

GEORGIAN MEDICAL NEWS

ISSN 1512-0112

NO 6 (351) Июнь 2024

ТБИЛИСИ - NEW YORK



ЕЖЕМЕСЯЧНЫЙ НАУЧНЫЙ ЖУРНАЛ

Медицинские новости Грузии
საქართველოს სამედიცინო სიახლენი

GEORGIAN MEDICAL NEWS

Monthly Georgia-US joint scientific journal published both in electronic and paper formats of the Agency of Medical Information of the Georgian Association of Business Press.
Published since 1994. Distributed in NIS, EU and USA.

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

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

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

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

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

WEBSITE

www.geomednews.com

К СВЕДЕНИЮ АВТОРОВ!

При направлении статьи в редакцию необходимо соблюдать следующие правила:

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

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

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

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

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

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

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

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

7. Фамилии отечественных авторов приводятся в оригинальной транскрипции.

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

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

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

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

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

При нарушении указанных правил статьи не рассматриваются.

REQUIREMENTS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

ავტორთა საქურაღებოლ!

რედაქციაში სტატიის წარმოდგენისას საჭიროა დაიცვათ შემდეგი წესები:

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

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

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

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

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

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

Tan Minh Hoang, Hung Dinh Kieu, Vu Nguyen, Trung Kien Tran, Tan Chor Ngee, Ha Dai Duong. CLINICAL AND IMAGING OUTCOMES OF XLIF SURGERY FOR LUMBAR SPINAL STENOSIS.....	6-11
Nino Totadze, Rishu Bansal. NUTRITION AND PHYSICAL ACTIVITY OF PREGNANT WOMEN INCLUDING BARIATRIC SURGERY.....	12-17
Arpine Muradyan. THE EFFECT OF DIFFERENT FITNESS TRAINING PROGRAMS AND FREQUENCY ON HEALTH-RELATED QUALITY OF LIFE.....	18-22
Serhii Terekhov, Andrii Proshchenko, Nina Proshchenko. ANALYSIS OF THE USE OF COMPLEX DIGITAL TECHNOLOGIES IN THE DIAGNOSIS AND TREATMENT OF OCCLUSAL ANOMALIES.....	23-32
Vahe Ashot Ter-Minasyan. FERTILITY FUNCTIONS IN 4VHPV VACCINATED ARMENIAN COHORT.....	33-37
Alaa S. Mahdi, Ahmed H. Salman, Zahraa K. Al-Hassani, Hayder A.H. Jalil. DECODING PEDIATRIC MENINGITIS UNRAVELING THE INTRICACIES OF ANTIMICROBIAL RESISTANCE IN IRAQI PEDIATRIC PATIENTS.....	38-43
Rajab A. Alzahrani, Soliman shreed Soliman, Saadi Rabea Saadi AlGhamdi, Mohammed Abdullah S Alzahrani, Abdullah Mohammed B Alghamdi, Ibrahim Abdulaziz A Alghamdi, Essam Mohammed S Alghamdi, Musab Mohammed B Alzahrani, Yahya Ahmed Salem Alzahrani, Mujtaba Alrayah Fadlalla, Mohammed A. Alghamdi. EFFECT OF ENLARGED ADENOIDS AND TONSILS ON BLOOD OXYGEN SATURATION IN AL BAHA, SAUDI ARABIA.....	44-48
Sivakumar Palanisamy, Priyatharshni Subramani, Prabhu Narasimman, Manikkampatti Palanisamy Murugesan. ADVANCEMENT IN ALPHA-SYNUCLEIN PROTEOMICS: EXPLORING ANALYTICAL TECHNIQUES AND THEIR CLINICAL IMPLICATIONS IN PARKINSON'S DISEASE.....	49-54
Teremetskiy VI, Frolova OH, Batryn OV, Myrza SS, Matviichuk AV, Ryzhenko OS. VECTORS OF DEVELOPMENT OF THE UNIFIED MEDICAL INFORMATION SPACE.....	55-60
Rajaa Hussein Fayadh, Rawnaq Thamer Kadium, H. N. K. AL-Salman, Falah Hassan Shari. HPLC METHOD FOR THE QUANTIFICATION OF SOME ACTIVE FLAVONOIDS IN ETHYL ACETATE EXTRACT OF LEAVES OF BUTEA MONOSPERMA LINN.....	61-64
Tchernev G, Ivanov L, Broshtilova V. MULTIPLE KERATINOCYTIC CANCERS AFTER INTAKE OF ANTIHYPERTENSIVES (LISINOPRIL/ BISOPROLOL/HCT) AND ANTIARRHYTHMICS (PROPAFENONE): THE IMPORTANT NEW LINKS TO THE NITROSO-CONTAMINATION AND THE METABOLIC REPROGRAMMING OF THE FUTURE CANCER CELL.....	65-71
Maryam A. Faiq, Nehad N. Hilal, Mohammed T. Dawood. LEVELS OF OSTEOPROTEGERIN AND IRISIN IN POSTMENOPAUSAL OSTEOPOROSIS WOMEN.....	72-75
Tianhua Du, Guangren Zhou, Shouzhi Wu, Haining Ni. UNDERSTAND THE CURRENT SITUATION OF STUDENTS' PHYSICAL FITNESS TEST AND MEASURES TO IMPROVE THEIR PHYSICAL FITNESS TEST SCORES.....	76-79
Sosonna L.O, Boiagina O.D, Yurevych N.O, Schevtsov O.O, Avilova O.V, Konoval N.S, Sukhina I.S. INDIVIDUAL ANATOMICAL VARIABILITY OF THE ANTEROPOSTERIOR LATERAL DIMENSIONS OF THE FACIAL SKULL IN MATURE ADULTS.....	80-84
Zhanat Ispayeva, Raikhan Bekmagambetova, Mereke Mustafina, Elena Kovzel, Galiya Tusupbekova, Marina Morenko, Timur Saliev, Shynar Tanabayeva, Ildar Fakhradiyev. RELIABILITY AND VALIDITY OF THE KAZAKH-LANGUAGE ACT QUESTIONNAIRE AS AN ASTHMA CONTROL TOOL.....	85-90
Khitaryan D.S, Stepanyan L.S, Khachatryan M.M, Barbaryan M.S. JUDO AS AN ALTERNATIVE INTERVENTION MODEL TO PREVENT BULLYING AT SCHOOLS: A PILOT STUDY.....	91-95
Rania M. Tuama, Entedhar R. Sarhat. THE ROLE OF MYONECTIN IN PATIENTS WITH TYPE 2 DIABETES MELLITUS.....	96-99
Rongmin Xu, Shundong Li, Anhua Zheng, Lianping He. EFFECT OF XIAOYAO PILLS COMBINED WITH ALENDRONATE ON BONE DENSITY IN POSTMENOPAUSAL PATIENTS WITH OSTEOPOROSIS.....	100-101
Nino Kiria, Teona Avaliani, Nino Bablshvili, Nino Chichiveishvili, Giorgi Phichkhaia, Lali Sharvadze, Nana Kiria. EFFICACY AND SAFETY OF SILVER NANOCOMPOSITES ON RIFAMPICIN-RESISTANT M. TUBERCULOSIS STRAIN.....	102-108

