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ЕЖЕМЕСЯЧНЫЙ НАУЧНЫЙ ЖУРНАЛ

Медицинские новости Грузии
საქართველოს სამედიცინო სიახლენი

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.

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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.

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WEBSITE

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 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.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. რენტგენოგრაფიების 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.

აღნიშნული წესების დარღვევის შემთხვევაში სტატიები არ განიხილება.

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PECULIARITIES OF USING A NEUROVASCULARIZED FLAP ON THE SURAL ARTERY IN PLASTIC SURGERY OF GUNSHOT DEFECTS ON THE FOOT AND LOWER LEG

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Abstract.

The results of treatment of 36 patients with extensive gunshot defects on the foot and lower leg with the use of a neurovascularized flap on the sural artery have been analyzed.

Goal: To investigate the effect of catheterization of the small saphenous vein, which is included in the flap, on the frequency of development of its ischemic complications.

Materials and methods: The 1st group (n=14) included the wounded, who underwent complex treatment of an extensive gunshot defect followed by its plasticity with a "sural flap" with temporary catheterization of the small subcutaneous vein included in its composition. The 2nd group (n=23) included patients who, after complex treatment of an extensive gunshot defect, underwent plastic surgery with a "sural flap" without catheterization of the vessels included in it.

Results and discussion: In case of using a flap without catheterization of the small saphenous vein, necrosis of the "sural" flap was observed in 5 (22%) cases. During catheterization of the small saphenous vein, the number of flap necrosis was 2 (15%) cases.

Conclusion: Catheterization of the small saphenous vein of the "sural" flap allows to reduce the frequency of complications related to blood supply disorders by 7%.

Key words. Compartment syndrome after gunshot polystructural injuries of the lower limbs, plastic gunshot defects of the limbs, sural nerve, catheterization of the small subcutaneous vein, artery, "sural" flap.

Introduction.

In the context of modern military conflicts, the percentage of firearm injuries to the limbs ranges from 65% to 78% of the total number of injuries [1,2]. The use of high-energy weapons leads to an increase in the proportion of firearm injuries with extensive tissue defects in the limbs, which can reach 37% of cases, with 48% being polystructural injuries (a combination of bone fractures with damage to vascular-nervous structures and tendons) [3]. In most cases, such conditions require reconstructive plastic surgery [4]. The application of a neurovascular flap on the sural artery ("sural flap") can be considered an alternative to free flaps for the restoration of complex defects in the lower third of the shin and foot [5]. However, the number of studies on the use of the "sural flap" in the treatment of extensive firearm defects is limited. One particular aspect of using such flaps is their relatively high susceptibility to ischemic complications, which can reach up to 22% of cases [6,7]. To prevent these complications, catheterization of the small subcutaneous vein included in the flap is recommended [5,6].

The aim of the study is to investigate the impact of catheterization of the small subcutaneous vein included in the flap on the frequency of its ischemic complications.

Materials and Methods.

Our study is based on a retrospective analysis of the treatment of 36 patients with extensive firearm-related soft tissue defects of the foot and shin, which required reconstructive surgeries using the "sural flap" (Table 1). All patients underwent treatment at the National Military Medical Clinical Center from 2014 to 2023.

By extensive soft tissue defect, we mean a defect involving the skin, muscles, and underlying structures that cannot be closed solely by suturing the wound edges. In most cases, the injured patients arrived at the National Military Medical Clinical Center at various time intervals after the moment of injury: within 3 days - 6 cases; from 2 to 10 days - 19 cases; from 10 to 20 days - 11 cases.

All patients were treated in accordance with the standards of military field surgery, according to which the only effective method of treating firearm injuries is repeated surgical debridement. This includes excising non-viable and contaminated tissues, revising damaged anatomical structures, fasciotomy of all muscle-fascial compartments, adequate drainage, and replantation of vascular-nervous structures, creating conditions for the restoration of the anatomical integrity of the damaged structures.

The use of ultrasound cavitation and NPWT (Negative Pressure Wound Therapy) significantly accelerates the wound cleansing process. The number of repeat surgical treatments ranged from 2 to 5 until the appearance of granulation tissue in the wound.

The decision regarding the application of the "sural flap" for plastic surgery of the defect on the foot and shin was made after dopplerography to determine blood flow in the small and large subcutaneous veins, the presence of a skin perforator of the lower leg artery in the projection of its exit point (5-6 cm from the outer ankle bone), and the absence of signs of sensory impairment at the outer edge of the foot (in the area of responsibility of the n. suralis).

Depending on the design of the "sural flap," patients were divided into 2 groups.

