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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.

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 ბაზებშიდან.

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 საყურადღებო!

რედაქციაში სტატიის წარმოდგენისას საჭიროა დავიცვათ 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, შემავსებელი და პროცენტული მონაცემები უნდა შეესაბამებოდეს ტექსტში მოყვანილს.

6. ფოტოსურათები უნდა იყოს კონტრასტული; სურათები, ნახაზები, დიაგრამები - დასათაურებული, დანომრილი და სათანადო ადგილას ჩასმული. რენტგენოგრაფიის ფოტოსურათები 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.

Nana Shavlakadze, Irine Phkhakadze, Ana Silagadze, Dali Kobuladze, Alina Pakhuridze. CHRONIC URTICARIA AND LEAD EXPOSURE: EVALUATION OF IMMUNOLOGICAL MARKERS.....	6-16
Jangirashvili T, Kikoria G, Tevdorashvili N, Kapanadze L, Odikadze N. PSYCHOLOGICAL WELL-BEING AMONG MEDICAL STUDENTS AT FIVE UNIVERSITIES IN TBILISI, GEORGIA: A CROSS-SECTIONAL STUDY OF PERCEIVED STRESS, ANXIETY, AND SLEEP QUALITY.....	17-23
Yueyue Lu, Yigao Wu. ADVANCES IN RESEARCH OF PSYCHOTHERAPY FOR SOCIAL ANXIETY DISORDER.....	24-31
Saburov Alisher, Kemelbekov Kanatzhan, Arybzhanov Dauranbek, Abdurakhmanov Babur, Huseinov Zafar, Saburova Saidakhon, Tuktibayeva Saule, Yernazarov Adlet, Alipbekova Sandugash. ROLE OF NEOADJUVANT THERAPY FOR PATIENTS WITH GASTRIC CANCER: MULTIDISCIPLINARY HOSPITAL WITH ONCOLOGY CENTER.....	32-37
David Tchkonია, Nino Gabashvili, Teona Mskhaladze, Tamari Kevlishvili, Mikolay Chkonia. EFFICACY OF ENDOBRONCHIAL VALVE PLACEMENT IN THE MANAGEMENT OF PULMONARY HEMORRHAGE: A COMPARATIVE STUDY.....	38-42
Baglan Kemelbekov, Ainur Amanzholykyz, Samat Saparbayev, Manarbek Askarov, Edgaras Stankevicius. IMPACT OF STEM CELL THERAPY ADDED TO GUIDELINE-DIRECTED MEDICAL THERAPY ON QUALITY OF LIFE IN PATIENTS WITH ISCHEMIC CARDIOMYOPATHY.....	43-50
Abramishvili T, Papava K, Mamisashvili M, Tkeshelashvili M, Tsinamdzgvrishvili B. CARDIAC STRAIN IN WOMEN WITH A DOCUMENTED HISTORY OF OVERT OR SUBCLINICAL HYPOTHYROIDISM: AN EXPLORATORY SPECKLE-TRACKING ECHOCARDIOGRAPHY STUDY.....	51-56
TEREZA Y. AZATYAN. FORMATION AND DISTRIBUTION PATTERNS OF FUNCTIONAL INTERHEMISPHERIC BRAIN ASYMMETRY IN CHILDREN WITH INTELLECTUAL DISABILITIES.....	57-63
Fai Twrki Althoini, Ebtehal Solaiman Almogbel. CARDIOMETABOLIC RISK PROFILES IN ADULTS WITH DIABETES: ASSOCIATIONS WITH GLYCEMIC CONTROL, DIABETES TYPE, AND DEMOGRAPHIC CHARACTERISTICS.....	64-77
Datumyan G.S, Shaboyan K.R, Muradyan A.A, Shaboyan E.K, Galstyan A.S, Badalyan A, Sargsyan M.V. IMPACT OF THE COVID-19 PANDEMIC ON THE SEVERITY AND OUTCOMES OF GUNSHOT INJURIES.....	78-84
Zhanar Kozhakhmetova, Nazym Yelemessova, Syzdykova Dinara, Abdullina Sayagul, Nagima Issatayeva, Assiya Turgambayeva, Gulnara Kamalbekova, Diana Zhumagaleyeva, Akmaral Mussakhanova. CRITICAL VALUES OF HEMOSTASIS PARAMETERS IN AN ONCOLOGY CENTER: A RETROSPECTIVE REGISTRY-BASED STUDY.....	85-92
Gradil G.I, Torianyk I.I, Yurko K.V, Shiyan D.M, Merkulova N.F, Mohylenets O.I, Tkachenko V.G, Karmazina I.S, Lantukh A.P, Hryhorov Y.B, Gargin V.V. ASSOCIATION OF PULMONARY AND CUTANEOUS CHANGES IN COVID-19-RELATED CONDITIONS.....	93-98
Alaa MA. Albayaty, Alaa M. Sadiq, Ali SJ. Al Qaissi. ASSOCIATION BETWEEN INFLAMMATORY MARKERS, LIVER ENZYMES, LIPID PROFILE, AND VITAMIN D STATUS IN ADULTS WITH OBESITY: A CROSS-SECTIONAL STUDY.....	99-104
Kenzhebaeva B, Baimuratova M, Kalmakhanov S, Budakoğlu I.I, Laktionova M, Abdukalikova D. IMPACT OF CLINICAL, ORGANIZATIONAL, AND PSYCHOSOCIAL FACTORS ON THE QUALITY OF LIFE OF PATIENTS WITH DERMATOVENEREOLGICAL DISEASES.....	105-114
Obidov F. Kh, Shamsiev E. A, Samatov F. F, Naimov Dilshod Kayim ugli, Khalimova F. T, Marwan Ismail. BIOMARKER-ORIENTED REHABILITATION IN CHRONIC CEREBRAL ISCHEMIA.....	115-122
Raghad Alkhalify, Lina Almutairi, Fatimah Alghofaili, Wasan Alhawaish, Thekra Alhumidi. COMPARATIVE IN-VITRO QUALITY EVALUATION OF COMMERCIALLY AVAILABLE DICLOFENAC SODIUM TABLETS.....	123-131
Ali S. Jumaah, Ali A. Younis, Shamil H. Othman. EFFECTS OF CURCUMIN ON CLINICAL OUTCOMES AND INFLAMMATORY BIOMARKERS IN KNEE OSTEOARTHRITIS: A RANDOMIZED TRIAL.....	132-138
Ashot Markosyan, Diana Alaverdieva, Mark Danghyan, Ani Mkrtchyan, Lusine Balayan, Khachik Hakobyan, Arpine Geolchanyan, Tigran Soghomonyan, Volodya Mirzoyan. SYNTHESIS AND SOME BIOLOGICAL PROPERTIES OF DERIVATIVES OF 2,3-DISUBSTITUTED 5,5-DIMETHYL-BENZO[h]QUINAZOLIN-4(1H)-ONES.....	139-143