Dubivska S.S, Hryhorov Y.B, Lazyrskiy V.O, Dotsenko D.G, Lebid P.B. THE INFLUENCE OF CHANGES IN CARBOHYDRATE METABOLISM INDICATORS IN PATIENTS WITH POLYTRAUMA COMPLICATED BY ALCOHOLIC DELIRIUM ON THE CHOICE OF THE SEDATION METHOD.....	109-115
Karapetyan A.G, Danielyan M.H, Badalyan B.Yu, Simonyan K.V, Grigoryan V.S, Simonyan M.A, Dallakyan A.M, Simonyan G.M, Simonyan R.M. PROTECTIVE EFFECT OF A NEW SUPEROXIDE-PRODUCING ENZYME COMPLEX FROM RASPBERRY IN RATS WITH THIRD- DEGREE THERMAL BURNS.....	116-124
Sura Z. Salih, Nehad N. Hilal. EVALUATION OF SERUM VASPIN LEVEL IN IRAQI WOMEN WITH GESTATIONAL DIABETES MELLITUS.....	125-130
Tchernev G, Ivanov L. MUSTARDE ROTATION FLAP AS ADEQUATE OPTION FOR HIGH-RISK BCC NEAR THE LOWER EYE LID: THE ADDITIONAL INTAKE OF N-NITROSO-FOLIC-ACID AND N-NITROSO-RIVOROXABAN AS COFACTORS/ TRIGGERS OF THE METABOLIC REPROGRAMMING OF THE FUTURE CANCER CELL.....	131-137
Nazym Ailbayeva, Aliya Alimbaeva, Saule Rakhyzhanova, Nazym Kudaibergenova, Duman Berikuly, Sayat Tanatarov, Zaure Dushimova, Timur Saliev, Shynar Tanabayeva, Sergey Lee, Ildar Fakhradiyev. THE IMPACT OF BIRTH WEIGHT ON INFANT MORTALITY IN KAZAKHSTAN.....	138-145
Voloshyn-Gaponov I.K, Lantukh I.V, Mikhanovska N.G, Gulbs O.A, Malieieva O.V, Dikhtiarenko S.Yu, Kobets O.V, Malieiev D.V. PSYCHOTHERAPEUTICAL FEATURES OF PERSONS WITH MULTIPLE SCLEROSIS AND HEPATOCEREBRAL DEGENERATION.....	146-151
Sevak Sanasar Shahbazyan. COMPARATIVE ANALYSIS OF EFFECTS INDUCED BY STANDARD AND MODIFIED LAPAROSCOPIC SLEEVE GASTRECTOMY PERFORMANCE ON SHORT TERM AND DISTAL COMPLICATIONS IN PATIENTS WITH 3RD DEGREE OF MORBID OBESITY.....	152-157
Qutaiba A. Qasim. ANTIOXIDANTS, LIPID PROFILES, AND GLUCOSE LEVELS, AS WELL AS PERSISTENT INFLAMMATION, ARE CENTRAL TO THE LINK BETWEEN DIABETES MELLITUS TYPE II AND OXIDATIVE STRESS.....	157-161
Stepanyan L.S, Khitaryan D.S. RESEARCH ON PSYCHOLOGICAL WELL-BEING AND EMOTIONAL PROFILE OF ADOLESCENTS IN THE CONTEXT OF SCHOOL BULLYING.....	162-166
Yi Jin, Zhi Luo, Hua-Qin Su, Cui-Ping Li, Cai-Li Wang, Li-Fen Zhang, Feng-Lian Peng, Lian-Ping He, Xiang-Hu Wang. SERUM CALCIUM WAS NEGATIVELY ASSOCIATED WITH SERUM IRON AMONG GENERAL POPULATION: FINDINGS FROM A CROSS-SECTION STUDY.....	167-169
Stela Dzotsenidze, Lali Pkhaladze, Jenaro Kristesashvili, Nina Davidovi, Samer Hammoude, Marika Zurmukhtashvili. FUNCTIONAL STATE OF THE REPRODUCTIVE SYSTEM AFTER UNILATERAL OOPHORECTOMY.....	170-174