Group I (main group, n=13) - included patients who underwent comprehensive treatment, including staged wound debridement combined with ultrasound cavitation and NPWT therapy for extensive firearm-related defects, followed by plastic surgery using the "sural flap" with temporary catheterization of the small subcutaneous vein included in it.

Table 1. Comparison criteria of the main and control groups.

	I (main) group, n = 13	II (control) group, n = 23	In total (n=36)	p*
Average age, years (M± SD)	36,7 ±1,3	38,1±1,4	37,1±1,0	>0,05
Time from injury to hospitalization, days (M± SD)	5.6±1,7	6,1±1,3	5,9±1,5	>0,05
According to the location of the defect, (%)				
foot	7	13	20	>0,05
lower/3- medium /3 shin	6	10	16	
The transverse size of the defect, abs. (%)				
From 4 to 6 cm	5	9	13	>0,05
From 6 to 10 cm	8	14	22	>0,05
If there is a fracture, abs. (%)				
No broken bones	3	8	11	>0,05
With broken bones	10	15	25	>0,05

Group II (control group, n=23) - included patients for whom plastic surgery using the "sural flap" was performed after comprehensive treatment of extensive firearm defects without catheterization of the vessels included in it.

The exclusion criteria from the study groups were as follows:

1. Multiple contiguous soft tissue injuries to the posterior surface of the shin with ultrasound signs of damage to the small and large subcutaneous veins.
2. Presence of injuries in the projection of the sural nerve in the critical zone of the "sural flap" - the area between the Achilles tendon and the lower edge of the lower leg bone, accompanied by sensory impairment on the outer surface of the foot.
3. Acute thrombosis or deep vein thrombosis in the shin.
4. Soft tissue defects larger than 10 cm in diameter.
5. Polystructural damage with extensive defects requiring amputation.
6. Nicotine abuse and patient refusal to abstain from smoking for up to 3 weeks after the surgery.

Age, time since the injury, localization of firearm defects, and the severity of polystructural damage were statistically comparable between the groups ($p>0,05$).

To assess the reliability of the obtained results, the mean (M) and standard deviation (SD) were calculated and analyzed for each group. The statistical significance of the difference between the means in the groups was determined using the results of a two-sample t-test with equal variances, and a difference with $p<0.05$ was considered statistically significant. Data analysis was conducted using Microsoft Office Excel software.

Surgical Technique. Unlike the classical technique in which the elevation of the "sural flap" is performed with the patient in a prone position, in our cases, the operation was performed with the patient in a lateral position. This was due to the presence of anterior tibial artery perforators (Figure 1). This forced position did not allow for a clear determination of the midline of the shin, which corresponds to the projection line of the sural nerve. Therefore, the flap elevation started distally and proceeded in a proximal direction.

The landmark for the first incision is the space between the posterior edge of the calf bone and the lateral edge of the Achilles tendon at a distance of no less than 5 cm from the level of the lateral ankle bone, corresponding to the projection



Figure 1. Firearm-related defect of the anterior surface of the tibio-tarsal joint.



Figure 2. Formation of the "sural" flap with a skin-fascial pedicle.

of the distalmost perforators. By separating the tissue from the sheath of the Achilles tendon on one side and the tendons of the long and short calf muscles on the other side, a complex of soft tissues is obtained, which includes the sural nerve and its accompanying vessels, with the mandatory inclusion of the small subcutaneous vein. Further formation of the flap leg occurs along an imaginary line representing the location of the sural nerve, from proximal to distal, running from the lateral ankle bone to the junction of the two heads of the calf muscle and continuing to the middle of the popliteal fossa. The flap leg was presented in two variants: with a skin-fascial leg up to 3 cm in width or in the form of a fascial loop (Figure 2).

The length of the flap is determined by the distance from the flap's pivot point to the area of the gunshot wound. The

Table 2. Ischemic complications after plastic surgery for gunshot wound defects using the «sural flap».

Ischemic flap complications		I group, n=13				II group, n=23				Σ, n	p
		foot		shin		foot		shin			
Irreversible	Transdermal necrosis	0	0	0	0	1	4,3%	0	0	1	p>0,05
	Margin necrosis	2	15%	0	0	4	17,3%	0	0	6	p>0,05
Reversible	Venous stasis	3	23%	0	0	4	17,3%	1	4,3%	8	p>0,05
The relationship is not inverse/inverse		2/3				5/5				7/8	



Figure 3. Catheterization of the small subcutaneous vein of the "sural" flap.



Figure 4. Day 10 after plastic repair with a "sural" flap.

size of the flap is determined using a template impression from the wound. When forming the proximal part of the flap at the level of the upper third of the calf, after the transverse incision, the small subcutaneous vein is identified, ligated, and cannulated with an intravenous catheter (22G-18G) (Figure 3). The sural nerve and artery are identified and ligated between the heads of the gastrocnemius muscle. The final flap consists of the superficial and deep layers of fascia and a "muscle cuff" around the sural nerve. Single sutures between the fascia and subcutaneous tissue prevent flap separation.