J. Gobadze, M. Nagervadze, T. Gogitidze, N. Bejanidze, N. Zarnadze, K. Dolidze. IMPACT OF GESTATIONAL DIABETES MELLITUS ON NEONATAL BIRTH WEIGHT, LENGTH, AND GESTATIONAL AGE: A RETROSPECTIVE CASE-CONTROL STUDY	144-151
Liudmyla Bashkistrova, Iryna Romanova, Vitalii Yatsynovych, Oleksandr Zlobin, Artem Lanskoi. EVIDENCE-BASED PHARMACOTHERAPY FOR ANXIETY DISORDERS COMORBID WITH PTSD: A SYSTEMATIC REVIEW	152-163
Madina Makhmudova, Tolegen Kerimbekov, Zhaina Berikbayeva, Dinara Turebekova, Lyudmila Akhmaltdinova, Yefim Alisseiko, Olga Avdienko, Madina Rashova. IN VITRO INVESTIGATION OF THE POTENTIAL OF C60 FULLERENES AS ADJUVANTS OF NONSPECIFIC IMMUNITY	164-168
Tchernev G, Tchernev KG Jr, Kordeva S. DERMATOLOGIC SURGERY ROUNDS: THE LIMBERG FLAP AND V-TO-T CLOSURE FOR CUTANEOUS/ MUCOCUTANEOUS DEFECTS FOLLOWING SKIN CANCER EXCISION IN HIGH-RISK FACIAL REGIONS	169-174
Nino Nadiradze, Zurab Ckhaidze. SELF-RATED HEALTH IN THE POPULATION OF MEDICAL WORKERS IN GEORGIA	175-180
Argjend Shala, Nexhmedin Shala, Fisnik Jashari, Blert Jashari, Rushit Jashari. SPORADIC CREUTZFELDT-JAKOB DISEASE: CLINICAL FEATURES, DIAGNOSIS AND THERAPEUTIC HORIZONS	181-189
Omar S. Salman, Adeeb A. Al-Zubaidy. ACEBROPHYLLINE REPROGRAMS INFLAMMATORY AND REDOX SIGNALLING IN EXPERIMENTAL ULCERATIVE COLITIS: A DOSE-DEPENDENT STUDY	190-199
Eib K. Eibov, Solikhabonu Khavaskhonova, Kamshat S. Taubay, Karlygash Zh. Sadykova. CALCULATED WHOLE BLOOD VISCOSITY IS SPECIFICALLY ASSOCIATED WITH ABDOMINAL OBESITY, BUT NOT WITH OTHER COMPONENTS OF METABOLIC SYNDROME: A CROSS-SECTIONAL STUDY IN A CENTRAL ASIAN ADULT COHORT	200-208
Shqiponje Gashi, Erza Voca Mulaj, Naser Rugova, Suzana Dvojakovska, Filip Koneski. MANAGEMENT OF PERIOPERATIVE BLEEDING IN PATIENTS WITH PLATELET HYPOAGGREGABILITY DURING DENTOALVEOLAR SURGERY: CLINICAL OUTCOMES AND THERAPEUTIC APPROACHES	209-214
Alina Articulo, Rigor Rey Cuevas, Hani Al-Najjar, Rahaf Alkhuraif, Rasha Aburmeishan, Abdulaziz Almatrody. EXPLORING THE SATISFACTION OF NEWLY HIRED NURSES USING AN EVIDENCE-BASED, PERSONALIZED ONBOARDING PROGRAM: A CROSS-SECTIONAL ANALYSIS	215-222
Nagima Issatayeva, Samal Duisekova, Meruert Saberbekova, Roza Tumanova, Larisa Guruleva, Sholpan Mukanova. APPLICATION OF THE FAILURE MODE AND EFFECTS ANALYSIS METHOD IN HEALTHCARE: A CASE STUDY OF A UNIVERSITY MEDICAL CENTER IN KAZAKHSTAN	223-237
Hisham R. Ezzat, Ibrahim M. Faisal. CARDIOPROTECTIVE EFFECTS OF SILYMARIN AND VITAMIN E AGAINST DOXORUBICIN-INDUCED CARDIOTOXICITY IN RATS: EVIDENCE FROM OXIDATIVE STRESS MARKERS AND HISTOPATHOLOGICAL ANALYSIS	238-245
Shishniashvili D.S, Bedinashvili Z.J, Tsomaia K.B, Svanadze L.M, Chkhikvishvili N.M, Durglishvili G.A. FIRST-VOID URINE VERSUS URETHRAL SWAB FOR MOLECULAR DETECTION OF SEXUALLY TRANSMITTED INFECTIONS IN MEN WITH MULTIPLE SEXUAL PARTNERS	246-252
Chekhovska G.S, Pustova N.O, Syzon O.O, Chaplyk-Chyzho I.O, Dashko M.O, Vozniak I.Ya, Volbyn S.V, Ivaniushko-Nazarko N.V, Zhemela O.D, Gargin V.V. NAIL PLATE DAMAGE INDEX IN DERMATOSCOPIC EXAMINATION OF PATIENTS WITH ONYCHOMYCOSIS	253-258
Meng-Yun Zhou, Shi-qi Yu, Shao-jie Zhu, Xiang Kong, Xin-Ming Yao. A NOVEL KCNJ5 GENE MUTATION ASSOCIATED WITH FAMILIAL ALDOSTERONISM TYPE III WITHOUT HYPERTENSION	259-265
Koba Kamashidze, Tina Beruchashvili, Irina Nakashidze, Sarfraz Ahmad, Tamar Peshkova. BRIDGING THE COVERAGE-PARTICIPATION GAP: BEHAVIORAL DETERMINANTS OF CERVICAL CANCER SCREENING AMONG WOMEN IN ADJARA, GEORGIA	266-273
T.N. Kosayeva, A.T. Amiraslanov, H.K. Muradov, A.Y. Gaziyeu, B.E. Abbasov. PD-L1 EXPRESSION AND SERUM CA125: CLINICOPATHOLOGICAL CORRELATIONS IN HIGH-GRADE SEROUS OVARIAN CARCINOMA	274-280
Ruziyeva Amira Asrorovna, Khamidov Obid Abdurakhmanovich, Murodqosimov Saidolim, Doniyorov Bakhridin Baxrom ugli, Khalimova F.T, Marwan Ismail. ACE I/D AND NOS3 G894T POLYMORPHISMS AND CARDIOVASCULAR ADAPTATION PROFILES IN ADOLESCENT FOOTBALL PLAYERS	281-288

