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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 ВИНИТИ 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 ВИНИТИ РАН-ის მონაცემთა ბაზებში. სტატიების სრული ტექსტი ხელმისაწვდომია EBSCO-ს მონაცემთა ბაზებიდან.

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. Корректура авторам не высылается, 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 compu-ter-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 საყურადღებოდ!

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, შემაჯამებელი და პროცენტული მონაცემები უნდა შეესაბამებოდეს ტექსტში მოყვანილს.

6. ფოტოსურათები უნდა იყოს კონტრასტული; სურათები, ნახაზები, დიაგრამები - დასათაურებული, დანომრილი და სათანადო ადგილას ჩასმული. რენტგენოგრამების ფოტოასლები წარმოადგინეთ პოზიტიური გამოსახულებით **tiff** ფორმატში. მიკროფოტოსურათების წარწერებში საჭიროა მიუთითოთ ოკულარის ან ობიექტივის საშუალებით გადიდების ხარისხი, ანათალების შეღებვის 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 ფჩხილებში 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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Содержание:

Hua-ting Bi, Wen-Wen Hao.
CORRELATION BETWEEN PREOPERATIVE MACULAR THICKNESS AND POSTOPERATIVE VISUAL PROGNOSIS IN PATIENTS WITH DIABETIC CATARACT…….6-9

Melik-Andreasyan G.G, Tkhruni F.N, Karapetyan K.J, Atoyan S.A, Aleksanyan N.J, Kotsinyan N.Yu, Israyelyan A.L.
COMPARATIVE SUSCEPTIBILITY PROFILES OF CLINICAL AND REFERENCE BACTERIAL STRAINS ACROSS MULTIPLE ANTIBIOTICCLASSES……..10-16

Khramtsov D.M, Chernyshov O.V, Stoyanov O.M, Gryb V.A, Vorokhta Y.M.
COGNITIVE RESERVE IN PATIENTS AFTER CORONAVIRUS INFECTION…….17-22

Egzon Daku, Leon B. Hajdari, Bese R. Morina.
OPTIMIZING SPINAL ANESTHESIA IN URGENT CESAREAN DELIVERY: THE TAYLOR APPROACH IN A PARTURIENT WITH CORRECTED SEVERE SCOLIOSIS AND PULMONARY COMPLICATIONS: A CASE REPORT……..23-28

Ana Maisuradze, Ketevan Kiguradze-Gogilashvili, Flavien Fettak, Ketevan Oghiashvili, Vaja Maisuradze.
CORRELATION BETWEEN RADIATION SAFETY TRAINING AND COMPLIANCE WITH RADIATION PROTECTION PRACTICES: A CROSS-SECTIONAL STUDY……..29-32

Sarmad S. Salih Al Qassar, Omar Hussein Alluazy, Ahmed Khalaf Ali.
A NOVEL NON-INVASIVE MODULATION OF ORTHODONTIC RELAPSE: INSIGHTS FROM A RABBIT MODEL…...33-44

Fitim Alidema, Lirim Mustafa, Egzona Papraniku, Arieta Hasani Alidema, Mirlinda Havolli.
BIOCHEMICAL ABNORMALITIES OF HEPATIC AND RENAL FUNCTION IN HOSPITALIZED PATIENTS RECEIVING PHARMACOLOGICAL THERAPY: A THREE-YEAR RETROSPECTIVE ANALYSIS…….45-49

Sion Jo.
DOUBLE LUMEN TECHNIQUE (DLT) - ENDOTRACHEAL TUBE GUIDED LEVIN TUBE INSERTION TECHNIQUE……50-53

Ellen Safadi, Aparnna Baburaj, Sara Musa Abdalla Elamin, Marwan Ismail.
ASSOCIATION OF DEMOGRAPHIC AND SOCIOECONOMIC VARIABLES WITH PATIENTS' COMPREHENSION AND CONTENTMENT REGARDING INFORMED CONSENT IN A UNIVERSITY HOSPITAL SETTING: A CROSS-SECTIONAL STUDY.54-59

Ostemirkyzy Darika, Kapsalyamova Elmira, Daryono Hadi Tjahjono, Ustenova Gulbaram, Eva Susanty Simaremare.
ISOLATION AND IDENTIFICATION OF β-SITOSTEROL FROM *ZYGOPHYLLUM FABAGO* L. HERB USING SUBCRITICAL CO_2 EXTRACTION…….60-66

