assessment, suture material, combined anorectal pathology, radio –wave surgery and high – frequency electrosurgery technologies.

### Introduction.

The urgency of the problem of combined pathology of the anal canal and rectum is quite high due to the lack of a unified approach to surgical treatment of this category of patients. Moreover, a rather small number of publications with the results of scientific research are devoted to the study of this problem [1]. Scar strictures of the anal canal, insufficiency of the anal sphincter, as well as deformities of the perianal area and perineum are often found among the complications after combined operations on the anal canal and rectum due to their combined pathology [2].

The main method of surgical treatment of the most common proctological diseases - hemorrhoids, anal fissures and fistulas remains traditional instrumental surgery, but it is often accompanied by severe postoperative pain and prolonged healing of postoperative wounds, which, according to some authors, is directly related to surgical trauma in the rich innervation zone of the anal canal, causing local edema, acute subclinical infection, and inflammation [3,4]. According to other authors, postoperative pain, and ischemic changes in tissues with their subsequent suppuration and delayed epithelialization occur due to compression of smooth muscle fibers of the internal sphincter and mucous membrane in the area of stitching with the development of subsequent tissue reaction to suture material, which is most common after closed hemorrhoidectomy [5,6].

The effect of suture on the healing of wounds of the anal canal and rectum in the postoperative period showed that using of sutures coated with triclosan reduced the incidence of infections in the surgical area to 6.9% compared with patients who used suture without this antibacterial coating in which the frequency of suppuration of wounds was 9.1-19.2% [7-9].

Ratto C. and co-authors proved the feasibility of using a continuous vicryl seam, and Yu JH. and co-authors of a large C-shaped suture for suturing the prolapsed mucosa and submucosal layers of the rectum, as an adjunct to the THD procedure for mucopexy in patients with chronic hemorrhoids. But unfortunately, these techniques are accompanied by bleeding, tenesmus, sometimes anal incontinence and recurrence of the disease [10,11].

The active development of high-tech methods of surgical treatment of diseases of the anal canal and rectum has reduced the trauma and duration of surgery, as well as the depth of thermal exposure to tissues. These techniques allow not to use suture material, which has a pronounced tissue reaction and purulent-inflammatory complications. Thus, Valleylab (USA) has developed a bipolar electrothermal system "Liga Sure" for surgical treatment of hemorrhoids [12,13]. Using this device there is no need to isolate and treat the vascular leg of the hemorrhoid, so this method of hemorrhoidectomy is called "closed sutureless hemorrhoidectomy" [12]. However, the depth of thermal exposure to tissues when using this system is from 1.5 to 2 mm, which is often accompanied by suppuration of postoperative wounds (2-15%), as well as the occurrence of strictures of the anal canal (2-9%) [13,14].

Thus, the urgency of the problem of postoperative wound healing after combined operations for combined anorectal pathology is quite high and contributes to the introduction of new modern surgical technologies and types of suture material



for the treatment of this pathology, which would have minimal damage to tissues, preventing occurrence of their inflammatory reaction and suppuration of postoperative wounds, promoting their rapid healing and causing faster medical and social rehabilitation of patients.

The aim of the study was to conduct a comparative morphological assessment of postoperative wound healing in patients with combined anorectal pathology after combined operations using different types of suture material, as well as modern devices for high frequency electrosurgery and radiosurgery.

### Materials and methods.

In the period from January 2007 to June 2021, 405 patients with combined diseases of the anal canal and rectum were operated on in the proctology department of Public Non-Profit Enterprise "Khmel'nyts'kyi regional hospital" under Khmel'nyts'ky Regional Council using the radio-wave surgery device "Surgitron" and the high-frequency electrosurgery device "KLS Martin". Among them 224 (55.4%) patients were male and 181 (44.6%) were female. The age of patients ranged from 18 to 74 years.

All 405 patients, who were divided into 2 study groups, signed a voluntary informed consent for anesthesia and surgery, which were performed under spinal anesthesia. Of these, 215 (53,1%) patients were operated with resorbable monofilament synthetic suture Caprosyn (3/0) and 190 (46,9%) patients were operated with resorbable polyfilament synthetic suture Polysorb (3/0).

The first study group consisted of 245 patients with combined pathology of the anal canal and rectum, who were operated using a radio-wave surgery device "Surgitron". Of these, 143 (58.4%) patients were male and 102 (41.6%) were female. The age of patients ranged from 18 to 74 years.

The second study group consisted of 160 patients with combined pathology of the anal canal and rectum, who were operated using a high frequency electrosurgery device "KLS Martin". Of these, 64 (40%) patients were male, and 96 patients (60%) were female. The age of patients ranged from 19 to 65 years.