Mukhriddin Umbarov Ochilovich, Shamsutdinova Maksuda Ilyasovna, Abdullayev Ravshanbek Babajonovich, Rokhila Bakhridinovna Mengliyeva. ASSOCIATIONS OF CYTOKINE PROFILE AND EXOCRINE PANCREATIC FUNCTION WITH A SYMPTOM-BASED DEHYDRATION CATEGORY AND SEASON OF PRESENTATION IN CHRONIC PANCREATITIS: A RETROSPECTIVE STUDY.....	289-297
Saeed H. Hussein, Hiba M. Ahmed, Ahmed A. Ahmed. DETECTION OF HEPATITIS B AND C VIRAL INFECTION AMONG CHILDREN WITH ACUTE LEUKAEMIA.....	298-302
Davit Kobuladze, Ahishtan Febrian Nishanthan, Nino Kedelidze, Rusudan Vadatchkoria, Magda Davitashvili, Lamara Zuroshvili, Darejan Margalitashvili, Nani Gvarishvili, Nazi Turmanidze, Tamar Peshkova, Naman Chauhan, Teona Gogitidze, Nameera Parveen Shaikh, Aleena Parveen Shaikh, Abeshana Febrian Nishanthan, Irina Nakashidze. SELECTED LABORATORY PARAMETERS IN PEDIATRIC PATIENTS WITH COVID-19 STRATIFIED BY WHITE BLOOD CELL AND PLATELET PROFILES.....	303-309
Rawan Waleed, Abrar Fadlalla, Jana Abdullah, Marwan Ismail, Mohammed Ibrahim Saeed, Ahmad Luay Osman Hashim, Abdelgadir Elamin Eltom. IMPACT OF HELICOBACTER PYLORI INFECTION ON VITAMIN B12 DEFICIENCY LEVELS: A RETROSPECTIVE STUDY.....	310-315
T.A. Asgarova, K.M. Rahimli, G.A. Valiyeva, Sh.I. Hasanova, F.E. Guliyeva, Kh.R. Mammadova. SOME HEREDITARY DISEASES PREVALENT IN THE REPUBLIC OF AZERBAIJAN.....	316-319
Sahadete Shala, Ferdita Haxhiu Derguti. PSOAS MUSCLE ABSCESS FOLLOWING CESAREAN SECTION: A CASE REPORT.....	320-322
N. Kajaia, L. Gabunia, M. Mantskava, S. Kalmakhelidze, G. Ormotsadze, S. Turabelidze-Robaqidze, T. Sanikidze. PRO-INFLAMMATORY INTERLEUKINS AND OXIDATIVE IMBALANCE IN L-NAME-INDUCED HYPERTENSION: COMPARATIVE EFFECTS OF β -BLOCKERS.....	323-330
Hussein Fadhil Abdulameer, Raed Aziz Badeia. COMPARATIVE EVALUATION OF TWO HERBAL MOUTHWASHES AND CHLORHEXIDINE ON CALPROTECTIN IN GINGIVITIS PATIENTS: A DOUBLE-BLIND RANDOMIZED CONTROLLED TRIAL.....	331-340
J. Gobadze, M. Nagervadze, T. Gogitidze, N. Bejanidze, T. Koiava. SOME BIOLOGICAL CHARACTERISTICS ASSOCIATED WITH GESTATIONAL DIABETES.....	341-348
Yurevych N. O, Sazonova O. N, Kachailo I.A, Hnidyk Yu. V, Pokotylo P. B, Podolyuk M.V, Blyshak N. B, Mykhalevych M. M, Zherebkin V. V, Kosynskyi O. V, Aliksieieva V. V. THREE-DIMENSIONAL CT-BASED MORPHOMETRIC ASSESSMENT OF THE MAXILLARY SINUS.....	349-355
Simbarashe Magaisa. PERCEPTIONS AND PRACTICES OF HEALTHCARE PROVIDERS IN MATERNAL MORTALITY AND STILLBIRTH PREVENTION AND MANAGEMENT: INSIGHTS FROM LEJWELEPUTSWA DISTRICT.....	356-363
Akezhan Rustemuly Astrakhanov, Ainur Amanzholkyzy, Samat Sagatovich Saparbayev, Meirambek Sagnaevich Kurmangazin, Aigerim Iskakova, Gulzhanat Nurlanova. THE ROLE OF CELL THERAPY IN THE COMPREHENSIVE TREATMENT OF CHRONIC HEPATITIS C-RELATED LIVER CIRRHOSIS.....	364-370
Miranda Shervashidze, Khatia Dolidze, Tamar Bakhtadze, Tamar Shervashidze. PREVENTING EXERCISE-RELATED SUDDEN CARDIAC DEATH THROUGH SYSTEMATIC PREPARTICIPATION CARDIOVASCULAR SCREENING: A TWO-YEAR REGIONAL COHORT STUDY OF PEDIATRIC ATHLETES IN ADJARA, GEORGIA.....	371-380
Waseem Hashim Alkhaffaf, Muhammad A. Alkataan. COMPARATIVE EFFICACY OF 200 UNITS VERSUS 155 UNITS OF ONABOTULINUMTOXIN A FOR CHRONIC MIGRAINE.....	381-388
K. Tovar Calderón, J. Orozco Pilco, C. Calderón Cabezas, K. Caiza Cuello. ETHNIC DISPARITIES IN BIRTH WEIGHT AND PRENATAL CARE UTILIZATION IN ECUADOR, 2024.....	389-394
Gaukhar Issakova, Suriya Yessentayeva, Daniyar Amangaliyev, Askhat Bralov, Assiya M. Issayeva, Yestay Abzalbek, Marat Akhetov. INDICATIONS FOR REMOVAL OF A PORT SYSTEM IN A PATIENT WITH SUSPECTED SEPTICEMIA IN THE ABSENCE OF OTHER LOCAL SOURCES OF INFECTION.....	395-398
Mohammed A. Hayawi, Duaa M. Al-Nafoly. PREDOMINANCE OF FOLLICULAR ADENOMA AND PAPILLARY CARCINOMA IN THYROID NEOPLASMS.....	399-403
Nino Buadze, Nata Kazakhashvili. POPULATION KNOWLEDGE, RISK PERCEPTION, GOVERNANCE AND PUBLIC HEALTH DETERMINANTS OF COVID-19 IN GEORGIA: A NATIONAL CROSS-SECTIONAL STUDY.....	404-422