FUNCTIONAL STATE OF THE REPRODUCTIVE SYSTEM AFTER UNILATERAL OOPHORECTOMY

Stela Dzotsenidze¹, Lali Pkhaladze², Jenaro Kristesashvili³, Nina Davidovi⁴, Samer Hammoude⁵, Marika Zurmukhtashvili⁶.

¹MD, PhD student, Department of Obstetrics, Gynecology and Reproductology, Ivane Javakhishvili Tbilisi State University, Tbilisi, Georgia.

²MD, PhD, Professor, Department of Obstetrics, Gynecology and Reproductology, Ivane Javakhishvili Tbilisi State University, Tbilisi, Georgia.

³MD, PhD, Professor, Department of Obstetrics, Gynecology and Reproductology, Ivane Javakhishvili Tbilisi State University, Tbilisi, Georgia.

⁴Zhordania and Khomasuridze Institute of Reproductology, Tbilisi, Georgia.

⁵MD, University hospital Sharjah, Sharjah, UAE.

⁶DMD, PhD, Assistant-Professor, European University, Faculty of Medicine, Tbilisi, Georgia.

Abstract.

Aim of the Study: To evaluate the functional state of the reproductive system following unilateral oophorectomy (UO).

Materials and Methods: Forty-three patients (aged 7 to 38 years) who underwent unilateral oophorectomy were divided into three groups based on their age at the time of surgery: Group I (7-15 years), Group II (16-30 years), and Group III (30-38 years). The functional state of the reproductive system was assessed 3 months and 1 year after the procedure.

Results: The indications for surgery were as follows: Group I: Follicular cysts were present in 69.2% of cases, while endometrial, dermoid, papillary, and corpus luteum cysts each occurred in 7.7% of cases. Group II: Follicular cysts were the most common, found in 57.9% of cases, with endometrial cysts occurring in 21.1% of cases. Group III: Endometrial cysts were predominant, observed in 54.5% of cases, while follicular cysts were found in 36.4% of cases. Following UO, functional cysts developed in the remaining ovary in 69.8% of patients, with a higher prevalence in Group III.

Three months after surgery, the Anti-Müllerian Hormone (AMH) levels decreased significantly across all groups. However, AMH levels recovered within one year in Groups I and II, but not in Group III.

Conclusions: Unilateral oophorectomy leads to a decrease in ovarian reserve in all age patients three months post-surgery. Nevertheless, functional ovarian activity is restored within one year for pubertal and early reproductive-aged women, unlike those in the late reproductive age group. Given the high incidence of functional cysts in the remaining ovary following UO, regular follow-up for these patients is essential.

Key words. Unilateral oophorectomy, ovarian reserve, functional cysts.

Introduction.