The dynamics of the wound process under the influence of Caprosyn (3/0) and Polysorb (3/0) was assessed by cytological examination of smears-imprints from the surface of postoperative wounds on 3, 5, 7, 14 and 21 days. For this action were used cytological brushes, with which the substrate was applied to slides. The material was fixed for 1 minute in a dye-fixative solution of May-Grunwald, then painted for 17 minutes with a solution of paint according to Romanovsky, washed with water and dried. Microscopy was performed with dry and immersion systems.

The cytological study was performed on 60 patients from the first and second study groups, where radio-frequency device "Surgitron" and high-frequency electrosurgery device "KLS Martin" were used for surgical treatment, as they had approximately the same depth of coagulation tissue necrosis [15]. Both of these groups were divided into two subgroups (30 patients each), in which Caprosyn (3/0) and Polysorb (3/0) were used as sutures for surgery. The severity and duration of the inflammatory reaction in the wound was assessed by the number of neutrophils, the presence of dystrophic changes, the presence of macrophages. The timing of reparative signs was assessed

by the appearance of cells such as histiocytes, fibroblasts, fibrocytes, as well as connective tissue fibers and squamous epithelial cells.

Statistical analysis of the obtained data was performed using IBM SPSS STATISTICS SUBSCRIPTIONAL TRIAL software. License number: L-CZAA-BHG85V. The statistical significance of the median difference was calculated using the Mann-Whitney test. The sample size was 30 people in each group, a total of 120 patients. The critical level of statistical significance was 0.05. Descriptive statistics of inpatient treatment duration and wound healing time were performed using the following indicators: 25th, 50th, 75th percentiles.

### Results and Discussion.

As a result of pairwise comparison between subgroups using Caprosyn (3/0) and Polysorb (3/0) as a suture material according to the Mann-Whitney test in the first study group, where the radio-wave surgery device "Surgitron" was used for surgical treatment, a statistically significant difference between the two subgroups was found in such criteria as a neutrophil duration, histocyte and fibroblast appearance, while according to the other two criteria (formation of collagen fibers and the appearance of cells of the multilayered squamous epithelium), there was no statistically significant difference between these two subgroups, as shown in Table 1.

**Table 1.** Comparison between subgroups using Caprosyn (3/0) and Polysorb (3/0) as a suture material in the first study group, where the radio-wave surgery device "Surgitron" was used.

Criterion	Suture material	Percentiles			Statistical significance of median differences, p (according to the Mann-Whitney test)
		25	50	75	
Duration of neutrophil reaction	Caprosyn	3	4	5	0,001*
	Polysorb	4	5	5	
Appearance of histiocytes	Caprosyn	5	5	6	<0,001*
	Polysorb	6	6	6,25	
Appearance of fibroblasts	Caprosyn	7	7	7	<0,001*
	Polysorb	7	8	9	
Formation of collagen fibers	Caprosyn	14	15	15	,191
	Polysorb	14	15	15,25	
Appearance of the stratified squamous epithelium cells	Caprosyn	19	20	20	,509
	Polysorb	19	20	20	

Note: \* statistically significant differences.

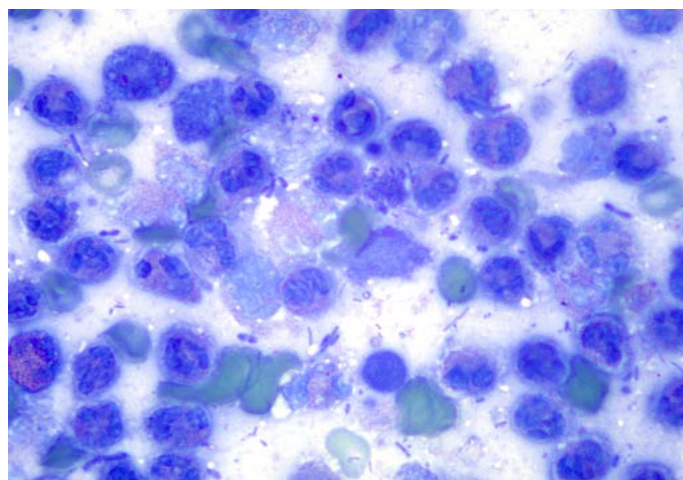
Comparison between subgroups using Caprosyn (3/0) and Polysorb (3/0) as a suture material according to the Mann-Whitney test in the second study group, where the high-frequency electrosurgery device "KLS Martin" was used for surgical treatment, a statistically significant difference between the two subgroups also was found in such criteria as a neutrophil duration, histocyte and fibroblast appearance, while according to the other two criteria (formation of collagen fibers and the appearance of cells of the multilayered squamous epithelium), there was no also statistically significant difference between these two subgroups, which is shown in Table 2.