Alaa H. Alfarhan, Bahir S. Allawi, Mohammed A. Aljodah, Ahmed Jawad. MINIMALLY INVASIVE FAT TRANSPOSITION IN LOWER BLEPHAROPLASTY	423-427
Ospanova Meruyert, Ospanova Saniya, Yernazarov Adilet, Amanbaev Rauan, Rakhmankulov Umarali. LOW-FREQUENCY ULTRASOUND AND OZONE/NO TECHNOLOGIES IN THE COMBINED TREATMENT OF EXUDATIVE HEMISINUSITIS USING THE YAMIK-3 SINUS CATHETER.....	428-432
Sodikjon Mashraf Ugli Makhmatkulov, Ibragimova Malika Shavkatovna, Khasanov Alisher Yurevich, Mavlyanova Zilola Farkhadovna, Khalimova F.T, Marwan Ismail. COMBINED BOTULINUM TOXIN THERAPY AND PERCUTANEOUS TIBIAL NERVE STIMULATION IN THE REHABILITATION OF WOMEN WITH URGENCY URINARY INCONTINENCE ASSOCIATED WITH DIABETES MELLITUS.....	433-444
Nellia Veretova, Alfiya Samigullina, Aigul Baialieva, Ruslan Abdyldaev, Begimai Muratbekova. PSYCHONEUROLOGICAL THERAPY FOR POST-COVID SYNDROME: A COMPREHENSIVE REVIEW OF METHODS AND CLINICAL EFFECTIVENESS.....	445-451
Azhar Giniyat, Natalya Slivkina, Viktor Tkachev, Gulbana Khussainova, Ayan Baigaliyev, Sara Kubekova, Aizat Seidakhmetova, Zilola Mavlyanova, Mirbanu Aikhodzheyeva, Raikhan Burumbaeva, Larissa Pavlovets, Raikhan Tleulinova, Raushan Baigenzheyeva, Mereke Alaidarova, Joseph Almazan, Aizhan Altynbekova, Bakyt Zhangabulova, Zinugul Baissova, Manzura Kankina, Parida Pirmanova, Magira Shaizadinova, Aliya Utenova, Zhansaya Raiymkul. DEVELOPMENT AND EVALUATION OF A NURSE-LED SELF-DIRECTED PEDIATRIC REHABILITATION MODEL: COMPARATIVE ANALYSIS OF INTERNATIONAL PRACTICES.....	452-465
Florina Sahiti, Argjira Veseli, Marija Peeva Petreska, Shera Kosumi, Nora Berisha, Enis Veseli, Kaltrina Veseli. BIOMARKERS OF BONE REMODELING AND INFLAMMATION IN CHRONIC PERIAPICAL LESIONS: A NARRATIVE REVIEW	466-473

IMPACT OF THE COVID-19 PANDEMIC ON THE SEVERITY AND OUTCOMES OF GUNSHOT INJURIES

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Abstract.

Objective: To evaluate the impact of COVID-19 infection on injury severity, clinical course, complications, and hospital outcomes in patients with gunshot injuries.

Materials and Methods: This retrospective descriptive-analytical study was conducted at the Central Clinical Military Hospital of the Ministry of Defence of the Republic of Armenia. The study included 80 male patients with gunshot injuries who were hospitalized during 2020. Of these, 55 (68.8%) patients were COVID-19-positive and 25 (31.2%) were COVID-19-negative. Injury severity was assessed using the Injury Severity Score (ISS) and the Glasgow Coma Scale (GCS). The rates of intensive care unit (ICU) admission, requirement for mechanical ventilation, length of hospital stay, complications, and in-hospital mortality were analyzed.

Results: The mean ISS was significantly higher in COVID-19-positive patients than in COVID-19-negative patients (22.8 ± 7.4 vs. 15.2 ± 5.8 , $p < 0.01$). Conversely, the mean GCS score was significantly lower in the COVID-19-positive group (12.9 ± 2.5 vs. 14.6 ± 1.8 , $p < 0.05$). ICU admission was required in 43.6% of COVID-19-positive patients compared with 16.0% of COVID-19-negative patients. Mechanical ventilation was required in 21.8% and 8.0% of patients, respectively. The incidence of complications was 29.1% in the COVID-19-positive group and 12.0% in the COVID-19-negative group. In-hospital mortality was 10.9% and 4.0%, respectively. Correlation analysis demonstrated a significant positive association between ISS and length of hospital stay ($r = 0.61$, $p < 0.001$), as well as between ISS and mortality ($r = 0.58$, $p < 0.001$).

Conclusion: COVID-19 infection in patients with gunshot injuries is associated with greater injury severity, an increased need for intensive care, a higher incidence of complications and mortality, and prolonged hospitalization. The coexistence of COVID-19 infection and gunshot trauma may be regarded as a mutually aggravating clinical condition that requires early diagnosis, intensive monitoring, and a multidisciplinary treatment approach.

Key words. COVID-19, gunshot injuries, trauma, injury severity score, intensive care unit, complications, mortality.

Introduction.

The COVID-19 pandemic has had a profound impact not only on the epidemiological landscape but also on the pattern of traumatic injuries. Although the initial phase of the pandemic was expected to result in an overall reduction in traumatic injuries due to mobility restrictions and social distancing measures, subsequent studies demonstrated that the incidence of gunshot wounds (GSWs) not only failed to decline but, in

many countries, increased substantially. Concurrently, the rates of severe injuries, complications, and mortality also increased [1].

Gunshot injuries are among the most severe forms of penetrating trauma because they are frequently associated with massive hemorrhage, multiple organ injuries, and high mortality. During the COVID-19 pandemic, the management of these patients became even more challenging owing to the systemic effects of SARS-CoV-2 infection, the overwhelming burden on healthcare systems, and the reallocation of surgical and critical care resources.

A nationwide study conducted in Canada demonstrated a significant increase in the incidence of gunshot injuries during the pandemic. The authors reported that the COVID-19 period was associated with an escalation in firearm-related violence, accompanied by an increased number of hospital admissions and a higher proportion of severe traumatic injuries [1].

Similarly, analyses from several trauma centers in the United States revealed a marked increase in the proportion of penetrating trauma, particularly gunshot injuries, during the COVID-19 pandemic. In several centers, the number of patients admitted with gunshot wounds increased by several dozen percent, while the proportion of patients presenting with severe injuries also rose substantially [2].

One of the most important consequences of the pandemic was related not only to the increased incidence of gunshot injuries but also to their clinical outcomes. A study by Kaufman et al. comparing COVID-19-positive and COVID-19-negative trauma patients demonstrated significantly higher mortality among patients with COVID-19, even when the Injury Severity Score (ISS) was comparable between the two groups. The same study also reported that gunshot injuries occurred approximately twice as frequently among COVID-19-positive patients as among COVID-19-negative patients [3].

These findings may be explained by the pathophysiological effects of COVID-19. SARS-CoV-2 infection is known to induce a systemic inflammatory response, endothelial dysfunction, microvascular thrombosis, and a hypercoagulable state. Collectively, these mechanisms contribute to the development of immunothrombosis, which may exacerbate tissue ischemia and organ dysfunction in patients with severe trauma [9,10]. Consequently, these pathophysiological alterations may aggravate the clinical condition of patients with gunshot injuries by increasing the risk of organ failure, thromboembolic complications, and death. This risk is particularly pronounced in patients with concomitant pulmonary injuries or massive hemorrhage [3].

A study conducted in South Korea demonstrated that the proportion of severe traumatic injuries increased during the

COVID-19 pandemic, despite a modest decline in the overall number of trauma admissions. At the same time, the incidence of complications, including pneumonia, sepsis, acute kidney injury, and surgical site infections, increased significantly. The authors concluded that the COVID-19 pandemic itself represented an independent risk factor for the development of complications in trauma patients [4].