Oleg Batiuk, Marharyta Shkabarina, Andrii Manko, Svitlana Cherneta, Iryna Bychuk.
THE DYNAMICS OF PERCEPTIONS AND EVALUATION OF THE COMPONENTS OF THE IMAGE OF AN IDEAL TEACHER DURING THE COVID-19 PANDEMIC…….67-75

Ghaith Wadhah Hamdoon, Aws Hazem Al-Numan, Nawar Yahya Ahmed, Rikan Sulaiman Jumaah, Mazin Mahmoud Fawzi, Banan Burhan Mohammed.
UMBILICAL STUMP CARE IN NEWBORNS: IS BREAST MILK AS EFFECTIVE AS CONVENTIONAL METHODS…….76-80

Sana Khamassi, Emna Bornaz, Nourhène Tayari, Amel Gamoudi, Kamilia Ounaissa, Haifa Abdesselem, Ichraf Ben Ammar, Bahija Riahi, Dorra Bousnina, Henda Jamoussi, Chiraz Amrouche.
OVERWEIGHT AMONG TUNISIAN SCHOOL-AGED CHILDREN: PREVALENCE AND ASSOCIATED FACTORS…….81-86

Tsisana Giorgadze, Tinatin Gognadze, Lasha Dolidze.
CERTAIN PROPERTIES OF β-GLUCOSIDASE FROM YUCCA GLORIOSA FLOWERS…….87-92

Issenova Saule, Rakhimzhanova Adel, Shukirgaliyeva Marzhana.
RISK MANAGEMENT AND HEALTH SUPPORT FOR PREGNANT WOMEN USING INOSITOLS……93-100

Lirim Isufi, Diellza Kelmendi, Adelina Ahmeti Pronaj.
GENDER DIFFERENCES IN EMOTIONAL REGULATION AMONG ADOLESCENTS WITH ELEVATED ADHD SYMPTOMS: A SCHOOL-BASED STUDY…….101-105

Ketevan Omiadze, Alikya Chipurupalli, Tea Abzhandadze.
CHRONIC URTICARIA RELATED TO *HELICOBACTER PYLORI* INFECTION – A CASE REPORT…….106-109

Dinara Aliyeva, Ildar Fakhradiyev, Marat Shoranov.
IDEOLOGICAL FAULT LINES IN PHARMACEUTICAL POLICY OF KAZAKHSTAN: A Q-METHODOLOGICAL APPROACH….110-119

Ahmed Abdalla Jarelnape.
ARTIFICIAL INTELLIGENCE UTILIZATION AND ITS ASSOCIATION WITH NURSING PRACTICE IN CARDIOLOGY AND INTENSIVE CARE UNITS: A CROSS-SECTIONAL STUDY…….120-124

Jiaqi Liu, Yan Pan, Zuliang Yan, Hong Jiang, Hanglin Li, Ying Yu.
GLOBAL, REGIONAL, AND NATIONAL BURDEN OF CHRONIC KIDNEY DISEASE DUE TO TYPE 2 DIABETES MELLITUS, 1990-2021, WITH FORECASTS TO 2035: A FORECASTING STUDY FOR THE GLOBAL BURDEN OF DISEASE STUDY 202……125-135

Ahmed Dallal Bashi, Noor Abdulmonim, Noor Salem, Saleh Nayf, Teba Ammar, Yosif Ismaeel.
THE MOST COMMONLY PRESCRIBED MEDICATIONS BY PEDIATRICIANS IN MOSUL CITY…..……136-142

Lukina Veronika V, Katibgadzhiev Magomed A, Solovyov Andrey A, Kovalenko Polina S, Kuzmich Vitaliy V, Eremeeva Mariia V, Gaevskaya Rinata R, Kuznetsova Anna A, Aleksandrova Iuliia S, Bulia Mariam Z, Sadrutdinov Tatam D, Saitova Atikat S.
COMPARATIVE EFFECTIVENESS OF CONSERVATIVE METHODS FOR ACCELERATING EPITHELIALIZATION IN ACUTE ANAL FISSURE……143-147

Yerzhan Sharapatov, Maida Tusupbekova, Yermek Turgunov, Yuriy Pak, Yersaiyn Zhiyenbayev, Kuandyk Beisenov.
COMPARATIVE EXPERIMENTAL STUDY OF MORPHOLOGICAL CHANGES IN THE KIDNEY IN ACUTE OBSTRUCTIVE PYELONEPHRITIS MODEL: INFLUENCE OF INFECTION ROUTE…….……148-155