It is widely known that with increasing age fertility of women decreases. In the modern world women often delay childbirth until their 30s or 40s to establish their careers first. The result of this trend is that women try to conceive at the age when their oocyte pool is decreased which causes fertility to be decreased. These women are considered to be subfertile. Current updates about the oocyte pool and its impact on fertility led scientists and clinics to introduce the term "ovarian reserve" and diminished ovarian reserve (DOR), which was first coined by Navot et al. [1]. The aetiology of diminished ovarian reserve is multifactorial. Women are born with a definite number of

oocytes, which build a total oocyte pool and determine ovarian reserve. The number of oocytes declining throughout life, causing depletion of the ovarian pool and the process of ovarian ageing [2]. Reproductive ageing is a continuous physiologic process, strongly influenced by genetic factors [3]. In addition, several further risk factors: environmental, pathological, and iatrogenic, can directly or indirectly have an impact on the physiologic process of ovarian aging. Among them, important role plays in surgical interventions, which can disrupt the blood supply to ovaries, or especially procedures that include the partial or total removal of ovarian tissues. According to past beliefs about ovarian function, it was expected that the removal of one ovary could lead to a reduction of the primordial follicle pool [4,5]. Unilateral oophorectomy (UO) is a frequent surgical intervention performed for benign and cystic formations of the ovary, extensive endometriosis, ovarian torsion, or other indications [6]. Usually, it is carried out in the premenopausal period, but often young women of active reproductive age endure the removal of the ovary. For unilateral oophorectomy, there are no absolute contraindications. However, because of the crucial role of the ovary in women's fertility, a thorough assessment of the risk and benefits ratio should be performed [7].

The age-related decrease in fertility is a complex process. The main physiologic mechanism behind this is the reduction of the oocyte pool. Women with diminished ovarian reserve experience no clinical symptoms. But there are certain hormonal changes detectable. At the same time, an FSH level increase is observed. The reason for that is reduced feedback from estrogen and inhibin. The level of the Anti-Müllerian hormone is reduced. To bring more clearance to the diagnosis of diminished ovarian reserve groups of scientists and clinicians such as Scott, Toner, and Hofmann have defined diminished ovarian reserve as a composition of abnormal ovarian reserve testing and poor ovarian response [8].

It should be considered that the European Society of Human Reproduction and Embryology (ESHRE) guidelines [9] include clear statements about the impact of surgical procedures on ovarian reserve. Guidelines suggest that since surgical interventions include the removal of certain quantities of follicles (more or less depending on the type of procedure), it should be considered that post-surgically ovarian reserve will be diminished [10]. Statistics of unilateral oophorectomy temporal trends showed the link between the incidence of unilateral and bilateral interventions [11-13]

Unilateral oophorectomy can be performed in women of reproductive age as an adverse outcome of a gynaecological emergency or may represent a planned necessary intervention of cases of pathologies such as ovarian torsion, ovarian rupture, uncontrolled bleeding, pregnancy, endometrioma, abscess, and cancerous diseases. A few decades ago, cases of unilateral oophorectomy prevailed over the number of bilateral ovariectomies, however, in the recent period, this trend has changed. Unilateral oophorectomy is performed with a higher frequency before the age of 40 in women of age and is mostly accompanied by hysterectomy. The results of bilateral oophorectomy have been widely studied. In the literature, there is little data on the effect of unilateral oophorectomy on women's reproductive health. For years, the dominant view was that one ovary is enough for the normal endocrine and female body to carry out the reproductive function. In the case of oophorectomy, ovaries can take over each other's function. Data on the effects of unilateral oophorectomy on female fertility, ovarian reserve, menopause, and in general, on women's health and well-being, are very limited.

Based on the above, it is important to assess the functional status of the reproductive system after unilateral oophorectomy. Determination of the nosological structure of intervention and subsequent side effects will allow to development of better practice guidelines for the management of gynaecological diseases in which unilateral oophorectomy may be required.

The aim of the study.

To evaluate the functional state of the reproductive system following unilateral oophorectomy (UO).

Materials and Methods.

The prospective and retrospective study included 43 patients (aged between 7 and 38 years), who underwent urgent or planned unilateral oophorectomy at different ages due to different types of cysts. Patients were recruited at the Center for Reproductive Medicine – Universe (Tbilisi, Georgia) and Academician O. Gudushauri National Medical Center Department of Obstetrics and Gynecology (Tbilisi, Georgia). The period for recruitment was between February 2017 and December 2022. The main inclusion criteria were a history of past unilateral oophorectomy or planned upcoming unilateral oophorectomy. Exclusion criteria were as follows: chronic diseases, hormonal therapy, and age more than 45. Patients were assigned to three groups according to the age when surgical intervention was performed: Group I – 13 patients aged 7-15 years (12.92±2.32); Group II – 19 patients, aged 16-34 years (23.16±4.73), Group III – 11 women at age 35-38 years (37.09±0.94).