Gunshot injuries involving the head and neck constitute a particularly severe category of penetrating trauma and are associated with exceptionally high mortality. A study from the United States reported that the incidence of head and neck gunshot injuries increased by more than 10% during the initial months of the COVID-19 pandemic. Notably, this increase coincided with the period of strict lockdown measures implemented to control viral transmission [5].

Particular attention should also be paid to the pediatric population. A study investigating pediatric firearm-related traumatic brain injuries demonstrated an increase in both self-inflicted and assault-related gunshot injuries during the pandemic. In several trauma centers, mortality increased more than threefold, while the need for neurosurgical interventions doubled compared with the pre-pandemic period [6].

In addition to biological mechanisms, social factors played a substantial role in the increased severity and incidence of gunshot injuries during the pandemic. Social isolation, rising unemployment, psychological stress, increased alcohol and substance use, and a marked rise in firearm sales collectively contributed to the escalation of firearm-related violence. Several studies also reported a significant increase in first-time firearm ownership, which may have contributed to the growing number of both intentional and unintentional firearm injuries [2,7].

Overall, the available evidence indicates that the COVID-19 pandemic exerted a multifaceted impact on both the epidemiology and clinical course of gunshot injuries. During the pandemic, the incidence of firearm-related trauma increased, particularly the proportion of penetrating injuries. Moreover, COVID-19 infection was associated with a higher incidence of complications and mortality, likely attributable to an exaggerated systemic inflammatory response, thromboembolic disturbances, and an increased risk of multiple organ dysfunction. Therefore, the coexistence of COVID-19 infection and gunshot trauma may be regarded as a synergistically aggravating clinical condition that warrants special consideration in trauma and critical care practice [3].

Therefore, the aim of the present study was to evaluate the impact of COVID-19 infection on injury severity, clinical course, complications, and hospital outcomes in patients with gunshot injuries treated at the Central Clinical Military Hospital of the Ministry of Defence of the Republic of Armenia.

Materials and Methods.

This retrospective descriptive-analytical study was conducted at the Central Clinical Military Hospital of the Ministry of Defence of the Republic of Armenia. The study included patients with gunshot injuries who were hospitalized during 2020.

A total of 80 patients with gunshot injuries involving different anatomical regions were enrolled. According to the anatomical location of the injury, patients were classified into the following groups:

- abdominal gunshot injuries – 20 patients (25.0%);
- thoracic gunshot injuries – 15 patients (18.8%);
- extremity gunshot injuries – 15 patients (18.8%);
- polytrauma involving gunshot injuries – 30 patients (37.5%).

Demographic, clinical, and therapeutic data were collected for all patients, including age, sex, injury location, length of hospital stay, requirement for intensive care unit (ICU) admission, surgical interventions performed, incidence of complications, and in-hospital outcomes. These variables are widely used in studies evaluating gunshot injuries and trauma during the COVID-19 pandemic [2].

Injury severity was assessed using the Injury Severity Score (ISS), which is internationally recognized as the standard tool for evaluating the anatomical severity of traumatic injuries. The ISS was calculated for each patient based on the anatomical characteristics of the injuries. In addition, the Glasgow Coma Scale (GCS) was used to assess the level of consciousness, particularly in patients with polytrauma and severe traumatic injuries [8].

Both the ISS and GCS are well-established prognostic tools for trauma patients and are widely applied in both civilian and military trauma research [11,12].

The following clinical parameters were also evaluated:

- systolic blood pressure at hospital admission;
- heart rate;
- hemoglobin concentration;
- estimated blood loss;
- presence of shock;
- requirement for mechanical ventilation;
- length of stay in the intensive care unit;
- in-hospital mortality.

These variables are considered major prognostic indicators of clinical outcomes following gunshot injuries and are routinely employed in international trauma research [1].

Patient management was performed in accordance with current military and civilian trauma management guidelines. Depending on the clinical indications, patients underwent primary surgical wound debridement, laparotomy, thoracotomy, vascular and orthopedic procedures, as well as intensive anti-shock management and intravenous fluid resuscitation.

Statistical analysis was performed using IBM SPSS Statistics version 26.0 (IBM Corp., Armonk, NY, USA). Continuous variables are presented as mean $\pm$ standard deviation (mean $\pm$ SD), whereas categorical variables are expressed as absolute numbers (n) and percentages (%). Comparisons of continuous variables between groups were performed using the independent-samples Student's t-test, while categorical variables were compared using the Pearson χ^2 (chi-square) test. Associations between variables were assessed using Pearson's correlation analysis, with the correlation coefficient (r) calculated accordingly. A p-value of <0.05 was considered statistically significant.

Results and Discussion.

The study included 80 male patients with gunshot injuries who were treated at the Central Clinical Military Hospital of the Ministry of Defence of the Republic of Armenia during 2020. The mean age of the patients was 32.8 ± 9.1 years (range, 18–61 years).

Among the study population, polytrauma was the most common injury pattern, observed in 30 patients (37.5%), followed by abdominal gunshot injuries in 20 patients (25.0%), thoracic gunshot injuries in 15 patients (18.8%), and extremity gunshot injuries in 15 patients (18.8%) (Table 1).

Laboratory-confirmed COVID-19 infection was identified in 55 (68.8%) patients, whereas 25 (31.2%) patients tested negative for COVID-19.

Analysis of injury distribution demonstrated that polytrauma was more prevalent among COVID-19-positive patients, accounting for 24 (43.6%) cases, compared with 6 (24.0%) cases in the COVID-19-negative group. Abdominal gunshot injuries were recorded in 13 (23.6%) COVID-19-positive patients and 7 (28.0%) COVID-19-negative patients, while thoracic gunshot injuries occurred in 10 (18.2%) and 5 (20.0%) patients, respectively. Extremity gunshot injuries were observed in 8 (14.6%) COVID-19-positive patients and 7 (28.0%) COVID-19-negative patients.

Injury severity was assessed using the Injury Severity Score (ISS). The results demonstrated that the mean ISS was 22.8 ± 7.4 in the COVID-19-positive group, which was significantly higher than that observed in the COVID-19-negative group (15.2 ± 5.8 , $p < 0.01$).

Assessment using the Glasgow Coma Scale (GCS) revealed a mean score of 12.9 ± 2.5 in COVID-19-positive patients compared with 14.6 ± 1.8 in COVID-19-negative patients ($p < 0.05$), indicating a significantly greater impairment of consciousness among patients with COVID-19 infection.

A total of 28 (35.0%) patients required admission to the intensive care unit (ICU), of whom 24 were COVID-19-positive. Mechanical ventilation was required in 14 (17.5%) patients, with the majority (12 patients; 85.7%) belonging to the COVID-19-positive group.