Aymar Kassa Boukat, Massine El Hamoummi, Yassine Sarboute, Beaouiss Mohamed, Andemey Leyoubou Emilie, Edderai Meryem, El Hassane Kabiri.
POST-CT-GUIDED BIOPSY PNEUMOTHORAX, ACCORDING TO THE COAXIAL TECHNIQUE WITH AN 18-GAUGE NEEDLE: EPIDEMIOLOGICAL, DIAGNOSTIC AND THERAPEUTIC ASPECTS…….……156-161

Azamat K. Kairgali, Raisa A. Aringazina, Murat K. Jakanov, Abdolreza Haghpanah, Marat N. Sarkulov.
THE EFFECT OF TRIVALENT CHROMIUM ON METABOLIC SYNDROME: A NARRATIVE REVIEW……162-169

Mohammed K.M Madi, Hannan Awad, Marwan Ismail, Maxmudjon Butaboyev, Jamoliddin Bobokalonzoda, Gaybiev Akmaljon Axmadjonovich, Elryah I Ali, Husham O. Elzein, Rasha Babiker, Amin SI Banaga, Salah Eldin Omar Hussein, Ayman H. Alfeel, Ahmed L. Osman, Asaad Babker.
RETICULOCYTE SUBPOPULATION ANALYSIS AND ITS CORRELATION WITH IRON DEFICIENCY ANEMIA: A RETROSPECTIVE STUDY IN A PREDOMINANTLY FEMALE POPULATION…….……170-176

Zena S. Tawffiq, Inas H. Ahmed, Luma M. Al-Obaidy.
PHYTOCHEMICAL SCREENING AND LIPID LOWERING EFFECTS OF *TERMINALIA CHEBULA* FRUIT EXTRACTS IN ALBINO WISTAR RATS…….……177-181

Azamat Shamsiev, Abdiqodir Shakhriev, Botir Yuldashev, Leyla Khakimova, Fariza Khalimova, Sagirayev Nodir Zhumakulovich.
CLINICAL EFFECTIVENESS OF TRADITIONAL TREATMENT METHODS FOR GRADE III CHEMICAL ESOPHAGEAL BURNS IN CHILDREN…….……182-186

Plaurat Krasniqi, Leon B. Hajdari, Fatos Sada, Egzon Daku.
POSTOPERATIVE MORPHINE USE IN ABDOMINAL SURGERY: CLINICAL INSIGHTS FROM A ONE-YEAR SINGLE-CENTER RETROSPECTIVESTUDY…….……187-193

Bashayr Z. Alamri, Reem F. Alnemari, Abduljawad S. Alharbi.
UNDERSTANDING FACTORS CONTRIBUTING TO PATIENTS' NON-ADHERENCE TO A LIFESTYLE MODIFICATION PLAN: A CROSS-SECTIONAL STUDY AMONG VISITORS OF LIFESTYLE CLINICS IN KING ABDUL-AZIZ MEDICAL CITY, JEDDAH…….……194-201

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BIOCHEMICAL ABNORMALITIES OF HEPATIC AND RENAL FUNCTION IN HOSPITALIZED PATIENTS RECEIVING PHARMACOLOGICAL THERAPY: A THREE-YEAR RETROSPECTIVE ANALYSIS

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Abstract.

Background: Monitoring biochemical parameters is an essential component of pharmacological safety and routine clinical practice. Abnormalities in hepatic and renal function observed during hospitalization may reflect pharmacological exposure, underlying disease processes, or their interaction. However, real-world data describing the frequency and distribution of such laboratory abnormalities in hospital settings remain limited.

Objective: This study aimed to evaluate the prevalence of biochemical abnormalities of hepatic and renal function among patients receiving pharmacological therapy and to assess the frequency of laboratory alterations associated with commonly prescribed drug groups.

Methods: A retrospective observational study was conducted using laboratory data from the Department of Clinical Biochemistry. The analysis included 3,500 adult patients who underwent biochemical testing while receiving pharmacological therapy between January 2023 and December 2025. The evaluated parameters included alanine aminotransferase, aspartate aminotransferase, serum creatinine, urea, sodium, and potassium. Patients were categorized according to the main pharmacological therapy received, including antibiotics, non-steroidal anti-inflammatory drugs, and antihypertensive medications. Abnormal values were defined according to institutional laboratory reference ranges.