The general variables compared between groups included age, height, weight, and body mass index (BMI) of patients, the features of patients' menstrual cycle before surgery (regular, irregular), the presence of polycystic ovarian syndrome, and menarche age. The exact types of cysts were determined histomorphologically after surgery. The monitoring of the functional state of the reproductive system lasted for 1 year after surgery intervention. After surgery, the features of the menstrual cycle (regular, irregular), and the functional state of the second ovary (presence of cysts) were evaluated 3 months, and one year after surgery which included the hormonal profile

- anti-Müllerian hormone (AMH), follicle-stimulating hormone (FSH), and luteinizing hormone (LH), index of LH/FSH. Prolactin (PRL) level was also determined.

Statistical analysis:

Data analysis was performed using the software program SPSS (version 26, for Windows IBM SPSS, NY, USA). Comparisons of data between groups were performed using one-way analysis of variance (ANOVA), Paired samples T-Test, and Chi-Square Test. Variables are presented as mean ± S.D. Statistically significant was considered $P < 0.05$.

Ethics statement:

The research project was approved by the Ethics and Research Committee of the Faculty of Medicine of Ivane Javakishvili Tbilisi State University. All participants were previously informed about the study, written informed consent was obtained and the confidentiality of the information provided was ensured.

Results and Discussion.

In all groups the mean age was 27.33±10.10; the mean age of surgery amounted to 23.63±9.72 years, the mean age of menarche was 12.24±1.67, and the mean BMI was 21.77±4.86.

The mean values of these variables in groups separately are presented in Table 1.

Table 1. Distribution of general variables into groups. All data are presented as mean ± SD.

GROUP	AGE	AGE OF SURGERY	AGE OF MEN-ARCHE	BMI
I (13)	17.23±6.70	12.92±2.33	11.42±1.31	21.1846±7.53
II (19)	26.84±5.70	20.11±2.85	12.47±1.69	21.6842±3.41
III (11)	37.82±3.46	34.36±2.25	12.73±1.79	22.5909±3.02

There was a significant difference in the mean age of surgery between the groups ($P=0.000$). It should be noted that all three groups of patients had normal BMI. There is an opinion that the probability of torsion of cysts is high in thin women, which is confirmed by our data - in the case of follicular and corpus luteum cysts, the vast majority of patients - $n=26$ (89.7%) underwent surgical manipulation due to torsion [14].

The average age at menarche was lower in group I, although the rate was not statistically different between groups ($P > 0.05$). This may indicate that menarche is not associated with cyst development.

In group I at the time of surgical intervention, the majority of patients (92.31%) were in the post-menarche period and only one patient (7.69%) had the procedure before menarche (at age 7). This can be considered a weakness of our study in terms of evaluation of the oophorectomy effect on achieving normal menarche. Despite this, in the first group mean age of menarche was lower (11.42±1.311) compared to the second and third groups (12.47±1.679 and 12.73±1.794). However, this difference was not statistically significant. The study by Zhai and colleagues evaluated the achievement of menarche in pediatric patients who underwent ovarian surgery in premenarche [15]. No difference in the achievement of normal menarche was observed. From this data, we can speculate that oophorectomy

in premenarche does not affect the ability to achieve normal menarche between ages 10 and 15 years.

Patients were histomorphologically diagnosed with different types of cysts. It should be noted that follicular cysts dominated. In group I nine patients had follicular cysts (69.2%), and the frequency of endometrial, dermoid, papillary and corpus luteum cysts was equal - 7.7%. The high rate of functional ovarian cysts in the group of adolescent girls is due to the immaturity of the hypothalamic-pituitary-ovarian axis, which is a physiological condition in this period. Consequently, follicle persistence, anovulation and the appearance of functional cysts are noted [16].

Follicular cysts were also dominant in group II – 11 cases (57.9%). Endometrial cysts were more frequent -4 cases (21.1%), compared to group I. The corpus luteum cysts were detected in 3 patients (15.8%), and papillary cysts were found only in 1 case (5.3%).

In group III, endometrial cysts were the most frequent – 6 cases (54.5%), follicular cysts were detected in 4 patients (36.4%), corpus luteum cyst - in 1 patient (9.1%) (Table 2), which is logical because endometriosis is a chronic progressive disease and with increasing age its clinical manifestation becomes more intense, including endometriomas that increase in size.

Table 2. Frequency of the morphologically different cysts in the groups.

Group	Follicular cyst	Endometrial cyst	Dermoid cyst	Papillary cyst	Corpus Luteum cyst
I	69.2%	7.7%	7.7%	7.7%	7.7%
II	57.9%	21.1%		5.3%	15.8%
III	36.4%	54.5%			9.1%
Total	52%	20%	4%	8%	16%

In the case of follicular cysts, there is a high risk of torsion of the ovary, which becomes the reason for oophorectomy, and which dominated groups I and II. In the third group, due to the high frequency of endometriomas, scheduled oophorectomy was performed [1].