**Table 2.** Comparison between subgroups using Caprosyn (3/0) and Polysorb (3/0) as a suture material in the forth study group, where the high frequency electrosurgery device "KLS Martin" was used.

Criterion	Suture material	Percentiles			Statistical significance of median differences, p (according to the Mann-Whitney test)
		25	50	75	
Duration of neutrophil reaction	Caprosyn	4	5	5	0,007*
	Polysorb	5	5	6	
Appearance of histiocytes	Caprosyn	6	6	7	<0,001*
	Polysorb	7	7	8	
Appearance of fibroblasts	Caprosyn	8	8	9	<0,001*
	Polysorb	9	9	10	
Formation of collagen fibers	Caprosyn	15	16	17	,522
	Polysorb	15	16	17	
Appearance of the stratified squamous epithelium cells	Caprosyn	20	21	22	,805
	Polysorb	20	21	22	

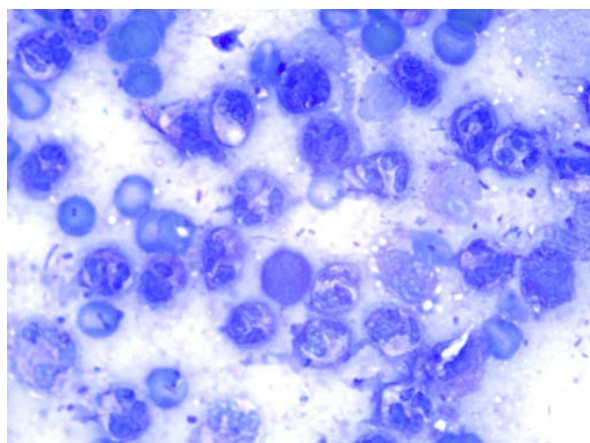
Note: \* statistically significant differences.

On the 3rd day after surgery in cytological examination of smears from the surface of postoperative wounds more pronounced neutrophilic reaction was observed in groups of patients using high frequency electrosurgery device "KLS Martin" and radio wave surgery device "Surgitron" using as suture material Polysorb (3/0) in compared with the groups where the suture material Caprosyn (3/0) was used (Figures 1 and 2).

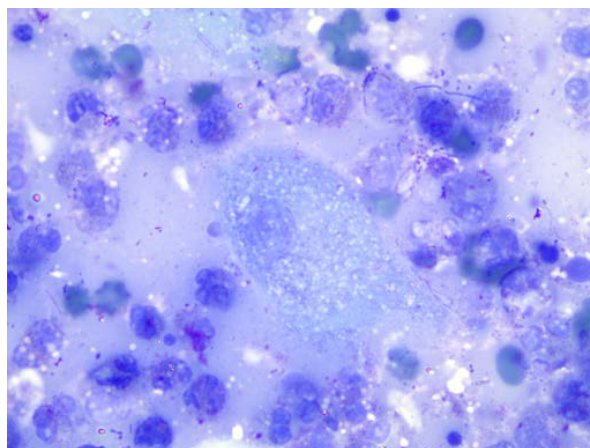


**Figure 1.** Cytogram of smears from the wound surface for 3 days after surgery using high-frequency electrosurgery device "KLS Martin" and suture material Polysorb (3/0) - a large number of elements of neutrophilic inflammation, the phenomenon of incomplete phagocytosis. Stained by Romanovsky. Magnification x1000.

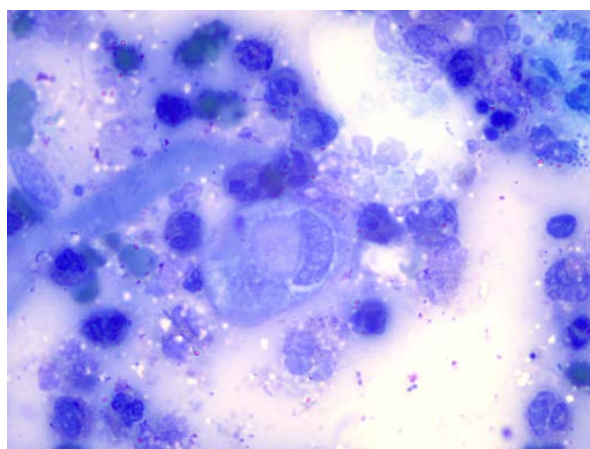
During the analysis of smears from postoperative wounds on the 5th day in groups of patients using high-frequency electrosurgery device "KLS Martin" and radio-wave surgery device "Surgitron" and suture material Caprosyn (3/0) observed the appearance of mononuclear histiocytes (Figure 3), while using suture material Polysorb (3/0), histiocytes appeared on day 7 (Figure 4).