Results: Among the 3,500 patients included in the analysis, 52.3% were male and 47.7% were female, with a mean age of 56.8 ± 15.4 years. Antibiotics were prescribed to 41.6% of patients, non-steroidal anti-inflammatory drugs to 33.2%, and antihypertensive medications to 25.2%. Elevated alanine aminotransferase levels were observed in 18.9% of patients, while increased aspartate aminotransferase levels were detected in 15.4%. Hepatic enzyme abnormalities were more frequently observed among patients receiving antibiotics and non-steroidal anti-inflammatory drugs, with statistically significant differences between therapy groups ($p < 0.05$). Renal function abnormalities were identified in 14.7% of patients for creatinine and 12.9% for urea, particularly among patients treated with non-steroidal anti-inflammatory drugs. Electrolyte disturbances were less frequent, with hyponatremia observed in 6.1% and hyperkalemia in 4.3% of cases. Overall, 27.6% of patients exhibited at least one clinically relevant biochemical abnormality during hospitalization while receiving pharmacological therapy.

Conclusions: A considerable proportion of hospitalized patients receiving pharmacological therapy present with clinically significant biochemical abnormalities affecting hepatic, renal, or electrolyte parameters. Although causality cannot be established in this retrospective design, these findings underscore the importance of systematic laboratory monitoring as part of hospital-based pharmacovigilance and patient safety strategies.

Key words. Clinical biochemistry, pharmacological therapy, hepatic function, renal function, biochemical abnormalities, retrospective study.

Introduction.

Monitoring biochemical parameters plays a central role in ensuring the safety and effectiveness of pharmacological therapy in routine clinical practice. Laboratory indicators of hepatic and renal function are widely used to detect early signs of drug-related toxicity, guide therapeutic decisions, and prevent potentially serious adverse outcomes. In hospital settings, clinical biochemistry serves as a critical interface between pharmacological treatment and patient safety, particularly among patients receiving commonly prescribed medications for acute and chronic conditions [1,2].

A substantial body of evidence has demonstrated that various drug classes are associated with alterations in liver and kidney function. Antibiotics and non-steroidal anti-inflammatory drugs are among the most frequently implicated agents in drug-induced liver injury and renal impairment, while antihypertensive medications may contribute to changes in renal function and electrolyte balance, especially in vulnerable patient populations [3-5]. Despite this knowledge, most existing studies are based on selected populations, clinical trials, or spontaneous reporting systems, which may not accurately reflect routine clinical practice. Moreover, variability in study design, patient characteristics, and outcome definitions limits the generalizability of available findings [6].

In recent years, increasing attention has been directed toward the use of real-world data to better understand the safety profile of pharmacological therapies. Retrospective analyses based on routinely collected laboratory data provide valuable insights into actual prescribing practices and their biochemical consequences in everyday clinical settings [7-10]. However, comprehensive real-world studies examining concurrent changes in hepatic, renal, and electrolyte parameters across multiple drug classes remain relatively scarce, particularly in hospital-based populations.

Therefore, the aim of this study was to evaluate changes in biochemical parameters of hepatic and renal function among patients receiving pharmacological therapy in a general hospital setting. By analyzing routinely collected laboratory data over a three-year period, this study seeks to quantify the frequency

of clinically relevant biochemical alterations associated with commonly prescribed drug groups and to highlight the importance of laboratory monitoring in pharmacovigilance and patient safety.

Materials and Methods.

Study Design and Setting: This study was designed as a retrospective observational analysis based on routinely collected laboratory and clinical data. The study was conducted at the Department of Clinical Biochemistry of the General Hospital in Ferizaj, reflecting clinical practice in a secondary care hospital setting.

Study Period and Population: The study included data collected over a three-year period, from January 2023 to December 2025. A total of 3,500 adult patients were included in the analysis. Eligible patients had undergone biochemical testing of hepatic and/or renal function during hospitalization while receiving pharmacological therapy within the study period.

Only laboratory values obtained during active pharmacological treatment were included in the analysis. Due to the retrospective structure of the dataset, systematic pre-treatment baseline laboratory values were not consistently available for all patients. Therefore, the present study evaluates the prevalence of biochemical abnormalities observed during pharmacological exposure rather than quantified intra-individual changes over time.

Inclusion and Exclusion Criteria:

Patients aged 18 years or older with at least one documented biochemical assessment of liver or kidney function during hospitalization were included. Patients with incomplete laboratory data were excluded.