It should be noted that the localization of cysts in most cases of our study was on the right side, especially in the first and second groups (76.9% and 63.2%, respectively) where follicular cysts predominated. This may be explained by the influence of chronic appendicitis, which contributes to the inflammatory damage of the ovarian tissue. This can be the reason for the formation of follicular cysts. Contrary to the results of Laughlin-Tommaso and colleagues and Keyhan S.et al., an oophorectomy was performed more frequently on the left side [7,11].

Retrospective analysis of the menstrual cycle before surgery in the groups revealed the following results: it is worth noting that in the early reproductive age menstrual cycle disorders were detected in 42.1% of patients, which was more frequent compared to the adolescent group (30.8%), although there was no statistically significant difference (P= 0.4). It should be noted that in the group of older reproductive age, menstrual cycle disorders before surgery were relatively rare (18.2%) compared to adolescents and women of early reproductive age. This is somewhat related to the high rate of endometrial cysts in this group, for which menstrual cycle disturbances are not characteristic [15,17].

In all groups, the high frequency of cycle disturbances before surgery, which was associated mainly with functional cysts, indicates a high frequency of hormonal dysfunction in those patients.

It should be mentioned that after oophorectomy in puberty, menstrual cycle disorders increased significantly from 30.8% to 46.2% (P=0.009). In the early reproductive period, the menstrual cycle became more regular - the incidence of oligomenorrhea before and after surgery was 42.1% and 36.8%, respectively (P=0.003). In the majority of late reproductive-aged patients, menstrual cycle became irregular after surgical intervention - 18.2% and 72.7% before and after surgery respectively (P=0.04) (Table 3).

Table 3. The percentages of cyst localization, cycle regularity before and after surgery.

Group (n)	Cyst right side	Cyst left side	Cycle before surgery		Cycle after surgery	
			regular	Irregular	regular	Irregular
I (13)	76.9%	23.1%	69.2%	30.8%	53.8%	46.2%
II (19)	63.2%	36.8%	57.9%	42.1%	63.2%	36.8%
III (11)	54.5%	45.5%	81.8%	18.2%	27.3%	72.7%

The physiological decline of ovarian function with advanced age is reflected in the disturbance of the menstrual cycle, which is further aggravated by the reduction of the ovarian reserve after unilateral oophorectomy [15].

It should be noted that despite the high frequency of menstrual cycle disorders in group I, the diagnosis of polycystic ovarian syndrome was rare (8.3%). Making this diagnosis is difficult for several years after menarche because the diagnostic criteria for polycystic ovary syndrome overlap with the physiological changes of puberty [14,18].

It is especially important to evaluate the functional activity of the second ovary in ovariectomized women. Following UO, functional cysts developed in the remaining ovary in 69.8% of patients. The highest incidence of cysts in the second ovary occurred in late reproductive age (72.7%), which is explained by the fact that the decrease in ovarian reserve caused by oophorectomy is added to the physiological decrease in ovarian reserve related to advanced age. As a result, follicle persistence and cyst formation develop [19-21]. After UO in the adulthood group, the rate of functional cysts in the second ovary was 61.5%, and in the early reproductive age group - 52.6%.

In general, one of the risk factors for torsion of cysts is the presence of a congenitally long suspensory ligament of the ovary. Therefore, in such patients, who have a history of unilateral oophorectomy, there is a high probability of torsion of the second ovarian cyst, which may become the reason for excision of the second ovary. This complication makes it impossible to realize the reproductive function in the future. Therefore, it is very important to monitor the second ovary in such patients. There are few similar data in the literature [22-24].

For the evaluation of the reproductive hormone profile, several tests were made. Moderate hyperprolactinemia was observed in all three groups (group I - 16.58±1.50; group II - 22.44±5.30; group III (18.75±2.90) - prolactin values exceeded the normal data of the corresponding age group.

Table 4. Hormonal indicators in groups (mean ± S.D. (standard deviation)). * - statistically significant difference between indicators in group I ($P < 0.05$), † - statistically significant difference between indicators in group II ($P < 0.05$), ‡ - statistically significant difference between indicators in group III ($P < 0.05$), § - statistically significant difference between groups I, II and III ($P < 0.05$).

Group	PRL	AMH in 3 months	AMH in 1 year after surgery	FSH in 3 months	FSH in 1 year	LH in 3 months	LH in 1 year
I	16.58±1.50	2.65±1.60	4.11±0.80*	6.10±2.35	5.01±0.86	5.56±4.30	7.23±1.68
II	22.44±5.30	2.38±0.86	3.34 ±0.65†‡	7.27±2.71	6.38±1.33‡	7.51±3.29	8.47±2.74
III	18.75±2.90	1.15±0.51	1.04±0.48	12.20±3.68	10.61±1.72 ‡§	5.19±2.09	6.24±1.07

Table 5. LH/FSH indexes in groups in three months and one year after surgery. P - values.