**Figure 2.** Cytogram of smears from the wound surface for 3 days after surgery using the radio-wave surgery device "Surgitron" and suture material Caprosyn (3/0) - the presence of segmental neutrophils, the phenomenon of incomplete phagocytosis. Stained by Romanovsky. Magnification x1000.



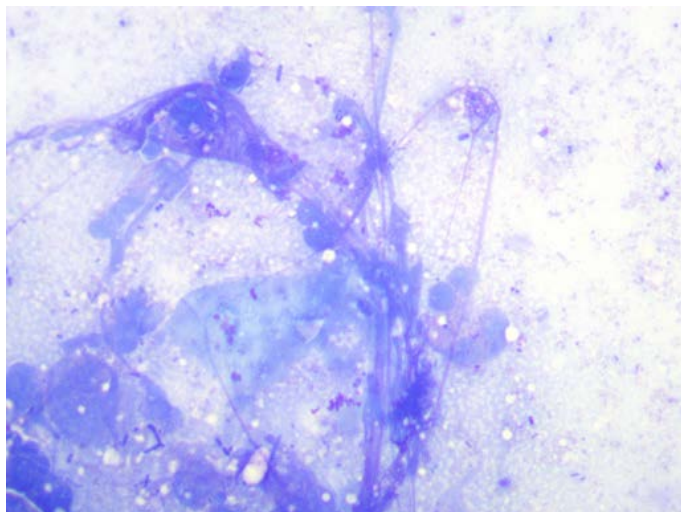
**Figure 3.** Cytogram of smears from the wound surface on the 5th day after surgery using the device of high-frequency electrosurgery "KLS Martin" and suture material Caprosyn (3/0) - the appearance of histiocytes. Stained by Romanovsky. Magnification x1000.



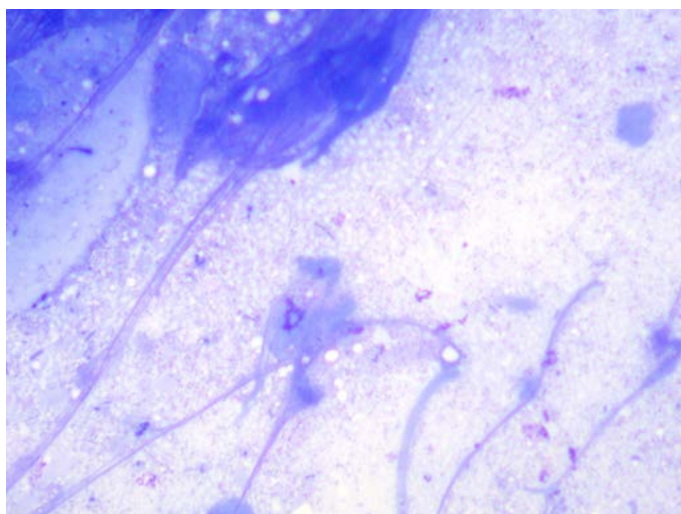
**Figure 4.** Cytogram of smears from the wound surface on the 5th day after surgery using the radio-wave surgery device "Surgitron" and as a suture material Polysorb (3/0) - the appearance of histiocytes. Stained by Romanovsky. Magnification x1000.



On day 7, most patients in the Caprosyn (3/0) suture groups developed fibroblasts and loose connective tissue fibers, indicating the appearance of granulation tissue as a sign of reparative changes (Figures 5 and 6).



**Figure 5.** Cytogram of smears from the surface of the wound on the 7th day after surgery using the device of radio-wave surgery "Surgitron" and suture material Caprosyn (3/0) - the appearance of fibroblasts and single connective tissue fibers. Stained by Romanovsky. Magnification x1000.