To minimize the influence of pre-existing severe organ dysfunction, patients with documented chronic liver disease, chronic kidney disease, active oncological conditions, or those receiving cytotoxic therapy were not included in the analysis.

Biochemical Parameters and Definitions:

The analyzed biochemical parameters were selected as indicators of hepatic and renal function and electrolyte balance. Hepatic function was assessed using alanine aminotransferase (ALT) and aspartate aminotransferase (AST) levels. Renal function was evaluated using serum creatinine and urea concentrations. Electrolyte status was assessed by measuring serum sodium and potassium levels. Abnormal laboratory values were defined according to the institutional reference ranges of the clinical biochemistry laboratory of the General Hospital in Ferizaj, as follows:

– ALT elevation: > 40 U/L
– AST elevation: > 40 U/L
– Elevated serum creatinine: > 1.3 mg/dL in men and > 1.1 mg/dL in women
– Elevated urea: > 50 mg/dL
– Hyponatremia: < 135 mmol/L
– Hyperkalemia: > 5.0 mmol/L

All laboratory analyses were performed using standardized automated analyzers in accordance with internal quality control and calibration procedures of the laboratory.

Pharmacological Therapy Classification:

Patients were categorized according to the main pharmacological therapy documented in their medical records at the time of laboratory testing. The analyzed drug groups included antibiotics, non-steroidal anti-inflammatory drugs (NSAIDs), and antihypertensive medications.

When multiple medications were prescribed, classification was based on the primary therapy considered most relevant to the clinical indication for hospitalization.

Given the retrospective design and the frequent presence of concomitant medications in hospitalized patients, the potential influence of polypharmacy on biochemical findings is acknowledged and addressed in the Discussion and Limitations sections.

For comparative analyses, the antihypertensive group was used as the reference category, as these medications are commonly prescribed for chronic cardiovascular conditions and are less frequently associated with acute hepatocellular or nephrotoxic effects compared with antibiotics and NSAIDs.

Data Collection and Management:

Laboratory and clinical data were extracted from existing hospital electronic records and anonymized prior to analysis. No personal identifiers were collected. Data completeness and internal consistency were reviewed before inclusion in the final analytical dataset.

Statistical Analysis:

Descriptive statistical methods were used to summarize patient characteristics, pharmacological exposure, and biochemical parameters. Continuous variables were expressed as mean values with standard deviations (SD), while categorical variables were presented as frequencies and percentages.

Comparisons of categorical variables between pharmacological therapy groups were performed using the chi-square test. For continuous variables, one-way analysis of variance (ANOVA) was applied where appropriate.

Binary logistic regression analysis was conducted to evaluate the association between pharmacological therapy group and the presence of biochemical abnormalities. The models were adjusted for age and sex as potential confounders. Results are presented as odds ratios (ORs) with 95% confidence intervals (CIs).

A two-sided p-value of less than 0.05 was considered statistically significant.

All statistical analyses were performed using SPSS software (IBM Corp., Armonk, NY, USA), version XX.

Ethical Considerations:

The study was conducted in accordance with institutional ethical standards and the principles of the Declaration of Helsinki. The use of anonymized retrospective data was approved by the Hospital Ethics Council of the General Hospital in Ferizaj. Due to the retrospective nature of the study and the use of anonymized laboratory data, informed consent was waived.

Results.

The main demographic characteristics, pharmacological exposure, and biochemical alterations observed in the study population are summarized in Tables 1-10.

Table 1. *General Characteristics of the Study Population.*

Characteristic	Total patients (n)	Male (%)	Female (%)	Age ≥65 (%)
Study population	3500	52.3	47.7	32.1

Table 2. *Distribution of Pharmacological Therapy Groups.*

Therapy group	n	%
Antibiotics	1456	41.6
NSAIDs	1162	33.2
Antihypertensives	882	25.2

Table 3. *Overall Biochemical Alterations.*

Outcome	n	%
Any biochemical alteration	966	27.6
No alteration	2534	72.4

Table 4. *Hepatic Enzyme Alterations.*

Parameter	Elevated n (%)	Normal n (%)
ALT	662 (18.9)	2838 (81.1)
AST	539 (15.4)	2961 (84.6)

Table 5. *Renal Function Alterations.*

Parameter	Elevated n (%)	Normal n (%)
Creatinine	515 (14.7)	2985 (85.3)
Urea	452 (12.9)	3048 (87.1)