Group	LH/FSH in 3 months	LH/FSH in 1 year	P value
I	0.99±0.91	1.47±0.37	0.02
II	1.13±0.59	1.36±0.48	0.03
III	0.49±0.37	0.61±0.19	0.12

The role of hyperprolactinemia in menstrual cycle disorders is well known [25-27]. It is possible to assume that these patients had a moderate increase in prolactin even before the operation, which could be associated with follicle persistence, anovulation, and consequently the occurrence of retention cysts. Hyperprolactinemia is also observed in endometriosis [28,29], which requires careful assessment. Probably, hyperprolactinemia could be one of the factors contributing to the formation of cysts.

It was interesting to determine the anti-Müllerian hormone three months and one year after the operation. At three months after surgery, the rates of AMH in puberty (2.65±1.60) and early reproductive age (2.38±0.86) were significantly higher than those of late reproductive age (1.15±0.51) ($P=0.00$). AMH levels were significantly increased in pubertal (4.11±0.80) ($P=0.01$) and early reproductive age groups (3.34±0.65) ($P=0.00$) one year after surgery, whereas AMH levels did not change in late reproductive age women (1.04± 0.48) ($P=0.45$). It is worth noting that the indicators of the first and second groups did not differ from each other after 3 and 12 months, but in patients of both groups, AMH was higher compared to patients of late reproductive age.

Data from several studies confirm that AMH decreases after surgery, especially in the first month due to tissue damage, therefore AMH assessment is not recommended immediately after surgery. Studies confirm that the ovary can increase the reserve gradually after surgery, which is also confirmed by our research [14,16].

It should be mentioned that FSH at 3 months after surgery was higher in the third group compared to the first and second groups, although there was no statistically significant difference between them. It was statistically significantly higher in women of late reproductive age compared to women of puberty and early reproductive age (Table 4).

FSH was significantly higher one year after surgery in group III compared to groups I and II. The FSH index reflected the tendency of decreasing ovarian reserve with increasing age. LH was not significantly different between groups I and II, and between groups I and III, while a statistically significant difference was found between groups II and III ($P=0.02$). It should be noted that the mean values of FSH and LH were within the

normal range in all age groups, however, it was noteworthy that the LH/FSH index was found to be less in groups I (0.99±0.91) and III (0.49±0.37) at 3 months after surgery, than in group II (1.13±0.59) which is evidence of ovarian failure.

After 1 year, the LH/FSH index increased significantly in groups I (1.47±0.37) and II (1.36±0.48) in contrast to group III (0.61±0.19), in which the index remained unchanged, which is probably associated with ovarian insufficiency expressed in the late reproductive age (Table 5).

It should be underlined that the functional stability of the second ovary is especially noteworthy in the case of UO. Because in most cases follicular cysts appear, which in such patients is an additional risk factor for ovarian torsion and, potentially, repeated surgical intervention and oophorectomy, it is very important to monitor the second ovary in women after unilateral oophorectomy and to prevent the occurrence of cysts. Large-scale studies in this connection should be continued.

Conclusion.

Unilateral oophorectomy leads to a decrease in ovarian reserve in all age patients three months post-surgery. Nevertheless, functional ovarian activity is restored within one year for pubertal and early reproductive-aged women, unlike those in the late reproductive age group. Given the high incidence of functional cysts in the remaining ovary following UO, regular follow-up for these patients is essential to maintain women's reproductive function.

Conflict of interests.

The authors have no conflicts of interest to disclose.

REFERENCES

1. Lawson AA, Rentea RM. Oophorectomy. StatPearls [Internet]. 2024.
2. Rustamov O, Krishnan M, Roberts SA, et al. Effect of salpingectomy, ovarian cystectomy and unilateral salpingo-oophorectomy on ovarian reserve. *Gynecol Surg.* 2016;13:173-178.
3. Rocca WA, Ulrich LG. Oophorectomy for whom and at what age? *Primum non nocere* (Editorial). *Maturitas.* 2012;71:1-2.