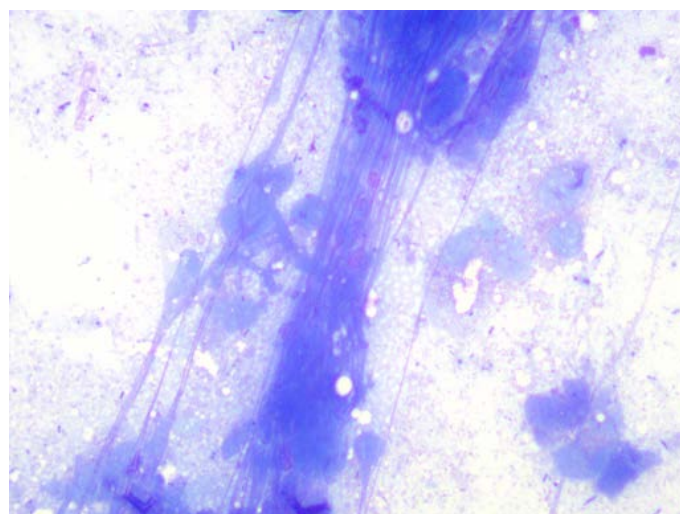
**Figure 6.** Cytogram of smears from the wound surface on the 7th day after surgery using of high-frequency electrosurgery device "KLS Martin" and suture material Caprosyn (3/0) - single fibroblasts that synthesize connective tissue fibers. Stained by Romanovsky. Magnification x1000.

On the 14th day of the postoperative period, all studied groups of connective tissue fibers form bundles, in places with the presence of cellular elements between the fibers (Figures 7 and 8).

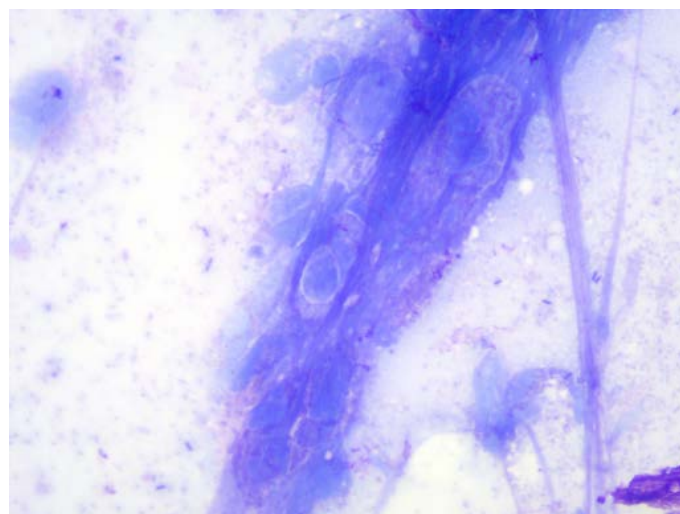
It is noted that in most patients during this period of wound healing almost disappears inflammatory infiltration. It remains only in isolated cases in patients where Polysorb (3/0) was used as suture material (Figure 9).

It was also found that in groups of patients using suture material Polysorb (3/0) bundles of fibers with cellular elements were thicker than in groups using suture material Caprosyn (3/0),

and fibroblasts with processes were found, which indicated the beginning of the formation of scar connective tissue (Figures 10 and 11).



**Figure 7.** Cytogram of smears from the wound surface on the 14th day after surgery using of radio-wave surgery device "Surgitron" and suture material Caprosyn (3/0) - connective tissue fibers. Stained by Romanovsky. Magnification x1000.

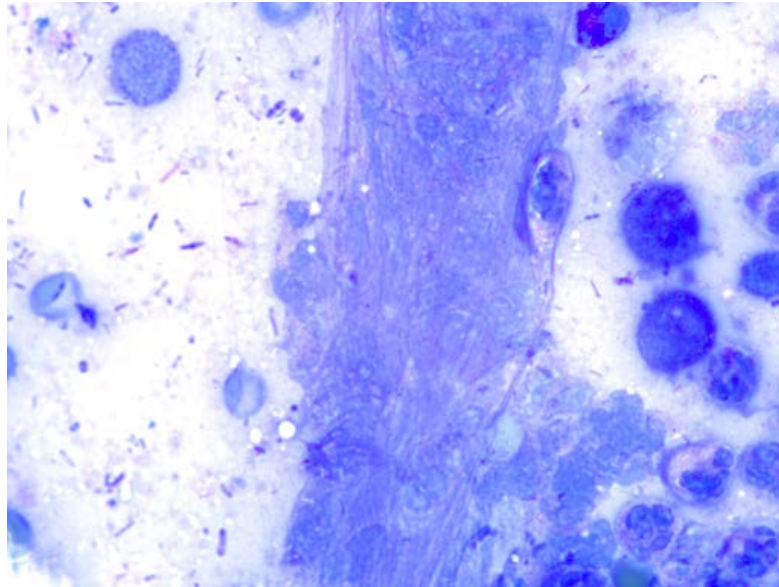


**Figure 8.** Cytogram of smears from the wound surface on the 14th day after surgery using the device of high-frequency electrosurgery "KLS Martin" and suture material Caprosyn (3/0) - connective tissue fibers. Stained by Romanovsky. Magnification x1000.