After releasing the tourniquet and performing hemostasis, the catheter in the small subcutaneous vein is opened to allow excess

venous blood to drain. The viability of the flap is assessed after 3-5 minutes based on color and the speed of capillary response. If the "bloodletting" procedure is ineffective, heparinization of its lumen is performed. The catheter is not removed. The flap is rotated into the area of the gunshot defect with the pedicle placed subcutaneously. In the case of a skin-fascial pedicle, it is placed in a formed "slot" after incising the soft tissues.

After placing the flap in the area of the gunshot defect, the sub-flap space is drained. The donor site wound is either sutured edge to edge or covered with a split-thickness skin graft. To prevent direct pressure on the flap on the anterior tibial surface, a triangular-shaped frame system is mounted, which elevates the shin (Figure 4).

The next day, during the bandage change, if there were no signs of impaired blood flow to the flap, the catheter from the small subcutaneous vein was removed. In case venous stasis persisted, repeat "bloodletting" procedures were carried out once a day for 3-4 days until venous insufficiency was fully compensated.

Results and Discussion.

The impact of catheterization of the small subcutaneous vein on flap ischemic complications was studied by determining the frequency of ischemic complications of the flap (Table 2).

Complications related to flap ischemia were observed in 7 (20%) cases in both groups. In the second (control) group of patients, where the flap was applied without catheterization of the small subcutaneous vein, irreversible ischemic complications occurred in 5 (22%) cases, including transdermal necrosis in 1 (4.3%) case and marginal necrosis in 4 (17.3%) cases. Reversible ischemic changes in the flap developed in 5 (22%) cases.

In the first (main) group of patients, where the catheterization of the small subcutaneous vein of the flap was applied, irreversible ischemic complications occurred in the form of marginal necrosis in 2 (15%) cases, and transdermal necrosis was not observed. Reversible ischemic changes in the flap developed in 3 (23%) cases.

A statistical analysis of the data was conducted using non-parametric criteria based on Pearson's method, but with Yates' correction. It demonstrated the lack of statistical significance between the results (p>0.05), likely due to the small sample size.

However, when comparing the data from both groups, a clear reduction of 7% in cases of irreversible ischemic changes after catheterization of the small subcutaneous vein in the "sural flap" can be observed. Therefore, this method can be considered as one of the effective ways to prevent ischemic complications.

In our opinion, after ligating the small subcutaneous vein in the "sural flap," conditions for the development of primary venous stasis are created. This is due to the impossibility of retrograde

blood flow because of the presence of a valve system in the vein. Catheterization of the small subcutaneous vein and blood drainage from its system allow for temporary compensation for the venous insufficiency of the flap.

Further adaptation of venous blood flow in these cases occurs through a system of small (unnamed) arteries and veins around the wall of the small subcutaneous vein. Although these accompanying vessels are very small, their connection with the small subcutaneous vein allows for bypassing its valves, ensuring retrograde venous drainage of the flap. At this stage, the functioning of this system enables the removal of the intravenous catheter from the flap without the risk of developing venous insufficiency.

It is also interesting to note that in both groups, all cases of blood supply disturbances to the flaps were observed during defects on the foot. No complications occurred during flap repair of defects on the shin. This is likely associated with the length of the flap, the longer the flap, the higher the likelihood of blood supply disturbances.

Another important factor in preventing ischemic complications is the formation of the flap with a skin-fascial pedicle. In this case, there is no need to place the flap in a subcutaneous tunnel, reducing the likelihood of ischemia due to compression, while the skin bridge increases vessel stability against torsion. Reliable hemostasis reduces the risk of hematoma formation around the flap. It is recommended to avoid excessive electrocoagulation and prefer ligation or metal clips.

Another guarantee for preventing ischemic complications is adhering to the flap's size during its formation: no more than 5 cm on each side of the projection of the sural nerve and artery.

It is important to note that when suturing between the fascia and hypodermis to prevent flap delamination, the sutures should not be too tight. Excessive suturing of the flap's perimeter after blood flow restoration can lead to ischemic complications.

In conclusion, the elevation of the "sural flap" is a complex procedure that requires attention to detail. However, this operation allows for the closure of extensive defects on the foot and shin without the need for microsurgery. The introduction of catheterization of the small subcutaneous vein, included in the composition of the sural flap, helps reduce the risks of ischemic complications of the flap and ensures a predictable and reliable long-term outcome.

Conclusion.

Complications related to the impairment of blood supply to the "sural flap" occur in 20% of cases during the plastic repair of extensive gunshot wounds.