Blood or blood component transfusion was administered to 37 (46.3%) patients. The need for transfusion was significantly greater among COVID-19-positive patients (52.7%) than among COVID-19-negative patients (32.0%).

The overall mean length of hospital stay was 15.2 ± 7.6 days. However, hospitalization was significantly longer in the COVID-19-positive group (17.2 ± 8.3 days) than in the COVID-19-negative group (10.8 ± 4.9 days, $p < 0.01$).

Complications were observed in 19 (23.8%) patients. The overall complication rate was 29.1% among COVID-19-positive patients, compared with 12.0% in the COVID-19-negative group.

Among postoperative and in-hospital complications, surgical site infections were the most frequent, occurring in 7 (8.8%) patients, followed by pneumonia in 5 (6.3%) patients and sepsis in 3 (3.8%) patients. Acute kidney injury was observed in 2 (2.5%) patients, while thromboembolic complications occurred in 1 (1.3%) patient. Notably, the majority of cases of pneumonia, acute kidney injury, and thromboembolic complications were observed among COVID-19-positive patients.

Analysis of injury severity according to anatomical injury location demonstrated that the highest Injury Severity Score (ISS) values were recorded in patients with polytrauma (28.9 ± 7.2), followed by those with thoracic gunshot injuries (22.1 ± 5.6) and abdominal gunshot injuries (19.6 ± 4.8). The lowest

mean ISS (11.4 ± 3.5) was observed in patients with isolated extremity gunshot injuries.

In-hospital mortality was recorded in 7 (8.8%) patients. Among COVID-19-positive patients, 6 (10.9%) died, whereas 1 (4.0%) death occurred in the COVID-19-negative group. The leading causes of death were multiple organ failure, hemorrhagic shock, sepsis, and severe respiratory failure.

The findings of the present study demonstrate that COVID-19 infection was associated with greater injury severity, a higher rate of intensive care unit admission, prolonged hospitalization, an increased incidence of complications, and higher in-hospital mortality among patients with gunshot injuries. These results suggest that COVID-19 may adversely affect the clinical course and outcomes of patients sustaining gunshot trauma.

Of the 80 patients included in the study, 71 (88.8%) underwent surgical interventions of varying complexity, whereas 9 (11.2%) were managed conservatively. The most frequently performed procedures were laparotomy, undertaken in 20 (25.0%) patients, and primary surgical debridement of extremity gunshot injuries, performed in 15 (18.8%) patients.

Hemodynamic Parameters at Admission:

At the time of admission, the mean systolic blood pressure was 108.4 ± 18.6 mmHg, while the mean heart rate was 102.7 ± 21.4 beats/min. Clinical signs of hemorrhagic shock were observed in 18 (22.5%) patients, most of whom had sustained polytrauma or abdominal gunshot injuries.

Pulmonary Involvement in COVID-19-Positive Patients:

Chest computed tomography (CT) examinations of the 55 COVID-19-positive patients revealed varying degrees of pulmonary involvement. The most common finding was CT-2 pulmonary involvement, which was observed in 21 (38.2%) patients.

Analysis of In-Hospital Mortality According to Injury Type:

The overall in-hospital mortality rate was 8.8% (7 patients). The highest mortality was observed among patients with polytrauma, with 5 (16.7%) deaths, whereas no deaths were recorded in patients with isolated extremity gunshot injuries.

Length of Stay in the Intensive Care Unit:

Among the 28 patients admitted to the intensive care unit (ICU), the mean length of ICU stay was 6.8 ± 3.4 days. COVID-19-positive patients had a significantly longer ICU stay (7.4 ± 3.6 days) compared with COVID-19-negative patients (4.2 ± 1.9 days, $p < 0.05$).

Correlation Analysis:

Correlation analysis demonstrated a significant positive association between the Injury Severity Score (ISS) and the length of hospital stay ($r = 0.61$, $p < 0.001$). The presence of COVID-19 infection was also positively correlated with intensive care unit (ICU) admission ($r = 0.42$, $p < 0.01$), the development of postoperative complications ($r = 0.38$, $p < 0.05$), and in-hospital mortality ($r = 0.34$, $p < 0.05$).

The findings of the present study suggest that COVID-19 infection may have acted as a factor aggravating the clinical course of patients with gunshot injuries. Of the 80 male patients included in the study, 55 (68.8%) were COVID-19-positive and 25 (31.2%) were COVID-19-negative. The high proportion of

Table 1. Distribution of Patients According to the Type of Injury.

Type of Injury	n	%
Abdominal gunshot injury	20	25.0
Thoracic gunshot injury	15	18.8
Extremity gunshot injury	15	18.8
Polytrauma	30	37.5
Total	80	100

Table 2. Comparative Characteristics of COVID-19-Positive and COVID-19-Negative Patients.

Variable	COVID (+) n=55	COVID (-) n=25	p
Age (years)	33.4±8.9	31.6±9.2	>0.05
ISS- Injury Severity Score	22.8±7.4	15.2±5.8	<0.01
GCS- Glasgow Coma Scale	12.9±2.5	14.6±1.8	<0.05
ICU admission	24 (43.6%)	4 (16.0%)	<0.05
Mechanical ventilation	12 (21.8%)	2 (8.0%)	<0.05
Blood transfusion	29 (52.7%)	8 (32.0%)	<0.05
Length of hospital stay (days)	17.2±8.3	10.8±4.9	<0.01
Complications	16 (29.1%)	3 (12.0%)	<0.05
In-hospital mortality	6 (10.9%)	1 (4.0%)	<0.05

Table 3. Postoperative and In-Hospital Complications.

Complication	n	%
Surgical site infection	7	8.8
Pneumonia	5	6.3
Sepsis	3	3.8
Acute kidney injury	2	2.5
Thromboembolic complications	1	1.3
Total	19	23.8

Table 4. Mean Injury Severity Score (ISS) According to the Type of Injury.

Type of Injury	ISS (M±SD)
Extremity gunshot injury	11.4±3.5
Abdominal gunshot injury	19.6±4.8
Thoracic gunshot injury	22.1±5.6
Polytrauma	28.9±7.2

Table 5. Surgical Procedures Performed.

Surgical Procedure	n	%
Laparotomy	20	25.0
Thoracotomy	11	13.8
Primary surgical debridement of extremity gunshot injuries	15	18.8
Vascular reconstruction	6	7.5
Osteosynthesis	8	10.0
Combined surgical procedures	11	13.8
Conservative treatment	9	11.2
Total	80	100

Table 6. Main Clinical Parameters at Admission.

Parameter	M±SD
Systolic blood pressure (mmHg)	108.4±18.6
Heart rate (beats/min)	102.7±21.4
Hemoglobin (g/L)	109.5±21.3
Glasgow Coma Scale (GCS)	13.4±2.4
Injury Severity Score (ISS)	20.4±8.6

Table 7. Severity of Pulmonary Involvement on Chest CT in COVID-19-Positive Patients.