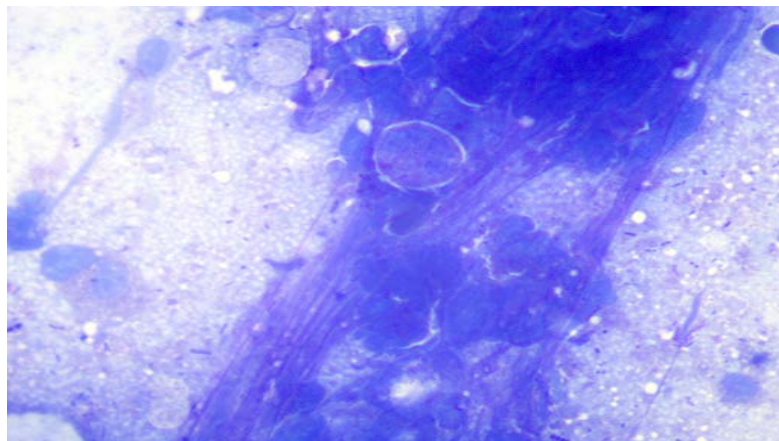
In addition, on the 14th day after surgery in groups of patients using suture material Caprosyn (3/0) there were phenomena of resorption of suture residues (Figure 12).

In groups of patients using suture material Polysorb (3/0), the pattern of resorption of suture material was observed on the 21st day after surgery (Figure 13).

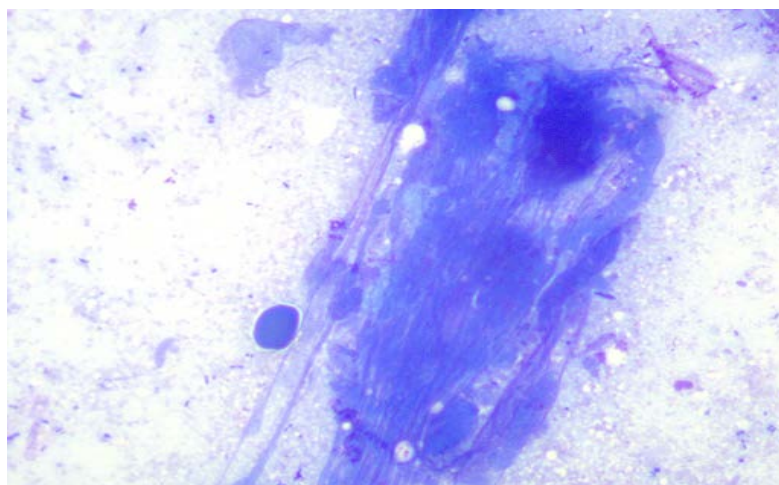
On the 21st day after surgical interventions using radio-wave surgery device "Surgitron" and high-frequency electrosurgery device "KLS Martin" and the use of both sutures, cytograms of most patients revealed epithelial cells with small nuclei and a



**Figure 9.** Cytogram of smears from the wound surface on the 14th day after surgery using radio-wave surgery device "Surgitron" and suture material Polysorb (3/0) - connective tissue fibers with cellular elements between them, the presence of segmental neutrophils. Stained by Romanovsky. Magnification x1000.

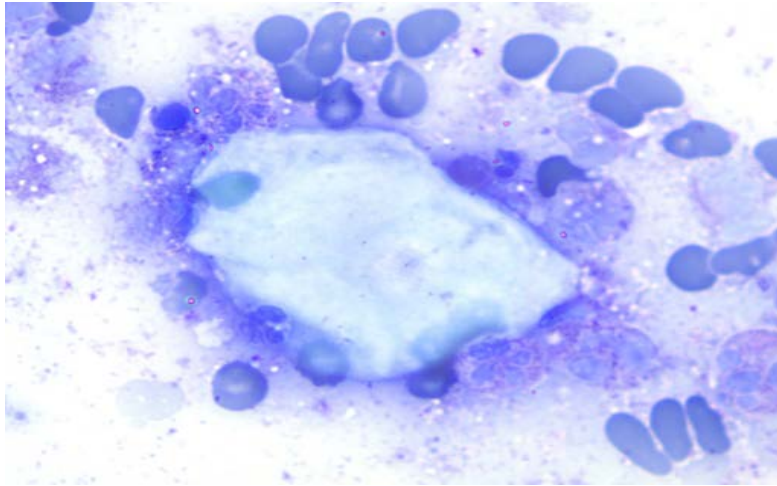


**Figure 10.** Cytogram of smears from the wound surface on the 14th day after surgery using the device of high-frequency electrosurgery "KLS Martin" and suture material Polysorb (3/0) - connective tissue fibers with cellular elements between them. Stained by Romanovsky. Magnification x1000.