Table 6. *Electrolyte Abnormalities.*

Electrolyte disorder	n	%
Hyponatremia	214	6.1
Hyperkalemia	151	4.3

Table 7. *Hepatic Alterations by Therapy Group.*

Therapy group	ALT elevated (%)	AST elevated (%)	p-value
Antibiotics	22.5	17.9	<0.05
NSAIDs	21.2	17.6	<0.05
Antihypertensives	10.0	8.4	Reference

Table 8. *Renal Alterations by Therapy Group.*

Therapy group	Creatinine elevated (%)	Urea elevated (%)	p-value
Antibiotics	13.2	11.9	<0.05
NSAIDs	18.4	17.0	<0.01
Antihypertensives	12.4	9.1	Reference

Table 9. *Electrolyte Disorders by Therapy Group.*

Therapy group	Hyponatremia (%)	Hyperkalemia (%)	p-value
Antibiotics	6.3	4.1	NS
NSAIDs	6.7	5.3	<0.05
Antihypertensives	5.1	3.4	Reference

Table 10. *Year-wise Distribution of Biochemical Alterations (2023–2025).*

Year	Patients (n)	Any alteration (%)	ALT elevated (%)	Creatinine elevated (%)
2023	1120	25.4	17.0	13.2
2024	1185	27.6	19.0	14.7
2025	1195	29.6	20.7	16.1

Discussion.

This three-year retrospective study conducted at the Department of Clinical Biochemistry of the General Hospital in Ferizaj provides real-world evidence on biochemical alterations observed among hospitalized patients receiving routine pharmacological therapy. The findings demonstrate that clinically relevant laboratory abnormalities are common, with more than one quarter of patients (27.6%) exhibiting at least one alteration in hepatic, renal, or electrolyte parameters during the study period. These results highlight the critical role of laboratory monitoring as an integral component of pharmacovigilance and patient safety in everyday clinical practice [1,11].

Hepatic biochemical alterations and pharmacological exposure:

Elevations in hepatic enzymes were frequently observed, with increased ALT and AST levels detected in 18.9% and 15.4% of patients, respectively. Hepatic alterations were more prevalent among patients receiving antibiotics and NSAIDs compared to those treated with antihypertensive medications.

It should be emphasized that, due to the absence of systematically recorded pre-treatment baseline laboratory values, the present study cannot determine whether these abnormalities developed de novo during therapy or were pre-existing at the time of hospitalization.

This pattern is consistent with existing literature identifying antibiotics and NSAIDs as leading contributors to drug-induced liver injury (DILI) in both hospital and outpatient settings [1-3]. However, in hospitalized populations, hepatic enzyme elevations may also reflect the underlying clinical condition, including systemic infection, inflammatory states, or metabolic stress, rather than direct pharmacological toxicity alone.

The mechanisms described in the literature underlying hepatic injury associated with these drug classes include idiosyncratic immune-mediated reactions, mitochondrial dysfunction, and direct hepatocellular toxicity. Importantly, even mild or asymptomatic elevations in liver enzymes may precede clinically significant liver injury, underscoring the importance of biochemical surveillance, particularly in patients exposed to potentially hepatotoxic agents or polypharmacy [2,3].

Renal function alterations and nephrotoxic risk:

Renal biochemical abnormalities were also prominent, with elevated creatinine and urea levels observed in 14.7% and 12.9% of patients, respectively. The highest frequency of renal alterations was noted among patients receiving NSAIDs, followed by those treated with antihypertensive medications.

These findings align with established evidence linking NSAID use to impaired renal perfusion and acute kidney injury, especially in older patients and those with comorbid conditions [4,5]. Nevertheless, in the context of hospitalization, renal function abnormalities may also be influenced by hemodynamic instability, dehydration, infection-related acute kidney injury, or pre-existing but undocumented renal impairment.

Renal function changes observed in patients receiving antihypertensive therapy may reflect both drug-related effects such as alterations associated with renin–angiotensin–aldosterone system blockade and the underlying cardiovascular disease burden common in hypertensive populations [6].

Accordingly, the associations observed in this study should be interpreted as clinical correlations rather than definitive evidence of drug-induced nephrotoxicity.

From a clinical standpoint, these data reinforce the necessity of careful renal monitoring during pharmacological therapy, particularly in hospitalized patients at increased risk of renal dysfunction.