4. Oskayli M.C, Gulcin N, Ozatman E, et al. Assessment of ovarian reserve using serum anti-Müllerian hormone after ovarian torsion surgery. *Pediatrics international: official journal of the Japan Pediatric Society*. 2019;61:504-507.
5. Rocca WA. History of the Rochester Epidemiology Project: half a century of medical records linkage in a United State population. *Mayo Clin Proc*. 2012;87:1202-1213.
6. Al-Turki HA. Fertility after oophorectomy due to torsion. *Saudi Med J*. 2015;36:368-370.
7. Laughlin-Tommaso SK, Stewart EA, Grossardt BR, et al. Incidence, time trends, laterality, indications, and pathological findings of unilateral oophorectomy before menopause. *Menopause*. 2014;21:442-449.
8. ASRM Practice Committee. Testing and interpreting measures of ovarian reserve: a committee opinion. *Fertil Steril*. 2012;98:1407-1415.
9. Dunselman GA, Vermeulen N, Becker C, et al. ESHRE guideline: management of women with endometriosis. *Hum Reprod*. 2014;29:400-412.
10. Kaaijk E.M, Hamerlynck J.V, Beek J.F, et al. Clinical outcome after unilateral oophorectomy in patients with polycystic ovary syndrome. *Human reproduction (Oxford, England)*. 1999;14:889-892.
11. Keyhan S, Hughes C, Price T, et al. An Update on Surgical versus Expectant Management of Ovarian Endometriomas in Infertile Women. *Biomed Res Int*. 2015;2015:204792.
12. Mansfield MJ, Emans SJ. Adolescent menstrual irregularity. *J Reprod Med*. 1984;29:399-410.
13. Navot D, Rosenwaks Z, Margalioth EJ. "Prognostic assessment of female fecundity". *Lancet*. 1987;2:645-647.
14. Huang Ci, Hong M-K, Ding D-C, et al. A review of ovary torsion. *Tzu-chi Med J*. 2017;29:143-147.
15. Zhai A, Axt J, Hamilton E.C, et al. Assessing gonadal function after childhood ovarian surgery. *Journal of pediatric surgery*. 2012;47:1272-1279.
16. Lozada Y, Bhagavath B. A Review of Laparoscopic Salpingo-Oophorectomy: Technique and Perioperative Considerations. *J Minim Invasive Gynecol*. 2017;24:364-370.
17. Somigliana E, Berlanda N, Benaglia L, et al. Surgical excision of endometriomas and ovarian reserve: a systematic review on serum antimüllerian hormone level modifications. *Fertil Steril*. 2012;98:1531-1538.
18. Christ JP, Cedars MI. Current Guidelines for Diagnosing PCOS. *Diagnostics (Basel)*. 2023;13:1113.
19. Ban Frangež H, Vrtacnik Bokal E, Štimpfel M, et al. Reproductive outcomes after laparoscopic surgery in infertile women affected by ovarian endometriomas, with or without in vitro fertilisation: results from the SAFE (surgery and ART for endometriomas) trial. *J Obstet Gynaecol*. 2022;42:1293-1300.
20. Emeksiz HC, Derinöz O, Akkoyun EB, et al. Age-Specific Frequencies and Characteristics of Ovarian Cysts in Children and Adolescents. *J Clin Res Pediatr Endocrinol*. 2017;9:58-62.
21. Mansouri G, Safinataj M, Shaheimaieil A, et al. Effect of laparoscopic cystectomy on ovarian reserve in patients with ovarian cyst. *Front Endocrinol (Lausanne)*. 2022;13:964229.
22. Bascietto F, Liberati M, Marrone L, et al. Outcome of fetal ovarian cysts diagnosed on prenatal ultrasound examination: systematic review and meta-analysis. *Ultrasound Obstet Gynecol*. 2017;50:20-31.
23. Tyraskis A, Davidson J, Billington J, et al. Ultrasonographic features associated with previous torsion and the impact of surgery in managing neonatal ovarian cysts: a 20-year single-centre retrospective study. *Pediatr Surg Int*. 2023;39:185.
24. Ulrich ND, Marsh EE. Ovarian Reserve Testing: A Review of the Options, Their Applications, and Their Limitations. *Clin Obstet Gynecol*. 2019;62:228-237.
25. Saei Ghare Naz M, Rostami Dovom M, Ramezani Tehrani F. The Menstrual Disturbances in Endocrine Disorders: A Narrative Review. *Int J Endocrinol Metab*. 2020;18:e106694.
26. Schuh-Huerta SM, Johnson NA, Rosen MP, et al. Genetic variants and environmental factors associated with hormonal markers of ovarian reserve in Caucasian and African American women. *Hum Reprod*. 2012;27:594-608.
27. Szukiewicz D. Current Insights in Prolactin Signaling and Ovulatory Function. *Int J Mol Sci*. 2024;25:1976.
28. Filip L, Duică F, Prădatu A, et al. Endometriosis Associated Infertility: A Critical Review and Analysis on Etiopathogenesis and Therapeutic Approaches. *Medicina (Kaunas)*. 2020;56:460.
29. Mirabi P, Alamolhoda SH, Golsorkhtabaramiri M, et al. Prolactin concentration in various stages of endometriosis in infertile women. *JBRA Assist Reprod*. 2019;23:225-229.