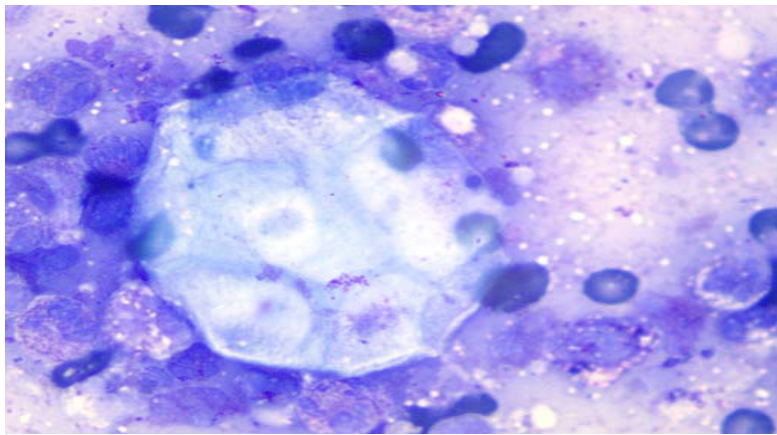


**Figure 11.** Cytogram of smears from the wound surface on the 14th day after surgery using the device of high-frequency electrosurgery "KLS Martin" and suture material Caprosyn (3/0) - connective tissue fibers, the presence of process fibroblasts. Stained by Romanovsky. Magnification x1000.

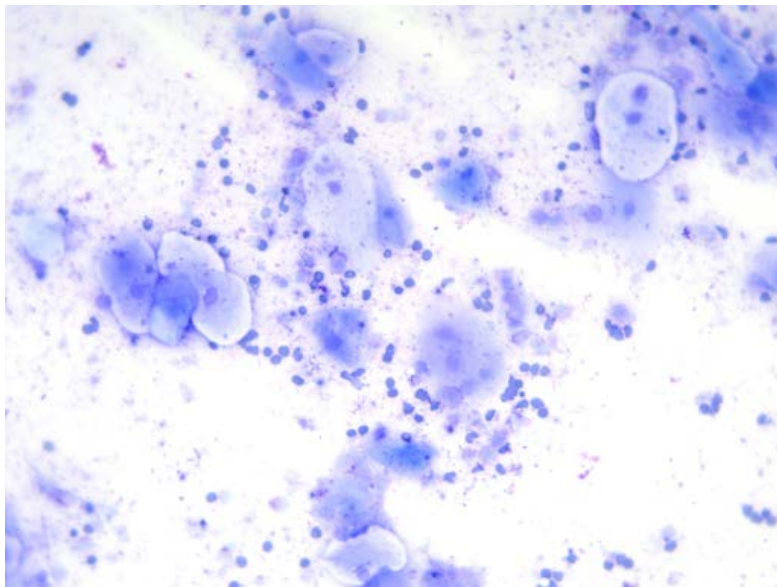




**Figure 12.** Cytogram of a smear from the wound surface on the 14th day after surgery using of radio-wave surgery device "Surgitron" and suture material Caprosyn (3/0) - resorption of the remnants of suture material. Stained by Romanovsky. Magnification x1000.



**Figure 13.** Cytogram of the smear from the surface of the wound on the 21st day after surgery using of radio-wave surgery device "Surgitron" and suture material Polysorb (3/0) - resorption of suture residues. Stained by Romanovsky. Magnification x1000.



**Figure 14.** Cytogram of smears from the wound surface on the 21st day after surgery using the device of high-frequency electrosurgery "KLS Martin" and suture material Caprosyn (3/0) - cells of mature multilayered squamous epithelium. Stained by Romanovsky. Magnification x400.

significant amount of cytoplasm- cells of mature multilayered squamous epithelium, which was a sign of epithelialization processes (Figure 14).

Therefore, using of Caprosyn (3/0) suture material in patient groups was accompanied by a less pronounced neutrophilic tissue reaction lasting only 3-5 days comparing to the groups where Polysorb (3/0) was used as suture material, where the duration of neutrophilic reaction was slightly longer being 4-6 days. But application of radio-wave surgery device "Surgitron" and high-frequency electrosurgery device "KLS Martin" with using of suture material Caprosyn (3/0) and Polysorb (3/0) significantly reduces the neutrophilic tissue reaction in postoperative anal canal wounds, which lasted only 3-6 days, helping to reduce the time of their healing, while according to some authors, such inflammatory changes in the wounds of the anal canal can last up to 14-15 days [12].