Electrolyte disturbances and clinical relevance:

Electrolyte abnormalities were less frequent than hepatic or renal alterations, with hyponatremia and hyperkalemia observed in 6.1% and 4.3% of patients, respectively. Despite their lower prevalence, electrolyte disturbances remain clinically significant due to their association with cardiovascular, neurological, and metabolic complications.

In the present study, NSAID exposure showed a statistically significant association with electrolyte disorders, while antihypertensive therapy also demonstrated relevant, though less pronounced, effects. These findings are consistent with previous reports indicating that both NSAIDs and antihypertensive agents can influence electrolyte homeostasis through renal and hormonal mechanisms [7,8].

Given the retrospective design and the lack of detailed clinical data regarding volume status, infection severity, or concomitant medications, causality cannot be established.

Systematic electrolyte monitoring therefore represents an essential component of safe pharmacological management, particularly in patients receiving long-term or combination therapies.

Temporal trends and implications for hospital pharmacovigilance:

A gradual increase in the proportion of patients with biochemical alterations was observed over the three-year period, rising from 25.4% in 2023 to 29.6% in 2025. Although causal inferences cannot be drawn from this retrospective design, this trend may reflect changes in prescribing patterns, increasing patient complexity, aging of the hospital population, or improved detection through more frequent laboratory testing.

Similar observations have been reported in studies utilizing real-world laboratory data, emphasizing the growing importance of hospital-based biochemical datasets for drug safety surveillance [9-11]. These findings support the implementation of structured laboratory-based pharmacovigilance systems, including alert thresholds and interdisciplinary collaboration between clinicians and clinical biochemistry services.

Strengths, limitations, and future perspectives.

The main strengths of this study include its large sample size and comprehensive evaluation of multiple biochemical domains over a three-year period.

However, several limitations should be acknowledged. First, the retrospective design precludes causal inference and limits control over potential confounders, including polypharmacy and unmeasured clinical variables.

Second, systematic baseline laboratory values prior to pharmacological exposure were not available for all patients, limiting the ability to quantify intra-individual changes or confirm new-onset abnormalities.

Third, detailed information regarding primary diagnoses (e.g., sepsis or acute infection), hemodynamic status, and the severity of underlying disease was not consistently available, and these factors may have contributed to the observed laboratory abnormalities.

Biochemical abnormalities were evaluated without formal causality assessment or correlation with clinical outcomes.

Future prospective studies incorporating baseline laboratory values, detailed clinical covariates, multivariable modelling, and standardized adverse event classification may provide deeper insight into the relationship between pharmacological exposure and organ function abnormalities.

Nonetheless, the present findings offer clinically relevant information regarding the frequency of biochemical abnormalities observed in hospitalized patients receiving pharmacological therapy and reinforce the importance of routine laboratory monitoring as part of hospital-based pharmacovigilance.

Limitations.

This study has several limitations. Its retrospective design limits causal inference and relies on the accuracy and completeness of medical records. Polypharmacy, drug–drug interactions, and baseline biochemical values could not be fully controlled. In addition, biochemical alterations were not systematically correlated with clinical outcomes or formally assessed for causality. These limitations should be considered when interpreting the findings.

Conclusion.

This three-year retrospective analysis demonstrates that clinically relevant biochemical alterations affecting hepatic, renal, and electrolyte parameters are common during routine pharmacological therapy in a hospital setting. Antibiotics and NSAIDs were associated with a higher frequency of hepatic and renal abnormalities, while electrolyte disturbances occurred less frequently but remained clinically important. These findings highlight the value of systematic laboratory monitoring as a key component of pharmacovigilance and patient safety, supporting the integration of real-world clinical biochemistry data into routine therapeutic decision-making and risk mitigation strategies.

Ethical Approval and Informed Consent.

The study was conducted in accordance with institutional ethical standards and the principles of the Declaration of Helsinki. Written permission to conduct the study was obtained from the Director of the General Hospital in Ferizaj, who represents the Hospital Ethics Council. Due to the retrospective nature of the study and the use of anonymized laboratory data, informed consent was waived.

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Author Contributions.

Conceptualization, methodology, and study design: A.H.A.; data collection and curation: L.M.; formal analysis and interpretation: M.H.; writing original draft preparation: F.A.; writing review and editing: F.A. All authors have read and agreed to the published version of the manuscript.

Conflicts of interest.

The author declares no conflict of interest.

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