Chest CT Severity Grade	n	%
CT-1	18	32.7
CT-2	21	38.2
CT-3	12	21.8
CT-4	4	7.3

Table 8. In-Hospital Mortality According to Injury Type.

Injury Type	Deaths (n)	Mortality (%)
Extremity gunshot injury	0	0
Abdominal gunshot injury	1	5.0
Thoracic gunshot injury	1	6.7
Polytrauma	5	16.7
Overall	7	8.8

Table 9. Intensive Care Unit (ICU) Treatment Characteristics According to COVID-19 Status.

Parameter	COVID (+)	COVID (-)
ICU admission, n (%)	24 (43.6%)	4 (16.0%)
Length of ICU stay (days), mean $\pm$ SD	7.4 $\pm$ 3.6	4.2 $\pm$ 1.9
Mechanical ventilation, n (%)	12 (21.8%)	2 (8.0%)

Table 10. Correlation Analysis of the Main Clinical Variables.

Variables	Correlation coefficient (r)	p-value
Injury Severity Score (ISS) – Length of hospital stay	0.61	<0.001
COVID-19 infection – ICU admission	0.42	<0.01
COVID-19 infection – Postoperative complications	0.38	<0.05
COVID-19 infection – In-hospital mortality	0.34	<0.05
Injury Severity Score (ISS) – In-hospital mortality	0.58	<0.001

COVID-19-positive patients reflects the study period (2020), when the COVID-19 pandemic coincided with a substantial influx of military trauma patients.

In our cohort, the mean Injury Severity Score (ISS) was significantly higher among COVID-19-positive patients than among COVID-19-negative patients (22.8 ± 7.4 vs. 15.2 ± 5.8 , $p < 0.01$), indicating that patients with concomitant COVID-19 presented with more severe injuries at admission. Similar findings have been reported by Kaufman et al., who demonstrated that trauma patients with COVID-19 had a significantly higher risk of adverse clinical outcomes and mortality, even after adjustment for injury severity [3]. Our findings therefore support the growing body of evidence suggesting that COVID-19 infection may independently worsen the clinical prognosis of trauma patients.

The need for intensive care was also substantially greater among COVID-19-positive patients. In the present study, 24 (43.6%) COVID-19-positive patients required admission to the intensive care unit (ICU), compared with only 4 (16.0%) COVID-19-negative patients. These findings indicate that concomitant COVID-19 infection considerably increased the demand for intensive care among patients with gunshot injuries. Likewise, Jang et al. reported that the COVID-19 pandemic altered both the severity profile of traumatic injuries and the spectrum of complications, with increased rates of pneumonia, sepsis, acute kidney injury, and surgical site infections among trauma patients [4]. Consistent with these observations, postoperative complications occurred in 16 (29.1%) COVID-

19-positive patients compared with 3 (12.0%) COVID-19-negative patients in our study.

The requirement for mechanical ventilation was also markedly higher among COVID-19-positive patients. Mechanical ventilation was required in 12 (21.8%) COVID-19-positive patients, compared with only 2 (8.0%) COVID-19-negative patients. This difference can be explained not only by the greater severity of traumatic injuries but also by pulmonary involvement associated with COVID-19 infection. Chest computed tomography (CT) demonstrated advanced pulmonary involvement in a substantial proportion of COVID-19-positive patients, with CT-3 findings in 12 (21.8%) patients and CT-4 findings in 4 (7.3%) patients. Consequently, COVID-19-related respiratory impairment likely contributed to the increased need for endotracheal intubation and mechanical ventilation. Previous studies have likewise shown that pulmonary involvement and the increased risk of acute respiratory distress syndrome (ARDS) in patients with COVID-19 substantially increase the likelihood of invasive mechanical ventilation [14].

Hospitalization was significantly prolonged among COVID-19-positive patients. The mean length of hospital stay was 17.2 ± 8.3 days in the COVID-19-positive group compared with 10.8 ± 4.9 days in the COVID-19-negative group ($p < 0.01$), indicating a more prolonged and resource-intensive clinical course. Kaufman et al. similarly identified COVID-19 infection as an independent predictor of poorer hospital outcomes in trauma patients [3]. Our findings further support this association, as COVID-19-positive patients also experienced significantly longer stays in the ICU (7.4 ± 3.6 vs. 4.2 ± 1.9 days).

Overall, postoperative and in-hospital complications were observed in 19 (23.8%) patients. The most frequent complications included surgical site infection (7 patients, 8.8%), pneumonia (5 patients, 6.3%), sepsis (3 patients, 3.8%), acute kidney injury (2 patients, 2.5%), and thromboembolic complications (1 patient, 1.3%). Similar patterns have been described by Jang et al., who reported increased rates of acute kidney injury, surgical site infection, pneumonia, and sepsis among trauma patients during the COVID-19 pandemic [4]. Notably, in our study, the incidence of complications was more than twice as high among COVID-19-positive patients compared with COVID-19-negative patients (29.1% vs. 12.0%), further supporting the hypothesis that concomitant COVID-19 infection adversely affects the clinical course of patients with gunshot injuries.

Regarding the anatomical distribution of injuries, polytrauma was the most common injury pattern, accounting for 30 cases (37.5%). This was followed by abdominal gunshot injuries in 20 patients (25.0%), thoracic gunshot injuries in 15 patients (18.8%), and isolated extremity gunshot injuries in 15 patients (18.8%). Patients with polytrauma exhibited the highest mean Injury Severity Score (ISS) (28.9 ± 7.2) and the highest in-hospital mortality rate, with 5 deaths (16.7%). These findings are consistent with the trauma literature, in which polytrauma is recognized as one of the strongest predictors of mortality and adverse clinical outcomes. Nevertheless, it should be emphasized that our study did not include a pre-pandemic comparison group; therefore, the high proportion of polytrauma cases cannot be directly attributed to the COVID-19 pandemic.

International epidemiological studies have demonstrated that the incidence of gunshot injuries increased in several countries during the COVID-19 pandemic. In a multicenter study, McGraw et al. reported a significant increase in firearm-related trauma admissions across six Level I trauma centers in the United States during the pandemic restrictions [2]. Similarly, Moisan et al. observed an increase in the number of patients with gunshot injuries during the COVID-19 pandemic in Canada [1]. Although our study was not designed to evaluate changes in the incidence of gunshot injuries, as it included only patients treated during 2020, our findings complement the existing literature by demonstrating that COVID-19-positive patients with gunshot injuries experienced a more severe clinical course than COVID-19-negative patients.