The appearance of histiocytes in the groups of patients using suture material Caprosyn (3/0) occurred on 5-7 days, while in the groups using suture material Polysorb (3/0) histiocytes appeared on 6-8 days. Reparative changes characterized by the appearance of fibroblasts and loose connective tissue fibers in patients using suture material Caprosyn (3/0) were detected on 7-8 days and in patients using suture material Polysorb (3/0) - on 8-10 days.

Despite all the above differences between groups of patients using two different types of suture material in the early stages of wound healing, the formation of scar connective tissue occurred almost equally on 14-17 days with the formation of bundles of collagen fibers with cellular elements between them. Epithelialization processes, which were characterized by the appearance of cells of mature multilayered squamous epithelium, in two groups of patients using suture material Caprosyn (3/0) and Polysorb (3/0) also occurred simultaneously on 19-22 days.

Given the data obtained, we consider it appropriate to widely using of polyfilament suture material Polysorb (3/0) for surgical treatment of more difficult combined pathology of the anal canal and rectum, which may consist of a combination of 3-5 diseases (combined hemorrhoids, anal fistulas, anorectal abscesses, anal fissures) using modern radio surgical and high-frequency electrosurgical technologies to reduce purulent and inflammatory complications and occurrence of strictures of the anal canal in the postoperative period.

Using of radio-wave surgery device "Surgitron" and high-frequency electrosurgery device "KLS Martin" and suture material Caprosyn (3/0) and Polysorb (3/0) was not accompanied by complications such as bleeding, suppuration of postoperative wounds, anal strictures, and recurrence of diseases, which according to other authors occurred with a frequency of 2-15% [2,10,13,14].

### Conclusion.

1. Application of radio-wave surgery device "Surgitron" and high-frequency electrosurgery device "KLS Martin" with using of suture material Caprosyn (3/0) and Polysorb (3/0) according to cytological examination of smears from wounds did not show significant differences in the timing of repair and epithelialization depending on the type of suture material.

2. Using of radio-wave surgery device "Surgitron" and high-frequency electrosurgery device "KLS Martin" and suture material Caprosyn (3/0) and Polysorb (3/0) was not accompanied by complications such as bleeding, suppuration of postoperative wounds, anal strictures, and recurrence of diseases.

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### Conflict of Interest Information.

potential or apparent conflicts of interest related to this manuscript do not exist at the time of publication and are not anticipated.

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## Резюме

**Влияние разновидности шовного материала на заживление ран анального канала после комбинированных операций по поводу сочетанной аноректальной патологии с использованием современных технологий**

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Актуальность проблемы сочетанной патологии анального канала и прямой кишки достаточно высока из-за отсутствия единого подхода к хирургическому лечению данной категории пациентов.

Целью исследования было провести сравнительную морфологическую оценку послеоперационного заживления ран у пациентов с сочетанной патологией аноректальной области после комбинированных операций с использованием различных видов шовного материала, а также современных аппаратов высокочастотной электрохирургии и радиоволновой хирургии.

Динамика раневого процесса под воздействием капросина (3/0) и полисорба (3/0) проведена у 60 пациентов первой и второй групп исследования, где использовались радиочастотный аппарат “Surgitron” и высокочастотный электрохирургический аппарат “KLS Martin”, так как они имели примерно одинаковую глубину коагуляционного некроза тканей, путем цитологического исследования мазков-отпечатков с поверхности послеоперационных ран на 3, 5, 7, 14 и 21 сутки.

Несмотря на все различия на ранних стадиях заживления ран между группами пациентов, использующих два разных типа шовного материала, формирование рубцовой соединительной ткани происходило почти одинаково на 14-17 сутки с образованием пучков коллагеновых волокон с клеточными элементами между ними. Процессы эпителизации, которые характеризовались появлением клеток зрелого многослойного плоского эпителия, у двух групп пациентов, использующих шовный материал Caprosyn (3/0) и Polysorb (3/0), также происходили одновременно на 19-22 дни.

Использование аппарата радиоволновой хирургии “Surgitron” и аппарата высокочастотной электрохирургии “KLS Martin” и шовного материала Капросин (3/0) и Полисорб (3/0) не сопровождалось такими осложнениями, как кровотечение, нагноение послеоперационных ран, анальные стриктуры и рецидивы заболеваний.

**Ключевые слова:** заживление ран, морфологическая оценка, шовный материал, комбинированная аноректальная патология, технологии радиоволновой хирургии и высокочастотной электрохирургии.