Catheterization of the small subcutaneous vein, included in the composition of the flap, allows for the compensation of primary venous stasis in the flap and reduces the risk of irreversible ischemic changes by 7% compared to the control group.

Conflict of interest.

There is no conflict of interest.

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Аннотация.

Особенности применения нейроваскуляризованного лоскута на суральной артерии при пластике огнестрельных дефектов на стопе и голени. Шипунов В.Г., Страфун С.С., Борзых А.В., Н.А. Борзых, Заговенко М.А.

В данной статье проанализированы результаты лечения 36 пациентов с обширными огнестрельными дефектами на стопе и голени с применением нейроваскуляризованного лоскута на суральной артерии.

Цель исследования - изучить влияние катетеризации малой подкожной вены, включенной в состав лоскута, на частоту развития его ишемических осложнений.

Материалы и методы. Пациенты из группы I (n=14) проходили комплексное лечение обширных огнестрельных дефектов с последующей пластикой с использованием "сурального лоскута" и временной катетеризацией малой подкожной вены, включенной в его состав. Пациентам из группы II (n=23) была проведена пластика с использованием «сурального лоскута» без катетеризации сосудов, включенных в его состав.

Результаты и обсуждение. В случае применения лоскута без катетеризации малой подкожной вены наблюдался некроз "сурального лоскута" у 5 (22%) пациентов. При катетеризации малой подкожной вены частота некрозов лоскута составила 2 (15%) случая.

Выводы. Катетеризация малой подкожной вены «сурального лоскута» позволяет снизить частоту осложнений, связанных с нарушением кровоснабжения, на 7%.

Ключевые слова: компартмент синдром при огнестрельных полиструктурных повреждениях нижних конечностей, пластика огнестрельных дефектов конечностей, суральный нерв, катетеризация малой подкожной вены, «суральный лоскут».

ბსტრაქტული.

ტერფის და ქვედა ფეხის ცეცხლსასროლი დეფექტების პლასტიკურ ქირურგიაში სურალურ არტერიაზე ნეიროვასკულარიზებული ფლაპის გამოყენების შიპუნოვი ვ.გ. სტრაფუნი ს.ს., ბორჯიხ ალექსანდრე, ბორზოხ ნატალია, ზაგოვენკო მ.ა.

36 პაციენტის მკურნალობის შედეგები ფეხისა და ქვედა ფეხის ცეცხლსასროლი იარაღის ფართომასშტაბიანი დეფექტებით, სურალურ არტერიაზე ნეიროვასკულარიზებული ფლაპის გამოყენებით. გაანალიზებული.

მიზანი. ფლაპში შემავალი წვრილი საფენური ვენის კათეტერიზაციის ეფექტის გამოკვლევა მისი იშემიური გართულებების განვითარების სიხშირეზე.

ასალა და მეთოდები. 1-ლ ჯგუფში (14) შედიოდნენ დაჭრილები, რომლებმაც გაიარეს ცეცხლსასროლი იარაღის ფართო დეფექტის კომპლექსური მკურნალობა,

რასაც მოჰყვა მისი პლასტიურობა "სურალურ ფლაპით" მის შემადგენლობაში შემავალი მცირე კანქვეშა ვენის დროებითი კათეტერიზაციით. მე-2 ჯგუფში (n=23) შედიოდნენ პაციენტები, რომლებსაც ცეცხლსასროლი იარაღის ფართო დეფექტის კომპლექსური მკურნალობის შემდეგ, ჩატარდათ პლასტიკური ოპერაცია „სურალური ფლაპით“ მასში შემავალი სისხლძარღვების კათეტერიზაციის გარეშე.

შედეგები და მათი განხილვა. წვრილი საფენური ვენის კათეტერიზაციის გარეშე ფლაპის გამოყენების შემთხვევაში „სურალური“ ფლაპის ნეკროზი დაფიქსირდა 5 (22%) შემთხვევაში. მცირე საფენური ვენის კათეტერიზაციის დროს ფლაპ ნეკროზის რაოდენობა იყო 2 (15%) შემთხვევა.

დასკვნა. "სურალური" ფლაპის მცირე საფენური ვენის კათეტერიზაცია საშუალებას იძლევა 7%-ით შემცირდეს სისხლმომარაგების დარღვევებთან დაკავშირებული გართულებების სიხშირე.

საკვანძო სიტყვები. ქვედა კიდურების ცეცხლსასროლი იარაღის პოლისტრუქტურული დაზიანებების შემდეგ კუპეს სინდრომი, კიდურების პლასტიკური გასროლის დეფექტები, სურალური ნერვი, მცირე კანქვეშა ვენის კათეტერიზაცია, არტერია, „სურალური“ ფლაპი.