Analysis of mortality demonstrated an overall in-hospital mortality rate of 8.8% (7 patients). Six deaths (10.9%) occurred among COVID-19-positive patients, whereas only one death (4.0%) was recorded in the COVID-19-negative group. According to injury type, the highest mortality rate was observed among patients with polytrauma (5 deaths, 16.7%), followed by thoracic gunshot injuries (1 death, 6.7%) and abdominal gunshot injuries (1 death, 5.0%). No deaths occurred among patients with isolated extremity gunshot injuries. Kaufman et al. likewise reported that COVID-19 infection was associated with an increased risk of mortality among trauma patients [3]. Our findings support this observation, demonstrating a higher mortality rate in COVID-19-positive patients than in COVID-19-negative patients.

Correlation analysis further confirmed the relationship between injury severity and clinical outcomes. Injury Severity Score (ISS) demonstrated a significant positive correlation

with both the length of hospital stay ($r = 0.61$, $p < 0.001$) and in-hospital mortality ($r = 0.58$, $p < 0.001$) [13]. Furthermore, the presence of COVID-19 infection was positively associated with intensive care unit (ICU) admission ($r = 0.42$, $p < 0.01$), postoperative complications ($r = 0.38$, $p < 0.05$), and in-hospital mortality ($r = 0.34$, $p < 0.05$). These findings indicate that clinical outcomes following gunshot injuries were influenced not only by the anatomical severity of trauma but also by concomitant COVID-19 infection.

The adverse impact of COVID-19 on the outcomes of patients with gunshot injuries may be explained by several pathophysiological mechanisms. Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection induces a systemic inflammatory response, endothelial injury, hypercoagulability, microvascular thrombosis, and pulmonary damage. These pathological processes may exacerbate hemorrhagic shock, aggravate tissue hypoxia, and promote the development of multiple organ failure. Consequently, the combination of gunshot trauma and COVID-19 infection may be regarded as a mutually aggravating clinical condition. Similar findings have been reported in international multicenter trauma registries, where COVID-19 infection has been identified as an independent predictor of adverse clinical outcomes [15].

Several limitations of this study should be acknowledged. First, this was a single-center retrospective study, which may limit the generalizability of the findings. Second, the absence of a pre-pandemic comparison group precluded direct assessment of the impact of the COVID-19 pandemic on the incidence and characteristics of gunshot injuries. In addition, the relatively high proportion of COVID-19-positive patients likely reflects the epidemiological situation during 2020 and the specific role of a military referral hospital. Despite these limitations, the present study provides valuable evidence regarding the clinical characteristics and outcomes of patients with gunshot injuries treated at a military hospital in Armenia during the COVID-19 pandemic. Our findings demonstrate that patients with concomitant COVID-19 infection experienced more severe injuries, required intensive care more frequently, had higher rates of postoperative complications, and exhibited greater in-hospital mortality than COVID-19-negative patients.

Conclusion.

The findings of the present study demonstrate that COVID-19 infection had a significant impact on the clinical course and outcomes of patients with gunshot injuries. Compared with COVID-19-negative patients, those with concomitant COVID-19 infection exhibited significantly greater injury severity, as reflected by a higher mean Injury Severity Score (ISS) (22.8 ± 7.4 vs. 15.2 ± 5.8 , $p < 0.01$), a higher rate of intensive care unit (ICU) admission (43.6% vs. 16.0%), a greater requirement for mechanical ventilation (21.8% vs. 8.0%), and a significantly longer hospital stay (17.2 ± 8.3 vs. 10.8 ± 4.9 days, $p < 0.01$).

Postoperative and in-hospital complications were more frequent among COVID-19-positive patients than among COVID-19-negative patients (29.1% vs. 12.0%). Likewise, in-hospital mortality was higher in the COVID-19-positive group (10.9% vs. 4.0%). The highest mortality rate was observed among

patients with polytrauma (16.7%), who also demonstrated the highest mean Injury Severity Score (ISS) (28.9 ± 7.2).

Correlation analysis identified injury severity as an important predictor of adverse clinical outcomes. Injury Severity Score (ISS) showed significant positive correlations with both the length of hospital stay ($r = 0.61$, $p < 0.001$) and in-hospital mortality ($r = 0.58$, $p < 0.001$). In addition, the presence of COVID-19 infection was associated with an increased likelihood of ICU admission, postoperative complications, and in-hospital mortality.

Taken together, these findings indicate that the combination of COVID-19 infection and gunshot trauma may be regarded as a mutually aggravating clinical condition requiring early diagnosis, close monitoring, and a multidisciplinary treatment strategy to improve clinical outcomes.

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Аннотация

Цель исследования: Оценить влияние инфекции COVID-19 на тяжесть повреждений, клиническое течение, развитие осложнений и исходы госпитализации у пациентов с огнестрельными ранениями.

Материалы и методы: Ретроспективное описательно-аналитическое исследование проведено в Центральном клиническом военном госпитале Министерства обороны Республики Армения. В исследование были включены 80 мужчин с огнестрельными ранениями, госпитализированных в течение 2020 года. Из них 55 (68,8%) пациентов были COVID-19-положительными, а 25 (31,2%) — COVID-19-отрицательными. Тяжесть травмы оценивали с использованием шкалы **Injury Severity Score (ISS)** и **Glasgow Coma Scale (GCS)**. Анализировали частоту госпитализации в отделение интенсивной терапии (ОИТ), необходимость проведения искусственной вентиляции лёгких (ИВЛ), продолжительность госпитализации, частоту осложнений и внутрибольничную летальность.

Результаты: Среднее значение ISS было достоверно выше у пациентов с COVID-19 по сравнению с COVID-19-отрицательными пациентами ($22,8 \pm 7,4$ против $15,2 \pm 5,8$; $p < 0,01$). В то же время средний показатель GCS был достоверно ниже в группе пациентов с COVID-19 ($12,9 \pm 2,5$ против $14,6 \pm 1,8$; $p < 0,05$). Госпитализация в отделение интенсивной терапии потребовалась 43,6% COVID-19-положительных пациентов по сравнению с 16,0% COVID-19-отрицательных. Искусственная вентиляция лёгких была необходима в 21,8% и 8,0% случаев соответственно. Частота осложнений составила 29,1% в группе COVID-19-положительных пациентов и 12,0% в группе COVID-19-отрицательных. Внутрибольничная летальность составила 10,9% и 4,0% соответственно. Корреляционный анализ выявил достоверную положительную связь между показателем ISS и продолжительностью госпитализации ($r = 0,61$; $p < 0,001$), а также между ISS и летальностью ($r = 0,58$; $p < 0,001$).

Заключение: Инфекция COVID-19 у пациентов с огнестрельными ранениями ассоциирована с большей тяжестью травмы, повышенной потребностью в интенсивной терапии, более высокой частотой осложнений и летальности, а также с увеличением продолжительности госпитализации. Сочетание COVID-19 и огнестрельной травмы следует рассматривать как взаимно отягощающее клиническое состояние, требующее ранней диагностики, интенсивного мониторинга и мультидисциплинарного подхода к лечению.

Ключевые слова: COVID-19, огнестрельные ранения, травма, Injury Severity Score (ISS), отделение интенсивной терапии, осложнения, летальность.